U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF EXPERIMENT STATIONS.

W. O. ATWATER, DIRECTOR.

MISCELLANEOUS BULLETIN No. 3.

PROCEEDINGS

OF THE

FOURTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

CHAMPAIGN, ILLINOIS,

NOVEMBER 11, 12, AND 13, 1890.

EDITED BY

A. W. HARRIS, for the Office of Experiment Stations,

AND

H. E. ALVORD, for the Executive Committee of the Association.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

WASHINGTON:
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1891.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
May 25, 1891.

SIR: I have the honor to transmit herewith for publication Miscellaneous Bulletin No. 3 of this Office, containing the proceedings of the fourth annual convention of the Association of American Agricultural Colleges and Experiment Stations, held at Champaign, Illinois, November 11, 12, and 13, 1890, which have been edited by the assistant director of this Office in conjunction with the chairman of the executive committee of the Association.

Very respectfully,

W. O. ATWATER,
Director.

HON. J. M. RUSK,
Secretary of Agriculture.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called The Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association.

MEMBERSHIP.

At any regularly called meeting of the Association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, the United States Department of Agriculture and the Office of Experiment Stations of the United States Department of Agriculture shall be entitled to one delegate. The same delegate may represent both a college and an experiment station, and may take part in the proceedings of the sections proper to either or both, but no delegate shall cast more than one vote either in a section or in convention. Other institutions engaged in experimental work in the interest of agriculture may be admitted to representation in this Association by a majority vote at any regular meeting of the Association.

Any person engaged in agriculture, who shall attend the conventions of this Association, not as a delegate, may, by vote of the convention, be admitted to all the privileges of the floor, except the right to vote.

OFFICERS.

The officers of this Association shall be a president, five vice-presidents, and a secretary, who shall act as treasurer. They shall be chosen by ballot, and shall perform the duties which usually devolve upon such officers. They shall hold office from the close of the meeting at which they were elected and until their successors shall be elected.

The president, secretary, and five persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

The executive committee shall determine the time and place of the meetings of the Association; shall issue its call for said meetings, stating the general purpose thereof, not less than 30 days before the date at which they shall be held; shall provide a well-prepared order of business and program of exercises for such meetings; and shall make seasonable issue of said programs.

It shall be the duty of each institution included in this Association to present at each regularly called meeting, a brief report of the work and progress of said institution, and such report shall be called for in the regular order of business.

The executive committee shall be charged with the general arrangement and conduct of the meetings called by it, at which meetings, before adjournment, a new executive committee shall be chosen.

SECTIONS.

The Association shall be organized into sections upon the several classes of special subjects, the consideration of which shall become desirable. Each institution represented in the Association shall be entitled to representation in each section by one delegate. Each section shall nominate to the convention a chairman, to hold office until the close of the next convention. Each chairman shall present at the first general session of the convention a report of progress in his subject during the preceding year, together with any other facts connected therewith which he may deem of interest. Such reports shall not exceed 15 minutes in length. The annual address of the president of the Association shall be given upon the evening of the same day. Provision shall be made in the program for meetings of each of the sections, either simultaneously or consecutively as the executive committee shall determine. At least two sections shall each year present in general sessions of the convention a portion of the subjects coming before them. The sections to thus report shall be designated by the executive committee, and general notice of the selection shall be given at least three months in advance. There shall be sections on agriculture, on botany, on chemistry, on college work, on entomology, and on horticulture, and the executive committee upon request of any five institutions represented in the Association, shall provide for the organization of new sections at any convention.

AMENDMENTS.

This constitution may be amended at any regularly called meeting by a vote of two thirds of the delegates present.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the program.

(3) Speakers invited to open discussions shall be entitled to 20 minutes each.

(4) In general discussions the 10-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general program shall be closely observed, unless changed by a two-thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION.

ELECTED AT WASHINGTON, D. C., NOVEMBER, 1889.

President.

J. H. SMART, of Indiana.

Vice-Presidents.

M. E. GATES, of New Jersey.
F. A. GULLEY, of Texas.
G. T. FAIRCHILD, of Kansas.
R. J. REDDING, of Georgia.
E. W. HILGARD, of California.

Secretary and Treasurer.

H. P. ARMSBY, of Pennsylvania.

Executive Committee.

The PRESIDENT, the SECRETARY,
H. E. ALVORD, of Maryland.
W. H. SCOTT, of Ohio.
S. D. LEE, of Mississippi.
M. A. SCOVELL, of Kentucky.
E. H. JENKINS, of Connecticut.

Chairmen of Permanent Committees.

Agriculture, F. A. GULLEY, of Texas.
Chemistry, C. W. DABNEY, jr., of Tennessee.
Botany, S. M. TRACY, of Mississippi.
Entomology, S. A. FORBES, of Illinois.
Horticulture, W. J. GREEN, of Ohio.

Chairman of Standing Committee on College Work.

G. W. ATHERTON, of Pennsylvania.

ELECTED AT CHAMPAIGN, ILLINOIS, NOVEMBER, 1890.

President.

H. H. GOODELL, of Massachusetts.

Vice-Presidents.

O. CLUTE, of Michigan.
J. W. SANBORN, of Utah.
A. Q. HOLLADAY, of North Carolina.
I. P. ROBERTS, of New York.
E. D. PORTER, of Missouri.

Secretary and Treasurer.

M. A. SCOVELL, of Kentucky.

Executive Committee.

The PRESIDENT, the SECRETARY,
H. E. ALVORD, of Maryland.
M. C. FERNALD, of Maine.
J. H. SMART, of Indiana.
J. A. MYERS, of West Virginia.
W. M. HAYS, of Minnesota.

Chairmen of Sections.

Agriculture, C. S. PLUMB, of Indiana.
College Work, G. W. ATHERTON, of Pennsylvania.
Botany, B. D. HALSTED, of New Jersey.
Entomology, A. J. COOK, of Michigan.
Chemistry, A. T. NEALE, of Delaware.
Horticulture, E. S. GOFF, of Wisconsin.

CALL FOR THE CONVENTION.

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES
AND EXPERIMENT STATIONS,
OFFICE OF THE SECRETARY,
State College, Pennsylvania, August 9, 1890.

By authority of the executive committee, a delegate convention of this Association is hereby called to meet at Champaign, Illinois, at noon of Tuesday, November 11, 1890.

Attention is called to the following article of the constitution of the Association respecting membership:

At any regularly called meeting of the Association, each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, and the Department of Agriculture shall be entitled to one delegate, but no delegate shall cast more than one vote. Other institutions engaged in experimental work in the interest of agriculture may be admitted to representation in this Association by a majority vote at any regular meeting of the Association.

In accordance with the requirements of the amendment to the constitution adopted at the last convention of the Association, the permanent committees on chemistry and on horticulture and the standing committee on college work are hereby designated to present a portion of the subjects coming before them in the general sessions of the convention.

The executive committee is not yet able to announce the program of the meeting, but will do so at an early day.

Very respectfully,
For the executive committee,

HENRY E. ALVORD,
Chairman.

H. P. ARMSBY,
Secretary.

PROGRAMS.

GENERAL SESSIONS.

TUESDAY, NOVEMBER 11.

3 *p. m.*—The Convention will be called to order. Report of executive committee. Appointment of committee on credentials. Action on program and rules of order Report of treasurer. Reports of chairmen of permanent committees: (1) Committee on agriculture, F. A. Gulley, chairman. (2) Committee on botany, S. M. Tracy, chairman. (3) Committee on chemistry, C. W. Dabney, jr., chairman. (4) Committee on entomology, S. A. Forbes, chairman. (5) Committee on horticulture, W. J. Green, chairman. (6) Committee on college work, G. W. Atherton, chairman. Report of committee on credentials.

5:30 *p. m.*—Adjourn.

7:30 *p. m.*—Address on behalf of the University, Regent S. H. Peabody, LL. D. Address on behalf of the citizens. Response and opening address by the President of the Association, J. H. Smart, LL. D., President of Purdue University, Indiana. Meeting of permanent committees.

WEDNESDAY, NOVEMBER 12.

9 *a. m.*—General session: Introduction and reference of resolutions and new business. "College and station work at the World's Columbian Exposition," A. W. Harris, assistant director of the Office of Experiment Stations.

10 *a. m.*—Meetings of permanent committees. Joint meeting of permanent committees on agriculture and chemistry.

12 *m.*—Adjourn.

2 *p. m.*—General session: Topics from permanent committee on horticulture: (1) "What effect will such legislation as is proposed for the protection of originators have upon experiment stations?" E. S. Goff, Wisconsin. (2) "The work of experiment stations in the reform of vegetable nomenclature," L. H. Bailey, New York. (3) "Methods of work in variety testing," W. J. Green, Ohio.

4 *p. m.*—Miscellaneous business and reports.

5:30 *p. m.*—Adjourn.

7:30 *p. m.*—General session: Discussion: "Should this Association take any action in cases where formal charges of misuse of the United States appropriations are made against any college or station?"

8:30 *p. m.*—Meetings of permanent committees, at which chairmen for the next year will be elected.

THURSDAY, NOVEMBER 13.

9 *a. m.*—General session: 1. Topics from standing committee on college work; "Waste in college work," J. H. Smart, Indiana. "To what extent can manual labor be advantageously employed in industrial colleges?" A. Q. Holladay, North Carolina. 2. Topics from permanent committee on chemistry: "Chemical research at the stations," C. W. Dabney, jr., Tennessee. Digestion experiments: (1) "Recent work abroad," H. P. Armsby, Pennsylvania; (2) "Work in America," W. H. Jordan, Maine.

12 *m.*—Adjourn.

2 *p. m.*—General business session: Reports of permanent committees and action thereon; reports of other committees; election of officers; consideration of resolutions; miscellaneous business.

5:30 *p. m.*—Final adjournment.

This evening is left open for social intercourse or such use as the Association may decide to make of it.

During the evening a train of sleepers will be made up on the Illinois Central Railroad and opened to passengers at 9 o'clock. This train will leave Champaign at 2:20 a. m., and arrive at Chicago early Friday morning. It is provided for those who wish to visit the Fat Stock and Dairy Show.

FRIDAY, NOVEMBER 14.

Permanent committees or subcommittees thereof may meet for consideration of special subjects not requiring reports to the general convention or any action on its part.

MEETINGS OF PERMANENT COMMITTEES OR SECTIONS.*

The following topics for discussion in the meetings of the permanent committees have been furnished by the chairmen of those committees:

PERMANENT COMMITTEE ON AGRICULTURE.

F. A. GULLEY, Arizona, Chairman.

A standard milk test .... G. E. Patrick, Iowa.

Is a digestion experiment fallacious? .... { H. P. Armsby, Pennsylvania. W. H. Jordan, Maine. }

(The above to be discussed in joint meeting of committees on agriculture and chemistry.)

Plat experiments—the ideal and faulty system .... W. C. Latta, Indiana.

Equalizing the irregularities of plats, caused by defective germination .... T. F. Hunt, Illinois.

Pot against field-plat experiments .... { W. W. Cooke, Vermont. C. E. Thorne, Ohio. }

Specific points bearing on feeding experiments .... { W. A. Henry, Wisconsin. H. H. Wing, New York. }

The physics of soil tillage .... J. W. Sanborn, Utah.

Station records .... G. E. Morrow, Illinois.

What does a Lysimeter teach? .... For open discussion.

Testing grasses .... { S. M. Tracy, Mississippi. F. L. Scribner, Tennessee. }

Coöperative field experiments .... C. L. Ingersoll, Colorado.

Testing varieties .... J. F. Hickman, Ohio.

PERMANENT COMMITTEE ON BOTANY.

S. M. TRACY, Mississippi, Chairman.

Opening remarks .... S. M. Tracy, Mississippi.

Arrangement and use of reference books and herbaria .... J. C. Arthur, Indiana.

Herbarium methods .... F. V. Coville, Washington, D. C.

Outlook for cultivation of forage plants in the arid regions .... George Vasey, Washington, D. C.

Seed testing .... Gerald McCarthy, North Carolina.

Notes upon entomogenous fungi .... Roland Thaxter, Connecticut.

Nomenclature of plant diseases .... B. T. Galloway, Washington, D. C.

Methods of work with plant diseases .... T. J. Burrill, Illinois.

New plant diseases .... L. H. Pammel, Iowa.

Copper salts for black rot; fungicide apparatus .... W. B. Alwood, Virginia.

Fungicides .... D. G. Fairchild, Washington, D. C.

Coöperation in bulletins .... W. J. Beal, Michigan.

What should go into the bulletins? .... B. D. Halsted, New Jersey.

* The name Permanent Committee, adopted at the Washington convention, was changed, by amendment to the constitution at the Champaign convention, to Section.

PERMANENT COMMITTEE ON CHEMISTRY.

C. W. DABNEY, jr., Tennessee, Chairman.

Artificial digestion .... Paul Schweitzer, Missouri.
Coöperative field experiments with fertilizers .... W. O. Atwater, Washington, D. C.
Methods for the analysis of milk .... G. E. Patrick, Iowa.
(The above to be discussed in joint meeting of committees on agriculture and chemistry.)
A review of newly proposed apparatus, methods, etc.... E. H. Jenkins, Connecticut.

PERMANENT COMMITTEE ON ENTOMOLOGY.

S. A. FORBES, Illinois, Chairman.

Practical notes upon the use of insecticides .... M. H. Beckwith, Delaware.
A new root rot disease of cotton .... George F. Atkinson, Alabama.
Notes on the more important experiments and observations of the season at the Iowa Experiment Station .... C. P. Gillette, Iowa.
Methods, technical and economic, with the contagious diseases of insects .... S. A. Forbes, Illinois.
On the life history of the white grubs, with descriptions of immature stages .... S. A. Forbes, Illinois.
On the life history of the corn plant-louse, with economic suggestions .... S. A. Forbes, Illinois.
New notes on the life history of the Hessian fly .... John Marten, Illinois.

It is recommended that the organization, equipment, and methods of entomological experiment stations be made a leading subject of general discussion in this section, and delegates are particularly requested to come prepared to report upon their own stations in these respects, and to describe the additions and improvements which their experience has shown to be desirable.

PERMANENT COMMITTEE ON HORTICULTURE.

W. J. GREEN, Ohio, Chairman.

Methods of note taking for fruits ....
Methods of note taking for vegetables ....
Should reports on varieties not disseminated be made public through the medium of station bulletins? ....
Is seed control in any form needed? ....
What important results may be expected from crossing and hybridizing? ....
What classes of plants are most promising for such work? ....
The uses of greenhouses in experimental work ....
Methods of conducting germination tests ....

PROCEEDINGS.

AFTERNOON SESSION, TUESDAY, NOVEMBER 11, 1890.

The convention was called to order at 3:25 p. m., in the physical lecture hall of the University of Illinois, by President Smart.

The following is a list of delegates and visitors in attendance as finally reported by the committee on credentials:

Alabama:

W. L. BROUN, President of the Agricultural and Mechanical College of Alabama.

GEO. F. ATKINSON, Biologist of the Agricultural Experiment Station of the Agricultural and Mechanical College of Alabama.

Arkansas:

C. W. WOODWORTH, Entomologist of the Arkansas Agricultural Experiment Station.

Colorado:

C. L. INGERSOLL, President of the State Agricultural College of Colorado and Director of the Agricultural Experiment Station.

F. J. ANNIS, Treasurer of the Agricultural Experiment Station.

Connecticut:

E. H. JENKINS, Vice-Director of the Connecticut Agricultural Experiment Station.

R. THAXTER, Mycologist of the Connecticut Agricultural Experiment Station.

B. F. KOONS, Principal of the Storrs Agricultural School.

C. D. WOODS, Chemist of the Storrs School Agricultural Experiment Station.

Delaware:

A. N. RAUB, President of the Delaware College.

A. T. NEALE, Director of the Delaware College Agricultural Experiment Station.

M. H. BECKWITH, Horticulturist of the Delaware College Agricultural Experiment Station.

District of Columbia:

E. WILLITS, Assistant Secretary of Agriculture.

W. O. ATWATER, Director of the Office of Experiment Stations.

A. W. HARRIS, Assistant Director of the Office of Experiment Stations.

C. V. RILEY, Entomologist of the U. S. Department of Agriculture.

L. O. HOWARD, Assistant Entomologist of the U. S. Department of Agriculture.

D. G. FAIRCHILD, Assistant Vegetable Pathologist of the U. S. Department of Agriculture.

T. T. LYON, Special Agent of the U. S. Department of Agriculture.

Florida:

F. L. KERN, President of the Florida State Agricultural and Mechanical College.

Georgia:

R. J. REDDING, Director of the Georgia Experiment Station.

J. M. KIMBROUGH, Agriculturist of the Georgia Experiment Station.

Illinois:

S. H. PEABODY, Regent of the University of Illinois.

G. E. MORROW, Agriculturist of the Agricultural Experiment Station of the University of Illinois.

T. J. BURRILL, Botanist of the Agricultural Experiment Station of the University of Illinois.

E. H. FARRINGTON, Assistant Chemist of the Agricultural Experiment Station of the University of Illinois.

T. F. HUNT, Assistant Agriculturist of the Agricultural Experiment Station of the University of Illinois.

G. W. McCLUER, Assistant Horticulturist of the Agricultural Experiment Station of the University of Illinois.

W. L. PILLSBURY, Secretary of the Agricultural Experiment Station of the University of Illinois.

Indiana:

J. H. SMART, President of Purdue University.

C. S. PLUMB, Vice-Director of the Agricultural Experiment Station of Indiana.

J. TROOP, Horticulturist of the Agricultural Experiment Station of Indiana.

F. M. WEBSTER, Entomologist of the Agricultural Experiment Station of Indiana.

D. LOTZ, Assistant Instructor in Chemistry in Purdue University.

J. C. ARTHUR, Botanist of the Agricultural Experiment Station of Indiana.

Iowa:

H. OSBORN, Professor of Zoölogy and Entomology in the Iowa State College of Agriculture and Mechanic Arts.

G. E. PATRICK, Chemist of the Iowa Agricultural Experiment Station.

C. P. GILLETTE, Entomologist of the Iowa Agricultural Experiment Station.

Kansas:

GEO. T. FAIRCHILD, President of the Kansas State Agricultural College and Chairman of the Council of the Kansas Agricultural Experiment Station.

G. H. FAILYER, Chemist of the Kansas Agricultural Experiment Station.

Kentucky:

J. SHACKLEFORD, Vice-President of the Agricultural and Mechanical College of Kentucky.

M. A. SCOVELL, Director of the Kentucky Agricultural Experiment Station.

H. GARMAN, Botanist of the Kentucky Agricultural Experiment Station.

Maine:

M. C. FERNALD, President of the Maine State College of Agriculture and the Mechanic Arts.

F. L. HARVEY, Entomologist of the Maine State College Agricultural Experiment Station.

Maryland:

H. E. ALVORD, President of Maryland Agricultural College and Director of the Maryland Agricultural Experiment Station.

H. J. PATTERSON, Chemist of the Maryland Agricultural Experiment Station.

Massachusetts:

H. H. GOODELL, President of Massachusetts Agricultural College and Director of the Hatch Experiment Station of the Massachusetts Agricultural College.

Michigan:

O. CLUTE, President of the Michigan Agricultural College and Director of the Experiment Station of the Michigan Agricultural College.

A. J. COOK, Entomologist of the Michigan Agricultural Experiment Station.

L. R. TAFT, Horticulturist of the Michigan Agricultural Experiment Station.

Minnesota:

CYRUS NORTHROP, President of the University of Minnesota.

N. W. MCLAIN, Director of the Agricultural Experiment Station of the University of Minnesota.

W. M. HAYS, Assistant in Agriculture in the University of Minnesota and in the Agricultural Experiment Station of the University of Minnesota.

Mississippi:

J. H. CONNELL, Professor of Agriculture in the Mississippi Agricultural and Mechanical College.

S. M. TRACY, Director of the Mississippi Agricultural Experiment Station.

E. R. LLOYD, Agriculturist of the Mississippi Agricultural Experiment Station.

J. H. BURRUS, President of the Alcorn Agricultural and Mechanical College.

Missouri:

E. D. PORTER, Professor of Agriculture in the University of the State of Missouri and Director of the Missouri Agricultural Experiment Station.

Nebraska:

J. S. KINGSLEY, Professor of Agriculture in the University of Nebraska.

C. H. MORRILL, Member of the Board of Regents of the University of Nebraska.

H. H. NICHOLSON, Director of the Agricultural Experiment Station of Nebraska.

L. BRUNER, Entomologist of the Agricultural Experiment Station of Nebraska.

E. W. HUNT, Associate Professor of Rhetoric and Oratory in the University of Nebraska.

New Hampshire:

C. H. PETTEE, Dean of the New Hampshire College of Agriculture and Mechanic Arts.

L. D. STEVENS, President of the Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts.

F. L. MORSE, Chemist of the New Hampshire Agricultural Experiment Station.

A. H. WOOD, Agriculturist of the New Hampshire Agricultural Experiment Station.

J. KIDDER, Member of the Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts.

W. BROWN, Member of the Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts.

S. B. WHITTLEMORE, Member of the Board of Trustees of the New Hampshire College of Agriculture and Mechanic Arts.

New Jersey:

J. NEILSON, Acting Director of the New Jersey Agricultural Experiment Stations.

B. D. HALSTED, Botanist and Horticulturist of the New Jersey Agricultural College Experiment Station.

J. B. SMITH, Entomologist of the New Jersey Agricultural College Experiment Station.

New Mexico:

H. HADLEY, President of the Agricultural College of New Mexico and Director of the Agricultural Experiment Station of New Mexico.

New York:

H. H. WING, Deputy Director of the Cornell University Agricultural Experiment Station.

North Carolina:

W. F. MASSEY, Professor of Agriculture in the North Carolina College of Agriculture and Mechanic Arts and Horticulturist in the North Carolina Agricultural Experiment Station.

North Dakota:

H. E. STOCKBRIDGE, President of the North Dakota Agricultural College and Director of the North Dakota Agricultural Experiment Station.

C. B. WALDRON, Horticulturist of the North Dakota Agricultural Experiment Station.

Ohio:

W. H. SCOTT, President of the Ohio State University.

H. A. WEBER, Professor of Agricultural Chemistry in the Ohio State University.

C. E. THORNE, Director of the Ohio Agricultural Experiment Station.

W. J. GREEN, Horticulturist of the Ohio Agricultural Experiment Station.

C. M. WEED, Entomologist of the Ohio Agricultural Experiment Station.

J. F. HICKMAN, Agriculturist of the Ohio Agricultural Experiment Station.

H. J. DETMERS, Veterinarian of the Ohio Agricultural Experiment Station.

Pennsylvania:

G. W. ATHERTON, President of the Pennsylvania State College.

H. P. ARMSBY, Director of the Pennsylvania State College Agricultural Experiment Station.

W. FREAR, Vice-Director and Chemist of the Pennsylvania State College Agricultural Experiment Station.

G. L. HOLTER, Assistant Chemist of the Pennsylvania State College Agricultural Experiment Station.

Rhode Island:

J. H. WASHBURN, Principal of the Rhode Island State Agricultural School.

C. O. FLAGG, Director of the Rhode Island State Agricultural Experiment Station.

South Dakota:

LUTHER FOSTER, Director of the South Dakota Agricultural Experiment Station.

J. M. ALDRICH, Assistant Entomologist of the South Dakota Agricultural Experiment Station.

Tennessee:

C. W. DABNEY, jr., President of the University of Tennessee and Director of the Tennessee Agricultural Experiment Station.

H. E. SUMMERS, Entomologist of the Tennessee Agricultural Experiment Station.

Texas:

G. W. CURTIS, Professor of Agriculture in the Agricultural and Mechanical College of Texas and Director of the Texas Agricultural Experiment Station.

Utah:

J. W. SANBORN, President of the Agricultural College of Utah and Director of the Agricultural Experiment Station of Utah.

Virginia:

W. D. SAUNDERS, Director of the Virginia Agricultural and Mechanical College Experiment Station.

W. B. ALWOOD, Vice-Director, Botanist, and Entomologist of the Virginia Agricultural and Mechanical College Experiment Station.

West Virginia:

E. M. TURNER, President of the West Virginia University.

J. A. MYERS, Director of the West Virginia Agricultural Experiment Station.

C. F. MILLSPAUGH, Botanist of the West Virginia Agricultural Experiment Station.

Wisconsin:

F. H. KING, Professor of Agricultural Physics in the University of Wisconsin and Physicist of the Wisconsin Agricultural Experiment Station of the University of Wisconsin.

E. S. GOFF, Horticulturist of the Agricultural Experiment Station of the University of Wisconsin.

F. W. WOLL, Assistant Chemist of the Wisconsin Agricultural Experiment Station of the University of Wisconsin.

The report of the executive committee was submitted by Henry E. Alvord, chairman.

REPORT OF THE EXECUTIVE COMMITTEE.

Immediately after the adjournment of the convention of the Association at Washington in November, 1889, the executive committee met and organized by the choice of Henry E. Alvord of Maryland as chairman, and H. P. Armsby of Pennsylvania as secretary and treasurer.

The committee having performed its duty under the constitution up to the opening of the annual convention of 1890, and having made the usual preparations for this meeting, now respectfully presents the following report:

When the last convention adjourned it was thought that this would be a year of comparative inactivity on the part of our organization, although a few matters were proposed as desirable to accomplish, but the year has proved to be one of much activity and some important results. The Association has aided in accomplishing four things worthy of special mention, two for the stations particularly and two for the colleges:

(1) Through proper representations made to the Agricultural Committee of the House of Representatives the annual appropriation under the Hatch act has been so framed as to secure the quarterly payments being made in advance. This is a great relief to most stations, and with a little attention this method of payment can be made permanent.

(2) Negotiations at the Post-Office Department secured an entire revision of the regulations for the free mailing of station reports and bulletins. The new regulations are liberal, and it is to be hoped that the advantages they give will not be abused.

(3) The special committee, appointed by the Washington convention, upon the relations of the colleges with the War Department, completed its labors in February, and the results were shown by the promulgation of a general order and a circular from the War Department, dated February 12 and 13, 1890, and further explained by the report of the committee, published in a circular bearing date of May 22, 1890.

(4) The Association has materially contributed to the early enactment of the law for "the more complete endowment and support" of land grant colleges. The executive committee holds a most gratifying letter from Senator Morrill, expressing his appreciation of the valuable assistance rendered by this Association in promoting the passage of the act of Congress approved August 30, 1890.

The new Morrill act had such inherent merits that it would probably have become a law in the course of time if left to pursue the usual routine of unaided legislation. It is safe to assert, however, that this measure is now operative law, and the colleges generally are now in receipt of the new income because this Association exists and because of its action during the last six months. This fact is recognized by the venerable author of the college acts of 1862 and 1890, and it has been characteristically acknowledged by the distinguished speaker of the Fifty-First Congress.

This new legislation was neither asked nor suggested by this Association and but few of its representatives knew that the author proposed to introduce the measure. But when the bill had been introduced, and Senator Morrill, in response to an inquiry, expressed a wish to have it well supported, the executive committee was called together at Washington in April, and then commenced the active operations with which all interested are more or less familiar and which have constituted the main work of the Association for the present year.

The executive committee has endeavored to keep the institutions specially concerned in this legislation informed of its progress and of the situation of affairs by the distribution of circular letters. Thirteen such circulars have been issued during the year. The one dated August 30, 1890, is here inserted as a summary record of the proceedings in Congress.

OFFICE OF THE EXECUTIVE COMMITTEE,
Agricultural College, Md., August 30, 1890.

"The new Morrill bill, for the more complete endowment and support of colleges for the benefit of agriculture and the mechanic arts, has now become a law.

"This bill was introduced by Senator Morrill on March 25, 1890; was rewritten and again introduced April 30, and referred as S. 3714; on May 17 it was favorably reported, with amendments, from the Committee on Education and Labor, accompanied by Senator Blair's report, No. 1028. After being discussed at length on three different days and considerably amended the bill passed the Senate June 23 by a practically unanimous vote. June 24 the bill was read in the House of Representatives and referred to the Committee on Education; from this committee it was favorably reported to the House, without amendment, on July 12, by Mr. McComas of Maryland, accompanied by a report, No. 2697. On the 19th of August, under a special order adopted by the House, the bill was considered and passed, without a roll call, by a vote of 135 to 39. One amendment, generally agreed upon and made known in advance, was adopted by the House, and in this the Senate concurred on the 20th instant. The act was approved by the President to-day, August 30, 1890.

"Arrangements have been made for obtaining several hundred copies of the act as printed by the Department of State, and a number will soon be mailed to every institution concerned.

"A certified copy of the act will be furnished at once by the Department of State to the Treasury Department. The officers of the latter will then examine the law and make rulings as to the first payments under it.

"Another circular from this committee may soon be expected, giving the rulings made and describing all papers which should be sent to Washington by governors and State treasurers or other persons, to facilitate payments under the law.

"It is advised that, until the next circular is received by those to whom this is sent, all correspondence with or applications to the Government officials at Washington should be suspended. Confusion, delays, and unfavorable complications, liable to result from disconnected and dissimilar efforts, may thus be avoided. This suggestion may well be made to your board of trustees, and perhaps to the governor of your State."

The substance of the bill introduced by Senator Morrill on the 30th of April became a law on the 30th of August. This is considered as pretty quick work for so important a measure. Yet it required two months more of constant watching and assisting in the removal of obstructions to get the law fairly into operation.

The executive committee, and especially its subcommittee appointed at the April meeting in Washington, have felt the responsibility resting upon them during the past six months, and have labored earnestly to favor the interests of every institution entitled to membership in this Association. Incident to the work which has been done, it became necessary for the committee to appeal for aid to our representatives and friends in every State. With few exceptions, the responses were prompt and gratifying. Gentlemen went to Washington from Maine and Florida, Kansas and Dakota, and from numerous States between these limits to help on the good work. One made journeys of 1,000 miles each five times during the season. Another visited Washington eight times, occupying at least three days on each trip. Several practically surrendered their summer vacation and held themselves in readiness to respond to the call of the committee for work either at Washington or in their respective States. Among the most active and effective workers were some who were unable to leave their homes. Nearly every college represented in this convention can claim a fair share in the labors which have resulted so well. The strength of our organization and its power for usefulness, when needed, have been once more demonstrated. The part which this Association has performed in securing the new Morrill act is just cause for pride and congratulation, although we can as yet form but a faint conception of the far-reaching effects of this act of August 30, 1890, upon industrial education and development in America.

A year ago the Association was congratulated upon being out of debt and the probability of getting along for a year or two with very small contributions to its treasury, but the unexpected work of the year has involved large necessary expenditures. A special request for $25 from each State was sent to the colleges [only] in June, and although this has been generally paid, as well as the contribution voted at the Washington convention, our treasury is now almost empty, while several hundred dollars are due upon accounts which ought to be promptly paid. Acting for the Association, in its name and for the good of all, the executive committee could do no less than promise to defray the necessary traveling and hotel expenses of those gentlemen who responded to the call for time and labor spent in visiting Washington and making other journeys incident to the work. The committee now appeals to the Association to make good these promises, and provide the means for settling the individual expense accounts still unpaid. The committee also considered it proper to relieve the Department of Agriculture from a part of the cost of a stenographic report of the proceedings of this convention

The report of the treasurer will show in detail that the receipts for the year have been $1,619.03 and the disbursements $1,472.51, leaving a balance on hand of $146.52. It is estimated that the unsettled accounts amount to about $1,000. This convention should therefore provide, before its adjournment, for raising $1,200 to $1,500 for the general wants of the Association during the next year. The committee recommends that each college be called upon to contribute $25 and each experiment station $10, as early as possible in the year 1891. Strangely enough, some of the colleges and stations which have received like benefits with the rest from the existence and work of this Association, do not seem inclined to participate in its conventions or feel any obligation to share in its proper expenses. Thus far the Association in all its operations has assumed that every institution eligible to membership under its constitution should be treated as an equal partner, although a silent one. But in view of this continued and unexplained silence in some cases, it is thought that this convention should consider what action, if any, should be taken in regard to future conditions of membership.

The committee repeats its belief, expressed in the report to the Washington convention, that in many ways not yet developed in detail the simple machinery of this Association, aided by the U. S. Department of Agriculture through the Office of Experiment Stations, may be made of direct practical use and economical value to the colleges and experiment stations in this country.

For the reasons stated last year, it has been found impracticable to secure concessions by the railroads to delegates attending this convention. It is understood, however, that the American Association for the Advancement of Science and several other organizations will meet in Washington next August It has been proposed that an effort should be made to have the annual meetings of all the various organizations which are usually attended by those likely to be delegates in our Association, held in Washington the same month in 1891. It is believed that a longer time in attendance, even if it should be prolonged for two or three weeks, will be fully compensated by saving time and expense in journeys to different places in different months. If this plan be adopted, arrangements can unquestionably be made which will secure very advantageous railroad rates and an attendance at our next convention beyond all precedence. It is recommended that this matter be considered at the present convention, and that some expression be given as a guide to the new executive committee.

The committee formally submits to the convention the program prepared for this meeting and asks its confirmation, subject to such modifications as may prove expedient. It is recommended that the rules of order which have governed the proceedings of the Association for two years be continued.

Very respectfully submitted, for the executive committee,

HENRY E. ALVORD,
Chairman.

On motion of Mr. Armsby the report was accepted as read, and on motion of Mr. Fairchild the program recommended was adopted, subject to modification. Mr. Sanborn moved the appointment of a committee of three to take into consideration other recommendations of the executive committee. The motion was adopted and the president appointed Messrs. Sanborn (chairman), Fairchild of Kansas, and Plumb.

The Secretary and Treasurer, Mr. Armsby of Pennsylvania, submitted his report, as follows:

REPORT OF TREASURER.

H. P. Armsby, Treasurer, in account with the Association of American Agricultural Colleges and Experiment Stations.

DR.

To amount received from former Treasurer	$189.03
To cash received on account of call for 1889	75.00
To cash received on account of call for 1890	680.00
To cash received on account of special call of executive committee	675.00
	1,619.03

CR.

By bills paid on order of chairman of executive committee, as per vouchers on file	1,472.51
By cash on hand	146.52
	1,619.03

Mr. Ingersoll moved the appointment of a committee to audit the Treasurer's accounts. The motion was carried, and the President appointed Messrs. Ingersoll, Redding, and Flagg.

The President then called upon the chairmen of the permanent committees for the reports provided for in the constitution.

In the absence of Mr. Gulley, chairman of the committee on agriculture, and of Mr. Tracy, chairman of the committee on botany, the reports of these committees were postponed, and Mr. C. W. Dabney, jr., chairman of the committee on chemistry, was called upon for his report. He spoke as follows:

REPORT OF THE PERMANENT COMMITTEE ON CHEMISTRY.

In accordance with the article of the constitution which requires the chairman of each permanent committee to present at the first general session of the convention a report of progress in his subject during the year, I have the honor to submit the following report for the committee on chemistry:

Although, in accordance with this provision, this report might have much larger scope and include everything connected with the recent progress in agricultural chemistry, it is thought best, as our stations are (a majority of them) comparatively new, that this report should confine itself to the present condition and work of the chemical divisions of the stations in the United States. Hatch experiment stations have been established in forty-five States, and with one or two exceptions, chemical work has been in progress in all of them for over eighteen months.

Although it would be much more agreeable to the present writer, and doubtless also to this honorable assemblage, to devote this report to a discussion of the more notable and important discoveries in agricultural chemistry recently made, it seems our duty at this particular time to devote our attention to the more difficult and perhaps less agreeable and flattering labor of reviewing, in as much detail as possible, the work actually accomplished by our American stations. As this report is limited to a few minutes, we will only be able to take a bird's-eye view of the field of work.

As a basis for this report, we have prepared from the annual reports and bulletins and the Experiment Station Record, a series of tables covering the chief points about the condition and work of the stations. The main object of our investigation has been to ascertain exactly what the facilities and prospects are for original research in agricultural chemistry. According to the act, these stations are "to promote scientific investigation and experiment respecting the principles and applications of agricultural science," and it is "the object and duty of said experiment stations to conduct original researches." The majority of the investigations named in the original Hatch act lie, for a part at least, in the domain of chemistry. Research was then the chief end and object in the establishment of these chemical laboratories.

It is almost too early yet to expect to see a great amount of profound research completed, discussed, and published, but it is not too early to investigate the condition of the stations as to men and outfit, and in their other relations which favor or hinder chemical research.

The first requirement for chemical research is the specially trained, skillful, and devoted chemist; the next requirement is a good working laboratory. Given these, we must see to it next that the chemist is not loaded down with distracting duties and has not his time and energy entirely consumed with routine work. In compiling a list of chemists, therefore, we have paid especial attention to their other positions and duties, and have endeavored to find out how much real opportunity they have had for doing systematic original work. I have omitted from the list all of the directors and other officials, who, though professional chemists, appeared to have their time entirely taken up with administrative work.

The operative chemists of the stations may be classified as follows, according to the positions they hold and the different functions they have undertaken to perform:

Of the forty-four *chief chemists* only eight are free from college or other station duties; three have one other station office, such as director or vice-director; one is station chemist and State chemist for the fertilizer control; three are directors, station chemists, and State chemists—all at the same time; fifteen hold a full position, such as the professorship of chemistry in the college, in addition; two are station chemists, professors of chemistry, and State chemists; nine are professors in two subjects in the college in addition to being station chemists; one is professor of chemistry, director, and chemist all at once; one is vice-director, chemist, and professor; and a last poor fellow is chemist, professor of chemistry, botanist, and professor of botany, etc., and here, at four different positions, I quit counting. There are two special chemists on the station staffs who are also full professors of chemistry in their colleges.

Next come the men who are doing the practical work, the assistant chemists. There are forty-three of these, who give all of their time apparently to station work, at least they have no college or other station work charged to them. One station has five, one has four, four have three, and two have two assistant chemists, each for all their time. Eight assistant chemists are assistant professors in the colleges, and one poor unfortunate is assistant director, assistant professor of agriculture, assistant chemist, and assistant something else, all at once.

This completes the list of chemists connected with the stations—forty-four chief chemists, fifty-two assistant chemists, and two special chemists in the forty-five stations reported, a total of ninety-eight chemists, and an average of nearly two and one fifth for each station; but there are only fifty-four chiefs and assistants who give the stations all of their time.

We have no means of ascertaining the special qualifications and training of these men. They are well furnished with degrees and loaded down with honors and offices, which must, I fear, consume all of their energies. But we will not be hasty in judging of this; "by their fruits ye shall know them," and their fruits are here.

The station laboratories.—But before taking up their fruits, there is another thing necessary for research—a well-furnished laboratory. We have endeavored to ascertain from the annual reports or college catalogues the condition of the station laboratories, and especially their relation to the college chemical laboratories. We have tried in each case to learn whether the chemical division had a separate building, a separate laboratory in the station building or one of the college buildings, separate rooms in the college chemical building or only an indefinite tenure to a portion of it. The information is not complete, but such as it is it is very significant and interesting.

The Massachusetts State Station has a separate building devoted almost exclusively to the chemical work of the station, and another laboratory building for botany and biology. The Connecticut State Station has a separate building devoted almost entirely to its chemical laboratories. California, Delaware, Indiana, Iowa, Kentucky, Louisiana Sugar, Maine, Maryland, Minnesota, New Hampshire, New Jersey, New York State, Pennsylvania, Tennessee, Vermont, and West Virginia Stations, all have good, some very handsome, separate station buildings containing the chemical and other laboratories and offices. The elegant new laboratory building of the New Jersey State Station merits especial mention as a model of its kind. From these fine outfits there are all grades of laboratories down to a "small basement room in the college building," which is reported by a new Western station. Thirteen stations are accommodated in an indefinite manner, perhaps very well, in the college laboratory; five have ample, well-equipped separate apartments in the college building. North Carolina has an extensive, well-equipped laboratory in the state board of agriculture building. The Connecticut Storrs Station has its laboratory at the Wesleyan University, at Middletown. On the whole, we think the stations are quite well equipped with buildings for chemical work.

Chemical work of the stations.—We endeavored to state, in the fewest words possible, in the table upon which this report is based, the subjects of the published chemical work of the stations from January, 1889, up to July, 1890. It includes the work contained in the annual reports for 1889, and in the Experiment Station Record as far as issued. We did not attempt to give all of the titles of the bulletins or papers published, but merely, in the most general terms, the subjects which have engaged the attention of the station chemist during this time, as exhibited by his published work. This work has been classified under three heads:

In one column we placed the work which may be considered as purely routine or ephemeral, such as the work on artificial fertilizers, manufactured or mixed feeding stuffs and other manufactured articles used in agriculture.

The second column is headed "Contributions to agricultural-chemical data," and includes all analyses of natural products or products of uniform character, such as analyses of soils, natural fertilizers, plants and parts of plants, fodders and grasses, ashes of plants, etc., and anything that might be included in any of our tables of chemical composition.

In the third column we have placed everything which could in any just sense be considered as belonging to systematic research. This portion of the table is doubtless very imperfect, as it is impossible in many cases to judge whether a certain piece of work should go in one of these last two columns or in the other; but the classification has been made in a liberal spirit, and with an earnest purpose to ascertain the general condition of the work of the stations. While we may not do full justice to individual stations, we believe the results as presented in the tables are of use for the purpose here intended.

Fertilizer work.—As fertilizer analysis forms such a large portion of the routine work of many of the stations, we have paid special attention to this, and give it two separate columns.

A circular letter was sent out to the directors of each station, containing the following questions:

(1) Please send me a copy of your State laws controlling the sale of fertilizers. What connection, if any, has your station with this control of fertilizers?

(2) What proportion of the annual appropriotion from the Government is used, directly or indirectly, in the control of commercial fertilizers? What aid do you receive from the State or from any other source for this special work?

The answers to these questions were compiled under two corresponding heads.

The result of this investigation may be summarized, as follows:

Five stations, Connecticut, Kentucky, Maine, New York State, and Vermont, exercise the entire fertilizer control—inspecting the fertilizers, making the analyses and publishing them. They are all well paid for their trouble by analysis fees or license taxes collected of the dealers in fertilizers. Maine is an exception which receives no tax money or appropriation from the State for this purpose. Five other stations, Arkansas, Alabama, Louisiana State, North Carolina, and Pennsylvania, make the analyses upon which the control is based. They all receive adequate compensation for their work, it appears, so that no Hatch funds are used for this purpose. In fact the fertilizer controls seem to pay the State boards of agriculture or the stations, as the case may be, quite handsomely. This appears to be a tariff, not so much for "protection" of the farmers as for "revenue" for the boards of agriculture and the stations. In the States of North Carolina, South Carolina, Georgia, Alabama, and some others the fertilizer control has produced large funds, which have been used for many other purposes besides the necessary expenses of the control itself. In seven cases, Georgia, Indiana, Mississippi, Michigan, New Jersey, South Carolina, and West Virginia, the station chemist or director is the State chemist at the same time, though there is no other connection between the fertilizer control and the station. In most instances the stations publish the analyses for the control. Nine States have fertilizer controls entirely independent of the stations and disconnected from them. Delaware, Florida, Illinois, and Rhode Island have separate fertilizer chemists; Maryland, New Hampshire, and Ohio have the fertilizer analyses made by the college professor of chemistry; Massachusetts has a fertilizer control by its State Station; fifteen States, all Western or Southwestern, have no fertilizer control at all.

It does not appear from our investigation of this subject that the business of analyzing fertilizers interferes directly with the legitimate chemical work of the stations. Some of our very best stations—those doing the highest class of chemical work—have entire charge of the fertilizer control. We think they are less fortunate where the station chemist holds the independent position of State chemist and the station has no control of the matter, and we consider those stations most fortunate that have nothing whatever to do with the fertilizer control. This inspection or analysis is no more the duty of a Hatch experiment station than the inspection of coal oils, or flour, or any other commercial product sold in the States and requiring State supervision; and the State has no more right to use a portion of the Hatch fund to make analyses for their State control than it would have to take these funds to pay for testing any of these other articles of trade. This is a point which appears to be zealously guarded by the management of the stations, with perhaps a single exception.

Classification of published work.—We now come to the most difficult and the most unsatisfactory part of our report. It has been difficult, in the first place, in a hasty reading of the reports and bulletins of the stations, to fairly state the subjects and justly weigh the results of the work published. When this was done, however, as best it could be, and the data were inserted in the tables described, we found that we had a very interesting summary of the situation as regards the chemical work of the stations. The summary there presented is incomplete, no doubt. It probably does not do individual stations full justice, and may give undue prominence to results published by others; but, taken as a whole, we believe that its general teachings are worth considering.

Let us first see how the stations stand in the columns headed, respectively, (1) "Purely or routine ephemeral work," (2) "Contributions to agricultural chemical data," and (3) "Research."

Nearly all of the stations have something, of course, in the column of routine work, and this is no discredit to them, provided there is enough in the other columns. A few of the new stations and some of the branch stations publish no chemical work at all, and we omit them altogether from our account. It is to the credit of the California, Connecticut Storrs, Delaware, Illinois, Missouri, and Wisconsin Stations that they publish nothing which is classed by us as purely routine. The routine work done by the other stations consists of analyses of fertilizers, fertilizing materials, agricultural chemicals, special manures, home-mixed manures, manufactured feeding stuffs and feeding mixtures, minerals, mineral and drinking waters, etc., many of these being made probably for the accommodation of friends. Twenty-three stations appear, we are sorry to say, to have bestowed a considerable amount of time and labor upon work of this sort, varying from a few week to several months in the year. While it is doubtless true that newly established stations must inevitably do a considerable amount of this sort of work as a means of interesting the people and attracting their attention, we must believe that many of them are being sadly imposed upon, and that a few are allowing their attention to be too much absorbed by this work. The older a station gets the less it should have to do in this way.

As might be supposed, the great bulk of the chemical work of the station falls in the second column headed, "Contributions to agricultural chemical data." Leaving the new stations and the branch stations out of consideration, again, all except four have something in this column, and if we omit the Massachusetts Hatch Station, which has its chemical work done by the State Station, there are only three which fail to put in an appearance in this column. It is interesting to note in a general way the kind of work that the stations are doing.

Soil investigations, upon a larger or smaller scale, have been carried on in Alabama, California, Indiana, Maryland, Nebraska, South Carolina, Tennessee, and Texas. Nearly all of the stations have been making analyses of feeding stuffs, fodders, grasses, and hay. Connecticut publishes "An attempt to establish a method of valuing feeding stuffs," and there has been considerable work of permanent value done in this line in many other States. A number of the stations have been making chemical studies of agricultural plants. The work of the Missouri Station on Indian corn is the most noteworthy under this head. Nine or ten stations have been making analyses of milk and dairy products and studying the methods of determining butter fat in milk. The Wisconsin Station has, as we all know, done the most notable work under this head, and a number of other stations have made valuable contributions to our knowledge. California, Florida, Maryland, and Tennessee have been studying their marls, gypsums, and other natural fertilizers. Georgia publishes a series of analyses of ashes of woods, and Massachusetts, of the ashes of fruits and vegetables. Five stations have been investigating Indian corn as a fodder and silage plant. The Iowa, Missouri, New Jersey, and Kansas Stations have been working on sorghum.

Among the more interesting special topics which fall in this column may be mentioned, investigations on the cow-pea by the Alabama, Georgia, and Connecticut Storrs Stations; of cotton-seed hulls and meal as food for stock, by the Tennessee, Texas, and Arkansas stations; of sugar-beets by the California, Colorado, Indiana, Iowa, Michigan, and Nebraska Stations. The California and Colorado Stations have been studying irrigation waters; the same stations and the Texas Station have made analyses of alkali soils; the New Jersey, New York State, and Colorado Stations have done especially notable work on alfalfa. Colorado has made analyses of tobacco.

Eight or ten stations have made notable contributions by way of laboratory methods or apparatus. Perhaps the thing we are all going to like the best is Dr. Babcock's new method for the determination of fat in milk. The New York Cornell Station gives us apparatus for drying in hydrogen and for the extraction of fats, and publishes a paper on Cochran's method of determining fat in milk and the variations as to fat in milk. The Maryland, New York State, South Carolina, and Texas Stations publish papers on the determination of moisture in air-dried feeding stuffs. The Pennsylvania Station publishes work along the same line, and the Connecticut State Station publishes some investigations on the determination of fat in feeding stuffs and on determining phosphoric acid by the citrate method. The Colorado Station has studied Professor Sachse's method for the determination of starch in potatoes, etc. Many of these subjects belong to the "research" column and are so located in the tables. We have enumerated them here because they belong with these studies of methods and apparatus.

Out of the forty well-established stations there are eighteen which publish work that comes under the head of "research." Being aware that our work is not complete and wishing to avoid invidious comparisons, we will not enumerate here those who do or do not appear in this column, but will content ourselves with mentioning some illustrations of the kind of work which we would especially commend. The California Station has a unique field of work, and one which it promises to occupy admirably. Its investigations of the soils of the regions represented by its branch station, of alkali soils, waters of irrigation, etc., are excellent. The Connecticut Storrs Station publishes a valuable paper on atmospheric nitrogen as plant food; its studies of the effects of nitrogenous fertilizers upon the production of crops and of different fertilizers upon the chemical composition of corn are of more than transitory interest. The Illinois Station has made a chemical investigation of silage, and the Kansas Station has been studying the composition of corn at different stages of growth. The Maine Station publishes many valuable results of feeding experiments with different feeding stuffs—hay, fodders, and silage—for milk and for growth. The Massachusetts State Station also publishes results of feeding experiments with cows and pigs. The New Jersey Station has given us a complete study of alfalfa, its composition and digestibility; and the New York State Station covers a good deal of the same ground in an excellent manner. The Pennsylvania Station studied the digestibility of corn fodder and silage in an exhaustive fashion. The work of the Wisconsin Station on fibrin in milk, on the general constitution of milk, and the conditions effecting the separation of cream well deserve to be classed under "research." This station publishes also many interesting digestion experiments with corn silage and fodder corn. The study of the life history of corn at different stages of growth, which has been published by the Missouri Station, is a fine specimen of this kind of work.

This quite incomplete list of some of the better pieces of work done at the chemical laboratories of our stations should give us great encouragement. A careful review of the publications of the stations will doubtless discover many other investigations having the right object. When we consider that almost all of the old ash analyses of American crops need to be made over again, owing to the imperfection of the methods and apparatus used at the time, we are surprised that only a few of the stations are making these analyses.

Altogether, we are impressed with the immense amount of chemical work that is being done at our American experiment stations; but when we sift out the small amount of original investigation which this mass contains we must acknowledge some discouragement. The chief object of these stations is, as stated at the opening of this paper, "to promote scientific investigation and experiment respecting the principles and applications of agricultural science." The chemical laboratory is the chief place for making such investigations.

Our leading object in this paper having been to give honestly the situation with regard to chemical investigation at the stations, we shall endeavor as honestly to state our conclusions with regard to the whole matter.

(1) We believe that our boards of control or directors are, many of them, too anxious to obtain immediate favor with the public, and are, by trying to show the farmer how he can make his business pay a little better, pandering for popular support to a very base motive. This is a natural mistake for the newly established station to fall into. The desire to make the ordinary farmer feel our importance and to make a good show at first, is leading many to build their stations without any solid foundation whatever in good work. What good does all this analyzing of fertilizers, feeding stuffs, and fodders do the science of agriculture? They may help the farmer of to-day to save a few dollars, or to make a few more pounds of beef or butter, but until we know more about the function of the different fertilizing elements in a plant, and of the value to the animal of the various compounds in them, we shall make little or no real progress with our science. We must teach our farmers that a system of practical agriculture can only be established upon the facts of chemistry, botany, etc., as a foundation, and that underlying all of our wonderful recent progress in agricultural methods are the long and tedious investigations, like those of Liebig and Hellriegel, in pure science. If we are in poor favor in our States let us try the charm of good work and taking time to do thoroughly what we undertake to do, and the public will be certain to appreciate it.

(2) As a result, we fear that only a minority of the station chemists possess the motive and the training to enter upon original work. Many, we believe, need only to be shown their duty and how to perform it. They are zealous but inexperienced. This difficulty will be most rapidly removed by training new men in the colleges and universities to enter this field and by giving the men who are already in the stations a little more time in which to gain the practical experience they need.

(3) Many station chemists who have the motive and the training are overloaded with other work, and have, when these routine duties are done, no strength or time left for investigation. The remedy for this state of things is plain. Every station should certainly be able to afford one well-trained chemist who could devote his whole time to its work.

In conclusion, let me read from a letter which I take the liberty to use, although I have not consulted the gentleman to whom it was addressed, Professor Sachse, of Missouri:

Much Esteemed Colleague: Your letter, with description of the existing condition of the American experiment stations, has interested me much; it shows them to be in about the same position that the German stations are in, or at least were in, for the belief in experiment stations as institutions intended to furnish the questioning farmer in every case with a receipt for the relief of his troubles, had to be fought here also. This view, however, is certainly one of error, for to give practical receipts is probably easier in every line of human activity than in acriculture, with its infinitely diverse conditions, and to follow blindly a given rule is almost certain to lead to disaster. I hold the opinion, therefore, that experiment stations should study the general conditions of the growth of plants and their relation to soil and atmosphere, including the conditions of the soil itself; and to strive to enable the farmer by instruction, somewhat like the lecture delivered before our own agricultural societies, to draw from general results the special conclusions applicable to his necessities.

You see I fully agree with your statement made in italics on page 28 of your ninth bulletin, viz: "that it is illusory for farmers to expect from any source such specific directions for the conduct of their business as to render the higher manifestations of intelligence on their part unnecessary." To be sure the benefits from really scientific work are not always plainly and immediately visible, but they are for that reason all the more certain and lasting; take, for example, R. Arendt's investigations on the growth of the oat plant, undertaken some 20 years ago, the value of which is perhaps only now recognized, when we refer certain phenomena in fertilization to the process of assimilation; or the works of Liebscher, in the *Journal für Landwirthschaft*, 35 Bd., 1887, page 335, who discusses these relations clearly, though not yet resting upon complete and satisfactory fundamental principles. So I might instance the work of Hellriegel and Wilfarth on the formation of root tubercles, with the splendid results following. And I should certainly not know where such important questions as to whether, when, and how fertilization by ammonia or nitrates can be solved to a better advantage than by the studying on the one hand the processes involved in the formation of albuminoids within the plant, and on the other, the relation of ammonia and nitric acid to soil, nitrification, etc.

I believe now, esteemed colleague, that your work has given quite handsome results in this very direction, and will certainly give more should circumstances permit you to continue it in the manner in which you began, and towards which I should be glad to have these lines contribute.

On motion of Mr. Atherton, it was ordered that the text of Mr. Dabney's report and reports from other permanent committees be incorporated in the proceedings, and that Mr. Dabney be requested to afford station directors opportunity to correct and complete the tables accompanying the report from the committee on chemistry, and that these tables then be published privately for distribution among colleges and stations only.

Mr. Forbes, chairman of the committee on entomology, was then called upon for his report. After stating that the report had been collected largely through circulars and letters addressed to agricultural colleges and experiment stations, that he had received replies from 43 stations, and had attempted to embrace in his report everything done since the last convention of the Association, he read as follows:

REPORT OF PROGRESS IN ECONOMIC ENTOMOLOGY.

Economic entomology is not a single, simple science, but its matter and its methods are drawn in part from each of several sciences. The really accomplished economic entomologist must be familiarly acquainted with the common insect species of his region, with their life histories and their relations to nature; he must have the training and facilities—the library, collections, and apparatus—and the ability to use these with expert skill, sufficient to enable him to learn rapidly and accurately whatever is known concerning any species having or likely to have economic relations, direct or indirect, immediate or remote; he must have the skill and mental methods of a practiced experimenter; he must be able to generalize correctly a mass of heterogeneous data, to sift and weigh evidence, to form hypotheses and to verify them, to state tersely and clearly, and to reason closely. He must have a certain store of chemical knowledge to draw upon for insecticide experiments, of methodical ingenuity for the invention and construction of apparatus, and a very considerable knowledge of the agricultural and horticultural practice to enable him to suggest and test methods of field and farm management against the insect enemies of the farm and garden. He should be enough of a botanist to recognize or determine plants—both phenogamic and cryptogamic—and should have a familiar practical acquaintance with the methods of biological microscopy, without which the critical study of many important parts of his subject will be impossible to him. I need hardly say that he must be an excellent observer and a fair draftsman and that he must be enamored of his work.

It is not remarkable that with such a bill of particulars to satisfy even approximately, several of our experiment stations remain without entomological assistants, especially if we take into account the fact that most of them also require of their entomologists work in one or more other fields, perhaps not less difficult and extensive. Neither is it remarkable that the entomological work of the stations has made a quiet beginning, and that the main effort has been expended thus far on the simpler and less difficult subjects.

There are now forty-three States which have agricultural experiment stations established under the Hatch act, and entomological work is regularly provided for in thirty-one of these, leaving twelve with no such present provision. Only three of the former number, Arkansas, Iowa, and West Virginia, have assistants charged with no other duties than those of station entomologist, and in one of these, West Virginia, the entomologist is described as a "special agent." Two of the station workers serve also as assistants to the Division of Entomology in the U. S. Department of Agriculture, one is styled the zoölogist of his station, eight are entomologists and botanists, two are called biologists (their departments being essentially those of entomology and botany combined), and five add horticulture to their entomology. In two stations where no entomologist is employed, entomological questions are referred to the horticulturist or the agriculturist; in two the botanist is responsible for the indispensable entomology; and in one the horticulturist. Nineteen of the station entomologists also teach in their land grant colleges, thirteen of them entomology only, one entomology and agricultural chemistry, one entomology and zoölogy, one entomology and invertebrate zoölogy, two entomology, zoölogy, and physiology, four entomology and horticulture, one entomology and botany, one botany only, and one general natural history.

There have been published in the station bulletins and reports since our last meeting 813 pages of entomological matter, if we include under this head reports of field experiments with insecticides. During this period 8 new native enemies to agriculture have been reported by station workers. Two of them are wheat insects (a leather jacket or tipulid larva from Indiana and a frit fly from Kentucky), 2 infest beans in Kansas, 1 is a cranberry scale insect detected in New Jersey, 1 a new peach plant-louse from Virginia, 1 a box-elder gall-fly (a new species from Iowa), and a rhubarb borer (a snout beetle) in Ohio.

Besides these contributions from experiment station workers, I may mention a new homopterous insect, Delphax, found injurious to corn in Florida; two burrowing web worms infesting corn and grass in Illinois; a snout beetle (*Sphenophorus*) destroying corn planted on swamp sod in Illinois and Indiana; a new plum borer (*Euzophera*), a very injurious species—from Illinois, and a new cut-worm (*Agrotis morrisoniana*)—also extremely destructive—from the same State; a tulip-tree gall-fly in Massachusetts and the District of Columbia; a new enemy of the strawberry—a flea beetle—reported by Dr. Riley; a cranberry caterpillar from Wisconsin; and a caterpillar seriously injuring the rye by feeding on the heads, in Maryland, the last two also being first mentioned in the last Report of the U. S. Department of Agriculture.

In addition to these native species, new and old, which have been first reported during the year as enemies to agriculture, three injurious European insects have been published by station entomologists as new or recent arrivals upon our territory, whose presence has been made manifest here by damage to plants of economic value. Perhaps the most important of these is a wheat saw-fly, described in November, 1889, by Professor Comstock, in New York, and the same observer has discovered a hitherto unnoticed European hot-house scale insect. The gypsy moth, first reported in destructive numbers by Professor Fernald, of the Massachusetts Hatch Station, is another very injurious species from Europe, affecting a large variety of fruit and forest trees and flowering and garden plants. This, however, was first noticed in July of last year in a New England agricultural journal.

Here may also be mentioned three other newly imported insects not detected by station workers: a rose saw-fly, discovered in the Arnold Arboretum at Cambridge; the Mediterranean flour moth, a mill and granary insect of the first class, now approaching our territory by way of Canada; and a new spinach beetle, observed by Miss Murtfeldt, in Missouri.

At least equally important with these new or newly observed insect species are new contributions to the life histories of the better-known enemies of agriculture. A very elaborate and important study of this sort has been made by Harvey, of Maine, on the apple maggot. Others deserving of special mention are that by Comstock, on the wire-worms; by Smith, of the New Jersey College Station, on the horn fly; by Gillette, of Iowa, on the time of oviposition of the cut-worms; by Weed, of Ohio, on the life histories of many species of plant-lice and on the borers of herbaceous plants. Webster, of Indiana, has also done some important new work on the so-called bill bugs, species of the genus *Sphenophorus*; and Comstock is engaged in an elaborate investigation of the hop louse in New York. Investigations of the insect enemies of the yellow locust and of the spruce in West Virginia have been made by Mr. Hopkins, the special agent there.

Outside the stations, valuable observations have been made by Osborn, of Iowa, on the life history of the grass-root louse, and here in Illinois on the life histories and early stages of white grubs, wire-worms, corn bill bugs, corn plant-louse, Hessian fly, several cut-worms, and a considerable variety of gall gnats. How much this kind of work is needed for even the oldest and best-known insects of the farm is shown by the fact that our Illinois investigations of the past year have amended in very important particulars the current account of the life history of the white grubs and have added a new generation to the biography of the Hessian fly.

An account of the progress of experiment station work in entomology would be very incomplete without special mention of a class of papers which contain, it is true, little or no new matter, but which, nevertheless, present the results of considerable expert work in a form which makes them very useful to the practical farmer and horticulturist, and to economic entomologists as well. These are general systematic summaries—monographs, we might almost call them—of existing knowledge of the insect enemies of certain crops or of previously published literature on specific economic subjects. A special bulletin on "Cranberry insects," published by the New Jersey Stations; one on "Insects affecting forest plantations in the West," from the Nebraska Station; articles on "Insects attacking willows and poplars" and on "The caterpillars of the oak," by Lugger, of Minnesota; and one on "Insects injurious to the American elm," by Perkins, of Vermont, are important examples of this class of contributions. Bruner, of Nebraska, reports that he is now engaged on a similar monographic treatise on the insects of the sugar-beet, and Riley has in hand some exhaustive reports on the insect enemies of live stock and on those of grain and grasses. A summary of observations, new and old, on the corn bill bugs, published in the last report of the Illinois office; an elaborate bibliography of the literature of the chinch-bug (in the same); and the bibliographical volume issued from the office of the United States Entomologist, on his own writings and those of Mr. Walsh, are the principal contributions of this class made outside the field of station work.

To this record of strictly entomological investigation we have to add a greater volume of new results of economic experiments. These are all, so far as I have seen, to be included under the head of experiments with insecticide measures and materials, either chemical or biological. I shall have something to say presently concerning the narrow range of this experimental work, but confine myself at present to a report of the facts.

A good deal of attention has been given this year, as last, to field experiments with arsenical poisons for the codling moth and the curculio. Additional codling-moth work with these poisons has been done at the stations in Iowa, Delaware, and Oregon, the most important contribution of the year on this subject being Gillette's Bulletin 10, of August, 1890. Insecticide experiments on the plum curculio are reported from Iowa, Ohio, Indiana, and Minnesota, Gillette of Iowa having included the plum gouger also in his work. While the efficacy of the arsenical poisons for the codling moth is now sufficiently established and the best methods and conditions of their application are fairly well made out, the case of the curculio is less clear and will require additional investigation, especially on the peach.

A very important study of the effects of the arsenical poisons on the foliage of plants, greatly helped forward last year by the careful experiments of Gillette and Popenoe, has been further advanced this season by Gillette, Weed, Woodworth of Arkansas, and Professor Bailey, horticulturist of Cornell University Agricultural Experiment Station of New York. Gillette's discovery, that the caustic effect of the arsenites on foliage is considerably diminished if these are mixed with lime, is especially worthy of mention. [In this connection a new spraying apparatus, proposed by Thaxter, of Connecticut, may be mentioned. It is intended for the distribution of a poison spray from a small tank carried upon the back.] Atkinson, of Alabama, has collected and collated a considerable amount of evidence highly favorable to the application of London purple or Paris green in the dry instead of the wet state, for the cotton worm.

Other experimental insecticide work has been done in Ohio and New York for the striped cucumber beetle; on granary insects in Oregon; on the asparagus beetle and the imported elm-leaf beetle in New Jersey; on the cabbage-worm in Delaware; and on the woolly aphis of the apple in Oregon, where kerosene emulsion and lye were successfully applied to the root form, and a combination of whale-oil soap, resin wash, and carbolic acid to that on the branches. Underground insecticides have been treated by Smith in New Jersey and Webster in Indiana; Alwood, of Virginia, has used whale-oil soap with success on plant-lice of the egg-plant, and kerosene emulsion on his new peach aphis; and kerosene emulsion, tobacco water, and carbolic soap have been used to kill apple lice in Nevada. The station entomologist in the latter State has also found a tobacco decoction effective for the pear slug, but has failed with the arsenical poisons and hellebore for a rose caterpillar. Gillette has used a spray of the kerosene emulsion to free hogs from lice. Smith's experiments with the rose-bug in New Jersey only served to show that that hardy veteran is proof against pyrethrum, tobacco, London purple, naphthaline, carbolated and hydrated lime, digitaline, quassia, copper compounds, iron solutions, and kerosene emulsion. Corrosive sublimate killed the beetles and also the plants, and only sludge-oil soap promised usefulness.

A very notable advance in the use of insecticides for scale insects has been reported during the year by Mr. Coquillett, of California, an assistant of the Division of Entomology of the U. S. Department of Agriculture. It consists in a direct method for the evolution of hydrocyanic acid gas from cyanide of potassium by the addition of sulphuric acid and a little water. By this improvement the cost of materials has been reduced to about 26 cents per tree, and that of application has likewise been greatly diminished. Coquillett has also advanced materially our knowledge of the value of resin washes for the scale insects, his experiments giving the preference to a solution of 18 pounds of resin, 5 of caustic soda, and 2½ pints of fish oil to 100 gallons of water.

Experiments with insecticides and fungicides combined, first undertaken here by Weed and Garman, have been continued by the former gentleman the present year; Maynard, of Massachusetts, has also tried Paris green and sulphate of copper together for the potato beetle and the potato rot; and Washburn, of Oregon, has combined sulphide of soda, whale-oil soap, and Paris green for the codling moth and the apple scab.

What I have called experimentation with biological insecticides has been limited to work with the vegetable and animal parasites of insects. Under the former head Webster has reported to the Division of Entomology of the U. S. Department of Agriculture some partially successful attempts at the transfer of the *Entomophthora* of the chinch bug to previously uninfected fields in Indiana; under the latter progress has been limited, so far as I am aware, to a continuation of the already famous and epoch-making work of the Division of Entomology in the importation and multiplication of the parasites of imported scale insects. Work has been begun likewise by this Division upon the multiplication of the insect parasites of the codling moth, and upon the transfer of the bacterial diseases of the cabbage-worm to the boll-worm of cotton.

After presenting as much of this entomological work as may be thus roughly classified, I have left upon my hands a miscellaneous débris of minor observations and experiments upon a variety of injurious species. Comstock, for example, has successfully poisoned the imago of the wire-worm in New York; Webster has discovered a fungous parasite (*Entomophthora*) of an injurious tipulid larva; Gillette has studied the parasites and diseases of the cut-worms and of the cabbage-worm, and has given particular attention to the potato-stalk weevil in Iowa; Wickson has continued his experiments in California on the effect of *Phylloxera* upon various kinds of vine roots; Smith has made special studies of injurious plant-lice in New Jersey, has continued his experimental work upon the root chafer, and has made some observations on the grain aphis. The last insect has also been closely studied by Webster in Indiana, and the screw worm has received special attention in Texas and Louisiana.

Among the contributions of the assistants of the Entomological Division of the U. S. Department of Agriculture the work of Osborn on grass leaf hoppers is particularly notable and valuable. He reaches the conclusion that the loss due to the grass insects generally is equal to the amount consumed by stock in ordinary pasturage.

I shall do no real violence to my subject by making mention also of the most admirable work of Atkinson in Alabama, upon the eel worms affecting the roots of various cultivated plants, a work he is still continuing; and of the observations of Halsted on the occurrence of these highly destructive pests in the oat field. The same observer has reported injury to violets by these worms, and they have been found affecting heliotrope and other plants in hot-houses in Champaign, as well as radishes and other garden vegetables. Comstock, who has been engaged on one of these eel worms for the last two years, reports his work substantially finished.

To this too rapid summary of progress during the year I will add only two or three comments of a general nature.

Although the work of the station entomologists has been thus far carried forward without any scheme of coöperation or any subdivision of the field among the different workers, I do not see that either undertakings or results show any waste of labor or disadvantageous duplication of effort. Even all the numerous insecticide experiments seem worth while, and the work of each has at least served to verify, correct, or complete that of the others. The time will doubtless come when a better organization will be profitable, but at present I am of the opinion that the advantage is clearly on the side of individual, initiative, and untrammeled adaptation to the conditions of one's own work. Great benefit would result, however, both to the work and to the workers themselves from the early selection by each station entomologist of a special field of technical entomology, in which he might hope soon to become an authority, whose determinations should be accepted by his fellow-workers, they, in turn, to reciprocate by passing upon his own special problems.

In scanning the experimental work of the past year I have been impressed by what I will venture to call its one-sided character. It will be noticed that this insecticide work is practically all experiments with poisons and with parasites, and that it is very nearly all horticultural. Nothing has been done even looking towards the use of apparatus for the mechanical destruction of insects. Very little has been attempted in an experimental way for the benefit of the farm as distinguished from the orchard and the garden. And, most serious omission of all, little or nothing has been done to improve what seems to me the great opportunity of the station entomologist—the opportunity to experiment with methods of farm management; with variations in the selection, distribution, and cultivation of crops; in the times of their planting; in the preparation and management of the soil; and, generally, in the resources of a skilled and intelligent agricultural method. Almost anyone so disposed may experiment with an insecticide, little being required by way of special preparation or facilities, but scarcely anyone not having land at his disposal from which no financially profitable crop is expected can experiment with variations in farm management as affecting insects injurious to the great farm crops; and even with this advantage, no one can work successfully who can not at least draw upon some store of agricultural skill, knowledge, and experience. In short, I would advise that from this time forward the entomologist and the agriculturist ally themselves for a joint attack on the great farm pests by a carefully studied adjustment of agricultural methods to the habits and life histories of the most destructive insects. I believe that the agricultural assistant or the skilled farm manager is quite as likely to be a useful ally of the economic entomologist as is the druggist's clerk.

Mr. Green, of Ohio, chairman of the committee on horticulture, next reported for that committee as follows:

The committee on horticulture organized by appointing three subcommittees, viz, on the revision of names of vegetables, on publication, and on revision of list of originators. The work undertaken in all these lines is still incomplete, hence nothing more than rate of progress can be reported.

The committee on revision of names of vegetables has formulated certain rules to be used in the naming of vegetables, which rules will be read and explained by Professor Goff.

About two thousand names of varieties of vegetables have been revised in conformity with these rules, but much remains to be done before the work is completed. The object of the work is to aid in bringing about a reform in vegetable nomenclature; also, to prevent the improper naming of new varieties. If the various stations coöperate in this, considerable influence can be brought to bear in both directions, particularly in preventing use of improper names in the future.

The committee on publication had in charge the work of collecting reports from different stations on new varieties of vegetables and fruits. Inasmuch as many varieties are sent to different stations for trial before dissemination, it has been thought best to collect and publish reports of the varieties in a special bulletin. The committee has not been successful in collecting a sufficient number of such reports to warrant the publication of a bulletin, but it is still too early in the history of many of the stations to expect much completed work of this kind.

When the horticultural committee was first organized the work of compiling a list of originators of varieties of fruits and vegetables was commenced. This list was completed and published, but the need of revision was soon apparent. This revision is now in progress and will soon be completed.

A résumé of the horticultural work in progress at the various stations need not be here dwelt upon, since the ground has been fully covered in a publication prepared last year by the committee.

Mr. Atherton then presented the report of the standing committee on college work as follows:

Mr. Chairman, your committee has no report to make, but the convention, of course, is entitled to a word of explanation. There are two lines that might have been followed in such a report: First, we might have made a statement of some quite important changes in the organization of the land grant colleges since our last meeting. In North Carolina, for instance, the land grant fund has been taken from the university, which had it for several years, and transferred to a new institution. In South Carolina the same thing has been done, the change taking effect on the first of the present month. In two or three other States similar changes have been made, but I supposed all our people understood them fully, and therefore did not think it worth while to take up time to make a full report on these matters.

Second, we might have referred to a matter which has occupied the attention of the committee, one about which we would have made a very full report, but from the fact that the subject is the principal topic in the report of the executive committee. I refer to the passage of the new Morrill act.

The President called for presentation of miscellaneous business.

Mr. Jenkins brought before the Association correspondence with Mr. Warington and Sir John Bennet Lawes, of England, with reference to a visit to this country to be made by Mr. Warington, with the object of delivering lectures upon the experiments carried on at Rothamsted, England. He spoke in substance as follows:

Sir John Bennet Lawes has made provision for the permanent establishment of a scientific experiment station at Rothamsted. By one condition of his gift it is required that once in three years some one from the station shall deliver in this country a lecture or a course of lectures on the results of the work of the station. Mr. Warington has been selected to deliver in 1891 a course of lectures, not exceeding six in number, on the nitrates in the soil, presenting the results of his observations and experiments. Some time ago I received from him the following letter:

You are doubtless aware that the Lawes Agricultural Trust has been constituted. One provision of the trust is that once in three years a lecturer shall be sent to the United States to lecture upon the Rothamsted experiments. The committee of management have asked me to go next year as the first lecturer.

The scheme being yet untried, it is important that we should be advised by the people in America as to what is best to be done. I now write to ask your advice upon the subject.

If I come I should propose, after an introductory lecture describing the Rothamsted experiments generally, to give an account of my own work while at Rothamsted on nitrification, denitrification, the nitrates in soils, drainage waters, etc. I may also add a lecture on the wheat crop. The lectures would not be less than six nor more than nine.

The first question that has to be answered I think is, What kind of audience is to be addressed? The audience might be (*a*) a general one, (*b*) farmers, (*c*) students at agricultural colleges. The introductory lecture might be easily made a popular one. Possibly one or two of the other lectures might have sufficient general interest to be worth giving to an unscientific audience; but I feel that I can not do justice to most of the subjects I wish to treat of unless I lecture to those who have some elementary acquaintance with science, and who have an interest in the questions which I discuss. As you are well acquainted with the topics I propose to bring forward, you will be able to advise me on the subject. It seems to me at present that the agricultural colleges will be the most suitable places for these lectures.

If the agricultural colleges are fixed upon the questions at once arise: Which colleges? If you advise lectures to college students, please tell me which are your principal colleges. Where would we find most agricultural students? Which are the most important centers? During what months of the year could lectures be conveniently given in such colleges? Please do not confine yourself to a reply to the definite questions asked, but let me know your opinion as to the best way of carrying out the provisions of the trust.

One point I may name. I am not authorized to go to any expense attending the delivery of these lectures; expense of room, lighting, attendance, and advertising, if any, must be borne by those who attend the lectures.

HARPENDEN, HERTS, 9, 22, 1890.

I wrote him, explaining that I did so entirely on my own responsibility, not having had time to confer with others, substantially to this effect:

The one audience, it seems to me, that can least afford to lose your lectures is the one that gathers at the annual meeting of the Association of Agricultural Colleges and Experiment Stations. Each college and experiment station in the country is expected to send one or more delegates to this meeting, usually the president or director, and where the distance is not too great, part of the working force also.

The session continues through four days, and if it were announced that you were to be present and give this course of lectures I have no doubt that the delegates would arrange to remain and hear the course, if you are physically able to lecture on consecutive days. In this way you would reach a center of education and investigation in almost every State in the Union, and would have an audience that would thoroughly appreciate a technical and scientific treatment of the subjects you propose.

The following is Dr. Warington's reply:

Your letter of the 6th instant has safely reached me. The information you give is very important. I sent your letter at once to Sir J. B. Lawes in Scotland, but he had returned to Rothamsted before the letter reached him; it will be a day or two before it comes back, and on receiving it Sir John will write to you himself. If the Association of Agricultural Colleges and Experiment Stations which you speak of, is willing that the lectures should be delivered during its meeting at Washington next year, no better course could, I think, be proposed. I should be ready to lecture every day for six days. After each lecture an opportunity might be given, if so desired, for remarks or questions. Will you kindly bring the matter before the Association when it meets at Champaign?

I should also be willing to visit a few other centers such as you have named and to lecture there.

Please tell me if illustrations by means of lantern slides would or would not be desirable. I might bring lantern slides showing Rothamsted House and laboratory, and portraits of Sir John Lawes and Dr. Gilbert. If I lecture on bacteria they might be shown in the same way. The use of a lantern of course necessitates a room that can be darkened.

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HARPENDEN, HERTS, 10, 18, 1890.

Sir John Bennet Lawes has since written the following:

Mr. Warington has given me your letter to him of the 6th of October to answer. He informed me he has accepted the offer of the "Lawes Trust" to deliver the first lecture upon the Rothamsted experiments in the United States in the year 1891, and has requested me to arrange with you, and those whom you are about to meet, both the time and the locality of the lectures. I understand from your letter that the meeting of the delegates will take place next year in the month of October at Washington, and further, that each college and station is expected to send one or more delegates to the meeting. It has always been our ambition, and, I may say, our aim and object to teach the teachers of agriculture rather than the agriculturists themselves, and I should consider it a great honor and also a great compliment if the invitation were sent to me from the delegates who will represent the stations and colleges of agriculture next year, requesting that the lectures upon the Rothamsted experiments should be delivered before them next year. Although the offer to be the first to deliver the lectures was made to Mr. Warington some time ago, his actual acceptance only took place the other day, and I have had no opportunity of discussing with him the character or scope of his lectures. Should the proposal I have made be accepted, it would be desirable that some one should be appointed to correspond with me in regard to the delivery of the lectures. I have for the last year or two been endeavoring to collect and bind up our various papers which have been published since 1844. I have recently sent a copy to your Department of Agriculture at Washington, and I hope before the end of the year to send several copies to your leading agricultural institutions.

On motion of Mr. Fairchild, of Kansas, this matter was referred to the executive committee of the Association, with instructions to provide for the course of lectures if possible.

The Secretary read a letter asking the Association to appoint delegates to a congress to consider the desirability of a federation of agricultural organizations and to devise a scheme for one. On motion of Mr. Atherton the invitation was referred to a committee of five to be appointed by the president. The president appointed Messrs. Atherton Fairchild of Kansas, Alvord, Flagg, and Scovell.

EVENING SESSION, TUESDAY, NOVEMBER 11, 1890.

The meeting was called to order by the president at 8 p. m., in the chapel of the University of Illinois.

Addresses of welcome were delivered by Regent Peabody on behalf of the University of Illinois, and by Hon. G. W. Gere, of Champaign, on behalf of the citizens of Champaign.

Addresses in reply were made by Mr. Dabney, Mr. Brown, and Mr. Atherton, after which the annual address of the president of the Association was in order. President James H. Smart spoke as follows:

LADIES AND GENTLEMEN: In obedience to the constitution of this Association, I have prepared a brief paper of somewhat professional character. It is chiefly intended for the members of this Association, but I hope that it will not be wholly uninteresting to our friends of this city who honor us with their presence to-night. I am unable to read my paper, owing to defective eye-sight, and I have therefore ventured to ask Mrs. Smart to read it for me.

Mrs. Smart then read the address of the President.

GENTLEMEN OF THE CONVENTION: I congratulate you upon the favorable auspices under which we meet here to-day. The last academic year was full of promise at its beginning and it justified its promise at its close. The reports from the various institutions recognized in this Association indicate for the most part increased prosperity. The attendance in most of the colleges has been larger than ever before; a higher standard of excellence has evidently been maintained; and in many instances endowment funds have been largely increased either by legislative action or by private munificence.

The experiment stations, called into existence scarcely three years ago, have become firmly established and are already commanding the confidence of the people, for whose benefit they were provided. Three years ago some of us were appalled at the magnitude of the problems which were presented to us by the requirements of the Hatch bill. Forty or more stations were to be established. Forty or more directors of the highest scientific attainments, of the widest experience, of the largest business capacity, and of the most practical common sense were to be selected. Two or three hundred heads of departments, skilled in special lines of investigation, were to be found. Reference libraries of a special character were to be secured, and laboratories were to be fitted up for special lines of work. And this was to be done almost in a day, because our title to the money for the work was not made clear until near the close of the year in which it was to be spent. Some stations, indeed, had been already established and the foundations of others had been laid, but for the most part the work had to be done from the beginning. The fact that so many competent men were to be found to take the various places, affords, in my opinion, the highest proof that the work in some of our older agricultural colleges has been superbly done. It seems to me a marvel that the difficulties which confronted us have been so thoroughly overcome.

I congratulate you especially upon the fact that the institutions represented in this Association have so commended themselves to the general public and to their representatives in Congress as to secure such splendid recognition as was accorded to them in the new Morrill bill, the benefits of which we are about to receive; and I congratulate you also upon having as the chairman of your executive committee a man so thoroughly effective in legislative work, to whom, as I believe, more than to any other, is due the honor of securing the passage of that act.

While no bill could have been pushed through, under the circumstances, that was not thoroughly and cordially indorsed as one of great merit, no bill, whatever its merits, could have been pushed through without the leadership of a great general.

In order to emphasize the importance which this meeting may assume, I venture to express the opinion that both station and college are entering upon a new era, and, as we may confidently hope, an era of great usefulness.

There is need of great reform in the treatment of the soil, in the methods of tillage, in the gathering and curing of crops, in the selection, care, and management of stock, in the preservation of the forests, and in the general management of our agricultural business. Three millions of dollars' worth of crops are destroyed annually by insect ravages, and as much more by plant diseases. The stations will show that much of this enormous waste can be prevented, and they will thus have an opportunity of leading in a campaign of industrial reform which will produce the most stupendous economic results.

I do not doubt that within a few years it will be generally conceded that the stations are showing that they are worth ten times what they cost, and that no movement of the general Government made in recent years has been productive of so much good as the act which established them.

Our collegiate departments, too, have before them a great future. They are leading and will still lead in the great educational reform that has already begun to sweep over this country both in the college and in the public school. I believe that some of the principles which underlie the methods adopted by the approved industrial college of to-day will ultimately prevail in all colleges, whether classical or technical. One of the most important of these may be stated thus: The college curriculum should be so arranged and the methods should be such that the student may receive much of his professional training in the same institution, and at the same time in which he receives his academic training. Or, to state the principle more accurately, the methods of work may be such that a man may receive much of his academic training through his professional training and thus effect a tremendous saving both in time and money.

It is generally conceded that the time now required by the preparatory school, the academic school, and the professional school is too long.

A student at Exeter three years, at Harvard four years, and at his professional school three years will come out at 26 having spent $8,000 or $10,000, and will enter a profession in which he can hardly make for himself a position before he is 30.

The average man does not now take this course, however desirable it may be. He can not take it with safety. It is taken by the few and probably not the best few. The average man, and possibly the best man, takes a short cut. He sometimes omits the professional school, or more frequently the academic school, very often both, and sometimes, I am sorry to say, all three. He will continue to take a short cut; he is forced to do so or remain out of the professions altogether. He will not remain out, and the result will be that the professions—and by the term professions I mean to include all work which may utilize the higher education—the professions will still remain filled with a large proportion of poorly equipped men.

The demand upon the American colleges is for a wider, a better opportunity for the man of average means; an opportunity to become well educated, well disciplined, and to obtain a reasonable professional training, so that he may go out and prove that he not only knows something, but that he is able to do something, and this must be given to him before he is 25.

Can the time now generally required be shortened without impairing the efficiency of the results? A study of the methods and results of the best technical schools will answer the question affirmatively. Let us begin by an examination of such elementary technical schools as are found in Chicago, St. Louis, and other large cities.

The modern manual training school grew out of the necessity for better educated and more skillful mechanics. The old apprentice system, now largely in use in England and until within a few years as largely in use in this country, was found to be a failure, wasteful as to time and destructive as to morals. It is plain to see why it was so.

Let us study the old method a moment. Suppose a boy enters a printing-office, for example, in which he expects and is expected to learn the trade in all its parts. How does he succeed? I once had occasion to frequent a printing-office in which were employed seven apprentices. The proprietor informed me that it would take them at least three years before they could become journeymen. They were to receive an average of 30 cents a day for three years. I found that the boys, although very busy, were spending their time in *not* learning the trade, and, so far as I could learn from inquiry and observation, no attempt was made to give them any systematic instruction. They were engaged for the most part in rude labor, but were permitted to "pick up" the trade, as the proprietor expressed it, as they had opportunity. Now, this "picking-up" process while it is possibly profitable for the employer, is not the most profitable method for the boys.

It results, in the first place, in waste of time. This is bad enough, but it results also in making poor workmen. Need I call your attention to the fact that the country is full of men who pretend to be carpenters and who are not; men who pretend to be machinists and who are not; men who pretend to be pattern-makers, molders, blacksmiths, shoemakers, tailors, and printers, who are shabby, incapable workmen at best? Who that has built a house does not know this? There is not a manufacturer in this country who does not know it, and to his cost, and one of the most difficult things that a manufacturer has to do is to sift out the few really good workmen from those who pretend to know how and do not. The engines that will not work, the machines that wear out, the houses that are shabbily constructed, and the fabrics that fall to pieces will attest the truth of what I say. How many workmen are there who take God's bounty and by careful, skillful, intelligent processes make the most of it? Here is a waste surely. But who could expect better results from a process so full of mischief?

A third result of the "picking-up" process comes from the fact that it fails to awaken in the boy a keen ambition, without which success in any employment is seldom secured, hence it is that many who enter factories and shops for the purpose of learning a trade, become restless, tired, and discouraged, and leave the business to try another, and thus to become a good-for-nothing jacks-of-all-trades or to join the ranks of the non-productives, and possibly the ranks of the destructives.

In the fourth place the "picking-up" process has a moral aspect. Every handicraft carried to a high degree of excellence may become a fine art. There is no dignity in labor, but dignity may be put into labor. When a man does something that is fine of its kind, whatever the kind may be, it awakens sentiment in respect to the products of even the commonest handicraft. The most valuable man is he who takes rude material and produces something of high value out of it, and who takes pride in what he has wrought.

Some years ago I sent out circulars to employers in some of the industries and in various parts of the country, asking the following questions:

(1) What is the average number of your employés who come to you for the purpose of learning the trade?

(2) How many of these remain with you long enough to become journeymen?

(3) Of those who become journeymen, how many succeed in becoming first-class workmen?

These were sent to (1) carpenters and joiners, (2) pattern makers, (3) molders, (4) blacksmiths, and (5) machinists. From the replies received, and they were numerous, I formulated the following conclusions:

(1) That out of every 10 who enter a carpenter shop with the intention of learning the trade, 4 abandon the business; of 10 pattern makers, 2; of 10 blacksmiths, 6; of 10 molders, 5; of 10 machinists, 6.

(2) Of those who pursue the business and become professed journeymen carpenters, but 3 become first-class workmen; of 10 pattern makers, 2; of 10 blacksmiths, 2½, of 10 machinists, 3½.

We can now construct a table which shows the number of boys out of every hundred entering each trade mentioned, who become first-class workmen, viz:

Carpenters	18
Pattern makers	16
Blacksmiths	10
Molders	17
Machinists	14

being an average of 15 to each 100. Thus it is that the very process we have taken to educate a boy into the various handicrafts is the process by which we have educated him out of them.

Now comes in the manual training school. It offers the boy a good academic education for a period of say 3 years, which is quite equal to that given in other schools. It also offers him instruction in the underlying principles of the great constructive trades with such laboratory practice as will enable him to go from school and obtain work at comparatively high wages. It is shown that by spending 2 hours a day in one of these schools for a period of 3 years the average student may become a fair draftsman, may be instructed in the theory of pattern making, molding, and in machine construction. He may also be so instructed that he may be able to do a first-class job at the bench, in the pattern shop, in the foundry, in the blacksmith shop, and in the machine shop. He knows how to interpret working drawings and can practically make a machine. He has not what is known as speed, but aside from this he is far better off than the average journeyman.

It has been shown quite conclusively that those who stand the highest in the working laboratories stand highest in their academic studies. There is a reason for this. When a boy does a fine thing in one direction, he can be induced to do a fine thing in another direction. When he puts two solid hours into hard work in the shops, he is prepared to go to his room and study with a freshness that enables him to accomplish a great deal in a short time. It is fairly claimed that the average student who spends two hours in the shops can do more with a given number of academic studies than one who does not.

But there is another reason, one to which I wish especially to call your attention. Suppose you ask a boy to plan and make the working drawings of a lathe or an engine, and then to make the patterns, then the castings, then to finish and set up the parts and run the machine, what faculties of the mind are not brought into play? The complete machine must be seen from the beginning in the imagination. Its purposes must be perfectly understood. Part must be adapted to part, material to uses. Strength and economy of material must be considered; the shrinkage and warping of wood and iron under various conditions must be considered; and the question of economy must be carefully studied. The manipulation of every piece at every stage must be understood while the boy is making his drawings. Everything must be worked out with mathematical precision. Every step in the entire process has a very definite relation to every other step. Here is a fine field for the active exercise of the mental faculties. You may be sure that if the machine runs, the thinking has been clear, definite, accurate. The mental habits that are formed by this process should be of the highest value. Experience has shown that they are of the highest value. The student in the manual training school has thus become well educated to a degree, and has become a skillful worker in the great constructive vocations.

Now if we turn to the advanced technical schools, such as are represented in this Association, we shall find that equally valuable experience and equally satisfactory results have also been obtained in the higher departments of technical instruction. It is found possible with the proper standard of admission, to give adequate instruction in most of the usual academic subjects and by the usual academic methods, and in addition, to afford high professional training and practice in applied chemistry and biology, or in civil, mechanical, and electrical engineering, all within a period of 4 years.

It has also been found that the technical and professional work has a tendency to enlarge, discipline, and refine quite as much as the purely academic work.

We may fairly claim, then, that the technical work of our industrial colleges presents something more than a merely commercial aspect. It has in it the highest educational value and provides a kind of discipline not possible through the ordinary academic methods.

Now the American school of liberal arts can not and ought not to become a school of industrial arts, but it can learn much from the experience of the schools of technology. It can omit some of the lesser subjects in its academic curriculum, and include a part of the work that is now left to the professional school. It might thus be found possible to shorten the time 2 years and without serious loss. Indeed I am more than half persuaded that if the time which many of our students spend in college society and politics, and in various other outside enterprises, some of which are wholly destructive, was spent in hard work, 4 years would be quite sufficient for all the academic work and for all the professional work now required by both schools.

Through modern laboratory methods many of our more prominent colleges of liberal arts are working in this direction, but there is still great necessity for reform, especially in the lesser ones. In this connection permit me to refer you to a recent article by President Eliot, of Harvard, in which he advocates the reduction of the academic course to 3 years, and to another by Professor Shafer, also of Harvard, in which he argues, more wisely, I believe, for the introduction of more professional work into the academic course.

There is room for all the better classical colleges we now have. They have done a grand work in the past—they will do a grander work in the future—but the modern technical school, brought into existence in obedience to a popular demand, has come to do a new work required by a new civilization. It comes to deal with a very different man from the one who was born into the world 50 years ago. Since that day the railroad has come in; the dynamo and the motor have come in; the modern newspaper and magazine have come in; in short, the new industrial age—the scientific industrial age—has come in, and the men who are born into it are new men and require new treatment.

The modern industrial school has a special work of its own which will lead it into a broader and broader field of usefulness.

What limit shall be placed upon the demand for men who can move things; who can design new appliances for utilizing the forces of nature; who can supply the material needs of mankind; who can prevent disease; and who can make things grow where they did not grow before?

The graduates of our departments of mechanical, electrical, and civil engineering, and of our departments of applied biology and chemistry are already securing recognition. The demand for them will be larger and larger, but I predict that our departments of agriculture—the schools that do not, in the opinion of many, justify their existence—will send out graduates who will also find a wide field of usefulness.

The question "Who is to feed the coming millions?" is, after all, one of the greatest economic questions of the day. It will be a greater question in the future. The products of the earth are scarcely sufficient to keep us now—not sufficient to make us rich, and the demand of the future will be greater. Who shall show us how to take hold of and solve the tremendous problems connected with agriculture, the greatest American industry—the industry upon which our material prosperity largely depends? Such men are now stepping to the front, and the institutions which are represented here to-day are furnishing them. We may therefore thank God and take courage and go on.

Morning Session, Wednesday, November 12, 1890.

The Association was called to order at 9 a. m. by the President.

Mr. Fairchild, of Kansas, asked whether one person might represent both a college and the station connected with it. After some discussion the Chair decided that no person could cast more than one vote in the general sessions of the Association and referred the question whether one person might represent a college in the section on college work and a station in other sections, to the Association.

The following resolution offered by Mr. Atherton was adopted:

Resolved, That one person may have but one vote in the general sessions of the Association, though appointed to represent both a college and a station; but one person may represent a station in one section, having one vote, and a college in another section, having one vote.

The Secretary read the following letter addressed to the President, by Merrill E. Gates, of Amherst College, formerly president of Rutgers College in New Jersey:

Permit me to present through you to the Association my resignation as a vice-president of the Association. This would as a matter of course follow my resignation of the presidency of a State college; but I avail myself of the occasion to extend through you to my many friends in the Association assurances of the regret I feel in leaving the Association, and of my most hearty good wishes for the success and the growth of that noble piece of popular educational work, industrial, scientific, and liberal, which is intrusted to the State colleges.

Through my brother Goodell, who is a neighbor of mine here, I hope to keep in touch with what is being done by these colleges. And I extend to the members of the Association generally a cordial invitation to remember me when they come to see the

Amherst Agricultural College, and to keep under kindly and scientific cultivation a friendship which to me has been most pleasant.

AMHERST, MASS., *October* 28, 1890.

The letter was referred to the Secretary with instructions to send a suitable reply.

Mr. Alvord moved to amend the constitution by inserting in the section relating to permanent committees the words "on college work" after the words "on chemistry" and before the words "on entomology." The motion was carried by a two-thirds vote and therefore adopted.

The committee to audit the accounts of the Treasurer reported as follows through its chairman:

Your committee appointed to take into consideration the report of the Secretary and Treasurer, would respectfully report that they have examined the report of this officer carefully and compared the receipts, bills, and other papers connected therewith, and find them to be correct.

They would also commend the neatness and arrangement, by means of which the committee was able to transact its business in a very short space of time.

In the line of our work we found that there were some stations and colleges that had not yet responded to the call made by the executive committee of the Association, probably from inadvertence, and we would recommend that the executive committee give all such an opportunity to fall into line at this convention.

Respectfully submitted.

C. L. INGERSOLL,
CHAS. O. FLAGG,
R. J. REDDING,
Committee.

The report was adopted.

Mr. Harris, assistant director of the Office of Experiment Stations in the U. S. Department of Agriculture, then presented the following paper as provided for in the program:

THE AGRICULTURAL EXPERIMENT STATIONS AT THE WORLD'S COLUMBIAN EXPOSITION.

Some time ago the Office of Experiment Stations was called upon by the Assistant Secretary of Agriculture to prepare plans and estimates for an exhibit to illustrate at the World's Columbian Exposition the line of work in which the Office is engaged. After consultation with Dr. Goode, Assistant Secretary of the Smithsonian Institution, in charge of the National Museum, who was at the time preparing a system of classification for the Exposition, the Office prepared and submitted to the Assistant Secretary a scheme which received his approval. This provisional scheme it is my purpose to describe to you to-day.

The plan provides for a coöperative experiment station and Office of Experiment Stations exhibit in connection with that of the Department of Agriculture. It is not necessary to enumerate all the reasons which led us to recommend a coöperative exhibit, but some of them may be rapidly mentioned:

(1) Such a plan will give a large number of the stations their only opportunity to exhibit.

(2) Such an exhibit will be expected by many persons.

(3) This plan, connecting the station exhibit with that of the Department of Agriculture, will call to the exhibit the attention of the farmers of the whole country.

(4) This plan, exhibiting the work of the stations collectively, will insure an unusually large and impressive exhibit.

(5) It will give a better and more nearly perfect demonstration of the enterprise.

It is not proposed that this coöperative exhibit shall in any way interfere with exhibits of individual stations, if desired, in connection with those of their States or colleges. Moreover it is believed that our plan will not involve any great amount of duplication.

General statement of plan.—The experiment station exhibit should be a unit of installation in connection with the exhibit of the Department of Agriculture and should be on a uniform plan contrived and carried out by the Department in coöperation with the stations. In order to distinguish the work of the stations from that of the Department the station exhibit should be in a room by itself. It should show that this enterprise has been recently organized, is national in its scope, and that while the different stations are carrying on their work separately in different States they have definite relation with the Department of Agriculture and with each other through the Office of Experiment Stations. The exhibit should be so arranged that the visitor to the Exposition will carry away a distinct impression of the importance of this enterprise, of the causes which led to its inauguration, and of its possibilities in the future.

Plan for experiment station exhibit.—The exhibit should occupy a separate room, of rectangular shape, 80 feet wide and 100 feet long. At one end there should be a room (80 by 20 feet) extending across the entire width of the allotted space. The remaining space should be divided into a broad central passage, and ten alcoves arranged along the sides.

In the room at the end of the hall are to be laboratories, workrooms, a station library, office, etc., *i. e.* an *experiment station in operation.* In each of the ten alcoves is to be illustrated a special department of station work, *e. g.*, soils, plant growth, dairying. Whatever any individual station contributes to these exhibits of special lines of work, should be labeled so as to give due credit to the station. In the central space is to be a general exhibit of the stations by States, including general facts, statistics, publications, models and pictures of buildings, and exhibits illustrating special lines of work. Here, also, will be the special exhibit of the Office of Experiment Stations.

THE EXHIBIT IN OUTLINE.

(1) *The index.*—As the visitor enters the hall he will see before him a large map (20 feet square) suspended near the opposite end of the central passage. On this map will be represented (*a*) different agricultural regions of the country by means of different colors; (*b*) the locations of the stations and their relations to other institutions; (*c*) references by figures or otherwise to things exhibited by the several stations. By this means the visitor will learn at once in what kind of region any particular station is located and where information regarding that station may be found in this exhibit.

(2) *Laboratories, workrooms, library, and office.—The experiment station in operation.*—The purpose is to have here chemical, physiological, and mycological laboratories equipped with appropriate apparatus and in charge of experts who shall be engaged in actual experimenting. The operations of course will be comparatively simple ones, adapted to illustrative purposes. There should also be a small, carefully selected library of technical books on the science and practice of agriculture and allied subjects. Illustrations of the best methods of mailing publications, keeping office files, keeping mailing lists, etc.

(3) *The alcoves.*—The plan of the exhibit in each of these would be, in general, as follows: At the entrance of the alcove an attractive showpiece illustrating some striking fact or process connected with the subject of the exhibit in the alcove. This would be used to draw attention to the subject and to excite the desire to study the exhibit of the subject more fully. Within the alcove would be cases containing apparatus, products, models illustrating processes, etc.; wall charts and diagrams setting forth in outline the history of investigations in a particular subject, the present state of knowledge on that subject, and the possibilities of discovery in that

line; photographs of buildings, apparatus, and prominent investigators arranged on wing frames. There should also be descriptive placards and leaflets of information for visitors. The general hand-books on the subject should be placed where they could be freely consulted by those who wish to spend some time in studying the subject in connection with the exhibit.

To illustrate what the exhibit in a single alcove may be, let the subject of plant growth and nutrition be taken. Here, as the showpiece near the entrance of the alcove, might be displayed a number of large glass jars containing live plants growing in water under different conditions as to periods of growth, kinds of plant food used, etc. In this way the entire plant, roots, stem and all, might be shown in a very attractive manner. Inside the alcove might be shown by means of colored diagrams, the different processes of plant growth as affected by peculiarities of soil, climate, and treatment. In cases would be specimens showing different stages of growth, chemical composition of plants at different periods of growth, or apparatus used in experiments on plant growth. Pictures of distinguished investigators in this line, and of apparatus which could not be conveniently shown otherwise might be arranged on wing frames as described above. Charts would give in a brief and striking manner much information regarding the progress of investigation in this line. There should also be a "primer" on plant growth and nutrition, with practical suggestions, to be distributed to visitors. On a table conveniently arranged for reference should be a small collection of the best general and special treatises on this subject. Any good work which Americans have done in this line should be clearly brought out, and the possibilities of making this a useful line of investigation by our stations should be enforced. Of course a thorough system of interesting and instructive labels would be indispensable.

Again, take the alcove devoted to soils. Here may be illustrated the classification of soils, their chemical composition, the methods of chemical and physical analysis, apparatus used in studying soils, *e. g.*, soil thermometers, lysimeters, models illustrating systems of drainage, irrigation, and tillage, etc.; the results obtained, some of the difficulties of forecasting crops by soil analysis, and the scope and importance of the work to be done in soil investigation. The possibilities of an exhibit in this line will be seen when we remember this alcove would include such subjects as the chemistry, geology, and physics of soils, drainage, irrigation, tillage, etc.

There will be no lack of interesting subjects to illustrate in the various alcoves. The great difficulty will be to make the best selection from so great a variety of good things. The number of different alcoves should not be so large as to make the exhibit monotonous and wearisome. It is thought that ten subjects will be as many as it is desirable to include in this exhibit. Among the subjects thought of as appropriate and interesting may be mentioned soils, fertilizers, seeds, plant growth and nutrition, feeding stuffs and feeding, dairying, silos, etc.

The exhibit of individual stations in the central passage should be arranged by States and include (1) the publications of the stations in the different States; (2) views of their buildings, charts describing their history, lines of work, and important results of their investigations; and (3) such collections, illustrating improved products and processes, apparatus, etc., as when taken together will show the wide range of station work in its extension throughout the entire country. This exhibit should be arranged along this central passage so that the visitor as he passed from one end of the room to the other would take in at a glance the distinctive features of the several stations and thus get a general idea of the scope of experiment station work, its variety, and what each station is contributing to the enterprise.

Opportunity should be afforded (by means of tables or desks and chairs) for the thorough study of a station's work.

It is hoped that it may be found practicable to have at the Exposition at all times a certain number of experts, selected in turn from all the various stations, who may be in attendance in the Exposition hall and increase the educational value of the exhibit by explanations, demonstrations, and lectures.

To recapitulate, the exhibit should be a unit by itself. It should consist of (1) a central exhibit of the work of each station arranged by States; (2) alcove exhibits by topics; (3) an experiment station in operation; (4) lectures, explanations, pamphlets, and labels.

Of course such an exhibit is impossible without the coöperation of the stations. About two years remain for preparation. Of these, fully one will be needed for the development of detailed plans. It must first be decided whether the stations care to enter into any plan for a coöperative exhibit. It is hoped that this Association may feel itself competent to take such action as will justify the Office of Experiment Stations in energetically entering upon its work, and that the Association will appoint the necessary committees to act with the Office.

At the conclusion of this paper, Mr. Peabody, Regent of the University of Illinois, invited the Association to take a recess for a few moments to attend the chapel service.

On motion of Mr. Atherton, the consideration of the paper presented by Mr. Harris was made the special order for 4 o'clock of the same day, and on motion of Mr. Hadley the Association took a recess of 20 minutes.

At 10:30 the Association reassembled.

Mr. PEABODY. I would like to announce that arrangements have been made to provide accommodations for those who desire to go from here to Chicago to visit the Fat Stock Show. The State board of agriculture will very highly esteem a visit from this body.

On recommendation of the executive committee as a committee on order of business, the Association adjourned to allow opportunity for meetings of the permanent committees.

AFTERNOON SESSION, WEDNESDAY, NOVEMBER, 1890.

The Association was called to order at 2:15 p. m. by the President.

Mr. ALVORD. According to the program, this afternoon from 2 until 5:30 is to be devoted to the general session of the Association. It is true that according to the requirements of the constitution we are to consider topics of a somewhat special character to be presented by the permanent committee on horticulture, but it is the evident intent of the constitution that these meetings should be attended by all the delegates of the convention. But notwithstanding this, and the fact that the program provides what is deemed sufficient time for meetings of the permanent committees, some of these committees are, as I am informed, in session at this moment. I suggest that a messenger be sent by the President to inform these committees that they are sitting unconstitutionally, and to request all delegates to come to the general session; and I further suggest that the President read to such delegates a constitutional lesson if that seem necessary. It certainly was intended when the constitution directed that at least two of the permanent committees should each year present topics before the Association in general session, that all persons attending the convention should be present to listen. The agriculturists, chemists, and entomologists have a right to be heard in their turn, and it is only proper that they should listen when other committees present matters of interest and importance.

Mr. Alvord for himself, but disclaiming to act for the executive committee, moved that a messenger be appointed to request the attendance of persons attending sessions of permanent committees. The motion was carried and the President requested the Secretary to courteously notify the chairmen of the various committees in session that the convention was ready for business and awaiting their attendance.

Mr. Atherton, chairman of the committee appointed to consider the question of a representation of the Association in the proposed pan-agricultural association or convention, asked leave for his committee to meet at 3 o'clock, during the general session of the Association, stating that this would be a convenience, but that he hoped the request would be denied if thought likely to be a bad precedent. On motion of a delegate, the request of Mr. Atherton was granted.

Mr. Alvord reported from the committee on credentials that 30 States were represented by 105 delegates and other persons in attendance, and that these persons represented 72 colleges and experiment stations and the U. S. Department of Agriculture (see p. 15).

Mr. Goff spoke as follows on "The work of the experiment stations in the reform of vegetable nomenclature:"

I had supposed that Professor Bailey would treat this subject, and I was not informed otherwise until after I had arrived here. I will give a brief report of the work of the committee on this reform, appointed at the Columbus meeting of horticulturists more than a year ago.

One of the things which it seemed desirable for the committee to undertake was the simplifying of the names of vegetables. All of you who have given any attention to the subject know that the nomenclature of the vegetables is in bad condition. The American Agricultural Society has undertaken a revision of the names of fruits, and the committee has undertaken a similar revision of the names of vegetables. The committee, in its work, has acted upon the principle that "a name is bestowed upon any plant solely for the purpose of designating it." In other words it has endeavored to make every name as short and simple as possible, and yet avoid confusion. It has been thought best in this list to keep separate all names which have been independently applied to varieties, and therefore no attempt has been made to determine synonyms. The five rules adopted by this committee, governing the form of the names and forming the basis of all changes, are:

(1) The name of the variety should consist of a single word or at most of two words. A phrase, descriptive or otherwise, is never allowable. (2) The name should not be superlative nor bombastic. (3) If a grower or dealer has procured a new select strain of a well-known variety, it shall be legitimate for him to use his own name in connection with the establishment of the variety. (4) When personal names are given to varieties, titles should be omitted. (5) The term hybrid should not be used, except in those rare instances in which the variety is known to be of hybrid origin.

It is impossible to make all published names of vegetables conform to the above rules, which are of necessity ideal, designed to control the making of new names rather than for the reformation of old ones. The committee has made all changes thoughtfully, and yet it is aware that its work may be often open to objection. In such cases it desires the advantage of any honest criticism. In the application of the code, many minor rules have been drawn, but there are many instances in which no rule or precedent could apply and purely arbitrary decisions were necessary. The following minor rules will explain the attitude of the committee:

(1) In all the revision the committee has simply modified the existing names; no new words have been introduced. (2) So far as practicable, it has selected for the proper name the one most important word in each customary appellation. (3) There has been no attempt in the name to give credit or honor to any person; the purpose of the name is to designate the plant and all other considerations are extraneous. If the originator or introducer desires to associate his name with his product, the proper way is to give the plant simply his name, omitting the burden of adjectives. (4) In proper names the possessive case has been omitted, and the name, if allowed to remain, stands in apposition or as an adjective. The only departure from this rule is in the case of new strains of old varieties (see rule 3 in code). Thus in peas, *Laxton's Prolific* becomes *Laxton Prolific*. Here the personal name would have been dropped altogether, only that the term *prolific* is so much used and abused that it means nothing by itself; and to have used the personal name alone would have added confusion because there are several other Laxton peas. (5) The word *seedling*, which is meaningless in this connection, is always dropped and the personal name attached to it becomes the name of the variety. (6) In the case of a few old varieties which are now little grown, it has not seemed worth while to attempt to revise the name. An example has been found in *President Garfield's Tomato*, which, it is to be hoped, will be forgotten before any new name could be learned. (7) All descriptive adjectives have been omitted whenever the change would not be likely to lead to confusion. In some cases, however, three of these adjectives must be retained in order to distinguish the variety, as *Dwarf Round Purple* and *Large Round Purple egg-plants*. Dwarf and large are necessary to distinguish the varieties from each other, round is necessary to distinguish both from the *Long Purple*, and purple distinguishes them from the *Long White*. (8) In phrases which could not be shortened to a word, the connection is usually dropped or, in rare cases, the phrase is transposed: *First in the Market* has been made *First Market* and *Champion of America* becomes *American Champion*.

The committee is aware that its labor is largely self-imposed and that it is in no manner dictatory; but if it shall succeed in inspiring "brevity, accuracy, and good taste in the naming of vegetables" in the future it will have done enough.

Mr. ALVORD. I would like to inquire whether it is proposed to publish this revised list.

Mr. GOFF. It has been published, but I believe not officially. Mr. Green will know.

Mr. GREEN. It has not been published officially because there is much more work that ought to be done on it, but we wish it so published when complete. This is simply a report of progress which we make in order to call the matter to general attention, as the list may be of use even now. It should be noticed that the committee has not attempted to carry its reform into the domain properly belonging to the agriculturist. Nothing has been done in regard to the names of varieties of corn and wheat.

Mr. ALVORD. Has the committee included potatoes?

Mr. GREEN. It has.

Mr. ALVORD. I suggest that this list when revised should be used by the stations and colleges generally, and that the list when completed or advanced far enough to be useful for temporary purposes, should become the property of the Association to be incorporated in these proceedings or in some special publication. It will then be recognized as having the authority of this body. If it appears simply in a periodical connected with our work it will not have the same effect, notwithstanding the fact that one of the leading workers in horticulture is the editor.

Mr. ATWATER. Allow me to say that if the Office of Experiment Stations can be of use in the dissemination of a matter of this sort it will gladly offer its services.

Mr. ALWOOD. This committee has done its work most faithfully, and the result of its labors is of great importance not only to the station horticulturists, but to all workers in horticulture throughout the country. I wish to indorse the views of Major Alvord in regard to the desirability of having the report published. I therefore move that the report of this committee and the revised list be printed officially and distributed through the Office of Experiment Stations at the earliest possible date.

The motion was adopted.

Mr. MASSEY. I would like to ask whether this committee proposes to deal with the question of synonyms. It seems to me very desirable that it do so, as great confusion exists in regard to synonymous names for vegetables.

Mr. GREEN. That work was not given to this committee. Its work, however, is preparatory to the subject of synonyms, as a revised list of the sort that the committee is preparing is necessary for intelligent work. This committee did not feel authorized to deal with this question nor capable of doing so. No three persons could do all the work required. It will be a long, tedious work, requiring coöperation.

Mr. LYON. The work of this committee is like that undertaken by the American Agricultural Society, which has had great trouble arising from the fact that its action has not been generally followed. Indeed, nurserymen universally use the old names and great confusion follows. I wish to inquire, therefore, whether this committee has any reason to hope for better results from this work.

Mr. GREEN. We can not compel anyone to use our list, but it is a matter of convenience to the horticulturists of the stations to have such a list, and if they will use it we think that some progress will be made towards a reform. We do not expect that seedsmen will at once take it up, but by persevering we hope to bring them to adopt our views, and I feel confident that many will do so soon. The greatest trouble will arise in cases where a seedsman's name and trade-mark has been cut out.

Mr. Green, of Ohio, being called upon, presented the following paper on "Methods of work in variety testing:"

Variety testing is by no means a difficult kind of experimental work, and yet but little has been done by the stations that shows a mastery of the subject. This arises largely from a misconception of the ends to be attained. It is a mistake to suppose that a botanical study of varieties completes the task. It is well to study varieties from a botanical standpoint, and to arrange them into groups or classes for convenience in order to determine synonyms, but this is merely the beginning and not the end of the work. It is the road along which every one must travel who would make a variety test of any class of plants. This road ends in the field or garden, where a conclusive demonstration must be given before the task is completed. The problem is not only to determine characteristics of varieties, but to demonstrate the existence of these characteristics as well. On the other hand, a satisfactory field test of varieties can not be made without a preliminary study of characteristics, mainly from a botanical standpoint. One can not read until he learns the alphabet. The A B C in this case means a thorough knowledge of the varieties with which one is working. After this knowledge is gained, and not before, comes the comparative and decisive field test. In fact, one must become an expert in varieties before he can test them. He must know them as well or better than a botanist does species, or the gardener does his pets. He must study varieties not only to learn what they are, but what they are good for; in fact, must take the utilitarian standpoint of view with the farmer and gardener.

A variety trial can not be made in a single season by any but an expert, because the ground can not be covered in that time. Even if one trial were conclusive it takes several seasons to work up to it. When this preliminary study is concluded and the work with any class of plants is to be commenced, the first thing to do is to reduce the list to the smallest possible dimensions. The mistake of the novice is to make the list of varieties as long as possible. This is proper and essential in preliminary work, but in a comparative test too many varieties overtax the observer, and in a report distract the attention and confuse the reader. Synonymous sorts must be rejected, also those that are similar, unless the design is to show their similarity. Old varieties that have been discarded and new ones not known to the public, unless of uncommon merit, must be thrown out.

Varieties that are not well fixed and are known to be variable, have no place in a comparative test, as they are likely to obscure results and to bring discredit upon the whole work. The best or leading varieties of all classes of plants show but little variation. One or more of these should be selected as a standard for comparison in each trial of varieties. Further selection is to be governed by the end in view, but the fewer the number of varieties the better. Seldom will the list need to exceed ten for any one class of plants, and less than that number is better than more, even though a seeming sacrifice must be made.

There is danger in attempting to cover too much ground in variety work, not alone by including too many species and varieties, but in endeavoring to make too many comparisons at one time. In nearly all experimental work there is danger of being drawn aside from the line of investigation first proposed, and in variety testing the temptation is peculiarly strong because it seems so easy to cover just one point more, and we are apt to persuade ourselves that it ought to be done.

If varieties are to be compared as to earliness, one and sometimes more are taken as standards, and such others are added to the list as may be required to carry out the object in view. In the same manner comparative productiveness or any other quality is determined. In each case different standards of comparison are used, and a new list of varieties taken.

If one character or quality in the various varieties is compared and studied at a time, the work is simple and easy, but it becomes complicated and difficult just in proportion as the number of characters investigated is increased. If one undertakes to gather data from which to compile a table of varieties giving date of ripening, size, weight, etc., he is apt to have his vision obscured by the multiplicity of objects before him. He sees nothing clearly, and of course can not make a clear presentation of the facts observed. There is force in concentration and weakness in diffusion.

The particular point upon which to concentrate must be determined with care, for it is useless to expend energies upon the elucidation of something that is well known, or that which no one cares to know. The investigator must be able to look at the matter from the same standpoint as the practical cultivator of the soil before he can see what is to be done. If he finds nothing of special importance that requires to be investigated, then there is nothing for him to do. He would as well do nothing as to compare and report upon varieties in a general way without bringing out and showing clearly specific points of difference and resemblance. When practical men are asking "Which is the earliest variety of strawberry? Which is the latest? Which is the best for forcing? Which is the best pollenizer? What varieties of the various fruits are best for evaporating, shipping or storing? What varieties of corn are best suited for silage? What varieties of wheat have the stiffest straw?" and numerous other specific questions, it shows that there are some difficult problems in variety work, and what questions should be investigated.

As has been indicated, the kind of information that is wanted is not general, but specific. This is the place where the practical man halts and wavers. It takes him but a short time to work up to this point, but it often requires a long and costly effort to get beyond it. He realizes his needs, but is unable, as quickly as he would like, to gain the knowledge from experience. Not only this, but without the requisite training there are few minds so constituted as to be able to sift and weigh evidence and to decide what constitutes proof.

The experiment station worker may, from inexperience, fail to see what specific questions are to be answered concerning varieties. The practical man can state the problem, and it remains for the trained observer to give clear and conclusive demonstrations. The answering of these specific questions is what really constitutes variety testing. Do one thing at a time and that thoroughly, is the only successful method in variety work. There is one class of experimental work that naturally falls in the line indicated. In cases where plants are subjected to different methods of treatment, as in work with fungicides, insecticides, and in varied methods of cultivation, there arises the question as to unlike effects upon varieties. The same is true of plant diseases. Unfortunately, the importance of this matter has in many cases been overlooked or ignored, but work of this nature can not be considered complete until the effect of varied treatment is noted for all of the most important varieties. The primary conception of such work is not a variety test, but that necessarily becomes a part of it.

As an illustration, some experiments in transplanting onions and radishes have been conducted during the last two seasons. The crop was doubled by this method of treatment with some varieties of onions, while others showed but little gain; hence a variety test was necessary before the result could be announced. Experience with radishes, celery, strawberries, and other crops has been similar. In each case the experiments in special culture were incomplete without the accompanying variety test. It is well known that applications made to the leaves of plants do not act alike upon all varieties of the same species, nor are all affected alike by plant diseases.

The variety specialist will readily determine how far it is necessary to extend observations in this direction, and where work involving special treatment of plants does not come under his supervision his aid will not only save useless labor, but will enhance the value of that which is done by others.

The determination and demonstration of variety characteristics must in most cases be made by actual field trials.

This leads to the consideration of an important matter in variety testing, namely, the size of the plats. For a preliminary study it makes but little difference what size of plat is used. When the number of varieties runs up into the hundreds, as is often the case, the plat must necessarily be small, often containing but a few plants of each variety. In field tests of varieties some new elements enter into the problem which render small plats inadmissible. Plants of some varieties show a marked individuality that vitiates results if small plats are used. It is not uncommon to find a hill of potatoes that yields twice as much as another hill in the same row. Some strawberry plants show ripe berries several days before others of the same variety along side. These individual differences may produce marked variations in small plats, but have less and less effect as the number of plants is increased. Varieties are not all equally well fixed; some vary more than others; hence a comparison where but few plants are used is far less trustworthy than where number is sufficient to distribute the effect of variability. It has been argued that small plats are less liable to be affected by inequalities in fertility of the soil than large plats. This may be true and it may not. In most fields there are small areas of higher or lower fertility than the surrounding parts, caused by a stump rotting away, or a tree having been overturned, or other causes that are unknown. These inequalities of limited areas seriously affect small plats, often greatly increasing or diminishing the yield, as the case may be. These spot variations have but little effect upon large plats.

The results obtained in plat work must be stated in terms familiar to those for whom the work is intended. To tell a practical man how many pounds of potatoes were dug from ten hills does not convey to him the same meaning as to state the yield in bushels per acre. If he learns that the rate per acre was obtained by the use of a large multiplier his confidence in the work is shaken and he may ridicule that which he would admire and use if it were done in what he would call the common-sense way. The practice of estimating yields is a dangerous one, yet with small plats it must be done or the results can not be presented in a manner that is satisfactory to the ordinary farmer or gardener. The best plan is to reduce the number of plats and increase the size, so that in making reports small multipliers can be used or none at all. The nearer that ordinary field practice can be followed the more satisfactory will be the results to both the experimenter and his constituents.

Duplication of plat work is recognized by all as essential, but whether it is better to confine the duplicates to one locality or to carry on the work upon different soil is an open question. On the one hand it is argued that the work can be carried on much better if it is all under one management than if widely separated and intrusted to different parties. The experience in Ohio has been that it is hard to find men who can give sufficient time to such work and bring to bear the requisite ability. Many to whom seed or plants are sent do not report, and those that do overlook very many important details. We have had some very fair reports, but many others that could not be used for want of details or evident inaccuracies. With the very greatest of care in selecting men for such work, only a small per cent will give reports of sufficient value to warrant publication. Possibly with more careful supervision, such as could be given if frequent visits were made to those with whom the work was intrusted, satisfactory results could be obtained in this manner. The argument is used that varieties vary so much on different soils that they can not be tested satisfactorily in any other manner. There is just enough truth in this belief that varieties vary according to the soil to make it dangerously false. Fortunately this is not true of all varieties, particularly not of the best. A variety test conducted simultaneously in different localities has less added value on that account than it is commonly supposed to have. It may be more convincing to most people and for this reason is possibly worth the extra cost if properly conducted.

It is best in all experimental work to conduct it in such a manner that it will have the confidence of the people and be convincing, but accuracy and thoroughness must not be sacrificed, for it is not worth while to try to convince the people of something that is not true.

Variety testing can not be put into incompetent hands with any more safety than other work. It requires the skill, patience, judgment, in short all the trained faculties of an expert to carry it on properly. An intelligent farmer or gardener can meet the requirements in part, but not wholly. The work must be laid out and fully explained to him, its progress watched, and the possible errors carefully guarded against. If it is necessary to concentrate upon a definite point in variety tests carried on at the station, it is still more essential when put into the hands of those who lack experience in such work. The work of a practical man is more to be trusted than his conclusions, but he ought not to be left to himself in work that is to be used for publication. The chemist, botanist, and entomologist may put certain work into the hands of the practical man for verification, but hardly more than that. Why the scientific worker can not intrust more than this to the practical man is evident from the fact that he has had no training in such work. So far as the execution is concerned the practical man would be better fitted to carry on variety tests than strictly scientific work, but his conclusions would be unsafe in both cases. If variety work is put into other hands than those connected with the station, it should be for verification only. The plan of having a few substations in different parts of each State, controlled by the central station and in the hands of trained observers, has proven satisfactory in some cases. No doubt it will in all where properly managed. At least it is much superior to the plan of sending seeds and plants out indiscriminately.

This paper is not intended as a plea in defense of variety testing, but the opinion may be offered that if such work deserves to be continued by the stations, methods must be carefully studied. Like all other work it must stand on its merits. It is too soon yet to say how much merit may be put into such work, but those who have given the matter the most attention say that the case is not hopeless.

A DELEGATE. The reader referred with great terseness to the importance of obtaining conditions as nearly as possible like those of field culture. It seems to me we can not be too careful in this matter. In some investigations in regard to soil moisture, I found a difference of 4 per cent between the amounts of water in the middle and in the edge of a naked strip of 2 feet left between plats of oats 10 feet broad, from which it may be inferred that there was a considerable difference between the amounts of water in the margin and in the middle of the plats. The yield from the edge of the plats was from 28 to 38 per cent larger than that for the interior. It seems to me best, therefore, in order to eliminate disturbing influences which we are unable to estimate with any degree of exactness, to make our tests upon small areas selected from large fields.

Mr. ALWOOD. After eight years' experience in variety testing, I have come to the conclusion that results obtained from plats are not to be relied upon, and have adopted the following method:

I lay off a field of sufficient width to give me plats of the size I desire by taking one, two, or more rows running clear across it. This allows cultivation across the plats, and as no bare spaces are left, avoids the difficulties mentioned of by the last speaker.

Mr. CURTIS. I have very little faith in variety testing, and I would like to ask Professor Green whether it is true that varieties which prove best in Illinois will, as a general rule, prove best for all other States having practically the same latitude and conditions.

Mr. GREEN. I am willing to answer that question in the affirmative as a nearly general statement. There are exceptions, but they occur usually in the case of those varieties which are unreliable anywhere.

Mr. CURTIS. We have in Texas many nurserymen pushing varieties on the market who make a point against Northern dealers on the ground that the varieties from other sections are uncertain because not tested in our climate.

Mr. GREEN. Climate certainly causes variations in crops, but climate has very different effects upon different plants. The strawberry, for instance, is quite uniform in different latitudes.

A prominent nurseryman in talking with me said that variations due to climate furnished nurserymen a convenient hole to crawl out of when one was needed. They are continually sending out varieties about which they know little, which may prove to be good or may prove to be bad, and in the latter case it is convenient to lay the fault to the climate and soil.

Mr. ALWOOD. I agree with Mr. Green in the main.

Mr. MASSEY. I have no reason to disagree altogether with Mr. Green's statements, but we know that there are differences in the same varieties grown with different climates.

Mr. GREEN. That we will admit.

Mr. MASSEY. For instance, the St. Atlas strawberry is not of sufficient value to make it conspicuous as a market crop in eastern Maryland, but in North Carolina it is accepted on all hands as a most valuable variety.

The fruit which upon test proves itself bad and worthless in one place will almost always be worthless everywhere. The soil has, however, a good deal to do with certain fruits, and particularly with strawberries. I am of the opinion that moisture supply has much to do with the success of the strawberry, more than either the climate or soil.

Mr. ALWOOD. I think Professor Massey's selection of the strawberry as an illustration is particularly unhappy, as the strawberry does better under a wide range of latitude and climate than almost any other fruit.

A DELEGATE. I agree with Professor Green in the main, but his statement that the so-called best varieties are the most reliable is not in accordance with my experience. In the case of the cabbage those varieties admitted to be the finest when grown under the best conditions are notoriously variable and unreliable when grown under ordinary conditions. It seems to me safe to say that the more highly developed a variety becomes the more susceptible it will be to variable conditions.

MR. BURRILL. I want to emphasize Mr. Green's statement of the necessity of great care in variety testing. The first thing thought of by Tom, Dick, or Harry when he decides to make experiments in agriculture or horticulture is to find out whether red apples do better than yellow apples, or something of that kind. If his work is to be of any benefit, it must be critical, given the best of attention, and expert through and through, otherwise the results will be of no value whatever. I believe much of the matter published in this line has been worse than nothing, because it is misleading. In this work, we must raise our ideas of exactness so that our conclusions when obtained shall be real conclusions. Our work must be so thorough that once done it will leave nothing more to be done.

Mr. REDDING. I judge that most of the speakers have had in mind only vegetables. In Georgia the testing and improving of varieties of cotton, sweet-potatoes, and to a less extent Indian corn, are of greatest interest. The cotton States are, of course, most interested in cotton. This furnishes a wide and useful field of investigation, and if we are to come into a general discussion on the present subject I hope that those interested in this particular line of work will give us what information they can. We are making a series of cotton tests. It seems to us important that the work for the first year should be preliminary, having as its particular object the development of seed to be used in further experiments. I am of the opinion that in testing a given variety all the seed used should be grown on the same stalk, fertilized alike, and in other respects grown under the same conditions.

Mr. FREAR. We should bear in mind the fact mentioned by Professor Green, but not dwelt upon, that varieties are adapted to different purposes and to particular climatic and soil conditions, and when we test varieties we should remember that the same treatment is fair only when applied to varieties especially selected with reference to their adaptation to the conditions under which the test is made. It seems to me that we can improve our varieties very much if we take this point into consideration, although it is very difficult to do.

Mr. ALWOOD. I should like to suggest to the chemists that in connection with this work of variety testing by the horticulturists there is a field for them. What is it that makes one plant more susceptible to certain influences than another? What is it that makes one plant more hardy than another?

Mr. ALVORD. One of the objects of bringing matters from the standing committees into the general session is to make possible their discussion in all their bearings. The Maryland Station has done much work and spent much money in variety testing which has been worthless and has season after season seemed more confusing in its results. We should do less work and do it more thoroughly after the most careful preparation and planning. At our station we have decided to take up one thing, the tomato, and do the most thorough work possible upon it. During the last two years a vast amount of work has been done by our horticulturists with 80 or 90 varieties of tomatoes in field comparison, and laboratory tests have been carried on in a comprehensive manner by our chemist. I judge from reports that similar work has been done in other places.

It seems to me very important to bring about coöperation in this work. If New Jersey and Maryland are to occupy themselves with the tomato, let them work closely together and confine themselves to that line, leaving the cabbage to the cabbage States. We have been talking for 3 years of coöperation, but very little has been done, and it is time we should come down to business and actually do some coöperative work. A large part of our work for the last 2 or 3 years seems to me to have been a waste of time and money, necessary perhaps in the early years, but showing the great need of close coöperation in the work of variety testing of small fruits, vegetables, and field crops.

Mr. ATWATER. It seems to me that Major Alvord has hit the nail on the head as squarely as can be done. Looking over the work of the experiment stations, as it is my duty to do, I have been most forcibly impressed with the need of more coöperation, and although I can not claim to be an authority in horticulture, this need has seemed to me to be especially great in the work of variety testing.

May I be permitted to make a suggestion? The agricultural production of the United States is one-sided. Our products contain an excess, for the purposes of animal and man, of the fats, and too little of the nitrogenous compounds. We are producing extra fat swine and very fat beef. One reason for this fact is that our great staple crop, corn, is relatively poor in nitrogen and therefore tends to produce fat in the animals to which it is fed. What shall be done? Two things. First, encourage the use of plants rich in nitrogen; second, develop a nitrogenous variety of corn. I think such a variety can be bred by careful selection. Is it not possible that by selecting a variety comparatively rich in nitrogen, taking seed from the ears which show the largest nitrogen content, and following this process through many generations we may eventually obtain a variety of corn suited to our needs? I throw out this suggestion to specialists in this line of work in the hope that they will consider this subject and agree with me that something can be done.

On motion of Mr. Alvord, it was ordered that 10 minutes be devoted to miscellaneous business and reports, and that then the general session be closed in order to give opportunity for meetings of the permanent committees.

Mr. Sanborn, for the committee appointed to take into consideration the recommendations of the executive committee, reported as follows:

(1) That the Association authorize and direct its executive committee to request each agricultural college to contribute $25, and each experiment station $10, to be applied to the liquidation of present indebtedness and the expenses of the Association for the coming year, and urge upon said institutions the importance of making these contributions early in the year 1891.

(2) That no college or station shall have a membership in the Association or enjoy its privileges until it has made contribution to its funds.

(3) That it is the sense of this Association that the Office of Experiment Stations of the Department of Agriculture can be and should be of assistance to the several stations of the country, by the preparation of indexes to station bulletins; by the purchase of periodicals; by the preparation of special record books; by keeping a record of applicants for positions at the stations, together with their recommendations, and of stations desiring workers; and in general by becoming in part, in the interest of the economy of both funds and time, what it has by some been designated, a clearing-house for the common interests of the stations, whenever common interests can be advantageously served.

We respectfully request of the honorable Secretary of Agriculture a consideration of the interest involved, and if the purpose is found feasible, the issuance from the ~~Office of Experiment Stations of a circular defining~~ " the directions in which assistance can be given and requesting a statement of the needs of the stations in the field outlined." 4

(4) This Association hereby directs its executive committee to call its next annual meeting at or near the time and place designated by the American Association for the Advancement of Science for its annual meeting, and that the secretary of the Association be directed to most respectfully request the several associations in the country engaged in the development of agricultural science to hold their annual meetings in such connection with the several associations meeting at the time specified that those interested may attend the meetings of each of the associations in question.

It should be stated that one member of the committee, Mr. Plumb, did not agree with the majority in regard to the fourth article of this report. Mr. Plumb stated that he objected to the fourth recommendation because he thought it desirable for the Association to hold its meetings as often as possible at an agricultural college or experiment station.

Mr. Sanborn called attention to the fact that for a large number of persons attendance at the meetings of the Association involved a long journey and a considerable outlay of money; that a large number desired to attend both this Association and the American Association for the Advancement of Science, and that this could be done in very few cases unless the place and time of meeting were the same.

Mr. Fairchild, of Kansas, said that by adopting the plan outlined in the fourth recommendation of the committee, persons attending this Association would be able to take advantage of the reduction in railroad fares obtained through the agency of the larger association.

The first paragraph of the report was read and adopted.

The second paragraph was read and it was moved and seconded that it be adopted.

Mr. Redding moved to amend by inserting the words "in arrears" after the word "station," making the resolution read, "That no college or station in arrears shall have membership," etc. The motion was seconded.

The President remarked that some stations were in arrears because no meetings of their board of directors had been held since the assessments on them had been made. He thought there was a disposition on the part of most of the colleges to pay, and thought it would be a matter of regret if any were cut off from membership because their governing boards had not been called together in special session. He said there might be some which had paid their assessments for a number of years but were in arrears at the time.

Mr. Turner stated that he had received no notification of the last assessment upon the institution he represented until a very short time ago; that he had then sent his personal check to the treasurer because the bill could not be paid from the college treasury until approved by the trustees.

Mr. Sanborn stated that these facts had been considered by the committee and had led them to prefer the second article as reported, and that the committee had further thought the obligations to several individuals incurred durng the last winter, so honorable and so binding upon the members' of the Association that the amendment would be unnecessary.

The amendment was withdrawn.

Professor Armsby read the following article from the constitution and urged that the resolution would be unconstitutional:

> At any regularly called meeting of the Association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, and the Department of Agriculture, shall be entitled to one delegate.

Mr. Curtis moved to amend the report by striking out paragraph 2.

The President stated that the motion before the house was to adopt the paragraph, and that in order to accomplish Mr. Curtis's object the pending motion should be voted down or laid upon the table.

Mr. Curtis doubted whether colleges had a legal right to pay the assessments made.

Mr. Atherton thought both the resolution and Mr. Curtis's proposition went too far; that the importance of the matter under consideration should be authoritatively urged upon delinquents by the executive committee in the name of the Association, and suggested that the motion to adopt be voted down and the executive committee instructed to make an urgent representation to the colleges and stations in arrears of the work of the Association and the necessity for contributions.

Mr. Sanborn said the committee believed the resolution recommended would be of great use in strengthening the hands of the executive committee, and of the presidents and directors of the delinquent colleges and stations in obtaining from their governing boards the necessary appropriations to discharge their obligations to the Association. He thought no institution could honorably expect representation unless it bore its share of the expenses.

Mr. Porter asked what part of the Hatch act or of the act of 1862 authorized governing boards to make the appropriations necessary.

Mr. Curtis said he was embarrassed by the question raised by Mr. Porter, but appreciated the force of Mr. Sanborn's statement, that each institution was in honor bound to bear its share of the expenses. He objected, however, to anything which seemed like an attempt to drive members into an honorable course, and believed that if the treasurer called attention to the condition of the treasury delinquent institutions would find some way to pay their dues. He therefore moved that the motion before adopted lie upon the table. The motion was seconded and adopted by an ayes and noes vote of 27 to 9.

The third paragraph was then read and after remarks of approval by Mr. Atwater and others, was adopted.

The fourth paragraph was then read.

Mr. ATHERTON. Do I understand this resolution to apply to next year only or to all future meetings?

The PRESIDENT. To next year only.

Mr. SCOTT. In order that we may vote intelligently, I desire to say that it is my purpose to invite the Association to meet next year at the Ohio State University and the Ohio Agricultural Experiment Station.

Mr. THORNE. I wish to second the invitation most heartily.

Mr. JENKINS. I have a very decided preference for meeting in the West and not in connection with the American Association nor at the same time. While I should appreciate the instruction and pleasure attendant upon meeting with that body of scientific men, it seems to me that we should lose by such an arrangement more than we could gain. We meet for business purposes. We would waste our forces in combining with any other association. There would be too many ways in which time might be employed. For myself I should much prefer to bear the extra expense of making separate trips to the different meetings. [Applause.]

Mr. MASSEY. I am authorized to request this Association to meet next year in Raleigh, North Carolina. The selection of this place would solve all difficulties, for those who desire to attend both meetings could do so at very trifling expense.

Mr. SANBORN. It was not proposed by the committee that the meetings of the two associations should occur upon the same days. If the meeting of the American Association was held in the third week of August our meeting could be held in the second or fourth week.

Mr. PLUMB. This Association has recommended the stations to send to its meetings as many of their workers as possible. If we meet in August, which is a very busy time, but few station workers will be able to attend. Moreover, as that time falls in the college vacation quite a number of college men will be in Europe or in other places, from which they can not come to the meeting. Furthermore, if the meeting be held in connection with that of the American Association business will not be transacted with celerity and but poor attention will be given to it.

Mr. ALVORD. As the suggestion under discussion originated with the executive committee, allow me one word. The original plan, intended to apply to next year only, contemplated holding the meetings of all the associations which members of this Association would like to attend at some one place, that place to be Washington, and the time to be so arranged that no two meetings should conflict. It was thought that this would tend not to diminish attendance, but to increase it largely, and to afford facilities which could not be obtained in any other way. Furthermore, our action will not fix the date or place of the convention absolutely, for the constitution reserves the final decision of this matter for later action by the executive committee. The fact that one other association in which many of us are interested is to meet in Washington may not be sufficient to lead us to meet there, but if it should prove that three or four associations which many of us are likely to attend next year meet in Washington on consecutive weeks or days it will be well, as the executive committee thought, to fix the time and place of our meeting so that our Association can coöperate in a general meeting. I understand that one member of the executive committee has already suggested in correspondence with Professor Warington, of Rothamsted, England, that the convention would next year meet in Washington.

Mr. SANBORN. We have never had a representative from the Pacific Coast. I think the plan would bring representatives from California, Washington, and Oregon.

Mr. JENKINS. The statement that it is not intended to hold our meeting at the same time with other associations quite changes my views. But there is one other matter which we need to consider, the temperature of the city of Washington in August.

Mr. SCOTT. If you want a comfortable temperature in the middle of August, come to Columbus. You can run over to the American Association at Washington in a night.

Mr. ATWATER. I have spent the larger part of two Augusts in Washington, and I have suffered less from heat there than I did at Philadelphia or Indianapolis in attendance upon meetings of the American Association.

Mr. THORNE. Is it not worth considering that this arrangement would give us good railroad rates?

Mr. MASSEY. There will be very little difficulty in getting cheap rates to Raleigh.

Mr. HADLEY. New Mexico has been expecting this Association to meet in Santa Fé next year—a good place, half way between the Atlantic and the Pacific.

Mr. ATHERTON. The plan of meeting in Washington every second year has seemed to me and to others, as I know, a good one, for the reason that it would bring together men from all parts of the country to that city where they might be in consultation with the Departments of the Government, and with members of the two Houses of Congress when legislation might be pending or when questions affecting us might be before Congress. But this proposition does not afford us this advantage, as the meeting is to be held not in November or December, when Congress is in session, but in August. I agree perfectly with Professor Plumb that the Association has done its best work, except the business done at Washington with reference to matters of legislation, at the meetings held at the stations. And I must beg to say that if our friend, Professor Atwater, had been in Washington during the session of the legislative committee last summer, he would have found it hot enough. For the present and until we get well upon our feet, I am very strongly inclined to think that we shall do better to pursue our own course, meet in our own places and in our own time.

Mr. CLUTE. It seems to me that the gentleman who has just spoken has struck the key note. Our Association meets for work for which our colleges and experiment stations pay our expenses. It seems to me that if we go to Washington in August, a time when there will be a great deal of interest and a great deal of excitement there, we shall accomplish but little.

Mr. ARMSBY. I desire to call the attention of the convention to the following provision of the constitution:

The executive committee shall determine the time and place of the meeting of the Association.

Of course the Association is competent to determine the place of this meeting. But I wish to suggest that this matter should not be so definitely fixed that in the case of some unforeseen combination of circumstances the executive committee may not have power to act.

Mr. SANBORN. The resolution is only an expression of the sense of the convention. If, in the judgment of the executive committee August proves to be an undesirable time, the executive committee will still have power to determine a time and place.

On a vote, the fourth paragraph of the report of the committee was lost.

Kansas City, Missouri, and Fort Collins and Denver, Colorado, were suggested in addition to the place mentioned before as places of meeting.

After some discussion, Mr. Atherton moved that the entire matter of time and place be left to the executive committee. Mr. Northrop, in seconding the motion, gave the Association an invitation to meet at Minneapolis, Minnesota.

The motion was carried by a vote of 31 to 15.

Mr. DABNEY. I move that the executive committee, in preparing the program for the next convention, provide for a session one day longer than the present one. My reason for this motion is that the permanent committees have not had time to transact their business. Some of them have had but one short meeting. It seems to me that we should take the whole of a week for the work that calls us together. The time has certainly come for an increase of one day.

This motion was carried.

Mr. CLUTE. I move that the executive committee be requested to omit addresses of welcome and responses from the program.

The motion was lost.

Mr. ALVORD. It was hoped that the permanent committees might hold meetings this afternoon, but it is now so late that it can not be done. I therefore suggest that we devote the whole of to-morrow morning from 9 to 12 to such meetings. Dr. Armsby proposes that he read his paper prepared for the general session before the chemical section. He states that it is very technical in character and that he will be entirely satisfied with the change. I now move that a committee of five on nominations be appointed by the chair. The motion was carried. The President appointed Messrs. Fairchild, of Kansas, Broun, Stockbridge, Curtis, and Pettee.

Mr. SCOTT. The executive committee at its meeting held yesterday, thinking it proper that the Association adopt some resolutions in regard to the resignation of President Gates, requested me to draft a minute, which I now offer:

Whereas Dr. Merrill E. Gates, by his resignation of the presidency of Rutgers College and the New Jersey State College of Agriculture and Mechanic Arts, has severed his connection with this Association:

We therefore desire to place on record our high appreciation of his ability and character, our sense of loss at his retirement, and our gratification at the merited distinction he has received in his election to his present position as president of Amherst College.

The Secretary is hereby directed to transmit a copy of this minute to Dr. Gates.

The resolution was unanimously adopted.

Mr. Harris called for the consideration of his paper on college and station work at the World's Columbian Exposition, which had been made the special order for this time. He suggested that the matter be referred to a committee for consideration before being taken up for general discussion. Mr. Dabney moved that a committee of five station directors be appointed to consider the matter and report later.

The motion was carried, and the President appointed Messrs. Armsby, Alvord, Tracy, Ingersoll, and Scovell.

Mr. PATRICK. I wish to say a word in regard to the programs. There are many here whose interest is almost entirely confined to special lines of work. I am a chemist, but I am obliged to attend all the general sessions of the convention, where we have had much horticulture and other things not particularly profitable for chemists, but no chemistry. I suppose the same is true in regard to the entomologists. I rise to protest against the regulations which require the attendance of specialists at the general meetings, instead of allowing them to meet in permanent committees. I know that others feel as I do.

The PRESIDENT. I am of the opinion that it would be a great mistake to divide the Association too completely. I am interested in all sections and would like to be everywhere. We need to get together and learn of each other to learn of the work of other departments as well as those in which we are working. Nevertheless, while in general I approve the present plan, I favor an arrangement of the program which would give more time to the permanent committees.

Mr. ALVORD. Allow me to call attention to the difference between our present program and those of previous years. If you notice them you will see that we are adjusting ourselves to the circumstances under which we meet. When we began we had general sessions only. This year the larger part of the time for the meeting is assigned to consideration of special subjects. Next year we shall add another day to our session, and I feel certain that ample time will be found to cover the whole field.

Mr. PATRICK. The addition of another day will doubtless relieve the troubles of which I spoke. The fact is, however, that up to this time the chemists have had no opportunity for work. The permanent committee met last evening long enough to organize, but no papers have yet been presented. The entomologists feel as I do, although they make no protest. The committee on entomology, however, at times assembling under another name, holds its meetings right through the general sessions. This shows that the feeling is general that the workers have come here to meet men in their own line and not to listen to discussions in other lines. I move that the executive committee be requested to so frame the program for the next convention that workers in special lines may have ample time to meet together for technical discussions.

Mr. ALVORD. I understand that to be in exact accord with the program as printed.

Mr. RILEY. I am in favor of the motion as made, or at least of the suggestion which it embodies. The entomologists have realized the difficulties growing out of the fact that in general sessions the special discussions have taken lines of but little interest to them. We do not wish, however, to antagonize the officers of the Association. So far as I am concerned I would much rather abandon shop and listen to something outside of my specialty, but others feel differently and wish to discuss questions in their own fields of work. They feel that the time given for such discussions has been too short. But now that another day is to be added to the convention the problem will be solved. The entomologists have been considering this matter and a committee has been appointed which will doubtless make a request to the Association this evening for some action next year in the way of a change in the program so as to permit greater freedom on the part of the permanent committees. I hope the tendency will be in the direction indicated by the former speaker, and that the Association will, like the American Association for the Advancement of Science, make the committees more or less independent.

Mr. ATHERTON. This morning the question was raised whether a delegate could represent college and station at the same time. To answer this question, I submit the following in the form of an amendment to the constitution.

Put a period in the place of the semicolon at the end of line 4. Then insert "The same delegate may represent both a college and an experiment station, and may take part in the proceedings of the sections proper to either or both." After the words " but no delegate shall cast more than one vote," insert "either in a section or in convention," so as to make the paragraph read as follows:

At any regularly called meeting of the Association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, and the United States Department of Agriculture shall be entitled to one delegate. The same delegate may represent both a college and an experiment station, and may take part in the proceedings of the sections proper to either or both; but no delegate shall cast more than one vote either in a section or in convention. Other institutions, etc.

Mr. DABNEY. It is but justice to the executive committee to say that the committee on chemistry has, up to the present time, had two and a half hours for its discussions. If they have not been used, that is not the fault of the executive committee.

Mr. MYERS. All the chemists ought to belong to the Association of Official Agricultural Chemists, in which chemical questions are more fully discussed than can ever be the case in a permanent committee of this Association.

Mr. SCOVELL. I think the program has been as well arranged as possible, and that no fault lies with the executive committee.

Mr. Patrick's motion was referred to the committee on order of business, to be assigned a place on the program.

I further propose that the constitution be amended by substituting the word "section" for the words "permanent committee" wherever they occur in the constitution.

Both amendments were adopted.

Mr. Fernald offered the following resolutions, which were referred to the executive committee for consideration:

Resolved, That the prominence and importance already attained by the cause of industrial education in this country, and its possibilities of future good in all our States and Territories, furnish to its friends and supporters just occasion for congratulation.

Resolved, That the eminent service of the Hon. Justin S. Morrill, of Vermont, not only in its relations to early legislation, by virtue of which the land grant colleges were established, but also in its relations to the recent act of Congress providing for a more ample endowment of these institutions, merits the approbation of all interested in the national welfare.

Resolved, That the Association of American Agricultural Colleges and Experiment Stations hereby expresses its grateful appreciation of the long-continued, faithful, and highly successful efforts of Mr. Morrill in the interest of these institutions, and hereby extend to him the hearty and earnest thanks of the Association for his invaluable services.

EVENING SESSION, WEDNESDAY, NOVEMBER 12, 1890.

The meeting was called to order by President Smart at 8 p. m., in the chapel of the university.

The subject for discussion, "Should this Association take any action in cases where formal charges of misuse of the United States appropriations are made against any college or station?" was by vote referred to the section on college work.

Mr. Stockbridge delivered a short address on the agriculture of Japan.

Regent Peabody tendered to the Association, on behalf of the faculty of the University of Illinois, an invitation to attend a reception at the house of the Regent the following evening at 7 o'clock, which was accepted by unanimous vote.

The Association then adjourned to give opportunity for meetings of sections.

MORNING SESSION, THURSDAY, NOVEMBER 13, 1890.

The meeting was called to order by President Smart at 9 a. m., in the physical lecture room of the university.

Mr. Alvord moved that the sections be authorized to hold meetings for the discussion of technical subjects, but not for the consideration of business, during the general business sessions of the Association, provided the accredited delegates of the Association are not thereby prevented from attending the general sessions of the convention. He explained that the committee on the order of business believed that the committees which met the preceding afternoon were not authorized to do so, but thought there was no objection to authorizing such a course if attention be devoted to technical discussions only. He called attention to the fact that the official program provided another day for meetings of sections without reports to the general convention.

The convention then adjourned to allow the sections to convene.

AFTERNOON SESSION, NOVEMBER 13, 1890.

The Association was called to order at 2:15 p. m. by President Smart.

The sections were called upon for reports.

Mr. Tracy, for the section on botany, reported as follows:

The section on botany has held regular sessions at all times available. The section selected as officers for the coming year, Mr. Halsted, of New Jersey, chairman, and Mr. Thaxter, of Connecticut, secretary. The desirability of securing uniformity in the fittings for spraying apparatus was considered, and after conference with the sections on entomology and horticulture, Mr. Fairchild, of Washington, D. C., was appointed to act with Mr. Alvord from the section on entomology and Mr. Troop from the section on horticulture as a committee in this matter.

On motion of Mr. Alvord, the report was accepted and the officers and the committee confirmed.

Mr. Sanborn, for the section on agriculture, reported as follows:

The section on agriculture has held meetings on the evening of the first day and this morning. The officers elected are Mr. Plumb, of Indiana, chairman; Mr. Morrow, of Illinois, vice-chairman; Mr. Thorne, of Ohio, secretary. Messrs. Atwater, Morrow, and Curtis were appointed a committee on coöperative experiments with milch cows.

On motion of Mr. Alvord, the officers and the committee were confirmed.

Mr. Dabney, for the section on chemistry, reported as follows:

The section on chemistry has met as provided for in the program, and has held two very interesting sessions jointly with the section on agriculture. Mr. Neale, of Delaware, was elected chairman, and Mr. Woods, of Connecticut, secretary, for the ensuing year.

The committee requests that Dr. Armsby's paper on recent work in digestion experiments be printed in the proceedings [see p. 132].

On motion of Mr. Alvord, the election of Mr. Neale was confirmed, and the publication of Mr. Armsby's paper was referred to the executive committee.

Mr. Forbes, for the section on entomology, reported as follows:

The section on entomology has to report a very successful meeting, in which all the time allowed by the executive committee has been occupied and no more. The chairman elected for the coming year is Mr. Cook, of Michigan.

The following was adopted as a resolution: "The section on entomology respectfully begs leave to state to the Association that the papers presented by its members have been of such general interest, and so much advantage has resulted to individuals (all of which will redound to the benefit of the stations and colleges), that they are encouraged to ask that if possible the program for the next convention be so arranged that more time shall be given for the consideration of special topics by the sections.

On motion of Mr. Alvord, the election of chairman was confirmed and the resolution referred to the executive committee.

Mr. Taft, for the section on horticulture, reported as follows:

Mr. Goff, of Wisconsin, was selected as chairman for the coming year. It was voted to continue Messrs. Green, Bailey, and Goff as a committee on the revision of nomenclature of vegetables, and Messrs. Taft, Butz, and Speth as the committee on the list of originators. Owing to the tendency of nurserymen and seedsmen to give objectionable names to new varieties, it was resolved that in station publications the names used for varieties should be in accord with the rules laid down by the American Pomological Society and the committee on vegetable nomenclature of the section. Mr. Troop was appointed to represent the section on the committee to secure from manufacturers uniform fittings and nozzles for spraying pumps.

On motion of Mr. Alvord, the election of chairman and the recommendations of the section were confirmed. A special vote was called for on the resolution in regard to the names of vegetables, which resulted in its adoption.

Mr. Atherton presented the report of the section on college work, and suggested that as it contained several matters requiring the action of the committee, it be considered in parts.

The section has elected as officers for the ensuing year, Mr. Atherton as chairman, Mr. Peabody as vice-chairman, and Mr. Kern as secretary.

On motion of Mr. Alvord, these elections were confirmed.

In connection with the new Morrill act, the section adopted the following resolutions: *Resolved*, That the college officers should endeavor to bring to the attention of the legislatures of the respective States, at the earliest possible date, the necessary legislative action under the provisions of the new Morrill act, and that until such action is perfected the representatives of the colleges present at this convention pledge their action and influence to insure an equitable division or impartial application of all moneys received under this act, in full accord with the spirit of the law.

After the addition of a recommendation that the executive committee prepare a copy of the resolutions for immediate distribution to the institutions represented and to the Secretary of the Interior and the Commissioner of Education, the resolutions were adopted.

Another matter which occupied considerable time was Senate bill No. 2779, for an increase to the Engineer Corps of the U. S. Navy. The interest we have in it lies in the fact that the bill provides for the introduction of a limited number of students from technical institutions, such as are represented in this Association, into this corps. After careful consideration the section instructed me to present this resolution with the request that it be adopted:

Resolved, That a committee of three, consisting of the chairman of the section on college work, and Presidents Smart and Dabney, be appointed to urge the prompt passage of Senate bill No. 2779 as one of the means of advancing the interest in the mechanical instruction in the colleges represented in this Association.

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Mr. NORTHROP. It is my fault that I was not present at the meeting of the section this morning when this matter was discussed. Had I been there I should have said then what I wish to say now, that I very much doubt the wisdom of the proposed action. We have taken part in agitation for government action in the past very successfully, but wisdom calls upon us to stop somewhere. It seems to me that wisdom teaches us to stop at this point. I suspect that the reason why we are asked to take action in this matter is that there is a possibility of some of the additional force of the Engineer Corps being appointed as instructors in the colleges without cost to them. There is already a law allowing something of that sort, but it has never been administered equitably; it has been the occasion of nothing but favoritism, and I for one want no more of it. [Applause.] I do not believe that the colleges should try to regulate the Engineer Corps of the U. S. Navy, and I think we will be wise to drop this matter where it is.

Mr. ATHERTON. I think I appreciate the position which Mr. Northrop takes, but I am constrained to believe that he is laboring under a misconception. There is a law providing for the appointment of twenty-five engineers and forty other officers as instructors in colleges, but the full number has never been detailed, and many institutions have been unable to obtain them. I am informed that Mr. Northrop has asked for a detail but never succeeded in getting one. I know many others who have tried in vain. I myself did so for five years. The Secretary of the Navy preceding the present incumbent told me that with the increase in the Navy, it was absolutely impossible to spare men from the duties of inspection, the supervision of construction of naval work, vessels, etc. About twenty officers were detailed at one time, but these are being gradually called in. As I supposed this matter would excite no discussion, I did not bring lists with me. In several instances officers detailed have been found so valuable to the colleges that they have been induced to resign their positions in the Navy to accept salaried college positions. I do not know what reasons moved Congress years ago to order these details to technical institutions from the Navy and also from the Army, but I think almost all agree that the measure was a useful one and that it is our interest and also the public interest to promote legislation of this sort. Naval instruction is not required in our colleges, but in many of them instruction is given in mechanical engineering, of which naval engineering is a part. Our institutions have received from the Navy help in the form of instructors who served without cost to the institutions. It seems but right that these institutions should contribute to the formation of the naval corps.

Again, the Navy, by virtue of the method of its organization—and I must use words that may be somewhat offensive—is something of a close aristocracy. Nothing will serve more effectually to bring the Navy into direct contact with the people of the United States than the taking of engineers directly from our colleges, as proposed by this bill. When a few months ago I found this bill pending I immediately took an active interest in it. I did not at first think it wise to ask this Association to approve the passage of the measure, but on reflection I concluded it right and proper for us to throw our influence heartily in favor of the passage of the law.

Mr. Curtis. I believe in a good navy and a good army, but I don't believe in this resolution. Four years ago we considered in this Association a measure whose object was to force upon West Point some of the graduates of these agricultural and mechanical colleges, and it will be remembered that the bill proposed permitted detail of U. S. Army officers to the colleges. The measure was defeated, I am glad to say. The only reason that I have heard urged in favor of this detail of military officers is that West Point graduates have nothing to do, and that places must be found for them or damage to West Point will follow. The naval officers are being recalled, but the military officers can easily be obtained.

Mr. Atherton. If the gentleman will allow me to interrupt him, I will state that the mechanical engineers' course at Annapolis was discontinued some years ago, so that unless some such provision as that called for in this bill be made, the Navy will soon be without engineers.

Mr. Curtis. I think we ought not to try to get engineers detailed. It is the business of our institutions to make engineers competent for the work of instruction in our colleges. Among our graduates there are many men quite as successful as teachers as any who have left West Point or Annapolis. We can not afford to go before the people with a record of having discouraged our own graduates.

Mr. Dabney. Some of us belonging to the section on college work thought the expediency of its action doubtful, and I believe that if those who are now opposing had heard the discussions in the section, they, like us, would be in favor of the resolution. The Navy at present has no source from which to obtain engineers. The institutions represented by this body though primarily agricultural colleges are also mechanical colleges, are growing stronger and stronger in this part of their work, and are the annual source of supply for the Navy. Moreover, if this bill be passed it will stimulate our students in the mechanical department to greater effort.

I am pleased to note that we are looked to for support. A member of this convention has received this telegram from the Chief of the Bureau of Engineers:

Resolution and appointment of a committee by your Association meet with my hearty approval. Good luck to you ever.

GEO. W. MELVILLE,
Chief of Bureau of Steam Engineering, Navy Department.

Mr. ATHERTON. I would like to say a few words in regard to the matter of favoritism. An instance in point that did not occur to me has been called to my attention by other members. When Secretary Whitney was in the Navy Department he received an application from his father-in-law, Senator Payne of Ohio, for the detail of a naval officer, which was refused.

Mr. Curtis has suggested that we turn out of our colleges every year men competent to give instruction, and that these men should have the appointments in our colleges. My experience has been that such men among our graduates are engaged before they leave us and that we are unable to offer them sufficient pay to hold them.

Mr. SANBORN. I am against the resolution because I think this Association ought not to get into a lobby in the interest of naval officers. I want men for our college as badly as any one, but I would not take them at this price.

Mr. NEILSON. It seems to me that this proposition is a plain business matter. It is universally recognized as important in educational institutions to supply to young men a stimulus for action, and certainly there can be no greater stimulus to the graduates of our mechanical departments than this opening of important positions in the Navy, and there certainly is need for this stimulus. Otherwise the business interests of the country would not so long have been calling for men of thorough mechanical training without finding them.

Mr. STOCKBRIDGE. It seems to me the discussion is drifting from the point. The question that we should consider is not the propriety of the original bill, but the advisability of this Association taking the action suggested. Allow me to recall an incident of our meeting at Washington last year. We were asked as an Association to take action on a bill then pending before Congress to transfer the Weather Service from the War Department to the Department of Agriculture. It was decided at that time almost unanimously that it would be impolitic on the part of this body to take any official action in relation thereto. I wish then to raise the question, whether we should not consider the advisability of any action by this Association rather than the wisdom of the bill before Congress.

Mr. ALVORD. I wish to call attention to the fact that in submitting this proposition, the section from which it comes had a precedent in the action of this body. At its last convention this Association appointed a special committee to confer with the War Department in regard to the administration of an act which had just passed Congress in regard to the detail of military officers to colleges, and it will be remembered that the action of this committee resulted in an understanding between the colleges represented in the Association and the War Department, which was in its main features similar to the provisions of this bill for carrying graduates of our colleges into the engineer corps of the Navy, viz, the honorable mention of meritorious graduates of the college in the Army Register, with a view, as expressed by the Secretary of War, to ultimately nominating them as candidates for appointment to vacant positions as officers in the Army.

While to some it may appear unseemly in this Association to act in a matter of this sort, I can not refrain from reminding the president of the Utah Agricultural College that twice lately at his personal solicitation I have visited the War Department for the purpose of having an Army officer detailed to his college. If I succeed in my effort, and I shall act under instructions until they are revoked, it will be because the influence of this Association secured the passage of the bill by the Fiftieth Congress increasing the number of officers to be detailed from the Army to the colleges and giving the colleges represented in this Association first claim on the War Department for the detail of its officers. [Applause.]

Mr. SANBORN. Major Alvord's diplomacy is greater than his logic. The act of 1862 placed upon us the obligation to teach military tactics and placed upon the United States the obligation to supply us with military officers.

Mr. DABNEY. It also obliged us to teach the mechanic arts.

Mr. SANBORN. It is our right, to be sure. I move an indefinite postponement.

Mr. SMART. This bill has a direct bearing upon our institutions. It is in a sense an educational bill, for in one of its most important provisions it touches vitally the interests of the colleges here represented in that it provides that students graduating from our institutions may upon competitive examination be admitted into the naval service. It is therefore a proper bill for us to consider. We have been asked by authorities at Washington to consider this matter, but that request should not be looked upon as an imposition, for the matter is one of vital interest to ourselves. Notice, if you please, that there is not one word in the bill in regard to detailing officers. That is entirely an outside matter. There is an act by which the Secretary of the Navy is permitted to make details, and he has made them for many years and will continue to have authority to do so, and we have nothing to do with the act. This is a bill to provide the means for the further education of our young men.

I do not care to discuss this matter fully, but simply to call attention to the fact that this case is not parallel to the one mentioned by Dr. Stockbridge regarding the transfer of the Weather Service to the Department of Agriculture, a matter with which we had nothing to do, whereas this is a bill of vital interest to our colleges. We have, therefore, a perfect right to consider it.

Mr. ATHERTON. Some things said here seem to indicate that there is a feeling that the college section is asking this Association to pass upon a matter of which it knows nothing and which it has not discussed. Allow me to say in justification of that section that as the question related entirely to the administration of the colleges and did not touch the experiment stations, either directly or indirectly, it was thought that the matter was a proper one to bring up in meetings of the college section, at which, it was assumed, all gentlemen interested in college work would be present. The section discussed the matter fully. Copies of the bill were at hand and all details were carefully followed, and only two or three gentlemen present expressed any doubts of the advisability of the action taken. I do not mean to dissent from the final conclusion which may be reached upon this resolution, but simply to relieve the section which I represent from the slightest suspicion of any attempt to bring undigested matter before this Association with a request for its approval.

Mr. FAIRCHILD, of Kansas. In justice to myself as a member of that section it is proper that I should say that my sympathies are with the statement of Dr. Northrop.

Mr. NORTHROP. May I say a further word in explanation? I hope no one will think I am making any factious opposition or that I have any particular feeling in this matter, for I have none whatever. I will tell you frankly what lies in my mind. We have just come out successfully from a long struggle to carry through Congress the Morrill bill. It is a most surprising success, and the passage of the bill by the Senate and the House is a matter of congratulation. But it is not a measure which has received unanimous applause throughout the country, and in more than one board of regents will be found intelligent and far-seeing men who criticise Congress for doing what it has done. Gentlemen having more intimate acquaintance with this Association than I have, think there may be trouble ahead; that we are to be watched and closely criticised. My thought is this: Let us not put ourselves in a position which will allow the country to say that we are insatiable in our demands; that not satisfied with $15,000 a year, with an annual increase of $1,000 each year until the sum reaches $25,000, we are now entering into a compact with certain officers of the Navy to secure the passage of a bill which will provide further for ourselves and graduate our students into the Navy. Do you see my point? I am perfectly willing that the bill should be passed; I am perfectly willing to have my graduates get the benefit of it; and I am perfectly willing to accept the benefits which will come to our college, but I do not think it wise at this time to make any effort for the passage of the bill.

Mr. ALVORD. This Association divides itself into sections and comes together in general session to confirm or disapprove the action of these sections. If we assign to the section on horticulture, for instance, the consideration of matters pertaining to that subject, would we not naturally suppose when the section came here with a recommendation that it had carefully discussed the subject? Would we not, except in an extreme case, heartily approve its recommendations and aid it in carrying on its work by the loan of the name of the Association?

Now, when the college section presents matters with the request that the Association indorse them, should that not be done? Should not this request, which refers to a matter of importance to the colleges only, be treated in a liberal spirit? It does not ask much. It simply requests the appointment of a committee of three to act in the name of the Association in furthering a measure which seems to that section to be of great importance to the colleges. We can do this as well as we can authorize a special committee on horticulture to act in the name of the Association. It would seem to be quite as good a thing to do as to appoint a committee to attempt to control the manufacture of nozzles for spraying-pumps. I think we shall be safe in trusting the three college presidents whom it is proposed to appoint, to do what is best for the Association. I think an important precedent is now to be established, that is, th at when a matter has been thoroughly digested by a section and a conclusion reached, the convention as a whole should abide by that action.

Mr. HADLEY. Allow one remark. It is quite proper for the sections and committees to discuss matters fully and to agree upon conclusions; it is just that their reports should be treated with great respect when reported; but it seems to me very important that this Association should reserve to itself full right to act upon these matters when brought before it as to it may seem best. [Applause.]

The PRESIDENT. The question is upon the passage of the resolution presented by the college section.

A vote was taken, and the Chair announced that the ayes seemed to be in a majority. A division was called for. The count showed 32 votes for and 17 against, and the resolution was declared adopted.

Mr. Atherton further reported from the committee to which was referred an invitation to take part in a congress of agricultural organizations, as follows:

(1) The committee to which was referred the invitation to this Association to take part in the formation of an American association of agricultural organizations, having given the subject the careful consideration which its importance justifies,

respectfully recommends the adoption of the following statements, to be sent as a reply to the invitation:

In view of the fact that the colleges and experiment stations represented in this Association are organized under the concurrent action of the United States and the several States, and that their duties, obligations, and sphere of action are defined by specific laws, and that they are severally subject to the control of boards of trustees, to whom they are responsible, and by whom alone the organic relations of each institution to other bodies can be determined, it does not appear to the Association that it could properly, or with advantage to either party, join in an association with other bodies differently organized and not subject to similar legal control. Nevertheless, in order to manifest a cordial good will towards a movement designed to occupy a portion of the same great field and, in order to prepare the way for such coöperation as may hereafter seem practicable, consulting delegates will be appointed, with authority to represent this Association in the proposed convention or conference, and to report to the next annual convention.

(2) Your committee also recommends the adoption of the following resolution:

Resolved, That the president and the chairman of the executive committee of the Association, with two additional members, to be appointed by the Chair, be and hereby are appointed consulting delegates, with authority to attend (if circumstances seem to render it advisable) the proposed convention or conference; but such delegates shall have no authority to commit this Association to any definite line of action or policy, but shall report to the next annual convention.

The resolution was adopted.

Mr. Armsby reported for the committee appointed to consider the advisability of a coöperative station exhibit at the World's Columbian Exposition, as follows:

Resolved, That in the opinion of this Association it is advisable to have a coöperative station exhibit at the World's Columbian Exposition.

Resolved, That in order to formulate and carry out such preliminary steps as are necessary during the year, a special committee, with power to represent the Association, be appointed by this convention to coöperate with the U. S. Department of Agriculture, and to take such other action as may be necessary.

Resolved, That the executive committee be authorized to pay from the funds of the Association the actual and necessary expenses incurred by the special committee above provided for, in the discharge of its duties.

On motion of Mr. Turner, the resolutions were adopted.

On motion of Mr. Alvord, it was ordered that a committee of five station directors be appointed by the Chair to carry out the plan proposed in the resolutions just adopted.

The President appointed Messrs. Armsby, Thorne, Morrow, Tracy, and Henry.

The committee on nominations, through its chairman, Mr. Fairchild, of Kansas, presented the following nominations for the ensuing year:

For president, H. H. Goodell, of Massachusetts.

For vice-presidents, O. Clute, of Michigan; A. Q. Holladay, of North Carolina; J. W. Sanborn, of Utah; I. P. Roberts, of New York; E. D. Porter, of Missouri.

For secretary and treasurer, M. A. Scovell, of Kentucky.

For executive committee, H. E. Alvord, of Maryland; J. H. Smart, of

Indiana; M. C. Fernald, of Maine; J. A. Myers, of West Virginia; W. M. Hays, of Minnesota.

On motion of Mr. Peabody the report was adopted, and the Secretary was directed to cast a ballot for the persons named in the report. The Secretary reported that the ballot had been cast and the President declared the officers duly elected.

Mr. Alvord offered the following resolution, which was adopted:

Resolved, That the publication of the proceedings of this convention, including the President's address in full, be referred to the executive committee in coöperation with the Department of Agriculture, with the recommendation for expeditious action and full authority to edit the same.

Mr. Redding offered the following resolution:

Resolved, That in the preparation of the printed program for the next annual convention of this Association, the executive committee be requested to state in brief, as far as practicable, the leading propositions that will be affirmed and maintained by the essayists or speakers, and that copies of such programs so prepared be sent to each delegate now in attendance, and to each college and station at as early a day as practicable before the next annual meeting.

He said he believed that he would receive much more benefit from the convention if he had beforehand more definite knowledge of what was to be discussed than could be derived from mere titles of papers; and, further, although the president and secretary of the agricultural committee duly made and prepared a program for the meeting, he had himself been unable to obtain a copy of it; neither had he seen a copy of the general program of the convention until he reached Champaign.

Mr. ARMSBY. The secretary would like to make a statement in regard to this matter. As all know, a notice of the convention was sent out, as required by the constitution, three months before the time set. At the same time correspondence was begun with members of the Association, earnestly requesting them to send in topics for discussion in the general and section meetings. They were urged to act as promptly as possible, as it was desired to prepare the program in good time. But it was found impossible to obtain programs from the chairmen of the sections in time to publish them earlier than was done. The programs were sent out about the 21st of October. I leave it to the convention to judge when the program could have been distributed had the chairmen been obliged, in addition to what they did, to prepare analyses of each paper to be presented. I desire to state that as soon as the programs were printed a copy of the general program and one of the committee programs, with an accompanying circular, were promptly mailed to each college president and each station director. It was, perhaps, an omission on the Secretary's part that he did not send programs to each station worker, but it was supposed that the presidents and directors would bring the matter to the attention of their subordinates.

Mr. SCOTT. I would like to suggest that hereafter a sufficient number of programs be sent to presidents and directors to supply their subordinates.

The resolution offered by Mr. Redding was referred to the executive committee for its consideration.

Mr. Clute offered the following resolution, which was adopted:

Resolved, That this Association hereby acknowledges the efficient services of its executive committee during the past year, and especially of its chairman, President Alvord, and that most hearty thanks are hereby extended to the committee and to its chairman.

Mr. Patrick having called for a resolution of his which had been referred to the committee on the order of business, Mr. Alvord, for that committee, presented it as follows, with recommendation for adoption:

Resolved, That the executive committee be requested to so frame the program as to allow more time for the meeting of the various sections.

The resolution was adopted.

Mr. ALVORD, for the same committee, recommended the adoption of the resolutions offered by Mr. Fernald (see p. 64).

Mr. Porter moved to amend the resolutions by the addition of the following:

Resolved, That the executive committee is hereby instructed to cause a copy of these resolutions to be engrossed and forwarded to the Hon. Justin S. Morrill.

The amendment was carried and the resolutions as amended were adopted.

Mr. Alvord then offered the following:

Resolved, That the secretary of this Association for the coming year be directed to invite Sir John B. Lawes to cause the first course of lectures on the Rothamsted experiments to be delivered before this Association at its next meeting. In case the invitation is accepted, the executive committee is instructed to notify the members of the fact, and to announce in the call for the next meeting the particular time in the course of the sessions when these lectures are to be delivered.

The resolution was unanimously adopted.

Mr. Alvord then offered the following:

Resolved, That the thanks of the Association are due and are hereby heartily tendered to the Regent, the faculty and students of the University of Illinois, and the citizens of Champaign and Urbana, for the welcome accorded to those attending this convention and the many courtesies by them received.

The resolution was unanimously adopted.

The Chair then called upon Mr. Atwater, Director of the Office of Experiment Stations of the U. S. Department of Agriculture, who desired to present some matters of importance to the convention. Mr. Atwater said:

MR. CHAIRMAN AND GENTLEMEN, I wish to speak to you about indexes to station and other literature about the publications of the Office of Experiment Stations; about compilations and investigations; and to make a few brief references to coöperative experiments.

In relation to indexes, I have with me a package of index cards such as we are making at the Office of Experiment Stations. Those of you who have noticed the last number of the first volume of the Experiment Station Record will remember that there are 32 pages of fine-print, double column index. This is, in fact, an index to the station publications for the year described in the volume, but that index alone will not suffice. After considering the various ways of making indexes we, like many others, have come to the conclusion that the best method is by the use of cards. I have here the outline of a system of indexes, but I have not time to read it in full. In brief, our card index will contain a short abstract of the subject matter, as well as the reference. This card index we propose to make cover all the station publications. Copies of this card index we would like to place at the disposal of each college and station.

We do not feel however that we can print them——

The PRESIDENT. We think you ought to do it.

Mr. ALVORD. We believe that is what your Office is made for and what your appropriations were given for.

Mr. ATWATER. For the printing of these cards?

Mr. ALVORD. Yes, to furnish us forms, information, and advice. We will get you money to do that if necessary.

Mr. ATWATER. Give us the money and we will do it. What we want is to have these cards printed and in your hands.

Noticing the lateness of the hour, Mr. Atwater, after mere mention of the other matters of which he desired to speak, resumed his seat.

It was suggested that a special meeting of station directors should be called at some convenient time and place to consult with Mr. Atwater.

The Chair announced as the consulting delegates to attend the pending convention of agricultural organizations, the incoming president of the Association, the chairman of the executive committee, and Mr. Neale and Mr. Atherton.

Mr. Atherton then stated that the article in the constitution on membership, which reads "At any regularly called meeting of the Association, each college established under act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, and the Department of Agriculture shall be entitled to one vote," etc., was drafted before the Office of Experiment Stations was created, and that whereas that Office has come to be an important connecting link between the Association and the Department, he wished, without any suggestion, direct or indirect, from any source whatever, to move that the constitution be amended so as to admit the Office of Experiment Stations, as such, and in addition to the U. S. Department of Agriculture as a whole, to membership in this Association.

The amendment was unanimously adopted.

Mr. Hadley offered the following resolution, which was adopted:

Resolved, That each experiment station be requested to attach to each bulletin such titles and analyses as would be suitable for use in cataloguing the said bulletin.

Mr. Alvord stated that in his opinion the time had come when the Association should proceed with more care in making amendments to the constitution, and gave notice that at the next convention he would move to amend the constitution so as to require previous published notice of an intention to offer amendments.

Mr. Neilson offered the following resolutions:

Resolved, That the executive committee be authorized to call at Washington during the coming winter a meeting of station directors for consultation with the director of the Office of Experiment Stations, if that be found practicable.

Resolved, That the preparation and publication of indexes of station publications by the Office of Experiment Stations is hereby recommended, and that the consideration of means necessary to enable that Office to do its work and also to serve as the medium of communication between station workers, be referred to the executive committee for consideration.

Resolved, That Congress be asked for sufficient means to defray the cost of the work above mentioned and to extend the work of the Office so as to enable it to enter into the compilation of the results of investigations by European stations.

Mr. Armsby said that he was heartily in favor of the first resolution and thought it highly desirable that a consultation of directors with the Office of Experiment Stations should be held, and inquired whether it had not been clearly shown at this convention as well as previous ones, that a section of directors should be organized for the special purpose of discussing such questions.

Mr. Jenkins suggested that the directors might profitably hold a meeting at the close of the convention for the discussion of such matters. The Chair suggested that the directors might have conference with the Director of the Office of Experiment Stations immediately upon the adjournment of the session of the convention.

The resolutions were adopted by separate votes.

The following resolution offered by Mr. Scovell was unanimously adopted:

Resolved, That the thanks of this convention are hereby tendered to the retiring President and Secretary for the efficient manner in which they have discharged their respective duties in this convention.

The President then spoke as follows:

I wish to thank the members of this convention for the kindness of this resolution, and to express my appreciation of the honor they conferred upon me in electing me president of this Association, and of the consideration they have extended to me in the performance of my duties. I extend my congratulations to the convention for the success with which the business of the meeting has been dispatched, and now declare the convention adjourned without day.

APPENDIX.

MINUTES OF THE PERMANENT COMMITTEES OR SECTIONS.

THE PERMANENT COMMITTEE ON AGRICULTURE.

MORNING SESSION, THURSDAY, NOVEMBER 13, 1890.

The meeting was called to order at 9 a. m., Mr. Sanborn in the chair. Mr. Thorne read the following paper:

POT OR BOX VS. PLAT EXPERIMENTATION, C. E. THORNE.

The subject announced for discussion is, "Pot or box *vs.* plat experimentation," but in discussing it I shall take the ground that when properly employed, there is no possible antagonism between the two methods, but each may be made to supplement the other.

The farmer deals not with pots and boxes, but with fields, and we must meet him in the field and there demonstrate by methods which he employs or can employ, the superiority of one process over another. If we can not do this we may as well admit that the idea of improving agriculture by means of the experiment station is a fallacy.

In my judgment, therefore, we have no choice as to whether we shall or shall not employ plat or field experimentation as one of our methods of research. We must employ this method, and therefore it behooves us to bend our energies toward perfecting the method and not to waste our time in railing at its numerous defects nor in searching for some easier method to take its place.

Let us remember that field experimentation is still in its infancy. A dozen years ago, when I began to study the soil through field experiments, there were scarcely half a dozen other men in the nation similarly engaged. Since that time I have had several years' personal experience in the work, during which my failures have largely outnumbered my successes. I have not been unobservant of the work of others; but I am to-day more firmly fixed than when I began, in the faith that it is possible to achieve trustworthy results through this method, and in the conviction that all our work with plants and soils must be subjected to this method as a final test before it can be accepted as a reliable guide.

The chief criticism made upon this method is the difficulty of securing sufficient areas of soil that are absolutely uniform in composition, drainage, and exposure. I fully recognize this difficulty. It is a much more serious affair to select a piece of land that is suitable for a field experiment than would be suspected by one who has never made such an experiment, and I am fully persuaded that a very large proportion of the field experiments that have been reported from time to time are utterly worthless if not actually misleading. But I am equally confident that it is both possible and practicable by judicious selection, drainage, and tillage, to so fit a plat of ground for comparative plat experiments that results may be obtained from it which will bear comparison with the best laboratory work.

I do not expect that it will ever be possible to secure precisely identical results from duplicate plats; this is not possible in the laboratory. I do not expect that it will be possible to reduce the margin of error to so low a point in the comparison of duplicate plats as it is in the laboratory analysis of duplicate samples of milk, for instance; but I do believe that this margin may be reduced quite as low in field tests as it is now possible to reduce it in soil analysis.

As a reason for the faith that is in me I offer the results of an experiment made at our station this season in the continuous culture of wheat on the same soil, without manure, and with various combinations of fertilizers. The plat of land selected for this work contains 24 plats of one tenth acre each, numbered from east to west. A grove of timber stands not far east of the plat, and a single tree stands nearer still.

The two crops grown on this plat give evidence that the plats from 19 to 24 inclusive, are lower in fertility than the remaining ones. As a whole, however, the plat is one of apparent uniformity in soil, exposure, and natural drainage. It slopes slightly to the north; the soil is a clay, lying upon the bowlder clay of the drift, and this in turn upon the Huron shales, the rock being probably between 12 and 20 feet from the surface. Originally the field was covered with timber, chiefly beech and elm, and the soil was water-soaked for a considerable portion of the year.

In preparing the field for this experiment it was first drained by three-inch tiles, laid 3 feet deep and 36 feet apart. It was then divided into plats 16 feet wide by 272¼ feet long, the plats being separated by alley-ways 2 feet wide. As the alternate alley-ways were located over the drains each plat has a drain running its entire length on one side or the other.

The field was in clover in the spring of 1888. The draining was done that spring, and during the summer the plat devoted to this experiment was plowed flat. The first harvest yielded at the rate of 43 bushels per acre for the unfertilized plats and no more for those fertilized. However, there were considerable irregularities in the yield, due partly to the fact that the drains had been filled by the plow, thus leaving dead furrows in the edges of the plats.

In preparing for the crop of this year the plats were plowed separately so as to give a furrow for surface drainage between them. The surface was also carefully planed so that no basins should be left to hold water during the winter, and great care was exercised in seeding, distributing the fertilizers, and harvesting and threshing the grain. The results attained are as follows:

Plat No.	Fertilizer.	Yield per acre.	Increase from fertilizer.
		Bushels.	*Bushels.*
1	Unfertilized	31.9	....
2	Superphosphate	35.6	3.7
3	Potash	32.1	0.3
4	Unfertilized	31.8	....
5	Nitrate of soda	36.5	4.3
6	Nitrate and superphosphate	38.6	6.0
7	Unfertilized	33.0	....
8	Superphosphate and potash	36.4	3.6
9	Nitrate and potash	36.8	4.2
10	Unfertilized	32.4	....
11	Superphosphate, potash, and nitrate, 16	36.9	5.6
12	Superphosphate, potash, and nitrate, 32	35.7	5.6
13	Unfertilized	29.9	....
14	Superphosphate, potash, and nitrate, 48	34.9	4.8
15	Superphosphate, potash, and ammonia	33.8	2.5
16	Unfertilized	32.4	....
17	Nitrate, potash, and rock phosphate	37.4	5.5
18	Nitrate, potash, and slag phosphate	37.3	5.8
19	Unfertilized	31.0	....
20	Barn-yard manure	34.7	5.2
21	Linseed-oil meal	33.9	5.9
22	Unfertilized	26.5	....

In calculating the increase on the various fertilized plats, it is assumed that the changes in fertility are uniform from one unfertilized plat to the next. Calculated in this way the increase for phosphoric acid on plat 2 is 3.7 bushels, and for phosphoric acid and potash on plat 8 is 3.6 bushels; that for nitrogen on plat 5 is 4.3 bushels, and for nitrogen and potash on plat 9 is 4.2 bushels. Potash apparently has had practically no effect when used alone on plat 3, or in conjunction with phosphoric acid on plat 8, or with nitrogen on plat 9. Neither has it added to the increase when used in conjunction with both phosphoric acid and nitrogen, as seen by comparing plats 11, 12, 14, 17 and 18 with plat 6.

Taking the plats receiving both phosphoric acid and nitrogen, that is, Nos. 6, 11, 12, 14, 17 and 18, the uniformity in the increase is very striking; so close is it as to warrant the suspicion that the figures have been doctored. The fact is, however, that the weights of grain in column 1 are the actual weights as taken from the field, without any change or correction whatever. Plat 14 shows a smaller increase than any of the other plats receiving nitrate of soda and superphosphate, and this was expected before the wheat was harvested, as the grain on this plat lodged early in the season and remained down. In fact the results in every case are in perfect harmony with the appearance of the plats before harvest. The effect of the fertilizers began to be apparent early in the season, and became more and more conspicuous as the season advanced, up to the time of heading out. After that period the unfertilized plats appeared to make greater progress than those that had received the fertilizers, but in every case the difference between the fertilized and unfertilized plats was apparent, while throughout the season it was impossible to distinguish any difference between plats 3 and 4, 8 and 9, or 17 and 18. In short, the coincidences in this experiment are too many and too uniform, and were too evident throughout the growth of the crop to be mere coincidences.

Allow me here to call attention to the method of computation employed in calculating the results of this experiment. As I have said, I have assumed that the changes in natural fertility from plat to plat were uniform; that is, that if plat A yields 30 bushels and plat D 33 bushels, both being unfertilized, the probability is that plat B would have yielded 31 bushels and plat C 32 bushels without fertilizing. Suppose, however, we had left but two unfertilized plats in this experiment, and those had happened to be numbers 7 and 16, and then that we had taken the average yield of these plats as that of the entire plat under experiment; our apparent increase from the fertilizers would then have been as shown in the third column of the following table, the increase actually found being repeated in the second column for comparison:

Plat No.	Increase as found.	Increase over plats 7 and 16.	Increase over average unfertilized.
2	3.7	2.9	4.5
3	0.3	....	1.0
5	4.3	3.8	5.4
6	6.0	5.9	7.5
8	3.6	3.7	5.3
9	4.2	4.1	5.7
11	5.6	4.2	5.8
12	5.6	3.0	4.6
14	4.8	2.2	3.8
15	2.5	1.1	2.7
17	5.5	4.7	6.3
18	5.8	4.6	6.2
20	5.2	1.8	3.4
21	5.9	1.2	2.8

Comparing the duplicate fertilized plats, disregarding potash, and omitting No. 14, for the reasons already given, we have the following results:

Fertilizer.	Plat No.	Increase as found.	Increase over plats 7 and 16.	Increase over average unfertilized.
Superphosphate	2	3.7	2.9	4.5
	8	3.6	3.7	5.3
Nitrate	5	4.3	3.8	5.4
	9	4.2	4.1	5.7
Superphosphate and nitrate	6	6.0	5.9	7.5
	11	5.6	4.2	5.8
	12	5.6	3.0	4.6
	17	5.5	4.7	6.3
	18	5.8	4.6	6.2

In the one case the extreme variation in the rate of increase on duplicate plats is but half a bushel, or 9 per cent of the lowest rate, whereas in the other it is nearly 3 bushels, or 97 per cent. In other words, the margin of error according to the first calculation, is about 1¼ per cent of the average total yield of the fertilized plats under comparison, whereas in the other case it is nearly 8 per cent.

If we had taken the average of the eight unfertilized plats as the basis of computation the case would have been scarcely any better, as shown by the last column of the tables. Moreover, either of these methods would have been totally misleading with respect to the relative yield of the barn-yard manure and linseed-oil-meal plats numbers 20 and 21, owing to the decided decrease in natural fertility of that end of the plat.

Averages are very convenient to the hasty computer, and averages must settle many questions for the most careful investigator, but it is plainly possible to draw wholly erroneous conclusions from an average.

In the same field with the plat devoted to the experiment just described, and lying contiguous to it, are two plats devoted to simliar experiments with corn and oats. There is this difference, however, between the soil of the wheat plat and that of the corn and oats plats, and that is, that while the surface of the three is quite uniform in appearance, digging reveals the fact that the corn and oats plats are located upon a gravel subsoil, lying from 2 to 5 feet or more below the surface. This gravel subsoil gives sufficient natural drainage for ordinary farm cropping, but in the hope of securing greater uniformity of drainage tiles were laid through these plats on the same plan as through the wheat plat. The desired end seems not to have been accomplished, however. We do not get the uniform results from this work that we do from the wheat, although further cropping may obliterate some of the inequalities that are now perplexing us.

But anyone who is familiar with the method in which sand and gravel are stratified in kames and moraines will realize that it is not probable that the soil resulting from such formations should be so uniform in quality as that from the weathering of a material like the bowlder clay of the Ohio drift or of limestone or sandstone rocks. The layers of sand will weather much more rapidly and form a soil of much greater depth than those consisting chiefly of coarse gravel.

In the case of deep beds of sand, the weathering may penetrate to such a depth as to impede drainage, whereas in that of coarse gravel the soil may be so shallow as to leach too rapidly. A large proportion of the field experiments made at the Ohio Station have been made upon soil of this character, and the more I work upon it and study it the more fully I am convinced that it is not the best soil for comparative tests.

POT AND BOX EXPERIMENTS.

I suppose that Dr. Paul Wagner, director of the Darmstadt Experiment Station, has made a greater number of pot or box experiments than any other man, and that he may with propriety be styled the leading advocate of this method of research. I regret that I am not able to quote directly from Dr. Wagner, but I probably do him no injustice in quoting from a report of his work published in No. 81 of United States Consular Reports. His position is there stated to be that "it is difficult to find parcels of ground like one another all in all; the measuring and dividing them off, the working, manuring, sowing, and harvesting, as well as the fixing of the weights of the products realized can not be the same in each instance."

All of this is quite true; but the question arises, Is the pot method wholly free from similar sources of error? and is it not probable that the errors of this method, insignificant though they may appear as they stand, may yet grow to proportions quite as great as those in well-conducted field experiments, when multiplied by the factors required to bring them into comparison with field work? But this multiplication must be made; the farmer deals with bushels and acres and our results must be stated in bushels and acres before they can be of any value to him.

In order to throw some light on this question I have calculated the percentage variation between the yields of neighboring unfertilized plats in the fertilizer experiment previously referred to, and also between those of certain synonymous plats of wheat in our variety test of this year, reported in our July bulletin. In this case, the seed had been derived from different sources, and some variation in product would be expected on this account. These lots were purposely sown on adjoining or neighboring plats for comparison. The soil is river bottom, underlaid with gravel at a depth of about 5 feet.

For comparison with this work I have calculated the variation in forty-five triplicate pot tests, as reported by Dr. Wagner, and thirty-five similar tests reported in Bulletins 6 and 8 of the Imperial College of Agriculture and Dendrology of Japan, by Dr. O. Kellner, who has closely followed Dr. Wagner's method. The variations are calculated in percentages of the lowest yields, and the results are shown in the accompanying tables:

Variations between duplicate plats.

OHIO STATION, 1889.

Fertilizer tests.

Plat No.	Wheat. Product.	Wheat. Variation.
	Bushels.	*Per cent.*
1	31.9	
		0.3
4	31.8	
		3.8
7	33.0	
		1.0
10	32.4	
		8.4
13	29.9	
		8.4
16	32.4	
		4.5
19	31.0	
		17.0
22	26.5	

Variety tests.

Plat No.	Wheat. Product.	Wheat. Variation.
	Bushels.	*Per cent.*
5	20.33	
		2.8
6	28.53	
		2.7
7	29.29	
11	36.16	
		0.0
12	36.16	
16	32.50	
		4.5
18	31.08	
		3.4
20	30.06	
24	27.50	
		9.1
27	30.00	
		7.0
28	32.16	
		3.6
29	31.04	
39	36.00	
		5.3
40	34.20	
51	29.58	
		1.6
52	29.12	

General average variation, 5.0.

Variations between triplicate pots.

DARMSTADT STATION, 1886.

Barley.		Wheat.		Flax.	
Product.	Variation.	Product.	Variation.	Product.	Variation.
Grams.	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*
11.01		6.90		18.63	
11.31	5.5	6.12	14.7	19.35	
11.50		6.11		21.04	16.6
11.62		7.01		19.63	
23.87		19.31		21.73	
24.45	6.0	18.78	9.0	59.36	
25.30		20.47		55.61	6.8
28.06		26.76		57.14	
30.04	7.0	25.25	6.0	67.52	
29.33		25.42		66.73	5.8
20.12		14.04		70.62	
20.41	2.9	13.64	5.7	43.26	
19.83		14.43		41.76	12.4
21.61		18.80		46.79	
23.12	7.0	17.13	9.7	53.96	
22.97		17.57		55.14	2.5
15.83		10.53		53.79	
14.93	7.3	9.13	15.3	30.44	
14.75		9.36		33.38	9.6
17.61		12.49		30.83	
16.72	4.8	10.82	15.4	34.15	
17.36		12.27		36.18	5.9
14.83		9.94		35.20	
15.06	3.3	10.08	5.2	29.03	
14.58		9.58		29.78	7.2
15.47		12.49		31.11	
16.01	3.9	11.06	20.7	35.12	
15.41		10.35		35.12	5.3
28.10		21.09		36.98	
29.20	3.9	24.00	13.8	65.33	
28.30		22.25		61.53	6.3
29.54		25.55		61.46	
30.03	4.6	26.14	2.3	68.26	
28.70		25.80		70.13	3.2
26.21		23.06		70.46	
28.00	6.8	21.09	6.4	59.72	
26.20		23.45		60.84	7.2
29.02		24.92		64.00	
30.41	4.8	25.95	4.1	71.68	
29.10		25.22		72.61	2.9
17.80		12.92		70.53	
18.10	1.2	13.00	8.6	44.14	
18.02		11.97		44.73	2.2
21.41		17.51		43.75	
20.20	6.0	16.21	8.9	52.22	
21.02		16.07		52.17	1.5
				52.99	
Av. variation...	5.0	....	9.7	....	6.3

JAPAN STATION, 1888-89.

Barley.		Paddy.		Rice.	
Product.	Variation.	Product.	Variation.	Product.	Variation.
Grams.	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*
140		112.0		633.9	
171	22.1	136.5		594.4	6.6
145		124.4	38.3	599.5	
208		105.4		688.4	
197	7.2	84.1		682.5	7.1
194		113.8		622.3	
244		95.5		669.3	
224	12.4	92.7	8.3	695.1	3.9
217		100.4		678.8	
242		375.6		688.8	
206	17.4	392.2	4.4	678.3	33.2
206		380.0		517.1	

Variations between triplicate pots—Continued.

JAPAN STATION, 1888-89—Continued.

Barley.		Paddy.		Rice.	
Product.	Variation.	Product.	Variation.	Product.	Variation.
Grams.	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*
307		592.2		717.1	
302	27.9	564.7	7.4	643.1	27.0
240		606.6		564.5	
164		467.0		695.5	
164	1.2	509.0	9.0	680.3	8.6
162		521.7		640.7	
245		495.6		697.3	
211	17.9	553.9	26.5	686.2	2.7
208		624.7		679.0	
252		514.2		604.7	
227	35.4	620.9	24.1	638.7	11.4
186		638.4		703.2	
335		596.4		693.5	
315	19.7	575.4	8.8	590.1	17.5
280		626.1		643.2	
580		590.2		359.0	
435	33.2	580.1	11.4	390.3	8.7
398		646.4		379.5	
		578.8		449.0	
		609.2	12.5	521.8	16.1
		651.3		481.9	
		289.8		484.4	
		328.4	21.8	436.2	11.4
		269.7		435.2	
		497.5		448.2	
		531.7	7.1	455.9	1.7
		496.4		453.1	
Av. variation...	19.4	....	14.9	....	13.4

These tables demonstrate the possibility of obtaining in the field results quite as consistent as those given by the best pot work; but in considering the table we should remember that in field work we expect some natural variation in the soil, whereas pot experiments are supposed to begin with a soil made absolutely uniform. When this is considered I think we must admit that unless pot culture can show very much more uniform results than those of the experiments referred to, we must assign the method to a secondary place, as compared with field experiments, in the study of the problem of the maintenance of soil fertility.

I would not be understood, however, as denying the utility of pot experiments. It may often be practicable to make such tests where field tests are impossible. In such case they may serve an excellent purpose, and as they are far more easily made than field tests and admit of indefinite duplication on small areas, they may often be usefully employed in preliminary surveys of lines of work, afterward to be followed by more accurate tests in the field. For such purposes there is an important place for pot experiments. We are employing them constantly in our work, as supplementary to our field work, and hope to largely extend their use.

Mr. Armsby said that all present who had anything to do with field tests would certainly feel encouraged by the results reported in the foregoing paper; their close agreement was very gratifying. Upon the question between pot and field experiments, however, there was something more to be said regarding the purposes of the two, which, according to his understanding, covered different grounds. Advocates of pot experiments claimed that by that method they could control all or very nearly all of the conditions, for example, the water supply, texture and depth of soil, position of the water-table in the soil, etc., to a far greater extent than was possible in the best-conducted field experiments, and were therefore able to experiment upon more strictly scientific principles, making all the conditions to conform save the one whose influence was to be tested. Pot experiments could be used in investigating scientific principles, such as the relative value of different forms of phosphoric acids, and the feeding capacities of different classes of plants, whereas such investigations he believed were impossible by field tests. In his judgment the pot experiment was designed as a means of investigation into scientific principles of plant nutrition, while the purpose of the field experiment was to test the application of the pot experiment. What was wanted was a field test as accurate as possible, conducted in some such way as had been described, not to test the correctness of the conclusions from the pot experiments, but their applicability to field conditions, some of which might tend to modify results. This seemed to be the essential distinction between the two classes of experiments.

Mr. Atwater wished to add a word in confirmation of points made in Mr. Thorne's paper. Those familiar with the experiments made by Sir John Bennet Lawes would remember how he commenced. One of his earlier ideas was to make a field experiment which should be uniform, and he selected a large portion of land and put in men with shovels and wheelbarrows to dig out and wheel away the soil, mixing it as he would if taking samples for analysis. The area thus dug out was then divided by brick walls lined with cement, into individual plats, each half a meter or a meter square, in which the carefully mixed earth was carefully replaced, the subsoil beneath and the surface soil on top, and stamped down as uniformly as possible. The labor of days and weeks being given to secure a number of uniform plats. It would seem that uniform results could be obtained from these plats, but as a matter of fact there were very wide variations, the reason for which became apparent: They were due to differences in moisture underneath. Another modifying factor in field experiments, and one which often caused considerable variation in results on plats in close juxtaposition, was difference in arrangement of the soil strata, the layers frequently varying widely within a short space. It was hopeless to expect uniformity of results unless uniformity of moisture was first made sure.

Mr. Thorne's method seemed to afford a crucial experiment for field tests. Some years ago he had followed that plan in a large number of experiments, and in making extended calculations based upon these experiments he had been astonished to find that while in certain experiments the effect of nitrogen, phosphoric acid, or potash was thoroughly uniform, in others a large minus was shown for nitrogen on one plat and on another plat a large plus. Again, with corn, taking 200 experiments, he had first cast out 120, and then weeded out half of the remaining 80, leaving only 40 that stood the test. He had supposed that these could be relied upon for generalizations, but oddly enough, when the average results of the 40 were compared with the average of all, the conclusions from both sets were found to be very nearly the same. When a great number of such experiments were calculated upon, the "might of average figures" would be realized.

On motion, the committee proceeded to the election of officers for the ensuing year. The following-named gentlemen were nominated and elected:

Chairman, Charles S. Plumb, of Indiana.

Vice-chairman, G. E. Morrow, of Illinois.

Secretary, C. E. Thorne, of Ohio.

Mr. Armsby read the following paper:

Is a Digestion Experiment Fallacious? H. P. Armsby.

Webster says: "A fallacy is an argument which professes to be decisive, but in reality is not."

It is to be observed, then, that the question under discussion is not that of the accuracy of a digestion experiment, but of the correctness of the logic upon which its conclusions are based. As regards this we have to ask:

1. What is the conclusion reached?
2. What is the reasoning by which it is reached?
3. Is that reasoning false?

1. The conclusion is that a certain percentage of each of certain groups of proximate constituents has been extracted from a certain fodder or ration by the digestive apparatus of the animal experimented on.

2. The reasoning has as its data the facts, (*a*) that a certain amount of these ingredients was eaten by the animal during a series of days; (*b*) that a certain amount of each of them was found in the solid excreta voided during the same time.

Starting from these data, the argument assumes as its premises:

(1) That matter is indestructible.

(2) That on the average of a sufficiently long time as much of any substance leaves the alimentary canal as enters it, or in other words, that the capacity of the latter is limited.

(3) That matter can escape from the alimentary canal only by digestion and resorption or in the dung.

The reasoning may be represented algebraically thus: Let A equal the amount which enters alimentary canal, B the amount which leaves alimentary canal, C the amount excreted in dung, D the amount digested.

From (1) and (2) we have $A=B$, from (1) and (3) we have $C+D=B$. Equating the two values of B we have $A=C+D$, $D=A-C$.

That is, the amount of any substance digested equals the amount entering the alimentary canal minus the amount found in the dung.

3. Is this reasoning correct? I am not a logician, but so far as I can see, the reasoning in the form given above is strictly correct. In an ordinary digestion experiment, however, we silently introduce another premise, namely, that nothing enters the alimentary canal except through the mouth, and say that food minus dung equals food digested. This assumption, however, has been proven to be false, and therefore, strictly speaking, the ordinary digestion experiment involves a fallacy. Practically, however, this is rather to be classed with the errors of experiment than as a logical fallacy. Its existence has been well known for years, although its importance was long underestimated, and we are even now able to make some approximate estimate of its amount.

My answer to the question proposed, then, is briefly, that a digestion experiment conducted according to the best methods we now possess, while not so accurate as might be desired, is not in any fair construction fallacious.

It occurs to me as just possible, however, that what the Chairman had in mind in propounding this question was not so much the digestion experiment itself as the conclusions sometimes drawn from it as to the nutritive value of the feeding stuffs in question.

It hardly seems necessary to remark before this audience that a digestion experiment, *per se*, gives us no *direct* information as to the nutritive value of the substances experimented on. The question whether the amount of digestible nutrients in a fodder, as determined by a digestion experiment, is a measure of its nutritive value, is an entirely distinct question, to be settled by an entirely different kind of experiment, namely, by comparing the amounts of digestible matter consumed in different cases and in different fodders with the actual nutritive effect produced. Now, while there is no serious difficulty in determining with reasonable accuracy the amounts of digestible matter fed, any one who has had any considerable experience in conducting feeding experiments knows it is by no means an easy matter to satisfy himself that he he has reached even an approximation to the true nutritive effect. If he makes any critical study of his results, he will, I am sure, appreciate the statement made by a student in a recent examination paper, that "A feeding experiment may be more or less accurate."

Who can tell what the live weight of his animals is, either at the beginning of his experiment or at the close? How much of the apparent gain or loss of weight is really solid matter and how much is due to changes in the percentage of water in the tissues? How much of the real gain or loss of solid matter is flesh? How much fat? How much ash? In how many feeding experiments can these questions or any one of them be answered? And yet without an answer to them the true nutritive effect remains uncertain.

I am not disparaging such feeding experiments as have been made by the majority of experiment stations, both in this country and Europe. For the practical ends which they have been designed to serve, the effect of the feeding can be determined with sufficient accuracy, and a vast deal of most valuable information has been afforded by these experiments. The question now under consideration, however, is of a different character, involving an exact scientific comparison of food with nutritive effect and requiring an exact control of all the conditions of experiment. I hold, therefore, that it is only by considering the results of large numbers of such experiments that we can get any trustworthy information on this point, and that even then we reach only a greater or less degree of probability. Even a considerable number of results apparently opposed to the view that the digestible matter of a fodder measures its nutritive value, I do not regard as decisive.

It would require vastly more time than I have had at my disposal, to investigate exhaustively the evidence bearing on this question, and the results would constitute a monograph for study rather than a paper for such a meeting as this. I may be allowed, however, to express my personal opinion that the balance of probability is steadily increasing in favor of the view that a determination of the digestibility of a fodder gives us a fairly accurate measure of its *potential* nutritive effect. Whether this potential effect is made actual in any given case depends very largely upon the skill and knowledge of the feeder. This conclusion, of course, does not exclude the possibility of finding a better measure of the nutritive effect or of greatly perfecting this one. Indeed I believe very strongly that our stations would in the end strengthen themselves by doing a fair share of strictly scientific work upon such problems as this, not only in connection with stock feeding, but with all branches of their work.

Mr. Curtis (in the chair) said that he, for one, desired to express his appreciation of the views presented in the paper just read; he presumed that most of those present would acknowledge an inability to discuss the matter. At his own station some digestion experiments were now being made, and some of the difficulties pointed out were met with there. It was hoped that by practice better work could be done in the future. The stations might expect errors in the first reports on these experiments; considerable experience was necessary, and until it was had the results would not be of great value.

Mr. Plumb said that in digestion experiments conducted at his station a higher percentage of nutriment was found in the dung than had been put into the animal. Those who had large experience in this line were skeptical in regard to the results obtained.

Mr. Thorne said that one difficulty in both digestion and feeding experiments was the great variation in individual animals. This factor could be handled only by dealing with very large numbers of animals; because of its presence he had great doubt in regard to the value which should be attached to many of the German experiments. In the ordinary feeding experiment the possibility of dealing with larger numbers was advantageous. He believed that digestion experiments should be pushed further and with larger numbers of animals.

Mr. Tracy said that last year the Mississippi Station had 60 head of cattle for feeding experiments. After handling them for 90 days it was found practically impossible to conduct the digestion experiment in connection with the feeding experiment, it covered so much ground. The combined action of the stations would be required, and the compilation of the various results might afford the final solution of the question. Until a basis should be fixed for judgment of the condition of the animal's system before feeding the way would remain rather dark and gloomy.

Mr. Armsby said that, so far as his experience went, while individual animals differed as to digestive power, their differences in regard to the nutritive effect of the same amount of food were far greater.

Mr. Atwater wished to confirm the position taken by Mr. Armsby. Some time ago he had made similar experiments on the human subject, and in Germany he had conversed with men who had had a varied experience in these matters. In compiling the data obtained he had been impressed with a general idea that he thought might almost be laid down as a general principle, which was, that the percentage of each nutrient digested and not resorbed by different animals of the same species—human or other—was much more constant than was generally supposed. A large number of cows would individually digest, in this sense, nearly the same quantities from the same fodder, under like conditions. The matter of individual difference came in play when the nutritive effects were considered, the variations in which might be very great.

Mr. Plumb said that the conditions under which digestion experiments were conducted were sometimes abnormal, as, for instance, in the case of a sheep, which was confined in a small pen so that he could not turn around easily. With cattle, while the conditions were more nearly normal, they were not average conditions. The circumstances under which even the most careful experimenters worked did not seem to be quite fair.

Mr. Armsby said that he gave each sheep about 10 feet square, which allowed plenty of room. The harness was made of carpet web, and the animal was entirely free. He was penned in while feeding and was then let loose.

Mr. Atwater said that he had conversed with Professor Hoyt, who had given special attention to this subject. It was remarkable how little influence the abnormal conditions had upon the actual quantity of nutrients digested as estimated by the system in use.

Mr. Armsby said that in the case of cows he had dispensed with harness, using a pail to collect the urine and a shovel for the dung. He sometimes attached a rubber bag to catch the urine. There was very little irritation of the animals from the harness; they were kept under as natural conditions as many animals free in stall. In digestion experiments he did not consider it essential to catch the urine, but did so in the case mentioned merely to keep the floor clean as a matter of convenience.

A member asked what was the effect of long-continued feeding on a single article of diet, perhaps not a very palatable one, as compared with that of feeding the same article in combination.

Mr. Armsby replied that a direct answer was impossible. If hay were fed alone its digestibility could be determined with considerable accuracy; if corn were then added, the digestibility of hay and corn would be determinable, but it could not be told what was due to the corn and what to the hay. The digestibility of hay was therefore assumed to remain the same. Perhaps the best way was to first feed a little hay alone, next the same amount of hay with a like amount of corn, and for the third period the same amount of hay with a considerably larger amount of corn. If the relative digestibility was found to be the same in the three cases it would perhaps justify the conclusion that the corn did not affect the digestibility of the other fodder; but this would not be an absolute demonstration, and he knew of no way of getting one on the point in question.

Mr. Atwater asked about the effect of carbohydrates upon the secretion of the nitrogenous digestive juices; it had been thought to interfere with the accuracy of the protein determinations.

Mr. Armsby replied that of late the general view had been that that was a question not so much of the amount of carbohydrates as of the digestible dry matter fed.

Mr. Wing read the following paper:

SPECIAL POINTS BEARING ON FEEDING EXPERIMENTS, H. H. WING.

If we exclude from the term "feeding experiment" all the experiments that have been made to determine the digestibility of fodders, we shall find that feeding experiments, with a very few notable exceptions, have been discussed solely from the standpoint of the effect of the chemical composition of the foods used upon the amount and quality of production. Now, while I would not underrate in the least the importance of the chemical composition of a fodder or ration on the animal economy, it seems to me that certain other considerations, that might perhaps well be called the physical relations of fodders and rations, have been entirely too much overlooked in our discussions of the results of feeding experiments.

It is to some of these physical relations that I desire to call your attention to-day, not with the idea of presenting anything remarkably new or startling, but that in the discussion the views of the members shall find expression as to the best means for determining or eliminating these influences.

Palatability.—While we recognize the importance of palatability in a general way, we make no effort to estimate its effect further than to say that good results can not be expected from the use of a fodder that for any reason may be unpalatable to the animal; nor can we even foretell when this is to be an important element in our experiments, as a case in point will illustrate.

Two pens of sheep were being fed on the same ration, of which one pen ate readily and with eagerness, and the other daintily and in much less amount, with the result naturally to be expected, that the one made a fair gain while the other made scarcely any. Here was a large difference in final product that was in all probability in large measure due to the different degrees of fondness of the two pens for the ration. And yet there was nothing to indicate to us at the beginning that the ration would be unpalatable to the one pen and not to the other.

Mechanical preparation.—To the mechanical preparation of fodders more attention has been given than to any other of the physical relations, and considerable good work has been done upon the relative effects of cut and uncut coarse fodders, whole and ground grains, and cooked and uncooked food, but our knowledge of these matters is still imperfect and it is extremely difficult to draw valuable generalizations from the work that has already been done.

Combinations.—In feeding experiments where two or more fodders have entered into the ration it has been the common practice to feed the fodders mixed in the proportions desired, and to feed the same mixture continuously during the course of the experiment. Is it by any means certain that such a mixture will have the same effect upon the animal as the same amount of the same fodders fed singly and alternately? It would seem that here is a field well worthy of careful investigation. Attention is often called to the bad results following the use of a single restricted fodder for long periods of time. Is it not possible that the continuous use of a single mixture, no matter how carefully "balanced," will be followed by largely the same results as continuous feeding on a single article? I do not know that the matter has been investigated, but it seems very likely that the animals under experiment may often be unfavorably affected by such feeding. Perhaps I may be pardoned a personal illustration. Oatmeal mush and milk is universally esteemed a healthful, nutritious, and palatable article of human food, but it has palled upon my appetite since I fed continuously upon it during my freshman year in college, and I do not think were I under experiment that I could be made to thrive upon it.

Consumption of water.—That the consumption of water will vary with animals upon different rations has been often noticed by experimenters; but little effort has apparently been made to trace its effect. From our own somewhat limited experience we have tentatively formulated the proposition that in feeding for flesh the gain in weight is in direct proportion to the amount of water consumed. To this we have as yet given scarcely the weight of a working hypothesis; the more so as it is in direct opposition to the teaching of German experiments, and it is only mentioned now that the attention of others may be turned in the same direction.

But whatever effects may be due to the chemical composition and whatever due to the physical relations, so called, by far the greatest obstacle that stands in the way of useful generalizations from feeding experiments is the difficulty of eliminating the individual peculiarities of the different animals from the results of the experiment. Of course by using animals whose inherited tendencies are the same—thoroughbreds or high grades—we eliminate to some extent the liability to extreme individual variations; but we know that even with thoroughbreds there are often striking differences in individuals closely related. From the fact that many of these individual characteristics are hidden to the eye or only develop themselves during the course of the experiment, about the only means of counteracting these variations lie in the use of a larger number of animals and in numerous repetitions of the experiment. Formerly it was the custom when two lots were being fed on different rations, to reverse the feeding, so that each lot might for a time receive each ration; but this practice seems to have been almost entirely given up, and with good reason, it seems to me, for often the mere act of change seemed to have as much influence as the different rations.

Finally, I suppose it is hardly necessary to call attention to the fact that we should be extremely cautious in publishing results where the sanitary conditions surrounding the experiment have not been of the best in all respects, or where we have not succeeded in attaining a production that would be considered good under ordinary methods of treatment.

Mr. Atwater thought the paper just read very much to the point, and was glad to say that some of the conclusions therein reached seemed deserving of most careful and thoughtful consideration. The plan of feeding the animals in lots A and B alike, and then diverging and feeding lot A on a narrow ration and lot B on a wide ration, whether feeding for beef or milk, seemed very likely to be fallacious in many cases, because, leaving out of account for the present the individuality of the animals, the residual effect of the ration in the first test period upon the apparent product of the second period was unknown. For example might be taken the case of feeding to test the effect of the fodder upon milk production. This product was dependent upon various factors; it was not elaborated from the food and filtered through the lacteal glands themselves, but it was known that in some way the condition of the animal very materially modified both the quality and the composition of the milk. While the exact facts were at present in darkness, it might be accepted as a convenient working hypothesis that the quantities of protein and fat in the body itself form an important factor in the storage of these substances in the body during the succeeding period. It was probable that the laws of nutrition for the cow were very similar to those for the dog or other animals, and it was known by such experiments as those made with the respiration apparatus in Munich (unfortunately too little understood in this country) to be possible, by changing not simply the amount, but also the composition of the food, to increase or decrease both protein and fat in the body, or to increase either and decrease the other. It was remarkable to see how the interior of a dog could be manipulated, and why was it not so with a cow? If during the first period the cows of one lot were fed with the nitrogenous ration and those of the other lot with the carbonaceous ration, and the quantity and quality of the milk tested, and then in a transition period of say two weeks, the experimenter passed on to the second period, how could it be known how much of the protein or fat stored in the first period affected the milk product in the other? There was a source of error which he mistrusted would be found so important that a very large amount of the best experimenting in past years would have to be given up. He did not see how any single experiment station could do much to secure the desired results in this line, however narrow might be the problem upon which it worked; but cumulative experience and the aggregation of data would afford what was wanted. For some time he had had in mind the making of a specific suggestion to the experiment station workers engaged in feeding experiments, that as many of them as possible should coöperate in the investigation of some one subject, for instance that of milk production. Were the constantly used dietary standards satisfactory, and how were exact data to be got? When these were obtained it would be necessary in the first place to make the question very narrow, and then unite and follow it up together for a long time, working on a common plan. While not now prepared to suggest either a specific question or a specific line of inquiry, he would be glad to receive from the experimenters interested any suggestions as to the point of attack at which the investigation of any one problem in question should be begun. He would, with the available means of the Office of Experiment Stations, do what he could to collate the latest and best information, European and other, regarding the specific question selected; and then he would be glad to meet with the others interested at Columbus, Ithaca, Washington, Denver, or elsewhere, and spend as many days as might be necessary to arrange plans. The Storrs Station, with its very small means, would gladly coöperate in carrying out the schedule to be made up, and so would Mr. Thorne's station; and though the experiment devised might not prove successful during the first season, some definite results would be obtained by keeping at the work. The suggestions now made were quite general; any of the questions involved might be taken up. He did not know whether the proposed coöperation was feasible, or if it were, whether the first experiments should be made in feeding for beef, mutton, milk, or pork; he had expressly thought of feeding for milk. The first question to be asked, however, was whether it was desired to join in any such work. If it was, he would do all that he could, personally, in the matter, and would invite those who would coöperate to visit Washington and hold a conference for the arrangement of some experiments. He would suggest, first, feeding for milk, and under that either one or both of two questions: (1) the quantities of protein, fats, and carbohydrates to be fed per 1,000 pounds of live weight, and (2) the effect of nitrogenous food upon the composition as well as upon the amount of milk produced—but this was only a suggestion. He thoroughly believed that work of this kind should be done, and that the sooner it was begun the better.

Mr. Plumb said that the question was one which could not be settled at any one meeting of the Association, involving as it did men and animals and the circumstances surrounding them. Like other men who dealt with cattle in experiment stations, he believed that he had a fair knowledge of stock; but if he went to a dealer in Shorthorns and used his best judgment in picking out three steers for a feeding experiment the Chicago stockmen would laugh at his selection. To illustrate, he had bought ten Shorthorns for a certain experiment. A stockman and one of the trustees accompanied him, both being very capable expert judges—men who attended and exhibited at fat stock shows. The trustee made the selections. When they got the animals home it was considered best to take them around to the barns; they were not suitable cattle for even the ordinary feeding tests. The matter of accuracy—the carefulness of the men who did the work—also entered into the question. Again, in New England one thing was fed and in Texas another; the conditions of the cattle varied in different places. In the past year he visited an experiment station which he considered equal in accuracy of work to any station in the country. Looking at the pig-feeding experiments, and being solicitous to know whether all the food weighed out and credited in the tables as eaten actually entered the bellies of the animals, he looked around and found on the floor and between the ends of the trough some corn meal and other stuff which had been rooted out of the trough, but which had probably been credited to the matter taken into the pigs' stomachs. All these details affected the results, and while he knew that there were many accurate workers in the stations, he thought the bulletins showed that there were some incompetent persons engaged in these experiments. Where was the line to be drawn? Who were to do the work? Who should be the judges? He believed that in the experiments carried on in this country there was a larger item of food wasted by nosing out of mangers and troughs and trampling into the manure than was ever credited, and it seemed to him that the most important point in all the work was accuracy. The work could not be carried on with the students furnished by the college men as helpers; regular assistants, worth their money in carefulness of work, should be employed, for without them the work could not be conducted successfully. He had thrown out the work of a whole winter because he had only students to help him in it. These students were sure they were right, but he had unexpectedly found something going on which destroyed his confidence in the work, leading him to reject it all without reporting it to the workers of the country. He would therefore say that Mr. Atwater's scheme was a splendid one if the primary conditions could only be assured.

Mr. Curtis was sorry to hear such a sweeping assertion against students and their work; it was not just to either. There were students and students, workers and workers; men and men, and it was unjust to discriminate against all students on account of one class. In his own experience with students, which has been large, he had found that about five out of a hundred would become accurate men for experimental work. He did not altogether agree with Mr. Atwater. He did believe that coöperation was good, but both the law and public opinion compelled the stations to experiment in lines productive of direct benefit in their own sections. In Texas it would be very foolish to feed corn meal, at from 75 cents to $1 a bushel, to cattle, hogs, or sheep; a coöperative experiment so planned would be expensive there, and he would not care to publish the results in that State. On the other hand, cotton seed and its products were cheap in Texas, and he made it a prime point to show the farmers the benefits they could derive from them; but in the North these were deemed useless, though really cheaper than what was used there. He therefore agreed with Mr. Plumb in thinking that most of this work would have to be determined upon by the individual States, some of which it might be necessary to divide; Texas, perhaps, was too large for anything in that line, but it was hoped that the ground could be covered by experiments made in the various sections.

Mr. Hunt moved that a committee of three, of which Mr. Atwater should be chairman, be appointed, with power to add to their number at their discretion. The motion was carried, and the Chair appointed Messrs. W. O. Atwater, George E. Morrow, and D. W. Curtis.*

Mr. Sanborn read the following paper:

Relation of Tillage to Soil Physics, J. W. Sanborn.

I am asked to speak upon the subject of relation of tillage to soil physics. The broader relations of tillage to soil physics are biological, chemical, physical, and with reference to cohesion and adhesion.

The biological relations of tillage primarily and mainly are its relation to the air supply of the soil. The degree and character of fermentation in the soil will depend in part upon the amount of air circulating through it. The action of ferments above ground we know are gauged largely by the supply of air. We know that the products of fermentation above ground in a restricted supply of air are quite different from those that occur in the free supply of air. The economic relations of this fact are very important. The same truth we believe is applicable to organic changes occurring below ground; we know that it is. Facts as yet secured, and especially the limited facts at my command, will not warrant any speculations in this field on my part. I can only suggest that biologists of our stations should look very carefully into this side of the tillage question. In speaking of the relation of tillage to the chemical physics of the soil I shall ignore the fact that much of the chemical manifestations that follow tillage operations are due to the organic changes that follow that high degree of fermentation which is due to tillage, and shall speak of the chemical changes as a direct result of tillage.

My remarks will be propositional and assertive, as time will not admit of argumentation over so broad ground. Tillage increases surface soil porosity; therefore

* The committee added to its members Messrs. Plumb and Thorne.

the ratio of the air of the soil which results in hastened soil decomposition. In a trial I found that the immediate surface of the soil increased 6.6 per cent in porosity by tillage. Between different weights of soil per cubic inch, due to varying tillage tools, there was 50 per cent variation found. Tillage increases the bulk of air in the soil. That increased fermentation and oxidation follow increase of air in the soil is shown by the trials of Sturtevant, of the Chemical Society of England, of Woolney, and of many others who have recorded greatly increased losses of nitrogen and of carbon from a tilled soil over that lost by an untilled soil.

Sir J. B. Lawes found that an untilled soil contained less than one half the nitrogen that a long-tilled soil did, notwithstanding the tilled soil was heavily manured. Also that ground under grass increased in nitrogen in ratio to the time that it was covered by grass. Thus a field laid down to grass in 1879 had 12 per cent nitrogen, 15 per cent when laid down in 1874, 17 per cent when laid down in 1873, and 20 per cent when laid down in 1858. Notwithstanding these facts tilled areas, though thus heavily reduced in nitrogen on account of aëration, were yielding yearly more organic matter in crops than the grass plats were with their stores of nitrogen.

Tillage for soil aëration should be limited, as in constant practice it reduces the organic matter too low for absorption and retention of moisture and gaseous matters of the air that may serve the plants. Alternate tillage and grass crop should follow each other for reasons that data given have unfolded.

The constant tillage system of the West has resulted in the fermentation and oxidation of the organic matter of the soil to such an extent that the soil has been reduced in its stock of nitrogen and in its water-holding capacity, and has become physically more compact in the surface through reduced organic matter. The result of this tillage has been the reduction by nearly 2 per cent per annum of the wheat crop of the West.

Tillage for aëration should not occur on loose soils; such soils are already too deficient in organic matter, and therefore in nitrogen supply, in the power to hold moisture, and in their capacity for gaseous absorption. Plowing loose soils should be by cylindrical plows having straight lines on their surface from front to rear, in order to compress the soil and to minimize the aëration necessarily secured in inverting the soil and through the interspaces between the furrows. Such furrows may be and should be flat. They also should be harrowed with wedge-toothed harrows in order to secure the compression of the ground and exclusion of air. Fermentation and oxidation will occur rapidly enough in all such soils, and at the best generally too rapidly. I have handled soils upon the compact surface of which manures were not fully expended for about twenty years. I have handled those in which the effects of manures quickly disappeared, and there are those in which the results of manuring is scarcely visible for more than a year. On compact soils, clays, and heavy loams in plowing, both plows and harrows should be used that increase the bulk of the soil. Such implements we have. Shall we plow deep for this chemico-physical effect? It has been held that tillage by readjustment of the soil particles, throwing them across the interspaces, necessarily increases the bulk of the soil just as wood or rocks loosely thrown together occupy more space or have larger interspaces.

Darwin's famous contribution to science on earth worms has shown that worms penetrate the soil most thoroughly and deeply, forming air passages in so doing. Freezing water increases in bulk one twelfth and thrusts all the particles of soil apart with an irresistible force.

I have been digging much ground for several years and find that after passing the first few inches of organic soil on the surface, the soil thrown out will not fill the same space again; in other words, there is more air space after moving the soil than before moving it. In practice subsoiling has given no gain in this country, as the average of many trials and compilations of trials by myself have shown. Tillage increases the area of the interspaces on the immediate surface of the soil through its lightening influence on the mat of roots, whose chief weight and favorable action is found in the first 6 inches of the soil.

It is doubtful whether more than surface tillage is useful for aëration or is useful at all. On moderately heavy to clayey soils tillage often lumps the soils, as much soil sifting has shown me. The untouched soil has its particles thrust asunder throughout its mass by the action of frosts. Alternate wetting and drying of tilled soils causes the formation of the clods mentioned.

A series of surface-tillage trials in fitting the ground for barley showed a gain of one harrowing over no harrowing that was quite substantial, but excessive harrowing was an injury. I suspect that packing by treading and by chopping the ground follows the first harrowing. If so, it does not bear upon the abstract question of the value of aëration.

TILLAGE TO COHESION.

The main force that overcomes cohesion in the soil is of chemical or of biological origin. The physical influence of plowing or the mere application of direct force to the pulverization of the soil particles that are held together by cohesion is of very small effect indeed and not worth consideration. Cohesion may be indirectly affected by changing the porosity of the soil and by changing its outward covering. The partial dead-air spaces of the soil formed by a grass sward are broken up by plowing. This is effective in the fall of the year, as not only the frequency but the depth of freezing is thereby very materially affected. When moisture surrounds the particles of the soil and insinuates itself into any depressions or around any irregularities of the particles, freezing may result in rending the particles into smaller ones.

The fermentation and oxidation engendered by tillage varies the heat of the soil, as Penhallow has shown. But the variation of a degree or so is not radical enough to merit much attention in its influence on cohesion through the unequal expansion and contraction of the minerals that make up the particles, and the tendency to disintegration thereby induced.

TILLAGE TO ADHESION.

In a recent experiment I found that the direct tendency of plowing is to compress the soil handled into less space. The plow is a double wedge, and should do this. The convex lines on the plow do make occasional rents in the soil. These open spaces where they occur do increase the lump bulk of the soil, but at the expense of draft, and make it questionable whether it is not better to dispense with this shape of the plow and leave the loosening of the soil to cultivators. The air chambers between the lap furrows afford air circulation between masses, as do the rended spots, but not where we desire it between particles of soil. The plow, then, has little influence on the adhesion or looseness of the soil. It serves to secure the supremacy of one plant by turning all foes to it under the surface, and opens the way to the formation of a seed bed on the surface of the soil.

Adhesion between the particles of the soil, then, must be overcome by other tillage tools. In a trial, I found that the several cultivators on the market run at only from 1.31 inches deep to 2.5 inches deep. The effect of surface-tillage implements on soil adhesion is therefore very limited, and with many implements does not increase either the fineness of the particles or the porosity of the soil over the same soil in grass.

What, then, are the pronounced beneficial effects of tillage? First, it destroys the close mat of grass, which greatly reduces air circulation in the soil; second, it insures the supremacy of the plant desired; third, it fits the surface for seeding; fourth, it breaks on old ground the crust that forms as the result of pounding rains and of rapid evaporation, and it readjusts the particles of a fine soil into whose surface pores the rain has run the finer soil, and thus it facilitates aëration. It also affects the movement of water in the soil by the law of adhesion or by capillary action.

These are all purely surface effects, and, as seen, must be largely confined to the surface.

TIME AND METHOD OF PLOWING.

I have said that lap furrows for heavy lands and flat-pressed furrows for light lands were the best. For very heavy lands inclined to be wet, narrow, erect furrows have been deemed the best in England. On a clay loam I found that such a furrow did best when it was quite moist, while a broad furrow did better in drier weather. This was presumably due to effect on the water supply or the capillary action of the soil, and to the direct influence of air currents on the spaces between the furrows.

TILLAGE TO CROP GROWTH.

I have confined my remarks to tillage in its abstract relations. I shall discuss briefly its relation to growing crops.

There are four prominent reasons assigned for tillage of growing crops, viz, its influence on weeds, soil disintegration, soil adhesion or looseness of soil, and the water supply of the soil. Its influence on the heat of the soil I will not discuss. Probably it may make soil temperature more equitable between night and day—a desirable end.

Sturtevant, Hunt, Hays, and others have shown that root cutting of corn is opposed to its most successful growth. Voelker, Sturtevant, and others have shown that the bulk of roots are found in the first 6 inches of the ground, and indeed most of them within the reach of the deeper-surface tillage tools. We must conform our practice in corn cultivation to this information, unless the loss of the assistance of the destroyed roots in feeding the plant is more than overcome by the consequent gains of tillage. These gains are the destruction of weeds, soil disintegration, and water conservation. The weight of the dried weeds of an acre of corn is far less than popular estimation, and very small in their influence on the crop through soil exhaustion. Water is often a pivotal plant food and the measure of a crop. Weeds are usually annuals of rank growth and despoil the crop of water supply at a critical time. Weed destruction is the merest of surface work when watched closely and need not affect the other tillage problems, for a shallow instrument has been run by me with great success. For soil disintegration the running of surface tools, after the close mat of grass has been turned under and the soil has been fitted for crops, will not pay in released plant food a tithe of the cost.

The conservation of the water of the soil can be the only adequate reason for tillage of corn or of crops at any depth or of tillage of crops at all, save as it may prove a cheaper method of removing weeds.

Surface tillage forms a porous layer of earth whose power to move water by adhesion is lessened and whose readjusted particles overlay the freer currents of capillary water and hold it for a time more successfully below the surface. It also restrains heat radiation at night and its influence on vaporization and soil temperature.

In these facts we find the main motives for crop tillage. At what depth should tillage stop to conserve most moisture, and at what depth does the good results from saving moisture become balanced by the evils of root cutting? We do not know, but a compilation of trials in New York (Cornell and Geneva), Ohio, Illinois, Minnesota, Kentucky, Alabama, Missouri, and Indiana show that it should not pass a moderate depth. Whether it should be positively shallow or not is a question to be further explored.

In Missouri I tried many methods of surface tillage and means to obviate the action of capillarity. A very thin mulch of cut straw, of sand, and of earth sown upon various plats was as efficacious, as gauged by crops, as a mulch formed by tillage. In these cases the few weeds that grew were removed by hand; on other plats the scuffle hoe run one fourth inch deep gave the best crop. Other methods were tried, one being a mere scarifying of the surface by spikes driven one fourth of an inch through a plank. The result of it all was that tillage was found unnecessary, or rather there were no physical conditions found that it was necessary to secure through tillage, as evaporation can be checked and weeds removed without the old-fashioned system of tilling at all.

In Utah for the past season I found that unhoed wheat gave better results than hoed wheat, and that wheat hoed one inch deep gave a better crop than wheat hoed from 2 to 4 inches deep. Potatoes hoed shallow gave 959 pounds, untilled gave 824 pounds, and hoed deep gave 726 pounds. The average result of untilled corn was 164 pounds, of corn tilled deep 135 pounds, and tilled shallow 127 pounds.

While the results on new and comparatively poor land must be uncertain, yet the average of duplicates shows that the great gain from no tillage over the tilled areas could not have been wholly accidental. On our station soil fresh from nature and in a section where weeds are not as prolific as elsewhere, in short on a soil where we had no weeds, the elimination of the weed question gives surprisingly favorable results in view of former convictions regarding the value of tillage.

At present, tilling is the cheapest method of securing these results, but justified invention may seek out other methods.

The efficacious results in checking evaporation of a mere film of earth when sown on the soil three times by me, leads me to believe that very shallow tillage will conserve well the moisture below; if so, it is desirable to secure very shallow tillage, as it suffices to destroy weeds if conducted early. It is especially desirable for the reason that I found that tilled areas dried out faster than untilled areas. There is a double reason for this result, viz: The supply was shut off from below through the physical effect of the position of the particles of the soil and through the greater porosity of the surface soil, whereby air circulated more freely and adhesion was lessened because of the greater diameter, so to speak, of the capillary tubes of the soil. If corn is shallow rooted, or if the roots of our crops are mainly in the surface of the soil, it follows that by surface cultivating the soil in a measure reduces the water of the surface area and cuts the roots within the area moved. For both reasons the new fibers are forced to seek a development below or in an abnormal position.

Nessler's deep-tillage trials indicated that the soil was made drier to the depth tilled, but was made moister below this tilled area. Neither his work nor mine showed whether deep tillage made a more effective mulch for retention of moisture below, nor does the fact that better crops are grown above shallow tillage throw any light on the matter, for the influence of root cutting forbids conclusions on this point. Direct trials only will answer. I have such trials in hand, but the first year's results are sealed to me until our laboratory is opened, which will be next month.

Any general conclusions that we may arrive at must be modified by soil and season. I may draw a minor practical deduction from the effect of tillage in drying out the surface to the depth tilled, namely, that a seed bed should be sown immediately after harrowing. So, too, ground needed for early use can be rid of its surplus surface water every spring by tillage, say by cross-plowing or deep cultivation. The clods that would ensue can be avoided by harrowing as the right degree of dryness is reached. If the soil is inclined to be dry late in the season, or dry weather comes on, this tillage will have saved the moisture of the layer below for the after use of crops.

ROOT PENETRATION.

The notion that we must till either before or after seeding for ease of root growth is of very doubtful force. I have said that the plow rather compresses the soil and that surface-tillage tools merely scratch the surface and at best increase porosity but little, and that frost sunders almost every particle yearly. Again, the penetrating power of roots is almost irresistible. In the marvelously beautiful and deep cañon back of the Utah Agricultural College are thousands of trees growing out of cracks in ledges and great rocks, which stand in a high and dry place unsurrounded by even dirt. It is sweetness of soil and the separation of the particles of soil, coupled with the right ratio of water,* that determines root penetration, and I am inclined to believe that decaying roots, worms, and frosts leave the soil in better condition for root penetration than tillage that converts separate particles into lumps and interspaces where before were pores and particles. I am not quite certain that a loose soil will feed plants as well with either solid or liquid food as will a soil which presses close around the roots.

Last year in Missouri the non-harrowed and non-plowed plats did well, while this year a soil which was never turned during the ages gave me fair results, but far from equal to plowed ground, or about two thirds of a full crop, and for obvious reasons. At the Kansas Agricultural College this year oats did best on non-plowed ground.

The A B C's of tillage are hardly known. We have speculated without knowledge. I do not wish to be understood to be an advocate of non-tillage. The necessity of removing weeds by some means is apparent. The great value of aëration of grass land is unquestioned, as is the necessity of breaking the crust formed on tilled ground in some sections of the country. That tillage restrains evaporation is not doubted. The other functions of tillage are probably exaggerated, or at least are very poorly understood. It is also possible that the factors above mentioned may in part admit of marked modifications.

Mr. Morrow read the following paper:

STATION RECORDS, G. E. MORROW.

I think of three classes of station records in which we are all interested, although as agriculturists we have especially to do with but one of them.

First, there should be a record of all decisions, directions, and authorizations by the controlling power. This is important where that power is lodged with a director, but is especially important where there is a board of control. I like the plan of having work decided upon after free conference between all parties interested, but there should finally be not a mere general understanding or verbal authorization, but a definite statement or direction, placed on record at the office of the station. This course will tend to properly fix responsibility, prevent misunderstandings, and secure accurate work.

Secondly, there should be a careful record and classification of expenditures by the station. Not only should the letter and spirit of the law be scrupulously complied with in making expenditures, but the records should clearly show that this has been done. Very few people will suspect any station of forging vouchers, very few would care to have opportunity to examine the bills paid, but all have a right to know in what proportion the funds of the station are used for different classes of work. This information is not satisfactorily given by a long list of unclassified vouchers. At least once a year there should be published a carefully compiled statement showing to any one how much has been paid for this and that class of work.

Thirdly, and this especially concerns us as agriculturists, there should be the most careful record of work done in experimentation or research. Of this there should be—shall I say always or almost always—duplicate records; one retained by the worker, the other on file at the central office. There is danger of relying on memory or on a record made on a slip of paper, and of waiting a little too long before making a proper record. Memory fails; slips of paper disappear; a fire or other accident may sweep away the record of weeks or months; the worker may be called to another field of labor, possibly leaving with a little unpleasant feeling, and he may not respond with cheerful alacrity to after requests for information; he may die, and all that he "has in his head" is lost. There is little danger that the records of work and observations will be too full. Make them as full as you like, and probably the time will come when you will wish they were even more complete. The mass of these reports may never be published. The condensing and arranging for publication is a difficult matter, but the publication will, ordinarily, be the more valuable in proportion to the fullness of the records from which it is compiled.

It will be a help, to suggest only one matter of detail, if each experiment have a letter or number by which it is always to be known. For daily note taking by the worker in field or stable a book is preferable. For his more permanent record I prefer instead of a book slips or blanks which can be filed. Very promptly the worker's record should be taken to the central office there to be copied, allowing the first record to be returned to the worker. For the central record we prefer blanks with proper headings. In this station we have a large cabinet in which these records may be kept, so classified that the record concerning any experiment may be at once referred to. Instead of taking more of your time, let me suggest that if any of you are interested in this matter you may visit the office of this station and examine the system in use here. It seems to me simple, complete, and very satisfactory. I may say this without impropriety as I did not arrange the plan.

Mr. Plumb asked to what extent the details of the experimental work were reported to the central office of the Illinois Station. He supposed there was a biologist, who made a great many laboratory notes, figures, etc. Were all these ultimately recorded in the central office?

Mr. Morrow replied that the matter was largely one of personal discretion; the details were recorded to a great extent, but a working, thinking, inquisitive man would not, of course, consider it necessary to report all the notes made for his own use. He believed, however, that the reports made by such a man were more likely to be too few than too many.

Mr. Hunt said that as a matter of fact the thousands of repeated experiments were recorded though not published.

Mr. Thorne said that his own present system was unsatisfactory. He thought of adopting some such plan as was followed by the clerks in dry goods stores, the use of note slips with carbon between them, by means of which duplicate notes could be made with a single operation, one for the central office and the other to be kept by the worker.

Mr. Hickman read the following paper:

Testing Varieties, J. F. Hickman.

Testing varieties has been and is one of the leading features or branches of, we may safely say, almost every experiment station established under the Hatch act. We may go still further, and assert that this branch of so-called investigation had its birth simultaneously with the founding or establishing of experimental work. To prove this from the written pages of history is unnecessary, because the memories of some of even the younger men of our Association will carry them back to the earliest history of our State experimental farms. It was with these institutions that variety testing found favor, and in more recent years has either been handed down by a predecessor or taken up by an imitator.

Going back to the earliest work of experimenters we find that the testing of varieties has always occupied a prominent place. Beginning with the present list of experiment stations in alphabetical order, we find that from Alabama down to Wisconsin, the entire list of stations, numbering more than fifty in all, are more or less engaged in variety testing. Taking this fact alone as a basis, I think we have reason to believe that variety testing comes in as one of the legitimate lines of station work. One of two things is certain: either variety testing is a lawful part of the work of stations, or four fifths of the stations now in operation are engaged in investigations which are not strictly in accordance with the intention of the Hatch act; and if this latter be the true rendering of the law, then those directing the lines of work in many cases have started upon a wrong assumption.

I am not sure whether it was intended that I should discuss the propriety of stations conducting variety tests or not, but certainly the point is germane to the subject on hand, and while I do not intend to elaborate upon this phase of the question, I will leave it by making this inquiry: If the experiment stations do not do it, who will? Our subject assumes that it is or may be the work of stations, and I shall treat it with that understanding, and shall attempt to discuss it under the following heads:

(1) Where shall the work be done?

(2) When shall it be done?

(3) How shall it be done?

The first place to conduct such an experiment or test is upon the station grounds, under the eyes of a vigilant superintendent and within reach of other inquiring minds, for even the best of men can not see everything that such an experiment suggests. While we may be experts in our business, experience teaches us that a novice or an amateur may think of something and suggest the same concerning the very work upon which we claim to be quite proficient.

If other suitable places can be secured in different parts of the same State, the variety testing at the station should be duplicated on as many representative soils as the means of the station will permit, or as the necessities of the case may seem to require. If the work is thorough, complete, and satisfactory in any State, it will be only after the tests have been made upon the lowlands, the highlands, the hillsides, the hilltops; the black lands, the clay lands, the sandy soils, the peat soils, and the various other soils which may constitute any large area of the State in which variety testing is undertaken.

Under this first head, Where shall we undertake the work? comes one of the most important points which we have to consider, and that is, the uniformity of the soil upon which such an experiment is conducted. To attempt to make a variety test upon irregular soil, or upon soil unequally rich in plant food would be simply to thwart the intention of the work, to destroy confidence in the kind of work, and to mislead in the final results. Then the first requirement is to have a piece of land about which there can be no question as to its uniformity in natural or added fertility.

The second heading brings up the question, When are we justified in making a variety test? I answer, if at all, certainly not until the interest in such a test is sufficient to justify its being undertaken. The interest referred to will be manifested by letters received, asking about this or that variety of wheat, oats, corn, tobacco, sugar-beets, cotton, or perhaps vegetables or fruits. Visitors at the station or farmers at institutes or other gatherings will bring these subjects to the surface, and thus indicate the timeliness of such work.

Having decided that it is the proper thing to do, and having secured the uniform tract or tracts of land, as suggested above, do not for a moment suppose that the only thing left to do is to secure the several varieties of grain or other field crop under consideration, to plant them and reap the harvest, and then publish a long list of names giving yields per acre, etc., without so much as estimating what the object of the test has been. But before starting out do some wide and deep thinking; settle upon some definite point to be gained; do not be too diffuse and attempt to cover too much ground with a single experiment; concentrate your efforts upon one or two most important points to be gained; shape your plans and ideas so as to bring out those points most forcibly; have a clear-cut and clean understanding of them yourself; and then when your work is done you will have no difficulty in placing the ideas and points gained before those whom the experiments were intended to benefit in a clear, concise, and impressive manner. In plain, simple words, know exactly what you want, and then you are ready to begin work.

Having decided where and when to do the work it remains now to tell how to do it. The amateur and the novice would say, "Oh, that is a small matter." But after some few years of experience I have been convinced that it is no small task to properly conduct a variety test. I am fully persuaded that I know far less about it to-day than I thought I knew when I first undertook the work.

To select a piece of uniform land, lay it out, and prepare it so that the several plats into which it may be divided are regular in size, uniform in substance, and of equal elevation and exposure, requires good judgment, well-tempered discretion, and experience beyond what we find in most heads. To select the land by mere superficial appearance is not safe, even with the expert; either he or somebody else should have a previous knowledge of its productions. I claim that the perfect experiment in variety work can not be made until after one or two years' experience with the soil upon which it is made.

Having gained a clear idea that the land selected is satisfactory in every particular, then the preparation of the same becomes a matter of vital importance. To plow the land equally deep all over requires a good, steady team, with a level-headed and painstaking driver holding the lever or plow handles. If the land is manured with yard manure much care will be required to be sure that it is evenly spread and that it is of equal strength, otherwise results will be vitiated and misleading conclusions follow. Whatever other tillage is given, the leading object must be uniformity of work. The seed bed properly prepared does not finish the necessity of care; but upon equal sized plats equal quantities of seed should be used; approximate amounts by guess will not suffice, but actual measurement, either by the scales or bulk measure, must govern quantity. Quality, regarding cleanness and purity, are important factors, and can not be disregarded.

The varieties to be tested are usually numerous and are being continually added to; therefore one of the first things to be done seems to be to reduce the list by eliminating those varieties which after one trial we are satisfied will not be a success upon our soil or probably in our climate. A single test will not be sufficient to reduce the number very materially, because the seed may have been imported a considerable distance and may have lacked vitality, or the climatic conditions may have been quite unfavorable, while further testing may bring out some desirable qualities and later develop a valuable variety.

The second way of reducing the number on the list is by detecting synonyms. This may be done after the first year by a careful comparison of characteristics of the several kinds under consideration. Those having like points of similarity, such as likeness in growth and quality of product, time of maturing, and other distinguishing features should be grouped together, so that in the second planting like varieties may be placed on adjoining plats and their identity confirmed or points of dissimilarity more readily recognized and more clearly defined.

Just at this point in our variety testing a word of caution should be noted. That particular point to which I would call attention can not be better illustrated than by relating this fact, namely: that we may, after a careful examination, decide two kinds of wheat to be the same in their tillering qualities, in their manner of growth, and in their botanical construction, but may find that one matures a little earlier than the other, or that the color of the berry or chaff is not identical, and therefore the wheats are of different varieties. Any one of the three points named may be misleading, for after the same two varieties in question have been raised near to each other for a series of years these characteristic differences may entirely disappear. It is a fact that the color of the grain is affected by change in locality in which the grain is raised; whether it is due to a change in soil, to climatic differences, or to the character of plant food applied to the soil I am not prepared to say, and a mere conjecture in our work should not be entertained. Especially is this true where so many important points are likely to enter into the cause of such a change.

The various ways of propagating and hybridizing are continually multiplying the number of varieties at a rate that indicates a continuation of a long list for some time to come. Besides these sources of new varieties, we must always expect to have some unscrupulous seedsmen, who will give new names to old varieties merely for the sake of the dollars and cents it will return to them.

In view of the foregoing facts, the experimenter who undertakes to test varieties must do so knowing that before him lies an unending task. He must realize that he will have to come in contact with some very puzzling and perplexing questions. He must also be prepared to combat unscrupulous companies and individuals; to stand up for that only which he knows to be correct. Having singled out of many varieties a few that are worthy of continued trial, he should then begin to inquire by practical experiments to what kind of land each variety is best suited. This, according to my own experience, is a leading question from persons seeking information on varieties, and very frequently comes in this form: "What variety of wheat would you recommend for a clay soil, a black soil, a sandy soil, a loam?" etc. These are questions which to the inquirer are of vast importance, and if the experimenter is able to answer these properly and with some degree of accuracy he has accomplished something which the farmer might not be able to do for a series of years by making experiments personally. He may thus have saved or rather have made for him hundreds of dollars, which he would have lost by experimenting for himself. These points of specific information can not be gathered in a single season, but will require time, patience, and experience such as none of our stations have had as yet. Since it will require a series of tests to decide such questions, it would seem an economical and safe plan for the stations undertaking such work to rent or lease a number of pieces of land in different parts of the State for a series of 5 years, with the privilege of a second lease if at the expiration of the first period the further test seems desirable. I am aware that many would advocate the plan of having the farmers themselves do this work. But I feel quite as certain that those approving or favoring that plan have not had any experience in attempting to carry out such a scheme.

The Ohio Station has made the effort to conduct variety tests by the gratuitous distribution of seed, sending with the same a blank indicating the kind of answers expected when the crops were gathered, and at the same time a postal card to be returned by the one receiving the grain. The postal was already written and indorsed, and needed only the signature of the person and to be dropped into the office to insure us that the grain sent had been received. These postal cards were in almost every case promptly returned, but this was too often the last heard of the experiment. I am very safe in saying that 50 per cent of such tests have never been heard from, and with the other 50 per cent (if the test was on wheat) we could pretty safely count on 10 per cent being reported as failures without any further explanation, 10 per cent sowed on corn ground among the corn, 5 per cent sowed on potato ground, 5 per cent on oats stubble, 5 per cent on clover sod plowed under, 5 per cent on ground that had been in wheat the previous year, 5 per cent on land top-dressed with a heavy coating of yard manure, 5 per cent on land fertilized with homestead fertilizers at the rate of 600 pounds to the acre. In view of these varying conditions of previous management and tillage it was simply an impossibility for any one to tabulate specific information. I have also tried to give directions from the home station, but without success.

The Chairman requested Mr. King to speak upon the subject,

WHAT DOES A LYSIMETER TEACH? F. H. KING.

Mr. King said that his selection was an unfortunate one. He had been invited to consider the question some time ago, when it had seemed impossible for him to attend this meeting. He had had no practical experience with the lysimeter. During the past year his work on soil moistures had been confined to studies made in the field, his only approach to lysimeter work being studies of the rate of capillary movement and of the rate of evaporation from a cylinder of soil 4 feet in length and 1 foot in diameter, a study with reference to the bare soil without vegetation. From his impressions on reading results of experimental work with lysimeters he had become in some measure prejudiced; he saw no hope of obtaining from them palpable results specifically applicable in field investigations or to field conditions. He thought it most important in the study of soil physics to make a wide study of field conditions and get at the facts irrespective of any preconceived theory. It seemed that in this, as in a great many other matters, investigators stood where Darwin would have stood had he lived a hundred years before his time and had attempted to build up the great doctrine which bore his name. He could not have succeeded, for at that time the facts had not been collated and the needful basis for reasoning was absolutely non-existent. Lysimeter and laboratory experiments might afford suggestions, but the conclusions derived from these sources should not be carried over into the field, which ought to be studied directly. In Story's Agriculture the capacities of different kinds of soil for moisture were given, but in his own study of that question as it presented itself in the field, involving the examination of more than 2,000 samples taken in different places, he had been unable to obtain results anywhere within experimental or scientific reach of those given by Story. To illustrate: The highest ascent of moisture that he had found in clay within a foot and a half of permanent water in the ground and immediately after long rains was only 30 feet, whereas the book made it much higher; and the highest percentage of moisture he had found in sand, even when taken below standing water in the ground, was 4 per cent below that given in the work referred to. In the approximation to a lysimeter which he had studied in the laboratory with a current of dry air at a high temperature passing over the surface of the soil the surface never became dry even when the water-table was maintained four feet below the surface; it remained wet throughout the experiment, covering more than six months of continuous action. All knew that this condition did not exist in the field where the surface did get dry; therefore it seemed necessary to make further studies of Nature as she exists, rather than, or at least side by side, with Nature as she might be produced.

On motion, at 12 o'clock m. the meeting adjourned.

THE PERMANENT COMMITTEES ON AGRICULTURE AND CHEMISTRY.

JOINT SESSIONS.

MORNING SESSION, WEDNESDAY, NOVEMBER 12, 1890.

The meeting was called to order at 10 a. m.

It was stated that the topics to be discussed in the joint meeting of the committees on agriculture and chemistry were as follows:

Artificial digestion*	Paul Schweitzer, Missouri.
Coöperative field experiments with fertilizers	W. O. Atwater, Washington, D. C. C. L. Ingersoll, Colorado.
Methods for the analysis of milk	G. E. Patrick, Iowa.
A standard milk test	G. E. Patrick, Iowa.
Is a digestion experiment fallacious?	H. P. Armsby, Pennsylvania. W. H. Jordan, Maine.

Mr. Atwater read a paper on coöperative field experiments with fertilizers, an abstract of which follows:

The experience of the stations in field experiments with fertilizers was referred to. A number had carried them out on the plan detailed in Circular No. 7 of the Office of Experiment Stations on Coöperative Field Experiments with Fertilizers. Among the objects of these experiments are—

(1) To work directly upon farm lands in different localities and aid owners in learning the deficiencies of their soils and the requirements of their crops.

(2) To help farmers to become familiar with the forms and action of commercial fertilizers and to better understand their profitable use.

(3) To encourage a spirit of investigation, and thus to gradually develop farm experimenters whose work will be useful to themselves and their communities, and who will serve as a means of connecting the stations more intimately with the agriculture of their respective States.

(4) To gradually accumulate data upon which may be based generalization of values regarding the wants of our soils, the action of fertilizers, and the feeding capacities of different crops.

* Not presented.

The experience of a number of stations was cited in illustration of the value of such experiments in the ways referred to. While they had been in many cases unsuccessful, yet on the whole those stations which had carried them out the most thoroughly had found them useful in a very high degree.

Special stress was laid upon the sources of error, the principal ones ~~being~~ variations in soil and the effects of plant food accumulated in the soil in residues of previous crops and from previous manuring. One great difficulty is the variation in the water supply from the subsoil. We do not realize until we have examined into the matter how great may be the variations in the subsoil where the surface soil looks quite uniform. It is not simply the supply of plant food but the mechanical condition of the soil and subsoil, and especially the supply of water which interferes with the results of field experiments.

The necessity of a more careful geological, chemical, and especially physical study of the soils and subsoils was insisted upon. It was also urged that the methods of field experimenting which experience has shown to be so valuable for obtaining information as to the effects of fertilizers upon our ordinary field crops and their different capacities for obtaining food from natural sources may be most advantageously applied to garden vegetables and fruits; in other words, that the station horticulturists as well as agriculturists may find here a way of doing most useful work.

Mr. Ingersoll read the following paper:

COÖPERATIVE FIELD EXPERIMENTS, C. L. INGERSOLL.

The subject on which I am asked to give a few thoughts is one which has engaged the minds of many of our experimenters. There are many considerations which, for the present at least, seem to forbid the active coöperation of many stations, unless it may be in the line of the determination of the use and action of fertilizers. For us in the Far West this question, while valuable, is one to engage our later consideration. I can see, however, that in certain directions Ohio, Indiana, and Illinois, for example, could unite in the study of questions that pertain to all of these States.

The board of agriculture in Colorado in organizing the experiment station, instructed the council in a general way (1) to plan popular experiments which would meet the immediate demand of the people; (2) to arrange a small amount of scientific work and carry it forward over a series of years to enable the station to determine some of the deeper questions involved in experiment station work. In Colorado the questions which lie at the foundation of our agriculture are:

(1) Water supply, division and use.

(2) Climatic conditions as modified by lack or distribution of rain-fall, prevailing winds, elevation, per cent of sunshine, etc.

(3) What to grow under these conditions.

(4) The particular varieties that are likely to be best suited to our climate, and the system of culture and irrigation which we must use.

You can then see that to the Colorado board of control and to the average farmer questions that are more deeply scientific have but little favor and would not be well received at this time; and while we may do some work looking in that direction, it must for some time to come be limited because of the great amount of fundamental work which must be performed. We of Colorado can join in some of this work with our neighbors. With Utah, Arizona, and New Mexico we can coöperate on matters which pertain to the arid region. With Kansas, Nebraska, and Dakota we can coöperate to a more limited extent. For example, we find by experimentation that the sugar-beet can be successfully raised and with sugar content enough to warrant experiments in raising them for profitable use in sugar manufacture. Whether we acknowledge it or not, the question of profit must influence us in our work and to some extent determine its lines. In this pushing, active age, the close of the nineteenth century, when competition is sharp, when the markets of the world are constantly changing because of movements of population and the opening of lines of traffic in many directions, because of the opening of new areas, and the great increase of certain products suddenly thrust upon the market, all these factors influence agriculture to a greater extent than we are willing to admit.

Amid all this the demand is made for work the interpretation of which shall bring to the farmers and stockmen of our country dollars and cents. To a certain extent we must meet this demand, and as we go West the demand seems to be more imperative. The older portions of the country are more willing to wait because their conditions change more slowly and the agriculturist can have time to adapt himself to the modified conditions.

On the whole, I do not believe that coöperative field experiments are to any extent practicable at this time. When 10 or 15 years of experimental work shall have been performed, when this Association shall be as many years older, then little by little and item by item this work may be taken up and carried forward under the general auspices of the Department at Washington, and in the light of its experience and that of this Association.

In the discussion which followed, Mr. Frear said one point that did not seem to have been touched upon in the papers already read was the matter of soil tests in the older States, where the farmers wanted to know what would be the most profitable to put upon their soils. The question of a maximum crop was not simply a question of maximum fertility, but of the best soil preparation, climatic condition, and water supply, and it was very often true that the climatic conditions and those of water supply were the ones that had the greatest influence upon the development of the crop. If negative results were obtained with fertilizer experiments, it showed that the soil did not require the addition of the ingredients contained in the fertilizer for the cultivation of the maximum crop, and the farmer learned what he wanted to know. Therefore the soil test was valuable, economically considered, without reference to its educational value, which should not be underestimated, and hence it seemed that in those States where fertilizers were needed there was a very great work to be done in the way of properly coördinated experiments with fertilizers, as economic soil tests simply, and not as studies of physiological matters.

Mr. Thorne said that the necessity for great care in the selection of soils for these tests should be emphasized. He thought that very much more attention than had been paid heretofore should be given to the geological history of our soils, beginning with drainage and exposure, which in some experiments made at his station seemed to be the all-important matters, the success of the experiments depending upon them. Referring to a statement made by Mr. Atwater, he deemed it no less important that the farmer should know how to maintain the fertility of his soil, even though it be quite fertile already, than that he should know how to bring up the barren field.

Mr. Atwater said that Mr. Thorne would find the application of certain fertilizers profitable on soils yielding 50 or 60 bushels of corn to the acre, and would probably agree that the application of these fertilizers for the sake of maintaining high fertility was also profitable.

Mr. Thorne said that the fertilizers would prove equally valuable in maintaining a high degree of fertility whether the soil yielded 30 bushels of wheat to the acre or only 15 bushels.

Mr. Hunt then read the following paper:

Equalizing the Irregularities of Plats, Caused by Defective Germination, T. F. Hunt.

The first requisite, of course, is to obtain good seed, so that the errors may be reduced to the smallest limit. In getting seeds from various sources equally good seed can not be obtained. We must experiment with the possible, not with the ideal.

With small grain, testing the sprouting power of the seed and sowing enough to offset the defective germination suggests itself. There are two fatal objections to this method: First, variations due to the method of testing are so great as to vitiate results; and, second, there is no direct relationship between that percentage of seed that sprouts under favorable conditions and that which grows in field culture.

Thirty-two varieties of oats were tested this spring in the Geneva apparatus, at two different times, 100 berries being used in each case. The mean temperature for the two periods was 60.4° and 60.1° F. The average variation in the result of the duplicate test was 6 per cent, and for nine varieties the variation was 10 or more per cent. With such variations, who would wish to decide how much seed to sow to compensate the defective germination? But suppose the method of testing perfect, what then? Mr. McCluer tested 110 varieties of sweet-corn in the greenhouse and afterwards compared the percentage which sprouted there with that which grew in the field, in order to find the relation of the vital power to the per cent of live seeds. For purposes of comparison he divided the seeds into four lots. The first lot included 32 varieties, of which 90 to 100 per cent sprouted; the second, 37 varieties, of which 75 to 89 per cent sprouted; the third, 24 varieties, of which 60 to 74 per cent sprouted; the fourth, 17 varieties, of which 45 to 59 per cent sprouted. Omitting fractions, the following was the result:

	1	2	3	4
No. of varieties in each lot	32	37	24	17
Average per cent of seeds germinating as shown in greenhouse tests	95	83	69	52
Per cent of seed germinating in field	76	61	60	55

How little indication does a test made under favorable conditions give of what will be the result in field culture under unfavorable conditions!

Any particular method of seed testing is not the most favorable for all classes of seeds. Of 82 varieties of corn tested in 1888, 94 per cent sprouted in the Geneva apparatus, while 80 per cent grew in the field. Of the same number of varieties tested in 1889, 95 per cent sprouted in the Geneva apparatus and 80 per cent grew in the field.

On the other hand, I have tested Kentucky blue-grass seed, from 17 different seedsmen, with the following results: In the Geneva apparatus, less than 2 per cent sprouted; in soil in the greenhouse, 9 per cent; and in soil in the open air, 21 per cent.

These tests show that no calculations based upon the sprouting of seeds in seed tests would be sufficiently trustworthy as a means of equalizing results due to defective germination.

With corn, it has been the custom at some stations to report yield and corrected yield. The corrected yield is the yield which would have resulted had there been a perfect stand and the yield with a perfect stand had been in the same ratio of corn to stalks as the yield from the fewer number of stalks. As a reason for declining the use of this method in the experiments with corn which have been reported from this station, I have heretofore stated that corn growing at different thicknesses would not yield in proportion to the number of stalks. I base my opinion on the following experiment: Corn was planted during the past three seasons at six different rates of thickness, ranging from 47,520 to 5,940 kernels per acre. From two to five plats of each thickness, differently distributed, were planted each season.

The following table shows the number of kernels planted, the number of stalks, and the bushels of corn harvested from each of the different plantings during each of the seasons given:

Number of kernels planted and the number of stalks and bushels of corn harvested, 1888-90.

No. of plats.	No. of kernels planted per acre.	1888.		1889.		1890.	
		No of stalks per acre.	Bushels of corn per acre.	No. of stalks per acre.	Bushels of corn per acre.	No. of stalks per acre.	Bushels of corn per acre.
5	47, 520	29, 460	89	36, 700	·61	37, 390	26
5	23, 760	17, 100	95	19, 820	86	19, 820	48
5	15, 840	13, 940	87	13, 270	91	13, 920	55
4	11, 880	12, 350	83	11, 110	93	11, 280	63
3	9, 504	11, 540	72	9, 170	82	10, 270	62
2	5, 940	8, 200	60	6, 260	56	7, 300	50

This table is sufficient to show that the yield of corn was not in proportion to the number of stalks harvested. The following table, giving the pounds of shelled corn for each 100 stalks harvested, brings the point out more clearly.

Pounds of shelled corn for each 100 *stalks harvested.*

No. of plats.	No. of kernels planted per acre.	Pounds of shelled corn for each 100 stalks.		
		1888.	1889.	1890.
5	47, 520	17	9	4
5	23, 760	31	24	14
5	15, 840	35	39	22
4	11, 880	38	47	31
3	9, 504	35	50	33
2	5, 940	41	50	39

There was not only a great variation in the ratio of corn to stalks for the different ratios of thickness, but the variation in the ratio was greater some years than others.

The plan of planting more kernels of corn than the number of stalks desired and then thinning to the desired number has doubtless suggested itself to every field experimenter. This plan is helpful, and in some experiments practicable. It must be done, however, at the right time and with care, or else the disturbance from thinning will be worse than the evil of irregular germination. It must also be remembered that the stand will not be perfect even with this precaution. The thinning will not be absolutely accurate, and many other causes will combine to cause slight irregularities. In some experiments this method can not be practiced, as, for example, when corn is planted at different times, for the variation in the germination is here one of the results to be studied. Before leaving this portion of the subject, I wish to point out that while the irregularities due to defective germination is an element not to be ignored, it is of less account probably than the irregularities arising from a multitude of causes which affect the result of an ordinary field experiment. With small grain especially, and with corn to some extent, as shown by the previous table, the plants themselves tend to equalize the irregularities by tillering or suckering and by yielding a greater or smaller proportion of grain to straw or stalk.

The results with oats in experiments in sowing different amounts of seed per acre made during the past 3 years at the Illinois Station illustrate this point. The following table gives the relative quantity of seed sown and the relative yield of oats during the three seasons:

Relative quantities of seed sown and of oats harvested, 1888–90.

Plat.	Relative quantity of seeds sown.	Relative yield.		
		1888.	1889.	1890.
1	100	82	97	75
2	87.5	93	100	85
3	75	96	91	95
4	62.5	100	84	100
5	50	97	82	[illegible]
6	37.5	98	63	74
7	25	95	70	87

As showing how the plant adapts itself to its circumstances, the following data are instructive:

The number of plants growing on $\frac{1}{1000}$ acre was determined in four parts of each plat, and the number of culms harvested on similar areas ascertained; the averages of the results are given below. Undoubtedly there is a very wide limit of error in the method used, but it is sufficiently accurate to carry the conviction that the plants are held in check by their neighbors or spread themselves as their resources, soil, water, air, and sunlight, will allow.

Plat.	Number of seeds sown.	Number of plants.	Number of culms harvested.
1	214	93	135
2	187	85	123
3	160	86	135
4	133	67	102
5	107	52	117
6	80	45	105
7	53	28	85

The method which I wish to propose to equalize the irregularities due to defective germination will also equalize the irregularities produced by many other causes. This method is simply a duplication of plats. What is wanted is not a few large plats, but a large number of small plats. Here is a table giving the relative yield of 18 pruned and 18 unpruned rows of corn. Each pruned row was adjacent to the unpruned row with which it is compared; the same quantity of seed was sown and the cultivation was similar.

Relative yields of pruned and unpruned rows of corn.

Row.	Pruned.	Unpruned.	Row.	Pruned.	Unpruned.
1	63	100	11	70	100
2	73	100	12	81	100
3	63	100	13	70	100
4	100	100	14	100	100
5	67	100	15	79	96
6	83	100	16	77	100
7	79	100	17	62	100
8	87	100	18	66	100
9	81	100			
10	75	100	Average	76	100

These 18 comparisons were made on 8 plats. The average relative yields from the pruned and unpruned portions of the plats were as follows:

Average relative yields from pruned and unpruned portions of plats.

Plat.	Pruned.	Unpruned.	Plat.	Pruned.	Unpruned.
1	82	100	6	72	100
2	80	100	7	83	100
3	76	100	8	79	100
4	72	100			
5	70	100	Average	77	100

Thus I have 144 comparisons between the pruned and unpruned portions. In these 144 comparisons there were six cases in which the pruned row yielded more than the unpruned, three pairs of rows in which the yield was the same, and 135 cases in which the yield was in favor of the unpruned portions. I have not told you anything about the size of the plats nor given you any information about the stand. Yet, have you any doubt that the difference in yield was in this instance directly the effect of root pruning?

The pruned and unpruned rows compared were only 1.360 part of an acre. The 144 comparisons were made on 0.8 of an acre.

On the other hand, here is another experiment which was made on 1.3 acres. The tract was divided into three equal parts. One plat was drilled with corn; on another the same amount of seed was planted in hills, and the corn cultivated one way. On the third, the corn was planted in hills and cultivated both ways. The kind and quantity of cultivation was the same on each plat. The yield was as follows:

	Yield per acre.	Relative yield.
	Bushels.	*Bushels.*
Hills, cultivation both ways	64	100
Hills, cultivation one way	59	90
Drills	50	78

Please notice that the greatest difference in relative yield was substantially the same as in the root-pruning experiment before mentioned. Notwithstanding a half more land was used, would I be justified in claiming with any degree of certainty that the difference in results was due to the method of planting and cultivating the corn?

No field experiment can be considered at all satisfactory unless there are at least two plats devoted to each item of the experiment whose results agree more closely than do those devoted to different items of the experiments. Of course if one gets corresponding results during a series of seasons, that is, has duplication by repetition, he may justly consider his results trustworthy; but if irregularities occur he does not know whether the difference is due to the season, soil, or accidental causes. He has no means of getting at the limit of error in his work.

In my judgment, three plats would be the best number, usually, to devote to a given item in an experiment. If an accident occurs to one of the plats we still have duplicate results. If one plat gives results considerably different from the other two the experimenter's attention is at once directed to seek the cause of the variation.

The plats need not be large. It is much easier to get comparable results from 10 tenth-acre plats than from 10 one-acre or 10 ten-acre plats. The large plats have no compensating advantages over small plats properly duplicated, but they have disadvantages. I find from one fortieth to one tenth acre plats answer well for many plat experiments. For most experiments with small grain I like twentieth-acre plats; and for corn, where it is desired to cultivate the plats with horse machinery, I like tenth-acre plats. For variety tests of corn I have used fortieth-acre plats with fairly satisfactory results if any variety tests may be considered satisfactory.

The plats devoted to a single item of an experiment should be as widely distributed over the tract as the separate items of the experiment will allow. It is not sufficient to merely ascertain the results from equal parts of a plat, although it is often desirable as an additional measure.

While I do not by any means think plat experimentation is the only method of agricultural research, I do think there are certain problems of importance to the farmer, for whose benefit the stations were founded, which are capable of demonstration by this method. With a proper duplication of results and a scrupulous regard to small details, I believe many of the irregularities of results in plat experiments will disappear, and with it the statement met with in some quarters, that plat experimentation is merely a means of pacifying the farmer.

Mr. Redding said that while he had been much interested in Mr. Hunt's paper and figures, it seemed particularly instructive to those who grew corn as closely as wheat and oats were grown in the South. He would suggest to those experimenting in corn, cotton, and other cultures involving the hill system or a small number of plants, varying from 1,800 to 3,000 plants to the acre, that when stands were defective in test rows the only scientific method of correction was to equalize the stands.

Mr. Morrow said that all experimenters in this line regarded with profound interest and great personal gratitude the work of Sir John Bennet Lawes, of Rothamsted, England. The young experimenters should not be discouraged so long as they do their best. No one could now doubt the care, patience, and skill evidenced in the work at Rothamsted after fifty years of experiments, but on his visit there last year he had been struck with the variation in stand of the root-crops, and as he saw the things that could not be avoided even with the best of care, and that those wonderful experiments in wheat did not mean just what they would if every stalk was just where it belonged, he had thanked God that we were not doing so very badly even in young America. If we did not get perfect results he should not feel that it was our fault. The young gentlemen should take courage and go ahead, recognizing that there are hosts of things that can not be done. Seeing that even Rothamsted could not control Nature and make her do exactly as we wished, had been a great help to him.

Mr. Armsby said that at the Pennsylvania Station in the past season they had eight plats (four pairs) of corn grown in drills for silage. The stand upon these plats was somewhat irregular. Instead of attempting to count the stalks, he and the assistant agriculturist went through each plat from end to end and formed a general idea of their appearance and nature. They then repeated this survey, staking off those portions which it was decided to reject, using as a criterion their best judgment as to the average yield of the plat and rejecting such portions as were manifestly wrong; for example, one portion where a heavy rain had made a washing and the crop was irregular the duplicate plats were separated by four other plats. The results of the four pairs of duplicates agreed very closely. While this of course was insufficient to prove the value of the method, it might serve to raise the question whether an experimenter's individual judgment was not a legitimate means of correcting errors in plats and whether it was necessary to rely upon mechanical methods for correcting yields. If the impartial estimate of one, two, or more experimenters was a legitimate means for such a purpose, the method might possibly lead to good results.

Mr. Myers said that there were difficult questions involved in plat selection. He tried to follow the advice furnished by the Department of Agriculture, but the problem in his plat experiments was to find a system that would answer the most questions from the farmers of West Virginia. In that State conditions were different from those in Illinois. Here was a great loam prairie, with the strata lying almost horizontally, so that a problem solved for Champaign would be solved for an area of perhaps 100 miles in diameter; whereas in West Virginia, for a stretch of 300 miles from one end of the State to the other, the strata lay nearly vertical, sometimes broken by river courses. The results of plat experiments on one stratum in the coal formation would differ greatly from results obtainable on any other stratum in that formation. If, for example, he stated to the farmers the results for watermelons at his station, they would make the trial and declare the statement a humbug, because their work would be subject to different chemical and geological conditions. Mr. Scovell, he thought, had most magnificent opportunities for carrying out plat experiments, his soil being uniform and his geological strata lying beautifully; but his experiments would answer only for the blue-grass region of Kentucky; on the tipped-up region extending from South Carolina to Vermont his deductions would amount to nothing. Outside of the simple problems involved in the feeding of plants, the excellent experiments made in New Jersey, Connecticut, and Massachusetts solved nothing for the farmers of West Virginia, where the geological formations were entirely different. So far as his investigations went, this matter had been wholly neglected in the plat experiments made in this and other countries, but attention should be paid to it in order to reach results worth having. The geological formation—coal, limestone, alluvial, etc.—

should be stated. Results obtained on the rich prairie land of Illinois were worth nothing in West Virgina or on the red hillsides of Georgia, solving nothing but the feeding capacities of plants.

Mr. Myers said that while he admired the good intentions of Mr. Atwater in regard to coöperative experiments, he could not altogether agree with him. Men in Ohio, Illinois, and Indiana could perhaps coöperate in a certain line of experiments, but farmers on rich prairies cared nothing for fertilizers. It was useless to pile corn in a pig pen and say, "Go in, pigs; we will give you more corn," when the pigs already had more than they wanted. A soil could be overfed or fertilizer work wasted upon it, which was a pity except so far as scientific interest was concerned. The geological problem contained the point he particularly wished to enforce. What did the results in these plat experiments mean? Probably no man present could tell from the results of his own experiments what their effects would be upon the soils in West Virginia, because the geological problem had been neglected, at least in published results.

Mr. Curtis said that he would go further than Mr. Myers and speak in regard to the especial value to the whole United States of Mr. Atwater's position in the matter of coöperative experiments. He thought that both gentlemen touched the borders, but failed to reach the center of the trouble. It would be well for Mr. Atwater not only to plan the general character of plat and fertilizer tests, but to define more clearly the conditions on which they should be based. For example, a set of experiments could be carried on in different parts of the country under temperature conditions as nearly alike as possible; another set could be conducted under similar geological conditions, and another set under like conditions of moisture. The question was, whether with these different conditions, results could be averaged, and whether Mr. Atwater could get something reliable from the average results in coöperative tests. The speaker differed from Mr. Myers in believing that he could. If certain fertilizer tests gave results on rich land and also on poor land, it was immaterial that the yield on the former was double or triple that on the latter; if the same relative proportions were the same, conclusions could be drawn from such results.

Mr. Hays said that in Minnesota the wheat farmers demanded fertilizer experiments and the station had made them, but the results were not yet summarized. In general it had been found that in those sections where wheat could no longer be profitably grown fertilizers failed to restore good crops, and it was considered a great point to tell farmers that they must handle barn-yard manure. Conditions in Minnesota were different from those in the East. In plat experiments on land that had been in wheat from 10 to 20 years commercial fertilizers containing the three elements spoken of, with the addition of lime, plaster, etc., were generally found unprofitable. Plats were arranged in long strips, the Minnesota method of seeding wheat being employed, sometimes with a fertilizer attachment. With crops planted in hills some work had been done with alternate rows; for instance, the pruning of roots in alternate rows.

On motion adjourned to 8:30 p. m.

EVENING SESSION, WEDNESDAY, NOVEMBER 12, 1890.

The joint committee reassembled at 8:30 p. m., Mr. Dabney in the chair.

Mr. Dabney stated that he and his co-chairman, Mr. Sanborn, were obliged to attend the session of another section. He announced the program for the evening, and appointed Mr. Jenkins to preside at the meeting.

The Chairman (Mr. Jenkins) said that the report of the committee on butter standard was first in order.

Mr. Scovell stated that the committee was a joint committee, composed of three members from the agriculturists and three from the chemists. Some of the committee were absent, and probably the report would not be concurred in by all; it was a report of progress, and the committee would ask that the subject be continued for another year. Some data had been expected from Mr. Jordan, of Maine, who was on the committee, but such data had not arrived.

The report was presented, as follows:

REPORT OF COMMITTEE ON BUTTER STANDARD.

Your committee appointed to investigate the matter in regard to a butter standard met at the outset with considerable difficulty just as to what its duties were. The question arose whether the object was to ascertain the amount of butter fat generally present in marketable butter, and from such data ascertain the minimum or average amount of fat in such butter to be used as a standard, or whether its duties were to suggest a uniform standard for butters to be used in butter tests based upon butter fat. From the drift of the debate which resulted in the appointment of the committee rather than from the wording of the resolution under which the committee was appointed, the majority of the committee concluded that the latter was the object sought, and therefore the data collected bear on this subject. It is unfortunate that in so many butter tests of cows so little chemical work has been done, and especially that so few analyses of the butter of the test have been made.

Finally, your committee do not feel justified from the data at hand in recommending at present a butter standard, but ask leave to make this a report of progress and allow it to continue the investigation.

M. A. SCOVELL,
E. H. JENKINS,
Committee.

Mr. Scovell said that from the drift of the lively debate had last year the committee had concluded that a butter standard was wanted by which to test reports of dairy cows. The question was as to the true basis which should govern calculations. Should the butter contain 10 or 20 per cent of water, or 80 per cent of fat, or what was the basis to be? When a Jersey cow gave 80 pounds of milk a week there were no data to show what butter fat that contained. The committee believed that for tests made by or through the stations a certain amount of fat, determined from the butter of Jerseys, Holsteins, or other cows, should be adopted as a standard. Unfortunately but few tests had been made.

Mr. Scovell detailed the results of certain tests, referring to the following table and to others which he placed upon the blackboard.

Results of a test of the cow Dora 26001.

Date.	Yield of milk.				Per cent of butter fat found in milk.			Calculated amount of butter fat in milk produced.			
	Morning.	Noon.	Night.	Total.	Morning.	Noon.	Night.	Morning.	Noon.	Night.	Total.
	lbs.	*lbs.*	*lbs.*	*lbs.*	*per ct.*	*per ct.*	*per ct.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
19	20.8	......	20.2	40.10	5.8	......	5.5	1.189	......	1.11	2.299
20	19.8	......	19.12	39.4	6.2	......	5.6	1.209	......	1.106	2.315
21	19.13	13.2	12.1	45.0	5.3	7.2	5.2	1.038	0.945	0.627	2.610
22	15.4	13.3	12.13	41.4	5.7	7.6	6.4	0.854	1.002	0.820	2.676
23	12.7	14.6	13.12	40.9	4.4	7.2	6.4	0.547	1.537	0.880	2.464
24	15.5	12.9	12.14	40.12	6.3	5.4	5.6	0.957	0.678	0.721	2.356
25	14.9	12.6	7.12	34.11	5.6	6.5	6.8	0.816	0.804	0.527	2.147
Grand total	......	......	......	282.3	......	......	......	......	......	......	16.867

Date.	Amount of buttermilk.	Percentage of fat in buttermilk.	Amount of fat in buttermilk.	Amount of fat less fat in buttermilk.	Calculated amount of butter of 80 per cent fat.	Actual butter found by churning.	Per cent of butter fat in butter.	Amount of butter fat in butter.	Loss (−) or gain (+) unaccounted for.	Amount of cream.
	lbs.	*per ct.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*per ct.*	*lbs.*	*lbs.*	*lbs.*
19	7.8	0.2	0.015	2.284	2.13¾	2.13½	82.21	2.308	+.024	11.4
20	8.0	0.25	0.02	2.295	2.14	2.12½	80.9	2.250	−.045	11.5
21	10.0	0.3	0.03	2.580	3.3½	3.3¾	81.2	2.626	+.046	13.8
22	10.8	0.3	0.032	2.644	3.5	3.81	78.21	2.761	+.117	14.2
23	9.0	0.2	0.018	2.440	3.2	3.4½	80.3	2.634	+.188	12.4
24	8.0	0.2	0.016	2.346	2.15	2.15	82.0	2.406	+.060	11.3
25	7.4	0.25	0.018	2.129	2.11	2.11½	81.1	2.200	+.071	10.12
Grand total	61.0	......	.149	16.724	21.0¼	21.5	......	17.185	+.461	84.6

Mr. Scovell thought it apparent from the reports cited that a continuation of the same standard and calculation of 80 per cent butter fat would afford a fair basis for future experiments. If all cows were alike the amount of butter fat to be produced could be very nearly ascertained by analysis of the milk and skim-milk. It was reported that some cows gave over 1 per cent in skim-milk, however treated. The committee asked to be continued, desiring further time for investigation before recommending the adoption of a regular standard for butter.

It was moved that the report of the committee be accepted and the committee continued.

Mr. Armsby asked whether Mr. Scovell could explain the fact that in many of the reported cases the butter contained more fat than was announced in the milk.

Mr. Scovell said that the amount was in excess in almost every instance; he could not account for it. The butter was analyzed in duplicate and the results were controlled by Babcock's method of gravimetric calculations.

Mr. Hays suggested that in continuing the work the committee should use some cows which had been taken to the State fair, taking "up and down" results for comparison.

Mr. Curtis inquired whether in the analysis of butter fat in the butter the figures "82" meant simply 82 per cent of the commercial butter.

Mr. Scovell said that they did; it was not water-free substance. Slices were taken from the pounds as made, placed in a bottle, slowly melted, and the sample taken.

Replying to a question by Mr. Wing, Mr. Scovell said that he had not meant to state that he could not find a trace of fat in the skim-milk; instead of "trace" he should have said a measurable quantity.

Mr. Wing said he had done some work in creaming milk during the past summer, and some dealers in dairy implements had claimed that the separation of cream according to their methods gave no trace of fat in skim-milk. This he did not believe, analyses by gravimetric methods showing an average of 0.23 per cent.

Mr. Scovell said that by the Babcock method there were little globules of fat, but four together showed less than 0.02 per cent. He could read to half of a division. By the Adams method he got less than the filter paper called for; it was the poorest looking skim-milk he had ever seen.

Mr. Lyons asked Mr. Wing at what temperature he set the milk.

Mr. Wing said that it was set at 44°, sometimes for 12 and sometimes for 24 hours.

Mr. Failyer inquired whether Mr. Scovell had made determinations as to the effect of more or less working upon the per cent of butter fat; whether the amount of water would vary much.

Mr. Scovell replied that the butter had been worked until he gave the order to stop, except in one instance, and in that there was only 78.21 per cent butter fat. Then the salt came to the outside; it did not in any other instance. He was therefore unable to answer the question.

Mr. Failyer said that in some butter a greater per cent of water was indicated, and he had thought it probable that this was because the butter had not been sufficiently worked.

Mr. Scovell said that he had taken the sample as soon as it was weighed.

Mr. Hays said that in working butter practically, without the check of an analysis, he had experienced trouble in getting it uniform as to the amount of water contained. The trouble arose from the time and temperature at which the churn was stopped and the temperature of the wash bottle; if stopped when the globules were small and the water cold, the water could not be worked out so well. He once worked out about an ounce of water to a pound on the scales after another man had worked the butter until he thought he had it dry.

Mr. Myers said that he believed the variation in the butter to be due to variation in churning. He had carried on some work with reference to testing cows by the churn, the agricultural papers having said a great deal about tests of cows, and a good many people, especially Jersey people, having insisted on the churn test. The question was, What reliance might be placed upon the churn test? He was extremely surprised at the closeness with which Mr. Scovell had been able to work in the instances cited. Last winter a long series of tests had been made in West Virginia. Ten pounds of milk were used in each test. It was found that although in the several tests the same quantity of milk was put into the churn and given the same number of revolutions at the same temperature, and all other conditions being made as nearly the same as possible, yet in 10 pounds of milk there would be a considerable variation, amounting to a number of ounces in the yield of cows. It was only necessary to overchurn the milk, or if that was not enough, to let the milk sour a trifle to excess, and throw in an excess of warm or hot water. It therefore appeared that in testing cows practically by the churn there were comparatively untouched problems. He was glad that Mr. Scovell had taken hold of the matter. The question of testing milk was now, he thought, reduced to a mechanical operation. Either Babcock's or Beimling's process would give results within the limits of chemical error, and with either apparatus or by Patrick's or some other method, milk could be tested rapidly in the creamery, so that he hoped the problem might be solved before the next convention of the Association. Light could already be seen, but it might be depended upon that the problem was not to be solved by the churn, which was not the key to the situation. A standard butter would have to be established, and he thought Mr. Scovell was close to the mark in fixing the standard at about 80 per cent. However, the percentage could be made to fluctuate. Eighty-two per cent butter could be raised to 85 per cent in ten minutes by simply working out a little more water, or it could be reduced down to nearly 70 per cent with perfectly fair churning, by stopping the churn, and salting and packing it in, as was done by creamery men. A great many people salted their butter in the churn with brine and sent it off between 70 and 80 per cent butter, keeping the water in on purpose. A practical creamery man who looked at the process used at the station, said that if it were employed in the creameries their business would be broken up by the oleomargarine people; it was necessary to put in more water. On being told that the butter would not then be honest, he replied, "It is all right, it is butter," and that he was willing to buy up all the butter he could, put it in the buttermilk, and give it a most tremendous dashing; he could make a profit by handling the butter in that way. Farmers and creamery men were as tricky as others, and could so doctor their butter as to make a very good quality into a very bad one. The churn was a very poor means of testing butter.

Mr. Scovell said that he had tried to keep the conditions uniform. He had expected to find that the churn was not fit; he thought there would be a great many more variations than there were. The cream was taken from the creamery and put in a stone water bath at 80° F.; he put it in at noon and took it out the next day to churn it; at 10 a. m. it was put in cold water and allowed to remain until it got to 63°. He had not experienced a great variation in churning. At one time when he stopped churning the buttermilk was at a temperature of 62° and at another time it was 66°; it varied so much and no more. He kept the temperature regulated as nearly as possible in churning.

Mr. Curtis said that at his station considerable work in that line had been done, and he was somewhat familiar with the bulletins on the subject. He was surprised at the closeness of Mr. Scovell's results; he would go further and say that he doubted whether they could be duplicated.

Mr. Scovell said that very likely they could not.

Mr. Curtis said that he feared there might be error in the closeness of Mr. Scovell's results. He himself had since his childhood been a practical dairy worker in prime dairies and creameries in different latitudes, and believed that he could churn as well as anybody. He could take test cows from any part of the world, churn their milk before those present, challenging them to detect anything wrong, and would give them the churn and the cows too if he failed to make a difference of from 2 to 10 ounces in their yield. It was utterly impossible for any churner in the United States to churn a dozen samples and work them to the same or within 5 per cent of the same amount of water. He had, therefore, for the last 3 or 4 years emphatically protested, privately and officially, against the use of churns in these tests. The time was rapidly approaching when all public tests would be made by a fat-extracting standard, he did not care by what method, but the simpler the better; it need not be one which a ten-thousand dollar chemist would be required to operate; one which could be worked by a man at 50 cents a day would be better. For the last 2 years he had made tests at the Texas State Fair, using the Patrick test, which had given universal satisfaction to the contestants. He did not believe in 80 per cent butter. If a sample of that, together with a sample of 75 or 78 per cent butter, were submitted for choice to a butter judge—a commission man, not a chemist—he would prefer the lower per cent butter for its flavor.

Mr. Patrick said that the public were rapidly adopting the opinion expressed by Mr. Curtis, being educated up to it by the State fairs, at which in each succeeding year fewer tests were made by the churn and more by the new, quick methods.

The Chairman said that it was questionable whether the ideal dairy tests of the future were to be made at State fairs rather than at the home stables, where the cows are under normal conditions and not worried by the presence of numerous spectators.

Mr. Hays thought that the Association might arrange to have some cows tested just before going to the State fairs and again just after their return, in order to ascertain whether or not the tests made at the fairs were valuable.

Mr. Atwater believed that the question before the meeting was worthy of serious attention. At the State fair in Vermont last year considerable effort was made to compare the milk of a number of cows brought together from all parts of the State. Being considerably interested in the result, he afterwards made inquiry of Mr. Cooke in regard to it, and was informed that it was not at all successful, and the conclusion had been reached that the test made at the fair was not a fair test of the cows. Some time ago the Office of Experiment Stations had received from Vienna copies of a report on such a test made at the International Agricultural Exhibition at Vienna, with the suggestion that the same be sent around to the stations. In replying he had not stated the fact, which he would state now, that the copies were not so distributed because it did not seem that reports of such a test were worth having. While it might be that this was a slightly exaggerated idea, he thought that it contained a good deal of force.

Mr. Neale said that the chemist of the Delaware Station had busied himself since January with analyses of butter made by the separator process, using the old-fashioned churn and the new-fashioned extractor. The lowest percentage of butter fat, according to the speaker's recollection, was 79, and the highest 85; in the vast majority of cases it ranged from 80 to 81, corresponding closely with the results reported by Mr. Scovell.

Mr. Scovell thought it would be well for the Association to adopt 80 per cent provisionally as a standard of comparison in its own work for the year, the data obtained to be reported to the committee, which would save refiguring in case any other basis was finally agreed upon. It was necessary to have a comparison between results by the churn and by analysis. He would recommend as a provisional standard 80 per cent on the test of the milk minus the skim-milk fat.

Mr. Myers said that the matter was now in the hands of the committee, which could send in communications and take such steps as were needful to perfect the investigation.

The Chairman said that Mr. Scovell's last suggestion would be considered as the first communication from the committee.

Mr. Patrick's remarks on a standard milk test were now in order:

A STANDARD MILK TEST, G. E. PATRICK.

Mr. Patrick said that the two subjects assigned him (a "Standard milk test," and "Methods for the analysis of milk") were very properly merged into one. The subject of milk tests had already been discussed to some extent, and as that was the more practical branch of the double-headed problem he would treat of it first as distinguished from methods of analysis. By a milk test was meant something different from the method used by the chemist in his laboratory; something was meant which an unskilled person could employ without a laboratory. All present were familiar with the fact that Europe had furnished us some years ago, with a number of so-called tests, for instance, the lactoscope and lacto-butyrometer, in which a separation of the fat was obtained by shaking up in a tube with ether; also with the lactocrite and with another centrifugal machine, in which the milk was placed in tubes with acid. American chemists had soon ascertained that the first two of these four tests were incorrect; the lacto-butyrometer was superior to the lactoscope, but was found to be not really trustworthy. The other two tests were too costly for general use on this side of the Atlantic, or in fact anywhere. Within the last 3 years, however, there had been a great revival of interest in America as to quick methods of milk testing. First, 2½ or 3 years ago, came Professor Short's, a most excellent method, familiar to nearly all, its outline being merely the saponifying of the fat in the milk by means of an alkali, solidifying the soap and throwing up the fat; and then followed a little bunch—Failyer's, Parsons's, Cochran's, and the Iowa Station test, with which latter the speaker had something to do. These appeared in quick succession about a year and a half ago. It might be said generally that in the first three ether or gasoline was used to dissolve the fat after its separation by means of chemicals, and the ether or gasoline had to be evaporated so as to leave the pure fat. With the exception of the European centrifugal machines the Iowa Station test was the first in which the casein was dissolved and the butter fat left pure without the use of a solvent. Since the shower of milk tests just mentioned nothing notable in their line had attracted much attention until about 3 months ago, when the Babcock and Beimling tests appeared prominently on the dairyman's horizon. The Babcock test had already been mentioned; it required nothing but the mixture of oil of vitriol, sulphuric acid, and milk in bottles brought up to necks, a number of which bottles were placed in a circular frame, their necks turned inward and inclined upward, and the frame made to revolve some 600 or 800 times a minute for 6 or 7 minutes, when the machine was stopped, some hot water put in to carry the fat up into the necks, and the revolution resumed for 2 minutes longer to throw all the butter up into the necks, which completed the test. The Beimling test was not so well known among chemists and dairymen as were some of the others. He had to-day seen for the first time a copy of a recent bulletin from the Vermont Station (No. 21), in which Professor Cooke described its latest form. The simplicity and quickness of that method seemed to place it in advance of any other test. According to the bulletin, one revolution of from one half minute to one minute—say 1 minute—was sufficient to separate the fat and bring it up into the necks of the tubes. He saw the test worked at the Dairy Convention a few days ago, when the time claimed was 2 minutes, but 1 or 2 minutes was sufficient to complete the test after the bottles were filled with the mixture. The question naturally arose, How was it that Beimling's centrifugal test worked quicker than Babcock's? It was simply because those who had perfected the invention of Beimling had introduced new chemicals. Beimling used pure oil of vitriol, and the test now called for oil of vitriol and for a mixture of hydrochloric acid and fusel oil—amyl alcohol—which, according to some tests made by the speaker, seemed to aid in the solution of the casein and also in the raising of the fat to the surface, having a sort of double action.

In regard to a standard milk test, the only one recognized was the gravimetric method, which was not called a test. He did not know that he was prepared to say which of the two or three tests which had been mentioned should be regarded as the standard test, but he would say that for creameries or dairymen who wished to make numerous tests Beimling's was a little nearer the standard than any other because of simpilcity. He supposed that under the head of milk testing would naturally come its application in the work; the chemists were understood to be intimately connected with the dairymen and creameries. It might therefore be of interest to state what the creamery men in Iowa were doing. The test that emanated from the Iowa Station was originally intended for farmers and dairymen, and was put out in such a form as to aid that class, but it very soon became evident that the only men who cared about a milk test were the creamery men. Undoubtedly farmers, breeders, and private dairymen would come to recognize the importance of testing individual cows and weeding out their herds, but at present it was a lamentable fact that only one in a great many hundreds of them saw the value of a quick-acting method of milk testing. A considerable number of creamery men in Iowa had adopted the plan of buying milk on what was termed the "relative value plan," which was found to work well. It might naturally be surmised that this plan would cause great disgust among patrons, but such was not the case, most of them actually approving the method. Occasionally a man's milk ran low, and he either dropped out disgusted and went into a pooling creamery or stayed where he was, like a man, and tried to grade up his cows as milk producers. The man who dropped out and went into the pooling creamery was not a godsend to its owner, and the patronage of a number of such men could bring about but one financial result. In one instance a relative-value-plan creamery and a pooling creamery were established in the same town, and it took but a few months to wind up the business of the latter; all the patrons with scrub cows went to it and the game was a losing one from the start.

Mr. Myers said that the Beimling test had been used at his station for some time, and to his mind it was by all odds the best test that had appeared, its work being as quick and accurate as could be desired. He was engaged in the preparation of a bulletin upon it when Mr. Cooke's came out. One of the station assistants, who was skillful in handling machinery, undertook with a 6-tube machine of that construction to beat the speaker, who used a Babcock, and succeeded in doing so, completing his tests in less than 2 minutes, starting with the milk in the vessel. These tests, compared with parallel work carried on by gravimetric analysis, using the Adams method, were perfectly correct. The only necessary condition was that the machine be turned long enough; if properly digested every bit of the fat would be thrown up into the tubes. No one engaged in milk investigations could do better than to get one of these machines as soon as possible it would save a great deal of trouble. He had a 6-bottle machine and the operation took only about 2 minutes. The milk was measured out, the hydrochloric acid and fusel oil put in, passing around the six tubes, then the sulphuric acid could be poured in, and while hot the milk was put in. At his station the machine was revolved a little longer than 1 minute; it was turned until it was sure that the butter fat was all out; 2 minutes would do the work completely every time. It worked excellently on separated milk; he had tried it on that and on buttermilk, sweet milk, and cream, but not on very sour milk, from which correct results could not be obtained.

Mr. Patrick said that he had obtained them.

Mr. Armsby said that according to Mr. Cooke the method was not good for skim-milk unless it contained a per cent of fat.

Mr. Myers said that was so unless the tubes were read with a magnifying glass. The tubes were similar to those in a Babcock machine. He always skimmed within one tenth, below which it was necessary either to put in two or three of the measured quantities and take aliquot parts of the result, or else read the tube with a magnifier. The tubes he used were half the width of the Babcock tubes. Smaller tubes, with gradations of any desired fineness, could be used. In his opinion this machine settled the question of testing milk as to cost, accuracy, and rapidity.

Mr. Curtis said that Mr. Adriance, assistant chemist at his station, had taken the liberty of attempting an improvement on the Patrick tubes. He had a set of half a dozen made to order, a little more than double length, and accurately calculated for the volume used by Mr. Patrick—10.4 c. c. This worked admirably, with the exception that it cooled so quickly that in a large series of tests it was practically impossible to read at a right temperature. It was true that the variation made was not very great, but at the same time if laid in hot water and taken out the fat would begin to get weight in a very few minutes. He himself had, by actual reading, made a difference of more than one tenth, and the time required was so short that he thought the narrow tubes were rather impracticable.

Mr. Patrick asked whether Mr. Curtis meant that there was only one tenth difference.

Mr. Curtis replied he meant that; he had said more than one tenth.

Mr. Patrick said that was not much.

Mr. Curtis said that it made a difference when the tests were multiplied.

Mr. Woll said that the test could be completed by the Babcock method in 2 minutes, provided the machine was revolved at least 800 times a minute, but he thought that point was not of great importance; those who had conducted large series of tests knew that the sampling and addition of acids were the time-taking factors in the operation. In the Beimling test there were two additions, first, that of the hydrochloric acid and fusel oil, and then that of the sulphuric acid; and when a large number of samples were tested there was necessarily a great waste of time. He was therefore inclined to think that the Patrick method, against which he had been prejudiced, was really preferable to Beimling's.

Mr. Failyer asked whether the time was reduced to 2 minutes by variation in the treatment.

Mr. Woll replied that it was a matter of better apparatus. He would say that when the speed was low the results were unsatisfactory; the matter of speed was important.

Mr. Myers asked how Mr. Woll got rid of the nasty curly precipitate that came up and got under the fat in nine out of ten cases.

Mr. Woll replied that excess of heat applied in Patrick's method caused the casein to rise in the fat. His own practice was to whirl for from 2 to 4 minutes, then fill up with hot water, whirl again, and heat the water in the drum so that it was about boiling by the time he was through with the whirling.

Mr. Scovell said that in regard to the quantity in tests of skim-milk, etc., Babcock had suggested that tubes holding four or five times as much milk could be used. The tube would not then have to be narrowed. If necessary 50 c. c. skim-milk could be put in.

Mr. Neale said that in certain lines of work it was absolutely necessary to be cautious in regard to the hundredths of a per cent in skim-milk, which would make a great difference in working on 3,000 pounds of milk, as they did at the Delaware Station.

Mr. Myers said that he had prepared and would publish a table, calculated to the third decimal place, for use in running the Beimling machine; it would enable one to figure as closely as in the ordinary gravimetric method. The Babcock test had disappointed him; the curd rose in the tube, and could not be gotten out without a great deal of trouble. There was something defective in the description or in the manipulation of that test, and whoever tried to carry it out according to Babcock's description would encounter a difficulty not easily overcome.

Mr. Woll said that the difficulty referred to might be entirely avoided by using no heat until after the tubes had been filled up.

The Chairman said that he had had but little experience with the quick methods, but was charmed with their rapidity and accuracy so far as he had tested them. They would certainly fill an important place in practical dairy work. In using them, however, it should not be forgotten that until much more experience was had and data obtained and compiled confirming their accuracy for strictly scientific work, investigators should not permit themselves to be led away from the gravimetric method, which had already been thoroughly tested and must remain as the standard for the present. Everyone who made extremely careful data owed it to himself and to the Association to publish them; until that had been done, these methods should not be trusted in a strictly scientific investigation. He had seen figures of the Beimling machine, but not the machine itself. In using any centrifugal machine, it should be remembered that good chemists were scarce, and if the machine was operated without a protection between the whirling bottles and the eyes of the manipulator it would be well to have a laboratory sweep or a bad chemist work the crank.

Mr. Holter said that at his station, in using Short's method, they had, as noted in their last bulletin, reduced the heat of the solutions one half, and thereby had done away to a very great extent with the mixture of fat and casein. His experience in hundreds of determinations had been that by heating the solutions at the lower temperature he was materially aided in reading the fat found.

On motion, it was decided that the agricultural and chemical committees should meet separately at 8:30 o'clock on the following morning for the transaction of special business, another joint session to be held immediately thereafter.

On motion, at 10 p. m. the meeting adjourned.

THE PERMANENT COMMITTEE ON BOTANY.

Mr. Arthur, of Purdue University, presented the first paper, namely, "Reference books, how to obtain and use them." In the preparation of a bulletin one of the leading things is to present the matter fully and clearly. Many things thought to be new are really old, and this indicates the importance of looking up the literature of the subject. The citations may be given in small type foot-notes with no inconvenience to the general reader and at the same time add greatly to the value of the bulletin to other investigators along kindred lines. There is no doubt that such copious foot-notes carry weight with what is presented above even to the most ignorant reader. In looking up the literature, first examine all general treatises. These often give helpful foot-notes. This is especially true of all the German writings. Among these the following are most important in botanical matters: *Botanischer Jahresbericht*, and *Botanisches Centralblatt.* The agricultural papers are of very little use, but the proceedings of agricultural and horticultural societies often contain much that is good. Sometimes monographs, theses, etc., may be found. The best way to obtáin reference books is through second-hand catalogues, mostly in German. Book houses in this and other countries will supply their catalogues upon application. It is not easy to borrow the needed books. It was suggested that the books of all station and agricultural college libraries be listed and each station worker furnished with these lists.

Several took part in the discussion.

The second paper was by Mr. Atkinson on "Anthracnose of the cotton." The fungus, a new *Colletotrichum*, recently named by Miss Southworth, of the U. S. Department of Agriculture, was first observed by Mr. Atkinson upon the leaf scars of the stem. Pure cultures were obtained in agar-agar and peptone broth. Many inoculations were made, the most susceptible parts being the cotyledons of the cotton seedlings.

The idea of a standard nutrient solution for parasitic fungi was suggested, and also that cotyledons may generally be the best parts of a plant for inoculation.

A second paper, on "Black rot of cotton," by the same author was presented at the opening of the session on Thursday morning. This consists of a number of fungi, the dark color being partially due to a *Macrosporium* and *Alternaria*, following usually upon spots infested with a *Cercospora* and sometimes the *Colletotrichum* mentioned in the previous paper. The "black rust" works upon all soils and in most situations. There is a "red rust" in North Carolina that seems to be due to peculiarities of soil, as thus far no fungus can be assigned as the cause. Sketches and blackboard drawings were shown of both the destructive fungi above treated.

Mr. Thaxter, of the Connecticut State Station, presented the results of his study on the nature and form of potato scab. He found a fungus associated with this trouble which he was able to grow in drop and solid culture. When growing upon agar-agar it has a lichenoid appearance and consists of minute grayish filaments. Many successful inoculations of healthy potatoes were shown and the cause of one form of potato scab is determined. As yet, the place the fungus holds in the classification of its group has not been located. Many inoculations upon agar-agar and healthy potatoes were shown and the methods involved described.

The paper, "New fungous diseases," by L. H. Pammel, was a list, with notes, of the various fungi injurious to crops in central Iowa during the present season. Special mention was made of the wheat blight, plum scab, clover smut, and currant anthracnose. A white mold (*Cystopus*) was found upon the cultivated beet, which is a matter of much interest to both gardeners and mycologists.

During the discussion of this paper, Assistant Secretary Willits visited the section to give an outline of the work in botany as being prosecuted by the Department of Agriculture. He spoke of the importance of botanical work in the station, as it underlies all experimentation with plants. The work should not be merely the collecting of plants, but data as to soil, climate, etc., as related to fungous diseases and crops. The work must be scientific but with a keen eye to the practical side.

Chairman Tracy, of Mississippi, assured the Secretary that there was the closest sympathy between the botanists of the country and the U. S. Department of Agriculture, and that botanical work had received a great impetus during the past few years.

Mr. Fairchild, of Washington, D. C., next presented a paper upon fungicides. An historical sketch of fungicide experiments was given, followed by a grouping of the various substances that have been employed—fifty materials in all. The theory of fungicidal action was pointed out and the importance of a thin soluble film of the compound being spread upon the foliage or affected parts. The substance used needs to be effective, easily spread, and cheap. Figures were given to show the harmlessness of fungicides to man. There are many new compounds recommended this year; several were exhibited and will be tested next year.

"Copper salts for the black rot" was the title of a paper by Mr. Alwood. He was dissatisfied with the Bordeaux mixture and hit upon the following, which gave good results, namely, 2 pounds of sulphate of copper and two and a half of quicklime mixed while hot, to which 5 gallons of water is added. A modification of the modified eau celeste having no ammonia was also employed with excellent results. Under spraying apparatus, Mr. Alwood divided all pumps into two classes—the aquapult, best for heavy pumps, and Isolateur, for knap sack pumps. Nozzles of various kinds were shown and a uniform size for screw and tubing recommended. A committee of three with reference to this matter was recommended—one member for each of the following sections: botany, horticulture, and entomology. Such committee was appointed with the following members: Messrs. Alwood, Fairchild, and Beckwith.

During one session a very profitable hour was spent with Mr. Burrill in his well-equipped laboratories. The interest centered in the rooms where the bacterial investigations were in progress. The various steps in the progress of a bacterial investigation were pointed out, the apparatus, much of which is the professor's own fabrication, being in hand. The importance of such an interview can only be appreciated by the worker in the same line and does not admit of a description upon paper.

In "Coöperation in bulletins," Mr. Beal emphasized the thought that whatever discovery the botanical departments of the different States may make, should, if it practically concerns them, become the knowledge of every farmer, gardener, and horticulturist in the Union. At present the contents of the bulletins of one State are made known to the public of other States only partially through the newspapers. He therefore urges that botanists when investigating any subject that is likely to be of general interest, should work conjointly and publish in their respective States the final results of their united investigations and thus save much time, labor, and expense, and thereby furnish a much wider territory with the valuable information.

"Weed killing in the prairie States" was considered by Mr. Keffer. Dakota is peculiarly favorable to weed dissemination, owing largely to lack of variety in crops grown, high winds unchecked by wind-breaks or timber belts, and to the presence of large herds of cattle. Especial pests of the grain fields are *Salsola kali*, the mustards, and the wild rose. Wild pastures after being cropped one or two years are overrun by the golden-rods. But little has as yet been accomplished by Dakota farmers toward weed extermination, and weed laws are practically worthless. A more diversified system of farming is recommended.

"Seed testing and its value" was presented by Mr. McCarthy. The importance of the subject was dwelt upon. A standard method, with uniform apparatus, needs to be established among the stations before the results of all can be comparable.

Mr. George Vasey, botanist of the Department of Agriculture, offered a paper upon "Grasses for arid regions," in which he outlined the work of the experimental grass and forage station of the U. S. Department of Agriculture at Garden City, Kansas. This station is in a typical region, where the rain-fall is about 20 inches and the native grasses scanty, principally gramma and buffalo grass. In 1888 plats of sods of several kinds of local grasses were transplanted to ground plowed 1 foot deep. In 1889 large areas were sown with seeds of many varieties of grasses and other forage plants. Several acres were also devoted to a variety of sorghums, some of which flourished. Seeds of the most promising native grasses were collected and those of foreign countries imported, and during the present season the work has been prosecuted on an enlarged scale.

Many of the seeds were poor and the unusually dry season has been against the best results. This discouragement has been compensated for in part by the experiments in other directions. Thus 40 acres sowed to winter rye yielded 17 bushels per acre and in an average season would easily have reached 25 bushels. Eighty acres were sown to sorghum of different varieties, all of which grew well until the desiccating winds of June came and ruined nearly all of them.

The experiments warrant the following conclusions: Broad-leaved perennial grasses will not answer, but if the rain-fall is up to the average, the annual broad-leaved sorts, as sorghums, will succeed. Strong, deep-rooting grasses are best, and those with bulbous swellings at the base will endure droughts. Grasses producing large amounts of foliage near the ground, serving as a mulch, are able to survive.

The grasses for cultivation in arid soils are to be sought for in dry countries. Among the species to be considered as very helpful are *Panicum virgatum*, *P. bulbosum*, *Setaria caudata*, *Phalaris intermedia*, *Andropogon scoparius*, several species of *Bouteloua*, *Sporobolus airoides*, and *S. wryhtii*.

Mr. Halsted presented a paper upon "The station bulletin," advocating that it be made attractive in press work and engravings, and that the matter, fully and clearly stated, be within the comprehension of the average farmer. Also, that the scientific journals receive all matters not suitable for the farmers' bulletin but of value to the scientific world.

The following were elected officers for the ensuing year: chairman, Byron D. Halsted, of New Jersey; secretary, Roland Thaxter, of Connecticut.

THE PERMANENT COMMITTEE ON CHEMISTRY.

At the session of the committee on chemistry, Mr. Armsby read the following paper on recent work abroad on the digestibility of feeding stuffs, which opened a discussion of the whole subject:

DIGESTION EXPERIMENTS—RECENT WORK ABROAD, H. P. ARMSBY.

In assigning this topic for discussion, I do not suppose the chairman of the chemical committee desired me to make a categorical statement of all recent digestion experiments and their results, like a section out of the *Jahresbericht* or *Centralblatt*. Such a method of presentation could hardly fail to be superfluous so far as the chemical committee is concerned, and decidedly uninteresting to the other members of the convention.

In place of this, I ask your attention to a brief consideration of some of the tendencies of recent investigation. By a digestion experiment is commonly understood an experiment in which the food of the animal and the solid excreta are weighed and analyzed for a period of several days, and the percentage digestibility of the several ingredients of the food computed from the difference between the amounts eaten and excreted. The seeming simplicity of this method led to its general adoption, and in years past large numbers of such experiments have been made in Europe, especially in Germany. A compilation by Wolff, in Mentzel and v. Lengerke's Kalender for 1888, contains the results of over 1,000 such experiments. A more critical study of the method, however, has led to the recognition of many sources of error. For our present purpose it is not necessary to enter into a detailed consideration of these, but I may mention:

(1) Irregularity in excretion, rendering it uncertain whether the observed amount of excretion corresponds with the amount of food eaten.

(2) The presence in the dung of substances not derived from the food, but coming from the wear and tear of the digestive apparatus itself.

(3) The complications frequently introduced by the incomplete and irregular consumption of food by the animals experimented on.

(4) In the case of concentrated feeding stuffs, the complication introduced by the necessity of feeding along with it some coarse fodder.

Such considerations as these, together with the very considerable amount of trouble and expense connected with a digestion experiment, naturally gave rise to a desire for a simpler and more exact method. Consequently, when Stutzer, in 1880, proposed to apply the methods of artificial digestion outside the body, already in use by the physiologists, to determine the digestibility of the protein of feeding stuffs, his experiments attracted much attention and led numerous other investigators to follow up the subject.

In looking up the literature of digestion for the last 3 years, I made a list of seventeen papers, nine of which were either a study of the methods of artificial digestion or recorded the results of experiments made by this method. Another line of work, which, although not strictly belonging under the head of digestion experiments, yet is of much value and interest in this connection, is that followed by Ellenberger and Hofmeister, in Dresden. These investigators have made very elaborate studies of the composition of the various digestive fluids of domestic herbivora and of their action on the various nutrients; but more especially they have studied the process of digestion as it takes place under normal conditions in different parts of the alimentary canal. In other words, they have occupied themselves with a physiological study of the *processes* of digestion, while a so-called digestion experiment aims to determine the final quantitative result of these processes. Out of the seventeen papers mentioned above, four related to experiments of this general character. Of the remaining four papers, two concerned themselves with the proportion of metabolic products in the fæces, and only two were digestion experiments as ordinarily understood; that is, determinations of the percentage digestibility of food materials. It is evident from this brief summary that in recent years European investigators have devoted their attention very largely to the methodology of the subject, particularly as related to artificial digestion on the one hand, and on the other, to a study of digestion as a physiological process.

The first branch of the subject is of most immediate interest to agricultural chemists. In order to get a clear understanding of the bearing of recent experiments, it will be desirable to review briefly the earlier results.

Stutzer's first experiments* were made by digesting the finely ground fodder at about the temperature of the body with a dilute solution of pepsin and HCl, followed in some cases by digestion with an alkaline pancreas extract. The general result which he reached was that a certain proportion of the nitrogenous compounds in each case was insoluble in these re-agents. By means of his well-known copper-hydrate method he was able to determine the non-albuminoid compounds, and thus to separate the nitrogenous constituents of the fodders into three classes, namely, non-albuminoids, albuminoids soluble in pepsin-HCl, and albuminoids insoluble in pepsin-HCl.

The latter group he regarded as indigestible by the animal and as probably consisting largely of nucleins, while the pepsin-soluble nitrogen he considered to represent the maximum amount of available protein in the fodder. The next step, naturally, was a comparison of natural and artificial digestion. In every case it was found that artificial digestion gave higher results than natural digestion, or, to express the same thing in another way, the total nitrogen excreted in the dung was more than the pepsin-insoluble nitrogen of the fodder.

Kellner found† a difference between the two of about 0.4 grams of nitrogen per 100 grams of dry matter digested. This difference corresponds to the average amount of nitrogen in the form of metabolic products which he found to be present in the dung in other experiments, and he consequently ascribes the low results of natural as compared with artificial digestion to the disregard of the presence of these products.

Pfeiffer‡ found a similar difference between natural and artificial digestion. He, however, determined the pepsin-insoluble nitrogen in the dung, and found it to be from 20 to 30 per cent less than the amount present in the fodder, showing that a portion of the latter had been digested by the animal.

Stutzer§ found in later experiments, that a treatment of the residue from the pepsin-HCl digestion with alkaline pancreas extract, in some cases, notably with fodders similar to those used by Pfeiffer, extracted from 20 to 30 per cent of the nitrogen which the pepsin-HCl failed to remove. According to him, the pepsin-soluble nitrogen of the dung is not derived from the food, but from the products of metabolism.

By means of experiments on pigs with a fodder containing either no nitrogen or no indigestible nitrogen, Pfeiffer‖ obtained a dung containing only metabolic nitrogen

* Jour. f. Landw., XXVIII, 195 and 435; XXIX, 473.

† Centralblt. f. agr. Chem., IX, 763.

‡ Jour. f. Landw., XXXI, 221.

§ Centralblt. f. agr. Chem., XIV, 322.

‖ Jour. f. Landw., XXXIII, 149, and Zeitsch. f. phys. Chem., X, 561.

and found the latter to be wholly soluble in pepsin-HCl without subsequent action of pancreas extract, thus confirming to a certain extent Stutzer's view, that the pepsin-soluble nitrogen of the dung comes from this source. In subsequent experiments with sheep upon the digestibility of dried diffusion residues from the sugar-beets, Pfeiffer* found that the pepsin-insoluble nitrogen of the dung corresponded very closely with the pepsin-pancreas-insoluble nitrogen of the fodder, and that by introducing this correction the figures for natural and artificial digestion agreed quite closely with each other, while the results upon the two animals were also rendered more concordant.

Before proceeding to a statement of results of recent investigations on this subject, an exact statement of the questions which must be answered before a final judgment upon the value of the method can be formed, will conduce to clearness. These questions are:

(1) Is the pepsin-pancreas-insoluble nitrogen of a fodder capable of exact determination? That is to say, is Stutzer's method of artificial digestion a conventional one, like the methods for crude fiber or reverted phosphoric acid, in which every change of condition gives a different result, or do fodders contain a group of nitrogenous substances insoluble in these reagents under conditions approximating those of natural digestion?

(2) Does the pepsin-pancreas-insoluble nitrogen of fodders also escape digestion in the animal and reappear in the dung?

(3) Does the pepsin-pancreas-soluble nitrogen of the dung belong exclusively to the so-called metabolic products?

An affirmative answer to these three questions would establish the accuracy of Stutzer's method, but in my judgment no final answer is now possible to any one of them. I shall consider recent results in their bearings on these three questions rather than discuss separately those obtained by each experimenter.

First, then, is the pepsin-pancreas-insoluble nitrogen of fodders capable of exact determination? Stutzer claims that the successive digestion with pepsin-HCl and alkaline pancreas extract, as prescribed by him, gives the maximum of possible digestible nitrogen. This is indicated in his earlier experiments on the action of pepsin-HCl alone, when increase of the volume of digestive fluid, of the time of digestion, and of the strength of acid used, gave but very insignificant increase in the digestive action beyond a certain point. In a recent paper† he has compared the action of a pepsin solution containing 0.2 per cent of HCl with that of a less volume of one in which the proportion of HCl was gradually increased to 1 per cent in the course of the experiment. Three different fodders were used in these experiments. It was found that when the action was continued for 10 hours only, the more acid solution dissolved the larger amount of nitrogen, but that subsequent digestion of the residue with pancreas solution diminished this difference, or in some cases caused it to disappear entirely. When the digestion with pepsin-HCl was continued for 24 hours and followed by the action of pancreas solution the results were identical whether the stronger or the weaker solution was used. What is specially worthy of note in this connection is that an increase of the time of digestion from 10 to 48 hours did not increase the amount of nitrogen dissolved.

Niebling‡ has compared the action of equal volumes of the two solutions just mentioned (that is, pepsin with 0.2 per cent HCl and the same with 1 per cent HCl) upon two fodders, and found the less-acid solution slightly less efficient, both by itself and when followed by digestion with pancreas extract, although the latter reduced the differences. Treatment of the fodder with 1 per cent HCl alone and then with pancreas extract also dissolved more nitrogen than was removed by the 2 per cent pepsin-HCl solution followed by pancreas extract. These results, however, are only

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* Jour. f. Landw., XXXIV, 444. † Landw. Vers. St., XXXVI, 321.

‡ Landw. Jahrb., XIX, 149.

apparently in conflict with Stutzer's. They show that with less acid in the solution than is prescribed by Stutzer slightly less nitrogen is dissolved, but they do not show whether, by increasing the strength or volume of the solution or the time of action, beyond the limits prescribed by Stutzer, still more nitrogen would be dissolved.

The indications, then, seem to be in favor of an affirmative answer to the question under discussion, but the results are far too few to suffice for any decisive conclusions. It would seem that further experiments upon this point might very profitably and easily be made; especially would it seem desirable to try the effect of successive treatment of the same substance with the digestive fluids. A comparison also of commercial scale pepsin, which has generally been used in this country, with the pepsin solution prepared directly from the stomach of the pig, according to Stutzer, would be desirable.

Our second question was, Does the pepsin-pancreas-insoluble nitrogen of the fodder escape digestion in the animal? As was noted above, Pfeiffer found that the pepsin-HCl-insoluble nitrogen of the dung corresponded quite closely to the pepsin-pancreas-insoluble of the fodder. Niebling, in his recent paper, found that the pepsin-pancreas-insoluble nitrogen of the dung was but slightly less in amount than that of the fodder. Jordan,* on the other hand (to trespass for a moment on ground assigned to the next speaker), found the pepsin-HCl-insoluble nitrogen of the dung on the average less in amount than the pepsin-pancreas-insoluble of the fodder, though this was not true in all cases. If we assume that in Jordan's experiments further digestion of the dung with pancreas solution would have dissolved more nitrogen from it, as was the case in Niebling's experiments, it would appear that some of the pepsin-pancreas-insoluble nitrogen of the fodder was digested by the animals, and the same remark may be made as regards Pfeiffer's experiments, just mentioned.

As regards our second question, then, the results are somewhat conflicting, and it is plain that further investigation upon this point would also be desirable, and would cost but comparatively little trouble, as Pfeiffer seems to have shown that all the metabolic nitrogen of the dung can be dissolved by pepsin-HCl.

Our third and most important question is, Does the pepsin-pancreas-soluble nitrogen of the dung belong wholly to the metabolic products contained in it? Pfeiffer's results upon dung containing only metabolic products, while they show that these are soluble in pepsin-HCl, do not show that in normal dung this re-agent does not also dissolve other material, and consequently the agreement of the results of artificial digestion with those of natural digestion corrected by his method is not conclusive evidence upon the point in question.

In Niebling's experiments, it was found that after all this metabolic nitrogen had been removed from the dung by pepsin-HCl there was a further quantity which was removed by digestion with pancreas extract. It would seem that this quantity must have been derived from undigested residues of the food, since, as previously stated, the pepsin-pancreas-insoluble nitrogen of the dung was practically equal to that of fodder. Extraction of the dung with ether, alcohol, and hot water to remove bile products, and with cold lime-water to remove nuclein, has generally extracted less nitrogen than digestion with pepsin-HCl. If we assume that this treatment is sufficient to remove all metabolic nitrogen, then the excess removed by pepsin-HCl must come from the food, but it appears to be at least doubtful whether this assumption is justified. Indeed, the difficulty connected with investigation of this branch of the subject lies in the absence of any criteria by which we can judge whether any given method removes from the dung all the metabolic nitrogen and no nitrogen from any other source. A study of this branch of the subject, while involving many difficulties, is unquestionably the direction which investigation must take in order to remove a very serious source of inaccuracy from our present methods—either natural or artificial—of determining digestibility.

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* Maine Station Annual Report, 1888, p. 196.

As an appendix to the above may be noticed results of an investigation by Weiske* into the nature of the pepsin-HCl insoluble nitrogenous compounds of the dung. Stutzer, it will be remembered, considered them analogous to nuclein. Liebermann has shown that when nuclein from yeast is extracted with cold dilute nitric acid the extract contains metaphosphoric acid, while the residue has all the properties of ordinary albuminoids. Weiske submitted sheep dung to this treatment and obtained phosphoric acid, but the nitrogenous compounds of the residue were no more soluble in pepsin-HCl than before, from which fact he concludes that they were not nucleins. He also observed that simple treatment of the dung with nitric acid extracted as much nitrogen as treatment with pepsin-HCl, and concluded that the HCl is the active agent in the latter case.

A brief notice of investigations by Hofmeister† upon the nitrogenous constituents of the contents of the alimentary canal, states that he found great variation in the amount of metabolic products in different parts of the digestive apparatus, but insufficient details for discussion are given in the abstract, and I have not had access to the original paper.

Some results recently obtained by the use of the method of artificial digestion may also be briefly noted. Morgen ‡ has applied it to the determination of the digestibility of fresh, dried and ensiled diffusion residues from sugar-beets. He finds that the protein of this latter material is not, as has been generally assumed, wholly digestible, but only to the extent of 75 to 80 per cent. Drying at a moderate temperature or ensiling did not decrease the digestibility. Drying at 125° to 130° C., however, did diminish the digestibility considerably.

Siebert § finds that the addition of 0.5 to 2 per cent of salt does not diminish the digestibility of protein as determined by Stutzer's method.

Cohn‖ finds that a pepsin-HCl solution tends to prevent the acetic and lactic fermentations, and that the gastric juice thus has a preservative action on the contents, of the stomach.

Stutzer ¶ finds that Fahlberg's saccharin interferes with digestion by pepsin-HCl but questions whether his results are of general applicability.

In addition to his work on the artificial digestion of protein, Stutzer ** in conjunction with Isbert has endeavored to devise a method for the artificial digestion of the carbohydrates of fodders by the action of ptyaline or diastase. The authors start with the assumption that the crude fiber of fodders is without nutritive value. By the successive action of disastase, pepsin-HCl, and pancreas extract they seek to determine the digestibility of the total organic matter, the carbohydrates, and the protein. The hasty conclusion to which not a few rushed, after the publication of Tappeiner's results upon the fermentation of cellulose in the digestive apparatus of herbivora, that this substance is of no value in nutrition, soon gave place to more moderate views; and Pfeiffer, in a critique on Stutzer and Isbert's results, has no difficulty in showing that the method, or rather the conclusions deduced from it, leads to absurd results in case of fodders containing much crude fiber. As a method for determining the digestibility of the nitrogen-free extract of fodders, however, it has had no adequate test, so far as I am aware, and for this purpose it seems worthy of some attention.

The second class of investigations mentioned at the outset of this paper, namely, those relating to the *process* of digestion, are of less direct agricultural interest, and this paper is already so long that it may be dismissed with a few words.

The general plan of these experiments, so far as they relate to the process of digestion in the normal animal, has been to slaughter animals at different intervals of time after a ration of known quality has been eaten, and examine separately the

* Jour. f. Landw., XXXVI, 439.

† Centralblt. f. agr. Chem., XVII, 317.

‡ Jour. f. Landw., XXXVI, 309.

§ Centralblt. f. agr. Chem., XVII, 315.

‖ Centralblt. f. agr. Chem., XVIII, 730.

¶ Landw. Vers. St., XXXVIII, 63.

** Centralblt. f. agr. Chem., XVII, 112.

contents of different portions of the alimentary canal. It has thus been shown that the digestive process is more complicated than has frequently been represented and that different chemical or fermentative actions may go on even in different parts of the same organ. In the stomach of the horse and hog, for example, it was found that in the cardiac end amylotic action may be taking place while in the pyloric end proteolytic digestion is going on. One important practical result from these experiments has been to show the importance of the saliva as a digestive fluid. It has generally been taught that when food enters the stomach the acid gastric juice immediately suspends the action of the saliva. These investigations have shown that in herbivora with a single stomach the action of the saliva upon the food may continue for 2 or 3 hours in the stomach. This fact is suggestive when taken in connection with the favorable results which have been obtained by Henry from the use of dry food as compared with wet.

In this hasty survey of the field assigned me I have sought to indicate the general character and tendencies of recent work rather than to report all its details.

In Europe a large amount of statistical work upon the digestibility of different fodders has been already completed. With us much remains to be done in this direction. We stand very much where the European investigators stood 30 years ago as regards our knowledge of the digestibility of our feeding stuffs, but with this important difference, that we have the benefit of their experience and investigations as to the experimental methods to be employed.

Our stations might profitably do much more work than they are now doing in determining the digestibility of American feeding stuffs, but it will be a great misfortune if in doing this they blindly follow the traditional methods and fail to devote a proper amount of attention to the questions which, as I have pointed out, are now occupying the minds of experimenters across the ocean.

Mr. Frear, of Pennsylvania, contributed the results of some investigations of the metabolic products in dung and of the action of pepsin solution on dung. In the discussion following attention was called to the fact that in artificial digestion with an acid pepsin solution as usually carried out, sufficient hydrochloric acid was added to seriously interfere with or wholly suspend the proteolytic action of pepsin. Hydrochloric acid of itself, of course, has a proteolytic action, but an addition of 0.5 per cent or even 0.3 per cent hydrochloric acid may suspend the action of pepsin.

Mr. Woll gave a brief account of observations made at the Wisconsin Station on the size and number of fat globules in cows' milk. The method followed was devised by Dr. Babcock, and consists essentially in diluting the milk with 49 volumes of water, taking the mixture in capillary tubes under the microscope, counting the globules between the divisions of an eye-piece micrometer, and from the diameter of the capillary calculating the volume of the milk in which the globules were counted.

The number was found to be from 100 to 400 in $\frac{1}{10000}$ cubic millimeter. In the course of lactation the number of globules increases, but the size decreases. Thus the number of globules per unit of volume may be quadrupled during lactation while the size will diminish in much the same proportion. In animals of different breeds, as pure-blooded Jerseys and Holsteins, the period of lactation has a greater influence than the breed on the size of the globules. The food also has a marked effect, dry food as a rule increasing their size and wet food having the contrary effect.

Mr. Jenkins, of Connecticut, read a paper on newly proposed apparatus, methods, etc., also a paper, by Messrs. Johnson and Osborne, of Connecticut, on the determination of phosphoric acid in phosphates containing oxide of iron and alumina. The authors show that while the official method is perfectly reliable for ordinary superphosphates and bones, it can not be used for the analysis of phosphates containing considerable quantities of the oxides named. For such phosphates the original Sonnenschein method must be employed.

In the discussion of apparatus and methods the Excelsior Mill was strongly recommended for grinding coarse fodders—hay, straw, cornstalks, etc. Its action, however, is rather cutting than grinding, and for reducing seeds, such as maize kernel, Mr. Neale called attention to a mill made by Drewes, of Halle, Germany, from plans furnished by Dr. Maercker, which consists essentially of a steel mortar and pestle driven by machinery; the pestle slowly revolves in one direction and the mortar in the other. For reducing sorghum and similar things, which are apt to be very sticky and clog the mill, he had found very useful a meat-chopping machine, with a revolving block and cutting knife some 10 inches long, which delivers 200 blows a minute.

After further discussion the committee nominated to the Association Mr. A. T. Neale as chairman of the permanent committee on chemistry for the next year, and Mr. C. D. Woods as secretary. The committee then adjourned.

THE STANDING COMMITTEE ON COLLEGE WORK.

The committee held several sessions at which the principal subject of discussion was the Morrill act. At an early meeting a subcommittee was appointed to draw up resolutions formulating the conclusions of the committee in regard to this act.

At a meeting held Thursday morning, November 13, this committee, through its chairman, Mr. Alvord, reported as follows:

The section on college work having had under consideration the obligation of the colleges under the act of Congress approved August 30, 1890, and the limitations thereof, recommend the adoption of the following declarations by this Association:

(1) That every college should keep a separate and distinct account with the income provided directly from the Treasury of the United States, and that charges against the same should be in the order of importance and preference: (*a*) for instruction in agriculture and mechanic arts; (*b*) for facilities for such instruction; (*c*) for instruction in the other branches of learning specified by the law; (*d*) for facilities for this latter class of instruction.

(2) That an effort be made to soon obtain the opinion of the Secretary of the Interior as to what class of expenditures will be approved by his Department under the clauses providing for "facilities for instructions," and that until official decision upon this point is promulgated college officers should confine expenditures under this head to such things as directly aid instructors in preparing their work and imparting knowledge to their pupils.

(3) That in view of the history of the new Morrill act, and the decision of the First Comptroller of the Treasury, under it two annual payments are now due and payable to the States; and the fact that instruction during the academic year of 1889-90 is a thing of the past, the annual payment of $15,000 for the year ending June 30, 1890, should be held and regarded as an equipment fund, and reasonable time allowed for its deliberate expenditure; and that the annual payment now part due for the year ending June 30, 1891, should be applied to the expenses of the current academic year.

(4) That the officers of this Association be requested to respectfully urge upon the Secretary of the Interior the early payment to every State and Territory having one or more institutions organized under the act of July 2, 1862, of both payments now due under the supplementary act of 1890, in accordance with the evident intention of Congress to apply these benefits equally to all States, and in order to avoid impeding the progress and development of industrial education, which would result from withholding payments, and reporting the same to Congress. It is believed that this would simply cause unnecessary delay, and certainly result in an enabling act or joint resolution sustaining the views thus expressed.

(5) That the first reports to the Secretary of the Interior by college presidents and treasurers should be made in the year 1891, before the 1st day of September, and should cover the operations of the year ending June 30, 1891, and the disbursements of the income for that year, as well as such expenditures as shall have been then made from the first payment of $15,000.

(6) That the interests of education will be conserved by making the Bureau of Education the depository of all papers and reports, and the agency for preparing all business between the Department of the Interior and the States and colleges under the act of August 30, 1890; and that the debate in the Senate of the United States June 21 and 23, 1890, indicates the intention of Congress as to the agency by which the duties of the Secretary of the Interior were to be performed under said act.

(7) That the college officers should endeavor to bring to the attention of the legislatures of their respective States at the earliest possible date the necessary legislative action under the provisions of the new Morrill act, and that until such action is perfected the representatives of the colleges present at this convention pledge their action and influence to insure an equitable division or impartial application of all moneys received under this act in full accord with the spirit of the law.

Mr. PEABODY. I move the report be received and taken up by paragraphs for discussion. The motion was carried.

The first paragraph of the report as amended and adopted was as follows:

That every college should keep a separate and distinct account with the income to be derived under the act of Congress approved August 30, 1890.

Mr. SCOTT. I move the second paragraph be laid on the table.

Mr. ALVORD. I would like to inquire of the gentleman making the motion whether it is his intention thereby to prevent the expression of opinion as to the expenditure of the money.

Mr. SCOTT. I prefer to let the law speak for itself and each college decide for itself.

Mr. INGERSOLL. I understand there is nothing binding in this report; that it simply recommends.

Mr. SMART. I do not agree with that view in reference to the proper division of this money. I think there is great danger in having it said that you have gone to Congress and got money to raise salaries and get more men. People are very sensitive about increasing salaries and getting additional men. While it was stated that we needed instruction, it was distinctly stated and ably urged that we especially needed greater facilities; that other schools largely endowed were standing in the lead because they had greater facilities, and that we needed facilities for instruction. Those who were present will remember that at the first meeting of the Senate Committee, at which representatives of the colleges were present, a suggestion was made that there was danger in taking this money, because the people would say, What is it for? It was granted for facilities for instruction, but it has been used for something else. You have increased your salary list unnecessarily, or you have paid an unnecessary amount to your station. That may not happen, but I believe there is great danger in expending this money for salaries. I think the section ought to make some declaration which would indicate that we intend to carry out this law in its spirit. I move that this paragraph be postponed until later in the meeting.

Mr. HADLEY. If I understand Mr. Smart, I agree with him exactly I am in favor of the motion to postpone.

The second paragraph of the report was laid on the table, and the third paragraph was then read.

Mr. FAIRCHILD, of Kansas. My object in moving to postpone the consideration of this paragraph is not to curtail in any respect the discussion, but it seems to me that we are trying to interpret the law too closely.

Mr. TURNER. I do not believe it is possible to make any satisfactory statement upon this subject, because the words which include also exclude, and it is very difficult to draw the line in exactly the right place. I think in this matter, as in every other matter of practical administration, we should use our good common sense, and determine on its own merits the question whether a particular facility for instruction properly comes within this law.

Mr. ALVORD. I entirely agree with Mr. Turner. It is a great deal safer to act upon our judgment in the expenditure of this money, and according to our several and varied needs, than to run too often to the Secretary of the Interior for a decision. With my board of trustees I have to take responsibilities which are sometimes quite burdensome. I do what in my judgment is best, and then I take the matter before my board of trustees, having acted under the discretion vested in me, and the board of trustees approves or disapproves it.

Mr. SCOTT. I move that this section be referred back to the committee, with instructions to draft a resolution which shall simply advise the institutions to be discreet about the expenditure of this fund.

The motion to recommit was carried.

Mr. SCOTT. I move that the second section, postponed a moment ago, be taken up and recommitted to the committee with the same instructions.

The motion was adopted, and the fourth paragraph was read.

After considerable discussion this section was amended and adopted. The other sections of the report were taken up in order and disposed of after discussion. The report was then referred back to the committee for final revision.

The resolutions as reported back from the subcommittee and finally adopted read as follows:

DECLARATIONS AS TO THE NEW MORRILL ACT.

The section on college work having had under consideration the obligations of the colleges under the act of Congress approved August 30, 1890, and the limitations thereof, recommend the adoption of the following declarations by this Association:

(1) That every college should keep a separate and distinct account with the income to be derived under the act of Congress approved August 30, 1890.

(2) That in the expenditure of the new college income the institutions here represented should conform to a strict interpretation of the language of the law as to the application of these funds.

(3) That in view of the history of the new Morrill act and the decision of the First Comptroller of the Treasury, under it two annual payments are now due and payable to the States, and the fact that instructions during the academic year of 1889–90 is a thing of the past, the annual payment of $15,000 for the year ending June 30, 1890, should be regarded as far as practicable as an equipment fund, and that the annual payment now past due for the year ending June 30, 1891, should be applied to the expense of the current academic year.

(4) That the officers of this Association be requested to respectfully urge upon the Secretary of the Interior the early payment to every State and Territory having one or more institutions organized under the act of July 2, 1862, of both payments now due under the supplementary act of 1890, in accordance with the evident intention of Congress to apply these benefits equally to all States and Territories, and in order to avoid impeding the progress and development of industrial education which would result from withholding payments and reporting the same to Congress.

(5) That the first reports to the Secretary of the Interior by college presidents and treasurers should be made in the year 1891 before the 1st day of September, and should cover the operations of the year ending June 30, 1891, and the disbursements of the income for that year, together with the use of the first payment of $15,000.

(6) That this Association desires to acknowledge its approval of the courtesy and liberal spirit shown by the Secretary of the Interior to the new Morrill act, and is gratified by the assignment of the business arising under this act to the Bureau of Education with which the institutions concerned have official relations already cited, and it is respectfully suggested that the future transactions between the Secretary of the Interior and the colleges may be simplified and all interests concerned benefited by making the Bureau of Education the depository of all records and reports, and the medium for direct intercourse with the colleges on all matters requiring the final act of the Secretary of the Interior.

(7) That the college officers should endeavor to bring to the attention of the legislatures of the respective States, at the earliest possible date, the necessary legislative action under the provisions of the new Morrill act; and that the representatives of the colleges present at this convention pledge their action and influence to insure an equitable division or impartial application of all moneys received under this act in full accord with the spirit of the law.

The chairman of the committee called up the question, "Should this Association take any action in cases where formal charges of misuse of the United States appropriations are made against any college or station?" appointed for discussion in the general session of the convention, but by vote referred to the committee on college work. The pressure of other matters was so great that the discussion of this question was indefinitely postponed.

Mr. Dabney called attention to United States Senate bill No. 2779, relating to the engineer corps of the Navy and providing for the admission, upon certain terms, of the graduates of the agricultural and mechanical colleges to that corps. He moved that a committee of three be appointed to coöperate with the officers of the Navy Department to promote the passage of a bill known as Senate bill No. 2779, and that the committee draft resolutions to be presented by the committee on college work to the general association for adoption.

After full and careful discussion the motion was amended and adopted as follows:

Resolved, That a committee of three, consisting of the chairman of the committee on college work and Messrs. Smart and Dabney, be appointed to aid in the passage of Senate bill No. 2779, in order by that means to advance the interests of mechanical instruction in the colleges represented in this Association.

In place of his paper called for on the program and entitled "Waste in college work," President Smart made a few remarks on the same subject, and in response to an invitation made by formal motion of the committee, agreed to present his paper in full at the next annual convention.

THE PERMANENT COMMITTEE ON ENTOMOLOGY.

MORNING SESSION, TUESDAY, NOVEMBER 11, 1890.

The committee was called to order at 10:35 a. m., by the chairman, Mr. Forbes.

Mr. Gillette was elected secretary.

The committee proceeded to the reading of papers, the first of which, by Mr. Gillette, entitled "Certain notes and observations of the season at the Iowa Experiment Station,"* comprised the following points: (1) To prevent squirrels from pulling corn; (2) Kerosene emulsion as a sheep dip; (3) The scurvy bark-louse; (4) Experiments with the arsenites; (5) Cut-worm parasites; (6) Insect diseases; (7) Potato-stalk weevil; (8) Pyrethrum experiments; (9) Kerosene extract of pyrethrum as an insecticide.

After discussion, a paper on the "Life history of *Baris confinis*, Lee" (published elsewhere), was read by Mr. Weed.

EVENING SESSION, TUESDAY, NOVEMBER 11, 1890.

Mr. Forbes in the chair.

Mr. Atkinson read a paper on "A new root rot disease of cotton" (published in Insect Life, vol. III, No. 6).

Mr. Weed read a paper on the "Life histories of certain *Aphididæ*." (The substance of this paper is given in the article entitled "Fifth contribution," by Mr. Weed, in Insect Life, vol. III, No. 6.)

On motion of Mr. Weed, the committee extended a cordial invitation to all entomologists present to take an active part in the meeting.

Mr. John Marten read a paper entitled "New notes on the life history of the Hessian fly" (published in Insect Life, vol. III, No. 6).

The committee then adjourned to 10 a. m., November 12.

MORNING SESSION, WEDNESDAY, NOVEMBER 12, 1890.

The committee was called to order by the Chairman, Mr. Forbes.

The minutes of the previous meeting were read and approved.

On motion of Mr. Smith a subcommittee of three was appointed by the Chair to confer with the committee on coöperation with the Association of Official Economic Entomologists, for the purpose of recommending

* Published in Insect Life, vol. III, No. 6.

means of obtaining more time and liberty for meetings of the present committee, and to increase, if possible, its membership in the future. Messrs. Smith, Weed, and Garman were appointed.

Mr. Woodworth read a paper entitled "The laboratory method of experimentation" (published in Insect Life, vol. III, No. 6).

Mr. Beckwith, of Delaware, read a paper entitled, "Practical notes on the use of insecticides" (published in Insect Life, vol. III, No. 6).

Mr. Weed read a paper entitled "Life history of *Pimpla inquisitor*," an abstract of which is published in Insect Life, vol. III, No. 6.

EVENING SESSION, WEDNESDAY, NOVEMBER 12, 1890.

Mr. Forbes in the chair.

The following officers were elected for the ensuing year: chairman, Mr. Cook, of Michigan; secretary, Mr. Gillette.

The subcommittee appointed to confer with the committee on coöperation with the Association of Official Economic Entomologists reported through its chairman, Mr. Smith. The report as adopted was as follows:

The committee on entomology respectfully begs to state to the general association that the papers presented by its members have been found of such general interest to station workers and teachers, and that so much advantage has resulted to individuals, all of which will redound to the benefit of the stations and colleges, that they are encouraged to ask that if possible the programs be so arranged hereafter that more time shall be given to the consideration of special topics by the permanent committees.

Mr. Woodworth moved that one member of the committee be appointed to act conjointly with two other persons, one from the permanent committee on botany and one from the permanent committee on horticulture, to secure if possible a set of standard, uniform connections for nozzles and pipe fixtures used in spraying machinery.

Mr. Alwood was appointed by the Chair to act in this capacity.

On motion of Mr. Cook the committee decided that in the circular sent out to call their next annual meeting a cordial invitation should be extended to any persons not members to be present and take part in the meeting.

Mr. Howard read a paper entitled "The host-relations of parasitic *Hymenoptera*" (published in Insect Life, vol. III, No. 6).

Mr. Snow (University of Kansas) presented a paper (published in Insect Life, vol. III, No. 6), the substance of which was as follows:

EXPERIMENTS FOR THE DESTRUCTION OF CHINCH-BUGS IN THE FIELD BY THE ARTIFICIAL INTRODUCTION OF CONTAGIOUS DISEASES, F. H. SNOW.

These experiments have been continued through the two seasons of 1889 and 1890, and have been remarkably successful. As entomologist to the Kansas State board of agriculture I had prepared an article for the annual meeting of that board in

January, 1889, stating what was known at that time upon the subject, and calling attention to the investigations of Professors Forbes, Burrill, and Lugger. In June, 1889, a letter was received from Dr. J. T. Curtiss, of Dwight, Morris County, Kansas, announcing that one of the diseases mentioned in the article (*Entomophthora*) was raging in various fields in that region, and stating that in many places in fields of oats and wheat the ground was fairly white with the dead bugs. Some of these dead bugs were at once obtained and experiments were begun in the entomological laboratory of the university. It was found that living, healthy bugs, when placed in the same jar with the dead bugs from Morris County sickened and died within 10 days. A Lawrence newspaper reporter learning of this fact, published the statement that any farmers who were troubled by chinch-bugs might easily destroy them from their entire farms by sending to me for some diseased bugs. This announcement was published all over the country, and in a few days I received applications from agricultural experiment stations and farmers in nine different States praying for a few "diseased and deceased" bugs with which to inoculate the destroying pests with a fatal disease. Some fifty packages were sent out during the season of 1889, and the results were in the main highly favorable.

It was my belief that sick bugs would prove more serviceable in the dissemination of disease than dead bugs. I accordingly sent out a circular letter with each package, instructing the receiver to place the dead bugs in a jar for 48 hours, with from ten to twenty times as many live bugs from the field. In this way the disease would be communicated to the live bugs in the jar. These sick bugs being deposited in different portions of the field of experiment would communicate the disease more thoroughly while moving about among the healthy bugs by which they would be surrounded. This belief was corroborated by the results. The disease was successfully introduced from my laboratory into the States of Missouri, Nebraska, Indiana, Ohio, and Minnesota, and into various counties in the State of Kansas. A report of my observations and experiments in 1889 has been published in the Transactions of the Kansas Academy of Science, vol. XII, pp. 34–37, also in the Report of the Proceedings of the Annual Meeting of the Kansas State Board of Agriculture in January, 1890.

The next point to be attained was the preservation of the disease through the winter in order that it might be under my control and be available for use in the season of 1890. To accomplish this result, I placed fresh, healthy bugs in the infection jar late in November, 1889, and was pleased to note that they contracted the disease and died in the same way as in the earlier part of the season. I was not able to obtain fresh material for the purpose of testing the vitality of the disease germs in the spring of 1890 until the month of April, and then only a limited supply of live bugs could be secured. I quote the following from my laboratory notes:

April 10, twenty-five chinch-bugs that had hibernated in the field were put in the infection jars. They were supplied with young wheat plants. The bugs appeared lively and healthy.

April 16, some of the bugs were dead and all appeared stupid.

April 20, all of the bugs were dead.

One week later a new supply of fourteen bugs was put into the jar; they were supplied with growing wheat. They ran substantially the same course as the first twenty-five. Some had died at the end of the first week and all were dead by the end of the thirteenth day.

The chinch-bug seemed to have been very generally exterminated in Kansas in 1889, and only three applications for diseased bugs were received in 1890 up to the middle of July. On account of the limited amount of infection material on hand I required each applicant to send me a box of live bugs, which I placed in the infection jars, returning in a few days a portion of the sick bugs to the sender. The three applicants above noted reported the complete success of the experiments. I give the following letter from Mr. M. F. Mattocks, of Wauneta, Chautauqua County, Kansas:

WAUNETA, KANSAS, *July* 7, 1890.

Professor SNOW,

Lawrence, Kansas:

DEAR SIR: I received from you a few days since a box of diseased chinch-bugs. I treated them according to instructions, and I have watched them closely and find that they have conveyed the disease almost all over my farm and the bugs are dying at a rapid rate. I have not found any dead bugs on farms adjoining me. I here inclose you box of healthy bugs that I gathered 1¼ miles from my place. I do not think they are diseased.

Yours,

M. F. MATTOCKS.

* * * * * * *

I personally visited Mr. Mattocks' farm and verified the above statements.

The difficulty of obtaining enough live bugs to experiment with in the laboratory led to the sending out of an advertisement, which was forwarded to twenty prominent papers on August 14, with requests for its publication. * * *

This request for live bugs was given wide circulation and resulted in keeping the laboratory fairly well supplied with material for experiment.

Before the close of the season of 1890 it became evident that there were at least three diseases at work in our infection jars, the "white fungus" (*Entomophthora* or *Empusa*), a bacterial disease (*Micrococcus*), and a fungus considered by Dr. Roland Thaxter to be *Isaria* or perhaps more properly *Trichoderma*.

The following report, which describes the bugs as "collecting in clusters," points to the bacterial disease as the cause of destruction in the field:

PIQUA, KANSAS, *July* 12, 1890.

DEAR SIR: Since writing you from Humboldt, Kansas, the 6th instant, I have made the happy discovery that the germs of contagious disease sent me were vital. On Sunday last upon examination of the millet field I found millions of dead bugs. They were collected in clusters. My idea is that dampness facilitates the spread of the contagion. The first distribution of diseased bugs two days after I received the package by mail, apparently produced no results. A part of them were retained in the infection jar (quart Mason fruit jar); one half pint of bugs were collected from the field; 3 days later a foul stench was found to emanate from the jar, and a part of the bugs in it were dead. On July 3, I took advantage of the cool, damp evening and taking a few buckets of cold water sprinkled the edge of the millet and distributed more infected bugs. On the 6th I found millions of dead bugs. I think the night and sprinkling the millet caused the disease to spread—we have had no rain in this neighborhood since June 17, if I remember correctly. The depredations of chinch-bugs are always more serious in dry, hot weather. Have not had my mail since writing you from Humboldt the 5th.

You have conferred a lasting benefit on the farming interests of the United States, the value of which can not be estimated in dollars and cents. It was estimated that during one of the visitation years of this insect the damage in the Mississippi Valley amounted to 10 million dollars. I have no doubt that by a proper manipulation of the contagious disease by intelligent persons it will prove an effective remedy. I think the contagion should be introduced among them early to prevent the migration of the young brood. In my case I received it too late. Early-sown millet presents a favorable place to infect the bugs, as they seem to collect in the shade and die. Hoping that when the next legislature meets an appreciating public will suitably reward you for your beneficent discovery. I am,

Gratefully yours,

J. W. G. MCCORMICK.

The field experiments were apparently equally successful in the months of July, August, and September.

[A field report from J. F. Knoble, of Florence, Kansas, is here given to indicate the favorable light in which the farmers regarded the experiment.]

The following report from R. L. Stangaard is inserted as being of a more scientifically circumstantial character than most of the other reports:

FLORENCE, KANSAS, *August* 22, 1890.

Prof. F. H. SNOW,
Lawrence, Kansas:

DEAR SIR: In reply to your favor of July 27, last month, would say that infected bugs were applied after they were kept with live ones about 42 hours. They were applied as follows:

Most of the bugs mixed were dead when taken out of the box. They were applied in seven different hills, being put into every ninth hill. I marked every hill with a number so as to be better able to watch the progress.

Examined after 48 hours' application with the following results: No. 1, mostly dead; No. 2, bugs mostly alive, seemingly very restless; No. 3, bugs seem to be sick; No. 4, bugs mostly dead (on hills around it the bugs seem restless); No. 5, not examined (on hills around it the bugs seem to be affected, sick). Examination 8 days after application with the following results, to wit: No. 3, bugs seemingly in a dying condition; on the hills around it the bugs seem to be well, with exception of one hill, where they seem to be dying and some dead; No. 4, not a live bug in the hill; No. 5, apparently dying, also dying in the hills around this; No. 6, bugs dying in hill; No. 7, apparently not dying.

On August 16, 12 days after application, I found the bugs to be dying and dead all through the field (12 acres).

On August 20, I again found the bugs to be dying rapidly. A field 40 rods dist .. had sure marks of bugs in a dying condition. What I mean by bugs in a dying condition is this: Some lay on their backs almost motionless, and others lay in the same position, moving limbs violently.

This remedy was applied on A. G. Rosiere's farm, on Bruno Creek, Marion County, Kansas, being 9 miles east and 3 miles south of Marion.

Thanking you for your favors, I remain,

Yours, truly,

R. L. STANGAARD.

October 16, many of the bugs were dead; the others apparently lively. The dead bugs were found to contain hyphal bodies similar to those with which they were infected. A live chinch-bug from the same jar was crushed and found to contain round hyphal bodies, but these refused to germinate.

November 5, not all of the bugs are yet dead. The few remaining are apparently lively.

The following is a summary of the results of the field experiments in the season of 1890:

Number of boxes of diseased bugs sent out, thirty-eight. Seven of these lots were either not received or received and not used. Reports were received from twenty-six of the thirty-one remaining cases. Of these, twenty-six reports three were unfavorable, nineteen favorable, and four doubtful concerning the success of the experiment. These doubtful cases are not to be looked upon as unfavorable, but more evidence is needed to transfer them to the list of favorable reports. Thus nineteen out of twenty-six reports, or 73 per cent, were decidedly favorable. The experiments will be continued during the season of 1891. In presenting this paper I wish to acknowledge the invaluable aid continually received during the progress of the work from my assistants, Messrs. W. C. Stevens and V. L. Kellogg.

The laboratory experiments have been continued through the season. Of the three diseases identified, that produced by the *Trichoderma* appears to be less fatal than the other two, as is indicated by the following laboratory notes:

September 28, dead chinch-bugs, showing no sign externally of fungus, were taken from the infection jars and crushed on a glass slide in distilled water. Oval hyphal bodies of a fungus (*Trichoderma*) were found in considerable number. These were put under a bell jar.

September 29, some of the hyphal bodies had put out slender mycelial growths, others, in immense numbers, were multiplying by division.

October 1, the hyphal bodies were still multiplying by division. The mycelial growths had become much longer, and in some instances had variously branched.

October 3, a dead chinch-bug taken from an infected field was crushed on a glass slide in distilled water. Both round and oval hyphal bodies were found in considerable numbers. These were put under a bell jar to prevent drying.

October 4, both round and oval hyphal bodies were multiplying by division and were putting out mycelial growths.

October 5, fresh chinch-bugs from an uninfected field were immersed in the liquid containing the above fungi, and were put in a new jar with young corn plants.

To Mr. Riley's question as to which of the three diseases mentioned was most common in destroying the bugs in the field experiments, Mr. Snow said that during the dry summer of the present year he thought the bacterial disease did most of the work, but in 1889 he thought the fungous diseases were most destructive.

Mr. Riley thought the fact that Mr. Snow had been able to carry healthy bugs through the season without infection in the same room with diseased bugs was rather a discouraging one, as it would indicate either that the germs were easily kept from reaching the bugs or that they were not carried long distances. Close proximity to, or actual contact with diseased individuals, if necessary, would materially lessen the value of their use in the field, while the evidence of farmers' experience in the field needed very careful weighing, because of the possibilities of error.

Mr. Snow said it had been found by his experiments that the diseases would spread over large fields and destroy nearly all the bugs within 10 or 12 days after the diseased bugs had been introduced, and that the expense was very slight.

Mr. Webster stated that it had been his experience that the spread of the *Entomophthora* was entirely dependent upon proper atmospheric conditions, and that he thought the disease might be continued from year to year by massing the bugs on small patches of some favorite food plant or millet where they are to be infected and destroyed and then to grow upon this ground the next year some crop to which the bugs are partial. In this manner the bugs the following year accumulate on the ground where the germs are most abundant, and most favorable natural conditions would be offered for starting the disease when proper atmospheric conditions were present. He did not think actual contact necessary for the communication of the fungous diseases, neither did he think that corn fields present favorable situations for the spread of the infection.

Mr. Snow thought none of the germs would live over winter under ordinary out-door conditions, but only in protected situations, and it was his opinion that such an attempt as Mr. Webster proposed, to carry the germs over from one season to another, would not succeed. His own experiments had shown that the diseases can be kept alive in the laboratory through the winter and sent out the next season on demand, as explained in his paper.

Mr. Cook stated that foul brood was readily carried over winter in a bee-hive, and he thought it not unlikely that the chinch-bug diseases might be carried over in the same way.

Mr. Fletcher thought that where the disease has been it is liable to appear again when proper conditions are present.

On motion of Mr. Harvey the committee tendered Mr. Snow a vote of thanks for his interesting and valuable paper.

Mr. Smith moved that the paper and discussions of the committee be sent to Insect Life for publication. The motion prevailed.

The committee adjourned.

THE PERMANENT COMMITTEE ON HORTICULTURE.

This committee was represented by ten workers, viz: Alwood of Virginia, Burrill of Illinois, Goff of Wisconsin, Green of Ohio, Lyon of Michigan (representing the Division of Pomology, U. S. Department of Agriculture), McCluer of Illinois, Massey of North Carolina, Taft of Michigan, Troop of Indiana, and Waldron of North Dakota.

Methods of note taking were discussed. The tabular system with blanks for special columns and remarks seemed most satisfactory.

It was agreed that varieties are tested for the benefit of the public and not for the introducers. Variety testing is necessary, but should not end with simply ascertaining what particular variety is earliest, or most productive, or keeps best. The information secured in variety testing should lead to the development of superior varieties at our experiment stations or it does not fulfill its whole mission. Especially should our experiment station horticulturists pursue the most advanced kinds of plant breeding, as, for example, the development of disease-resisting varieties and the securing of crosses with reference to acquiring special qualities now wanting; in other words, the kind of plant breeding that the ordinary seed grower does not undertake.

Mr. McCluer gave an interesting and instructive account of some experiments in crossing corn.

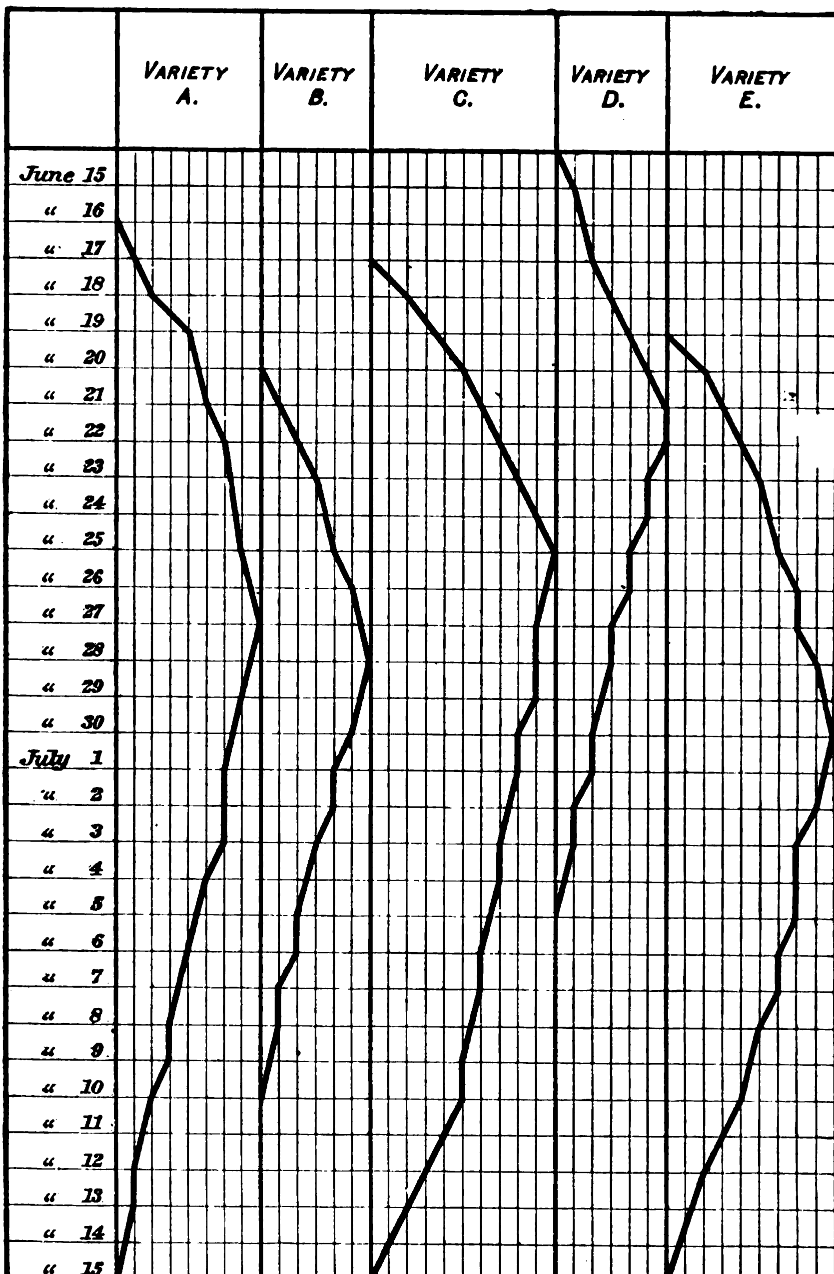
Mr. Waldron mentioned several of the promising wild fruits of North Dakota.

Mr. Goff explained a very concise and clear method of reporting the yields of small fruits and other crops in which the harvesting is necessarily done at frequent intervals. This method is shown in the accompanying illustration: The dates of the various pickings are recorded at the left and the names of the varieties are written at the top of the broad vertical columns. The narrow columns within the broad columns represent units of measurement. The yield of each variety at each picking is counted from the left side of the broad column, each vertical line representing one quart, pound, or bushel, as the case may be. The comparative maximum yield of the different varieties is shown by the width of the broad columns. The relative earliness or lateness appear clearly by glancing across the top or bottom of the diagram, while the length of time the variety continues in bearing appears from the total length of the yield line.

The election of officers resulted in the choice of Mr. E. S. Goff, of Wisconsin, as chairman, and Mr. W. J. Green, of Ohio, as secretary.

Members were urged to prepare and forward papers for the next meeting, without waiting to ascertain if their presence would be possible.

The report of the committee on reform of vegetable nomenclature was read in the general session by Mr. Goff, and a paper on methods of work in variety testing was read by Mr. Green.



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U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

A. W. HARRIS, DIRECTOR

EXPERIMENT STATION BULLETIN No. 7

PROCEEDINGS

OF THE

FIFTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

WASHINGTON, D. C.

AUGUST 12–18, 1891

EDITED BY

A. W. HARRIS, for the Office of Experiment Stations,

AND

H. E. ALVORD, for the Executive Committee of the Association

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1892

LOCATIONS AND DIRECTORS OF THE AGRICULTURAL EXPERIMENT STATIONS.

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*President of board of direction. †Assistant director in charge. ‡Chairman of council. §Acting director.

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Communications intended for this Office should be addressed to the SECRETARY OF AGRICULTURE, for the *Office of Experiment Stations, Department of Agriculture, Washington, D. C.*

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
December 22, 1891.

SIR: I have the honor to transmit herewith for publication Experiment Station Bulletin No. 7 of this Office, containing the proceedings of the fifth annual convention of the Association of American Agricultural Colleges and Experiment Stations, held at Washington, D. C., August 12–18, 1891. The lectures delivered by Mr. R. Warington, F. R. S., of Rothamsted, England, are printed in separate form as Experiment Station Bulletin No. 8. The stenographic report of this meeting was made by Mr. Talma Drew, official stenographer of this Department, who also largely assisted in the editing.

Very respectfully,

A. W. HARRIS,
Director.

Hon. J. M. RUSK,
Secretary of Agriculture.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called The Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association.

MEMBERSHIP.

At any regularly called meeting of the Association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, the United States Department of Agriculture, and the Office of Experiment Stations of the United States Department of Agriculture shall be entitled to one delegate. The same delegate may represent both a college and an experiment station, and may take part in the proceedings of the sections proper to either or both, but no delegate shall cast more than one vote either in a section or in convention. Other institutions engaged in experimental work in the interest of agriculture may be admitted to representation in this Association by a majority vote at any regular meeting of the Association.

Any person engaged in agriculture, who shall attend the conventions of this Association, not as a delegate, may, by vote of the convention, be admitted to all the privileges of the floor, except the right to vote.

OFFICERS.

The officers of this Association shall be a president, five vice presidents, and a secretary, who shall act as treasurer. They shall be chosen by ballot and shall perform the duties which usually devolve upon such officers. They shall hold office from the close of the meeting at which they were elected and until their successors shall be elected.

The president, secretary, and five persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

The executive committee shall determine the time and place of the meetings of the Association; shall issue its call for said meetings, stating the general purpose thereof, not less than 30 days before the date at which they shall be held; shall provide a well-prepared order of business and program of exercises for such meetings; and shall make seasonable issue of said programs.

It shall be the duty of each institution included in this Association to present at each regularly called meeting a brief report of the work and progress of said institution, and such report shall be called for in the regular order of business.

The executive committee shall be charged with the general arrangement and conduct of the meetings called by it, at which meetings, before adjournment, a new executive committee shall be chosen.

SECTIONS.

The Association shall be organized into sections upon the several classes of special subjects, the consideration of which shall become desirable. Each institution represented in the Association shall be entitled to representation in each section by one delegate. Each section shall nominate to the convention a chairman, to hold office until the close of the next convention. Each chairman shall present at the first general session of the convention a report of progress in his subject during the preceding year, together with any other facts connected therewith which he may deem of interest. Such reports shall not exceed 15 minutes in length. The annual address of the president of the Association shall be given upon the evening of the same day. Provision shall be made in the program for meetings of each of the sections, either simultaneously or consecutively, as the executive committee shall determine. At least two sections shall each year present in general sessions of the convention a portion of the subjects coming before them. The sections to thus report shall be designated by the executive committee. and general notice of the selection shall be given at least 3 months in advance. There shall be sections on agriculture, on botany, on chemistry, on college work, on entomology, and on horticulture, and the executive committee, upon request of any five institutions represented in the Association, shall provide for the organization of new sections at any convention.

AMENDMENTS.

This constitution may be amended at any regularly called meeting by a vote of two thirds of the delegates present.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the program.

(3) Speakers invited to open discussions shall be entitled to 20 minutes each.

(4) In general discussions the 10-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general program shall be closely observed, unless changed by a two thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION.

ELECTED AT CHAMPAIGN, ILLINOIS, NOVEMBER, 1890.

President,

H. H. GOODELL of Massachusetts.

Vice Presidents,

O. CLUTE of Michigan, J. W. SANBORN of Utah,
A. Q. HOLLADAY of North Carolina, I. P. ROBERTS of New York,
E. D. PORTER of Missouri.

Secretary and Treasurer,

M. A. SCOVELL of Kentucky.

Executive Committee,

The PRESIDENT, the SECRETARY,
H. E. ALVORD of Maryland, M. C. FERNALD of Maine,
J. H. SMART of Indiana, J. A. MYERS of West Virginia,
W. M. HAYS of Minnesota.

Chairmen of Sections,

Agriculture, C. S. PLUMB of Indiana; College Work, G. W. ATHERTON of Pennsylvania;
Botany, B. D. HALSTED of New Jersey; Entomology, A. J. COOK of Michigan;
Chemistry, A. T. NEALE of Delaware; Horticulture, E. S. GOFF of Wisconsin.

ELECTED AT WASHINGTON, D. C., AUGUST, 1891.

President,

W. L. BROUN of Alabama.

Vice Presidents,

C. W. DABNEY, jr., of Tennessee, H. E. STOCKBRIDGE of North Dakota,
J. W. NICHOLSON of Louisiana, F. E. EMERY of North Carolina,
W. H. JORDAN of Maine.

Secretary and Treasurer,

M. A. SCOVELL of Kentucky.

Executive Committee,

The PRESIDENT, the SECRETARY,
H. E. ALVORD of Maryland, J. A. MYERS of West Virginia,
H. H. GOODELL of Massachusetts, W. FREAR of Pennsylvania,
A. T. NEALE of Delaware.

Chairmen of Sections,

Agriculture, C. L. INGERSOLL of Nebraska; College Work, E. M. TURNER of West Virginia;
Botany, G. F. ATKINSON of Alabama; Entomology, L. BRUNER of Nebraska;
Chemistry, M. A. SCOVELL of Kentucky; Horticulture, E. A. POPENOE of Kansas;

Secretaries of Sections,

Agriculture, T. F. HUNT of Pennsylvania; College Work, H. E. STOCKBRIDGE of North Dakota;
Botany, L. H. PAMMEL of Iowa; Entomology, F. M. WEBSTER of Ohio;
Chemistry, H. H. HARRINGTON of Texas; Horticulture, T. L. BRUNK of Maryland.

CALL FOR THE CONVENTION.

ASSOCIATION OF AMERICAN AGRICULTURAL
COLLEGES AND EXPERIMENT STATIONS,
OFFICE OF THE EXECUTIVE COMMITTEE,
College Park, Maryland, July 1, 1891.

By authority of the executive committee, a delegate convention of this Association is hereby called to meet at the Columbian University, Washington, D. C., on Wednesday, August 12, 1891, at 10 a. m.

In accordance with the requirements of the constitution, the sections on agriculture and on entomology are hereby designated to present a portion of the subjects coming before them in the general sessions of the convention.

The chairmen of the several sections will each be called upon for a report of progress, not to exceed 15 minutes in length, on Wednesday, the first day of general sessions.

The first course of lectures in America under the Rothamsted trust, established by Sir John Bennet Lawes, Bart., to be delivered by Mr. R. Warington, F. R. S., chemist and accredited representive of Rothamsted, under the auspices of this Association and upon its special invitation, will constitute the prominent feature of this convention. No other matter will be allowed to conflict with the assignments for these six lectures, and other scientific associations meeting in Washington on some of the days named have arranged their work so as to allow all their members to attend these lectures.

All delegates and others intending to attend this convention are urged to apply to Prof. M. Baker, local secretary of the American Association for the Advancement of Science, Washington, D. C., for a circular announcing the August meeting of the American Association for the Advancement of Science and the other scientific bodies meeting in Washington about the same time. Many advantages will be derived from at once joining the American Association for the Advancement of Science. The Association of Official Agricultural Chemists meets August 13, 14, and 15. The Society for the Promotion of Agricultural Science meets August 17 and 18. For botanical, chemical, and entomological meetings, see the circular mentioned.

For the executive committee,

HENRY E. ALVORD,
Chairman.

PROGRAMS.

All sessions will be held at the Columbian University, southeast corner Fifteenth and H streets.

ASSIGNMENT OF ROOMS.

All general sessions and evening lectures in the law lecture room, No. 12, first floor.

Sectional meetings on the second floor: Section on botany in room No. 18, section on entomology in room No. 15, section on horticulture in room No. 14, section on college work in room No. 17.

Sectional meetings on the third floor: Section on agriculture in room No. 31 (the chemical lecture room), section on chemistry in room No. 28.

Hours for meetings: 9 a m., 2 p. m., and 8 p. m.

SPECIAL NOTICE.

The chairmen and secretaries of sections are requested to hand to the secretary of the Association, in advance, written announcements of the section meetings from day to day. Also to preserve such records of the section meetings as will serve for a correct journal of their proceedings.

WEDNESDAY, AUGUST 12, 1891.

10 a. m.—General session. Organization and reports of committees; reports from the chairmen of sections.

2 p. m.—General session. Reports concluded and discussions on these questions: (*a*) Is it desirable to have a collective exhibit of the agricultural colleges in the agricultural building of the World's Columbian Exposition? (*b*) What coöperation is desirable between the colleges and stations and the Weather Bureau of the Department of Agriculture? (*c*) Shall this convention hold an adjourned session at some other place the present year?

8 p. m.—Opening address by the president of the Association, H. H. Goodell, LL. D., president Massachusetts Agricultural College. First lecture of the Rothamsted course, by R. Warington, F. R. S., vice president Chemical Society of England; subject, The Rothamsted Experimental Station, illustrated with lantern.

THURSDAY, AUGUST 13.

9 a. m. and 2 p. m.—Meetings of the sections on agriculture and botany, and others if desired, excepting the section on chemistry.

8 p. m.—General session for business, not to exceed 1 hour. Second Rothamsted lecture, subject, The Circumstances which Determine the Rise and Fall of Nitrogenous Matter in the Soil.

FRIDAY, AUGUST 14.

9 a. m. and 2 p. m.—Meetings of the sections on horticulture and college work, and others if desired, excepting the section on chemistry.

8 p. m.—General session, not to exceed 1 hour. Subjects presented from the section on agriculture. Third Rothamsted lecture, subject, Nitrification, illustrated.

SATURDAY, AUGUST 15.

9 a. m.—Meeting of section on entomology, and other sections if desired.

2 p. m.—General session. Election of officers and other business. Fourth Rothamsted lecture, subject, Nitrification and Denitrification, illustrated with lantern.

MONDAY, AUGUST 17.

8 p. m.—General session. Subjects from the section on entomology. Fifth Rothamsted lecture, subject, Nitrification of Soils and Manures, with diagrams.

TUESDAY, AUGUST 18.

8 p. m.—General session. Final business from the sections. Sixth Rothamsted lecture, subject, Drainage and Well Waters. Closing business. Adjournment.

SECTION ON AGRICULTURE.

C. S. PLUMB, Chairman. C. E. THORNE, Secretary.

(1) How may fiber plants be studied to best advantage? C. D. Smith of Minnesota.

(2) How many cattle should be used in a feeding experiment? F. A. Gulley of Arizona.

(3) Physical conditions surrounding animals in experimental feeding, especially as related to stalls and mangers, W. A. Henry of Wisconsin.

(4) Model coöperative plat work, W. P. Brooks of Massachusetts.

(5) How can the results of work be most successfully presented to the farmer? I. P. Roberts of New York.

(6) Experimental work of importance to coast line States, as affected by maritime conditions, C. O. Flagg of Rhode Island.

(7) Soil features that should be recognized in all plat work, M. Whitney, of Maryland.

(8) The relation of teaching to experimental work, G. E. Morrow of Illinois, H. E. Alvord of Maryland, and J. S. Newman of Alabama.

(9) Implement tests and use of the dynamometer, J. W. Sanborn of Utah.

(10) What should be the duties of a station agriculturist? For open discussion.

(11) State soil surveys, how far are they practicable and how should they be conducted? E. W. Hilgard of California and M. Whitney of Maryland.

(12) Variety testing in cereals, how can it be rendered more decisive? C. L. Ingersoll of Nebraska and J. F. Hickman of Ohio.

No other sectional program has been received in time to distribute before the convention.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

The following is a list of delegates and visitors in attendance as finally reported by the executive committee, acting as a committee on credentials:

Alabama:

College: N. T. Lupton,* chemist; W. L. Broun, president. *Station* (Auburn): G. F. Atkinson,* biologist; J. T. Anderson, assistant chemist; J. F. Wilkinson, assistant chemist.

Arizona:

College: C. B. Collingwood,* chemist. *Station:* F. A. Gulley,* director.

Arkansas:

Station: G. L. Teller,* chemist.

California:

Station: E. W. Hilgard,* director.

Colorado:

College: W. J. Quick,* agriculturist; R. A. Southworth, board of agriculture. *Station:* C. S. Crandall, botanist and horticulturist.

Connecticut:

Sheffield School: W.H. Brewer,* professer of agriculture. *State Station:* E. H. Jenkins,* vice director; W. C. Sturgis, mycologist. *Storrs School:* C. S. Phelps,* professor of agriculture. *Storrs Station:* C. D. Woods,* chemist.

Delaware:

College: A. N. Raub,* president; C. L. Penny, chemist; G. A. Harter, meteorologist. *Station:* A. T. Neale,* director; M. H. Beckwith, horticulturist and entomologist.

Florida:

N. Robinson.

Illinois:

College: G. E. Morrow,* professor of agriculture. *Station:* E. H. Farrington,* chemist; J. C. Arthur, botanist.

Indiana:

Station: C. S. Plumb,* director; H. A. Houston, chemist.

Iowa:

College: H. Osborn,* zoölogist and entomólogist; G. E. Patrick, chemist; L. H. Pammel, botanist.

Kansas:

College: J. E. Hessin,* governing board. *Station:* E. A. Popenoe,* horticulturist and entomologist.

Kentucky:

College: H. Gibson,* secretary of board of trustees. *Station:* M. A. Scovell,* director and chemist; H. Garman, entomologist and botanist.

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* Delegate.

Louisiana:

College: J. W. Nicholson,* president. *Station:* W. C. Stubbs,* director; B. B. Ross, chemist.

Maine:

College: W. H. Jordan,* chemist. *Station:* J. M. Bartlett,* chemist.

Maryland:

College: H. E. Alvord,* president; M. Whitney, professor of soil physics; H. B. McDonnell, agricultural chemist; E. W. Doran, professor of zoölogy. *Station:* T. L. Brunk,* horticulturist; H. J. Patterson, chemist; A. I. Hayward, agriculturist.

Massachusetts:

College: H. H. Goodell,* president.

Michigan:

College: W. J. Beal,* botanist. *Station:* A. J. Cook,* entomologist; R. C. Kedzie, chemist.

Minnesota:

College: D. N. Harper,* agricultural chemist. *Station:* C. D. Smith,* director.

Mississippi:

College: J. H. Connell,* professor of agriculture. *Station:* S. M. Tracy,* director; L. G. Patterson, chemist. *Alcorn College:* J. D. Burrus,* professor of agriculture.

Missouri:

College: E. D. Porter,* professor of agriculture. *Station:* J. W. Clark,* horticulturist; H. J. Waters, assistant agriculturist.

Nebraska:

College: C. L. Ingersoll,* professor of agriculture. *Station:* H. H. Nicholson,* director; L. Bruner, entomologist.

New Hampshire:

College: C. H. Pettee,* dean. *Station:* F. W. Morse,* chemist; H. H. Lamson, botanist and bacteriologist.

New Jersey:

College: A. Scott,* president; B. D. Halsted, professor of botany. *State Station:* E. B. Voorhees,* chemist; L. A. Voorhees, chemist; J. P. Street, chemist. *College Station:* J. B. Smith,* entomologist; C. S. Cathcart, assistant chemist.

New Mexico:

College: J. A. Whitmore,* trustee. *Station:* A. E. Blount,* agriculturist.

New York:

College: I. P. Roberts,* professor of agriculture.

North Carolina:

College: F. E. Emery,* professor of agriculture; W. A. Withers, professor of agricultural chemistry. *Station:* H. B. Battle,* director; B. W. Kilgore, assistant chemist; F. B. Carpenter, assistant chemist.

North Dakota:

College: H. E. Stockbridge,* president.

Ohio:

College: W. H. Scott,* president; W. R. Lazenby, professor of horticulture; L. B. Wing, trustee. *Station:* C. E. Thorne,* director; J. F. Hickman, agriculturist; N. W. Lord, professor of mining and metallurgy; F. M. Webster, entomologist.

Pennsylvania:

College: T. F. Hunt,* professor of agriculture; W. H. Caldwell, professor of agriculture. *Station:* H. P. Armsby,* director; W. Frear, chemist.

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* Delegate.

Rhode Island:

Station: H. J. Wheeler,* chemist.

South Dakota:

College: J. H. Shepard,* professor of chemistry; C. A. Cary, veterinarian. *Station:* L. Foster,* director.

Tennessee:

College: C. W. Dabney, jr.,* president. *Station:* C. F. Vandorford,* agriculturist; F. Lamson-Scribner, director and botanist.

Texas:

College: J. E. Hollingsworth,* commissioner of agriculture. *Station:* G. W. Curtis,* director; D. Adriance, meteorologist; H. H. Harrington, chemist.

Vermont:

College: M. H. Buckham,* president. *Station:* W. W. Cooke,* director; L. R. Jones, botanist.

Virginia:

College: W. B. Alwood,* professor of horticulture; C. Ellis, veterinarian. *Station:* R. J. Davidson,* chemist. *Hampton Institute:* J. W. Hatch,* agriculturist and horticulturist.

West Virginia:

College: E. M. Turner,* president. *Station:* J. A. Myers,* director; D. D. Johnson, agriculturist; R. De Roode, chemist.

Wisconsin:

College: W. A. Henry,* professor of agriculture. *Station:* S. M. Babcock,* chemist.

Wyoming:

College: A. A. Johnson,* president.

U. S. Department of Agriculture:

E. Willits,* Assistant Secretary; H. W. Wiley, chemist; A. L. Colton and A. G. McAdie, Weather Bureau. *Office of Experiment Stations:* A. W. Harris,* director; E. W. Allen, editor; W. H. Beal, editor.

England:

R. Warington, chemist, Rothamsted.

Canada, Guelph, Ontario:

College: J. Mills, president; J. Fletcher, entomologist.

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* Delegate.

PROCEEDINGS.

MORNING SESSION, WEDNESDAY, AUGUST 12, 1891.

The convention was called to order at 10:30 a. m., in the law lecture room of the Columbian University, by President Goodell.

The report of the executive committee was submitted by H. E. Alvord, chairman.

REPORT OF THE EXECUTIVE COMMITTEE FOR THE NINE MONTHS ENDING AUGUST 12, 1891.

Immediately after the adjournment of the convention of the Association at Champaign in November, 1890, the executive committee were called together and organized by the choice of H. E. Alvord as chairman and M. A. Scovell as secretary.

This committee has endeavored to perform its duty as defined by the constitution and the instructions of the last convention, and having made arrangements for the convention of 1891, now respectfully presents the following report:

At the time of the Champaign convention the executive committee was obliged to report that the Association had heavy liabilities for expenses necessarily incurred during the year previous, which it was unable at that time to discharge. Accordingly the convention of 1890 directed that every college eligible to membership in the Association be requested to contribute $25 to the Association treasury for the year 1891, and every experiment station the sum of $10, and that these payments be made prior to July 1, 1891. Notwithstanding the fact that several institutions that are quite willing to accept whatever benefits may be derived from the Association still fail to contribute to its support and the additional fact that less than 9 months have elapsed since the adjournment of the last convention, the contributions have been so general and so prompt that our energetic Treasurer is able to report all the old debts paid and a good balance on hand. The Treasurer's report will show that he received from his predecessor the sum of $146.52 and collected $1,570, making the total receipts $1,716.52. Of this there has been disbursed the sum of $1,407.03, leaving a balance of $309.49 on hand at the time of closing the accounts. Several additional contributions are promised soon on this year's account. There are some unpaid special committee expenses and the expenses attending this convention to be paid soon, but it appears certain that the business of the present calendar year can be closed and all obligations discharged without any additional call for funds.

Anticipating no extraordinary expenses for the year 1892, it is recommended that the present convention should authorize an invitation to every institution eligible to membership to contribute $10 to the treasury of the Association for the purpose of defraying the necessary expenses of the year 1892, and that the same be paid as early as practicable in that year.

Since the last convention this committee has transacted a good deal of business with the departments of the Government at Washington on behalf of the Association, some of it being of special importance to the colleges. It has also assisted in procuring by Congressional appropriation additional means for the Office of Experiment

Stations of the Department of Agriculture, for the special purpose of facilitating the preparation of an index of the literature of experimental agriculture. Some matters of importance are still pending at the Interior Department which can be more appropriately reported to the section on college work.

During the last 9 months the committee has printed and distributed five circulars of information, and these have been sent to all institutions eligible to representation here, whether or not they have sent delegates to the conventions heretofore held or assisted in the work of the Association.

The resolutions passed by the Champaign convention as an acknowledgment of the eminent services of Senator Justin S. Morrill have been duly engrossed, suitably framed, and transmitted to the Senator at his home in Vermont. A duplicate has been retained.

The Association at its last convention directed that an invitation be extended to Sir John Bennet Lawes to cause a series of lectures upon the work at Rothamsted to be delivered in America during the present year by his chosen representative and under the auspices of this Association. This invitation was accepted, and Mr. R. Warington, Fellow of the Royal Society of England and vice president of the Chemical Society, was designated to perform this duty. The time and place of this convention was determined by the committee mainly with reference to accommodating the delegate from Rothamsted and securing favorable conditions for the delivery of this first course of lectures in America by one of the principal participants in the famous work of Lawes and Gilbert.

No duty performed by the present executive committee during its existence has been found so perplexing as the decision as to the time and place for holding this convention. Although the constitution gives the committee full power over this subject and the last convention by most considerate action refrained from giving instructions in the premises, it has been the desire and purpose of the committee to respect the views and preferences of all likely to be delegates or in attendance, as far as practicable, and at the same time to serve the general interests of the Association. The committee fully appreciates the fact that at the Champaign convention a proposition, emanating from the former executive committee, to hold the convention for 1891 in this city the present month was discussed, and developed decided opposition. and although no action was reached, it was apparent that the objections were shared in by many of the delegates then present. A declaration on the subject was prevented by the courteous reference of the whole matter to this committee.

It is therefore due to the persons now present and to those who hope to attend this year's convention but are unable to be here at this time, and to the members of the executive committee, individually and collectively, to declare that until some time after the Champaign convention there was no thought of holding the convention of 1891 before the middle of November, or of locating it in Washington. Subsequent events presented the subject to the committee in such form that the whole question was discussed anew, with a view to the best interests of the Association. The consideration of the subject by the committee began in April and was carried on most earnestly and conscientiously for over 2 months, resulting in a a practically unanimous decision, as announced on July 1. This prevented designating the two sections to "present in general sessions of the convention a portion of the subjects coming before them" and the "general notice" of this selection 3 months in advance, as the early date finally selected for the convention had not been contemplated. The committee therefore gave this notice at the time of the first general announcement regarding this convention, which was fully 6 weeks ago. This whole subject has caused the committee so much anxiety that a full statement was deemed desirable; and it may properly be added that in the decision reached nearly every member of the committee acted at variance with his personal preferences as to either time or place, or both, and exercised his judgment as to his duty in the premises.

By law of Congress annual reports are now required from nearly all the institutions at any time participating in the Association, and a general interchange is made of these reports. The time of the convention is fully occupied, and the annual record is already a substantial pamphlet, making its publication a serious matter. It is therefore recommended that the provision of the constitution of this Association be repealed which requires a "brief report of the work and progress" of every institution represented at every convention to be presented, and time provided for such reports in the regular order of business. It might also be well to assign to a committee the duty of scrutinizing the constitution as a whole, with a view to removing some uncertainties which have resulted from repeated amendments.

The committee formally submits to the convention the program prepared for this meeting and asks its confirmation, with the hope that few changes will be found necessary. It also recommends the adoption of the rules of order which have governed former conventions of this Association, and that this committee be authorized, as heretofore, to receive all credentials and prepare the official roll of delegates.

Respectfully submitted, for the executive committee,

HENRY E. ALVORD,
Chairman.

The report of the executive committee was adopted.

The President called for the report of the chairman of the section on agriculture, the Treasurer, whose report was in order, being temporarily absent from the room.

Mr. Morrow stated that Mr. Plumb, chairman of the section on agriculture, was also absent.

Mr. Halsted, chairman of the section on botany, presented the following report:

REPORT OF THE SECTION ON BOTANY.

The present season is one of unusual activity among the station botanists. While several stations have newly been established and botanists appointed, thus enlarging the corps and its field of labors, it is to the older stations that we must look for present substantial results. Three weeks ago, as soon as it was learned that this Association would hold an August meeting, a letter was sent to each of the station botanists asking for the leading facts, in brief, that had been determined during the past 12 months. From the responses made, in the midst of a season's work, this report of progress is condensed within the limit assigned. It has seemed best, at the risk of repeating the subject matter, to touch briefly upon the leading results obtained by the several workers, and in the alphabetical order of their names.

Alwood of Virginia has demonstrated an effective treatment for a leaf blight of the apple and established the fact that weak Bordeaux mixtures are as effective for grape rot as stronger ones. He has been successful in the artificial pollination of wheat.

Arthur of Indiana has shown that in soaking wheat to kill smut spores the water can be heated to a considerably higher temperature than heretofore thought safe, and that this treatment while effective in destroying the smut spores, largely increases the yield of the grain. He has shown that the copper-sulphate method is effective with oats, but detrimental to the yield, and that the hot-water method is equally effective. Results in the method of preparing seed potatoes have been obtained that may materially modify the customary ways of planting.

Atkinson of Alabama has considered the fungous diseases of cotton, describing some new species, and recommending methods of treatment. He finds *Colletotrichum gossypii*, South., on leaves and stems, as well as on the bolls; notes great injury to the fig by *Uredo fici*, and gives suggestions as to spraying the trees to prevent it;

and records for the first time in the United States *Cercospora bolleana* on leaves of the fig. He describes the nature of "Frenching" in cotton and shows that it is due to a fungus, a species of *Fusarium*. Critical notes have been published upon *Erysipheæ* of the Carolinas and Alabama, including the new species *Microsphæra calocladophora* on *Quercus aquatica*.

Beal of Michigan continues his experiments on grasses and clovers planned several years ago.

Bessey of Nebraska has investigated the natural forestry of the State and will soon publish the results. He is continuing his study of the forage problem of the plains.

Burrill of Illinois has ascertained practical methods of exterminating Canada thistles. These pests do not seed in the rich prairie soil, but spread by rootstocks. Excellent results have been obtained with the copper compounds, as fungicides for grape rot, apple scab, and potato blight. The latter is demonstrated to be a bacterial disease. A serious trouble of the blackberry and raspberry has been traced to the twig blight of pears (*Micrococcus amylovorus*). Studies are in progress upon several other bacterial diseases. *Puccinia rubigo-vera* has been found living over winter in leaves of wheat and producing rust spores, which grow upon fresh foliage in early spring.

Chester of Delaware while confining himself almost exclusively to treatment of fungous diseases, has, in connection with the chemist, reached important conclusions as to the preparation of fungicides, for example, the use of carbonate of ammonia instead of aqua ammonia, the employment of glue, and the use of a double hypophosphite. It is now too early to report upon the many field experiments. A study has been made of leaf spot of alfalfa, wheat scab, and rot of scarlet clover.

Crandall of Colorado is making a botanical survey of the State and is engaged upon forage problems.

Detmers of Ohio is studying the life history of anthracnose of the blackberry and raspberry, apple scab, and potato blight, and the value of various fungicides. A State herbarium is being made.

Dudley of New York (Cornell) has found that the clover rust, prevalent from New England to the Sierras, is chiefly propagated in the uredo form, and is carried over the winter as mycelium. It was demonstrated that æcidiospores produce uredo spots and therefore the *Æcidium* of *Trifolium repens* and *Uromyces trifolii* are stages of the same species. The rust spores germinate best at a low temperature. As the second crop is most frequently infested and as this is a valuable fertilizer it may often be well to plow it under. The ordinary spores of the quince blight (*Entomosporium maculatum*) winter on the fallen leaves, not on the twigs, and germinating in early spring infect the host directly. Therefore all leaves should be burned in autumn.

Garman of Kentucky shows that Bordeaux mixture and eau céleste will check the strawberry blight. Salt and lime may be used to prevent the growth of the broom rape but will injure the host plant. Bluestone is satisfactory except for its expensiveness. Hot water may be used to kill the broom rape seed and is beneficial rather than injurious to hemp seed. Broom rape seed will retain its vitality in the soil for at least 2 years. Anthracnose of the grape can be controlled by using 6¼ pounds of bluestone and 3¼ pounds of lime to 22 gallons of water.

Harvey of Maine in his tests of germination of seeds, finds that a solution of corrosive sublimate, of a proper strength to destroy the germs of mold, will not injure the vitality of the treated seed. Fungicides and weeds are receiving attention.

Humphrey of Massachusetts has found the true pycnidial form of the black knot fungus; has identified the damping-off fungus with that causing the same trouble in Europe; and has added new facts concerning the scab of potato, the hibernation of cherry rot (*Monilia fructigena*), and the Peronosporæ of cucurbits.

Jones of Vermont during this his first year is experimenting with fungicides upon potato rot, apple scab and rust, and oat and corn smut, but it is now too early to report results.

Lamson of New Hampshire writes that his work in the station for the year consists in collecting grasses, weeds, and weed seeds, and making beginnings in mycology and bacteriology.

McCarthy of North Carolina besides preparing a hundred-page bulletin upon best agricultural grasses, has given much attention to field experiments with fungicides. The Burgundy mixture with soap is superior to the Bordeaux, and the latter is improved by adding a small amount of glue. Seed testing is continued in coöperation with other stations.

Mell of Alabama has made a microscopic study of the cotton plant and is endeavoring to improve its fiber and seed by crossing. The effect upon lumber of tapping for resin is being investigated. Wild grasses for grazing purposes, and weeds are receiving attention.

Pammel of Iowa during this his first year with the station has published considerable information upon fungous diseases of Iowa forage plants, including an illustrated paper of some length in a recent bulletin upon the treatment of these troubles, especially in the orchard and garden.

Scribner of Tennessee has a report upon the grasses of the State nearly ready for the press. The work upon fungous diseases is being continued.

Thaxter of Connecticut, we regret to note, has retired from distinctively station work, after doing excellent service in economic mycology. The results of his study of onion smut, potato scab, apple rust, and other fungous enemies, and means of combating them will be of permanent value.

Tracy of Mississippi is investigating the tomato blight, so destructive in his State, and preparing a flora of Mississippi.

A few have not responded. Of these Kellerman of Kansas is doubtless busy moving to Ohio, but his works upon smuts and breeding of corn will remain as fine examples of his many important investigations beyond the Missouri. Buckhout of Pennsylvania and some others have full loads of college work. Bolley of North Dakota and Wooton of New Mexico are new to their respective fields.

B. D. HALSTED,
Chairman.

The report was accepted.

Mr. WILLITS. Mr. Wilber, the representative of the Associated Press, is here this morning and wishes to obtain for general publication abstracts of our proceedings, addresses, and papers. I have just heard in part the report read by Mr. Halsted, and have told Mr. Wilber that I should like to have an abstract of that paper sent out, as it indicates in a large measure the general field of experiment covered. The Associated Press will deal generously with all the associations in convention here at this time, and will receive and telegraph as much as a column and a half a day if desired. In my judgment a committee should be appointed to furnish abstracts of all important papers and discussions to the Associated Press. If the substance of Mr. Halsted's paper can be delivered to-night at Room 72, Corcoran Building, it will be generously appreciated.

The SECRETARY. Mr. Halsted tells me that he will make an abstract of his paper this afternoon.

Mr. MYERS. I move that a committee of three be appointed to take charge of the work of preparing these abstracts for the Associated Press.

Mr. ALWOOD. I would like to suggest that if we can get each man who presents a paper to prepare an abstract of it himself the work will perhaps be done more intelligently than it could be by a committee of which the author is not a member.

Mr. MYERS. The object of the motion is to have some central point to which these papers can come to be abstracted. A few moments ago, at the suggestion of Mr. Willits, I had a consultation with the representative of the Associated Press, who suggested that this would be a most excellent way of accomplishing the work. They are very anxious to get full reports, and I agree with Secretary Willits in thinking that these should be furnished by our Association.

The motion was carried.

Mr. WILLITS. We will send from the Department of Agriculture a stenographer and typewriter to assist you in this work, and will facilitate it in every way possible. Of course it would be well to let each individual who has a paper make the abstract himself under the direction of the committee, which should simply act as the central authority, representing the Associated Press.

The PRESIDENT. How shall the committee be appointed?

Mr. MYERS. By the Chair.

The PRESIDENT. The Chair will appoint the committee later on (see p. 24).

We will now listen to the report of the Secretary and Treasurer.

The Secretary and Treasurer, Mr. Scovell, submitted his report.

The PRESIDENT. I think it has been usual to refer the report of the Treasurer to an auditing committee.

Mr. FREAR. I move that the report just read be received and referred to an auditing committee of three, to be appointed by the Chair.

The motion was carried.

Mr. ARMSBY. Knowing something of the difficulty of making these collections, it seems to me appropriate that we should return some acknowledgment to our Treasurer for his efficiency in the matter. I move that a vote of thanks be extended to Mr. Scovell for his very efficient services as treasurer.

The motion was carried.

The PRESIDENT. I will appoint on the auditing committee Messrs. Tracy of Mississippi, Phelps of Connecticut, and Smith of Minnesota.

We will now hear the report of the section on chemistry.

Mr. Neale, chairman of the section, presented the following report:

REPORT OF THE SECTION ON CHEMISTRY.

On the first of July a circular letter was addressed to each station asking for a brief synopsis of the chemical work which had been either attempted or completed since the last annual meeting of this Association. The replies indicate that forty-five different subjects have been considered. For present purposes each of these subjects may be brought under some one of the following general classes:

1. Detective duty.
2. Agricultural manufactories.

3. Work of immediate value in directing farm management.
4. Development of analytical methods and invention of apparatus.
5. Investigations of interest chiefly to students and scientists.

1. *Detective duty.*—Under detective duty the aim has been to classify lines of work which are carried out by chemists for the protection of the farmer, that is for his protection against fraudulent practices in the business world. The following may be cited as specific examples:

(1) The chemical analyses of fertilizers, condition powders, and similar secret preparations.

(2) The examination of fodders and feeds.

(3) The detection of adulterations in dairy products.

(4) Attempts to grade wheat at elevators by methods less objectionable than those now in ordinary use.

Thirteen stations report that the control of the fertilizer interest has been placed in the hands of their chemists. It is known that in very many instances the expenses of such work are paid from State treasuries, and this subject, therefore, would not properly come before this Association were it not that it covers a disputed field in some sections of the country.

In one case at least, in order to withstand pressure exercised by a powerful interest, it was necessary to secure an opinion from the office of the Secretary of Agriculture. This opinion indicates that the expenditure of the national fund in the support of a fertilizer control already established under State management, is contrary to the spirit of the Hatch act.

Thirteen stations also report that attention is devoted to analyses of feeding stuffs. A method for establishing a control system similar in all respects to that already established for the fertilizer trade was published 2 years ago by one laboratory. Present indications point to an increased interest in this question. One director, in replying to the circular letter of inquiry, expressed his conviction that the need of such a control in his State is now urgent.

Sixteen stations have devoted time to analyses of butter and other dairy products. In many instances this work has been done with higher aims, but in some cases the chemist has simply acted the necessary but disagreeable part of the expert witness in detecting fraudulent adulterations.

Only one American station reports that attention has been given to the question of establishing better standards for grading wheat. This question is not an easy one; it has busied one of the most active thinkers in Europe for 12 years past, and has led by slow stages up to the development in his laboratory of a complete flouring mill, capable of turning out, on a quantitative scale, all of the products from small samples—say 20 pounds—of wheat. Connected with it is a bake oven, in charge of trained chemists who have learned the baker's art by practical experience.

This miniature flouring mill and bakery have demonstrated that the laboratory tests used in grading wheat are not true guides to the value of the flour for bread making. Good milling varieties still have precedence over extremely productive varieties, a fact which the farmer must regard in selecting his seed if he would escape the penalty when the grain reaches the market.

2. *Agricultural manufactories.*—This class includes those lines of work in which machinery or appliances are used in reducing crude agricultural products to merchantable forms, the duty of the chemist being to determine the waste or deterioration in quality, due to imperfections in said machinery. It covers investigations made (1) in sugar houses, (2) in starch works, (3) in oil mills, (4) in wine cellars, (5) in creameries, (6) in fiber works, (7) in tannin extractors.

That a domestic sugar industry is regarded as extremely desirable is made evident by the generosity shown by Congress in appropriating money for investigations and arranging bounties for producers. That such an industry will be established in the near future may be foretold from the energy displayed North, South, East, and West in the study of the maple, the tropical cane, the sorghum, and the sugar beet.

The oil mills, the fiber and tannin works, the wine cellars, and the starch-washing plants are at present of local importance. Generally speaking, illustrations of each may be found in profitable operation somewhere in this country. Under such conditions the duty of the chemist who seeks to introduce such industries consists in securing available information, demonstrating its accuracy, familiarizing himself with details, and imparting his knowledge to those who can use it to pecuniary advantage.

3. *Work of immediate value in directing farm management.*—An underlying idea in this classification is that the question never appears to be definitely answered, no matter what degree of accuracy may have been attained by the experimenter. In this fact, possibly, lies the value of the tests; they are suggestive rather than positive. Illustrations are offered as follows:

(1) The chemical work involved in soil tests with commercial fertilizers, whether conducted on the plat plan or on the field scale.

(2) Feeding trials carried out as object lessons.

(3) Test of fodders and feeds regarded as new when considered locally.

(4) The ordinary analyses of plants at different stages of their growth.

(5) Chemical work connected with the trials of different breeds of milch cows.

(6) The ordinary soil and water analyses.

4. *Development of analytical methods and invention of apparatus.*—Each station devotes much time to tests of new, more accurate, or more rapid methods of analysis. Those interested in details are referred to the annual reports of the Association of Official Agricultural Chemists.

5. *Investigations of interest chiefly to students and scientists.*—Examples of this classification are—

(1) Experiments on the digestibility of fodders and feeds.

(2) The absorption of atmospheric nitrogen.

(3) The isolation of the proteids of maize, oat, and flaxseed.

(4) Studies of the heat of combustion of fats and carbohydrates.

While these subjects are of interest particularly to those who are busied with methods and reasons, it is also true that an intelligent and progressive class of farmers is rapidly growing in this country—farmers who are even now watching advances in theory and hastening to put conclusions to practical tests. The eagerness for information regarding leguminous plants, which has developed since the studies on the absorption of atmospheric nitrogen were renewed, serves as an illustration of that tendency. The space granted by our leading agricultural journals to inquiries concerning feeding standards and to replies thereto, serves as another indication of the spirit of the times.

It is evident from this summary that the ruling conditions in this country have turned the attention of chemists into relatively well-worn paths, which the purely chemical stations of continental Europe have been developing for a quarter of a century. Under proper management this work, with modifications, should soon be adapted to American wants, and then new paths must be opened.

American stations are built upon a broader foundation than are some of those in the older countries, and with increased resources come deeper responsibilities. For instance, the stations of Europe in the past afforded few opportunities for intercourse among botanists, entomologists, horticulturists, veterinarians, and chemists, and very few men working in one field were well informed as to the methods and results gained in other fields.

The staff of nearly every station in this country has a representative of each of the sciences, and unexcelled facilities therefore exist for coöperative investigations. If, for example, specialists in the study of animal nutrition feel that chemistry has been of very little assistance to them in untying their knotty problems, then the time has come for them to define their troubles sharply and ask for the attention which their field so well merits. If the botanist, busied in the field of plant pathology, finds that the products of fungous or bacterial life are factors either in causing decay or in checking it after a certain stage has passed, he should be' eager for a partnership with one trained in identifying chemical compounds and in studying chemical changes. If the student of animal pathology is confronted with mysterious troubles, he may do well to invite the mycologist or bacteriologist and the chemist to share his field. If the horticulturist wearies of present methods of comparing varieties, and seeks more definite reasons for observed differences in any given fruit or vegetable, it is not unreasonable to expect the chemist to furnish material assistance. This proposal was made years ago to the director of one of the leading German stations, but could not be accepted then simply because of lack of facilities for the work.

To conclude, much of the chemical work of the day fulfills the demands characteristic of new fields. As the stations age and as information among farmers becomes general the present marked tendency toward coöperative work will become more clearly defined, and the real value of the present organization of American stations will become evident.

A. T. NEALE,
Chairman.

The report was accepted.

The PRESIDENT. The report from the section on entomology is postponed by request until next Monday. The report from the section on horticulture is in order. Who is chairman of that section?

Mr. ALWOOD. Professor Goff.

Mr. HENRY. Professor Goff is not in attendance.

The PRESIDENT. The consideration of the report will be postponed. Next is the section on college work, of which Mr. Atherton is chairman. He is not present.

Are there any reports of committees? If not, the regular business assigned for this morning, namely, reports of committees and those of chairmen of sections, is completed.

Mr. ALWOOD. I would like to say that this Association at its general session at Champaign confirmed the selection of three members as a committee to attempt to secure standard sizes of connections and fittings for nozzles and pipe fixtures in spraying apparatus. I was appointed on that committee, with Mr. D. G. Fairchild of Washington, D. C., and Mr. Troop of Indiana. I have no formal report to make, but will state for general information that we have succeeded very well in interesting manufacturers in the matter. I think that by next year the best makers of insecticide machinery in this country will make the parts of their apparatus uniform in size and interchangeable. This is a very important point to some of the workers.

Mr. ALVORD. I move that the executive committee be authorized to make up a roll of the delegates and others in attendance at this con vention, and that for this purpose the members present hand in their names and the names of their institutions to the secretary of the Association, together with a statement as to whether they are here as delegates representing their respective colleges or stations. This should be done as soon as possible in order that we may proceed with the enrollment and have the list for use during the remainder of the day.

The motion was carried.

The PRESIDENT. Is the committee appointed to prepare a collective station exhibit for the World's Columbian Exposition ready to report?

Mr. HENRY. Dr. Armsby is rewriting some parts of his report. He will be prepared to report at the afternoon session.

The PRESIDENT. I will appoint as the committee to take charge of the matter of abstracting the various reports, etc., Messrs. Myers of West Virginia, Halsted of New Jersey, and Roberts of New York.

At 11:30 a. m. adjourned to 2 p. m.

AFTERNOON SESSION, WEDNESDAY, AUGUST 12, 1891.

The meeting was called to order by Vice President Roberts at 2:20 p. m.

The CHAIRMAN. President Goodell is detained at his hotel by illness, and I am informed that I am first vice president, or first on the list of the vice presidents present, and that consequently I am to assume the chair. I suppose that the real reason for putting me here is that I may be kept from talking too much on the floor, as I am likely to do.

As I understand, the reports of the sections on horticulture and entomology will not be called for this afternoon. Reports of committees are in order, and I believe that the chairman of the committee appointed to audit the report of the Treasurer is ready to report.

Mr. Tracy read the report referred to, as follows:

Your committee to which was referred the report of the Treasurer, has carefully examined his accounts and finds them correct. His receipts during the year have amounted to the sum of $1,716.52, and bills have been paid to the amount of $1,407.03, leaving a cash balance of $309.49 now in the hands of the Treasurer. For the amounts paid out vouchers are on file, all of which have been properly approved and receipted.

S. M. TRACY,
C. S. PHELPS,
C. D. SMITH,
Committee.

AUGUST 12, 1891.

The report was accepted.

Mr. ARMSBY. The committee on the exhibit at the World's Columbian Exposition is prepared to report at this time if it is desired.

The CHAIRMAN. I notice that the program calls for discussion of the questions involved in the reports presented. I suppose that if it is desired to bring up for discussion any of the matters that have gone before such discussion would be first in order. If there are no objections the report of the committee will be read.

Mr. Armsby, chairman of the committee, presented the following report:

REPORT OF THE COMMITTEE ON COÖPERATIVE STATION EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Your committee has held two meetings, a brief one immediately after its appointment and one April 8 and 9. A very considerable amount of work has also been done by correspondence between the several members of the committee and with the various stations.

The work of the committee has necessarily been chiefly of a preliminary character, and we are not able as yet to make a very specific or detailed report. We trust, however, that we have been able to so plan and organize the work of preparation that, especially after the personal consultations rendered possible by the present meeting, it will go forward rapidly and successfully.

The degree of interest in the project manifested by the stations in general has been very gratifying to the committee, as being the best assurance of the success of the undertaking. We feel confident from the tenor of our correspondence with the stations that the institutions represented in this Association appreciate the value of the opportunity afforded by the Exposition to bring their work before the public, and that they will subordinate all personal considerations to the success of the exhibit as a whole.

We desire also to take this opportunity of expressing our appreciation of the very cordial spirit which has been manifested by the U. S. Department of Agriculture, as represented by the Assistant Secretary and the Director and Assistant Director of the Office of Experiment Stations. In all our consultations with these gentlemen they have shown a most hearty and unselfish desire to promote the interests of the stations, and it is the hope of your committee that the coöperation which has been inaugurated in this matter will do much to foster that feeling of community of interest which should exist between these two agencies for the advancement of agriculture.

We likewise wish to acknowledge the interest which has been manifested in the proposed exhibit and the many courtesies accorded to us by the Exposition authorities, especially by Hon. Benjamin Butterworth, secretary of the Directory and of the Congress Auxiliary, and by Mr. W. I. Buchanan, superintendent of the agricultural department.

The resolutions under which we were appointed were quite general in their terms, and we have felt justified in assuming that it was the intention to leave considerable latitude for the exercise of our discretion. As will appear, subjects have presented themselves to us for consideration which were not specifically included in the resolutions appointing us, but which, in our judgment, were of such general interest and importance that we felt we should not justify the confidence so generously reposed in us by the Association if we declined to consider or act upon them. In all cases, however, we have aimed to avoid committing the Association to any line of action, leaving it free to adopt such a policy as it might deem best.

The coöperative exhibit.—The committee, as stated, held a brief meeting for consultation at Champaign immediately after its appointment. It being obvious that a definite and tolerably detailed plan for the exhibit was the first requisite, it was agreed that the chairman of the committee should, as soon as practicable, visit Washington for consultation with the U. S. Department of Agriculture. As a result of this consultation and of correspondence between the members of the committee, the following general scheme for the exhibit was prepared and distributed to the stations for their suggestions and criticisms. A copy of the plan, together with a circular letter sent out with it, is appended.

STATE COLLEGE, CENTER COUNTY, PENNSYLVANIA.

January 1, 1891.

DEAR SIR: At the recent convention of the Association of American Agricultural Colleges and Experiment Stations at Champaign, Illinois, the subject of a coöperative station exhibit in connection with that of the U. S. Department of Agriculture, at the World's Columbian Exposition, was brought forward, and a plan for such an exhibit was presented by Mr. A. W. Harris, Assistant Director of the Office of Experiment Stations. After considering the subject the convention adopted the following resolutions:

Resolved, That in the opinion of the Association it is advisable to have a coöperative station exhibit at the World's Columbian Exposition.

Resolved, That to formulate and carry out such preliminary steps as are necessary during the year a special committee, with power to represent the Association, be appointed by this convention to coöperate with the Department of Agriculture and to take such other action as may be necessary.

Resolved, That the executive committee be authorized to pay from the funds of the Association the actual and necessary expenses incurred by the above-named committee in the discharge of its duties.

In pursuance of these resolutions the following committee was appointed: H. P. Armsby of Pennsylvania, G. E. Morrow of Illinois, C. E. Thorne of Ohio, S. M. Tracy of Mississippi, and W. A. Henry of Wisconsin.

This committee, in coöperation with the Office of Experiment Stations of the Department of Agriculture, has further considered and elaborated the plan proposed, and it will shortly be submitted to the several stations for their consideration.

The time available for preparing such an exhibit is comparatively brief, and to insure that it shall adequately represent the work of the stations it is imperative that a definite plan should be agreed upon at as early a date as is consistent with a due consideration of all the interests involved. The committee therefore urgently requests you to inform it as promptly as possible after the receipt of the proposed plan—

(1) Whether your station will probably coöperate in such an exhibit.

(2) Of any modification of or additions to the proposed plan which you consider desirable.

(3) Of any specific contributions which your station can make, either to the exhibit of the individual stations or to the topical exhibit.

In formulating a final plan for the exhibit, it is desired to adapt it as far as possible to the circumstances and desires of all concerned. The committee hopes, therefore, that you and all those associated with you in the work of your station will not fail to give it the benefit of your counsel in a matter which so largely affects the common interest of all. It is hoped, too, that the very cordial attitude of the U. S. Department of Agriculture and its generous proposition (only contingent on the amount of funds available to defray a considerable share of the expense of the proposed exhibit) will meet with a general and hearty response.

In behalf of the committee,

Very respectfully yours,

H. P. Armsby,
Chairman.

Proposed plan for a coöperative station exhibit at the World's Columbian Exposition, prepared by the U. S. Department of Agriculture and the committee of the Association of American Agricultural Colleges and Experiment Stations.—In preparing this plan the following have been leading considerations:

(1) The Exposition will afford an exceptional opportunity to bring the work of the stations to the notice of the public, and one of which it is desirable to take the fullest possible advantage. The work of the stations covers a wide range of subjects related to scientific and practical agriculture, and thus includes many things which are intimately connected with the life and work of a very large proportion of the people of the country. At the same time it is so clearly distinguished from that of the practical agriculturist that their exhibit would be very different from that of agriculture in general. Dealing with subjects of common interest and in ways which are new to most of our people, the stations will be able to make an exhibit which will be very attractive, highly educational in its influences, and decidedly beneficial to the stations themselves. By its means the people will be enabled to get some idea of the importance and value of this great scientific enterprise in behalf of agriculture, and will thus be led to give the most hearty support to the work which these institutions are carrying on.

(2) In order to adequately represent the work of the experiment stations of the United States as a whole, a coöperative exhibit by the stations generally, upon a

uniform plan, is indispensable. While separate exhibits, which will doubtless be made by stations in connection with the various State exhibits, will most fully represent the work of the individual stations, only a collective exhibit will impress upon visitors the scope and magnitude of the experiment station enterprise or render it practicable for the student to grasp its bearings on scientific, agricultural, and social questions.

(3) The object of such a collective exhibit should be to illustrate the work of the experiment stations as a whole, rather than to make a complete showing of that of individual stations. Consequently the exhibit should be largely topical in character, but with provision for showing the main features of the work of each station. Each contribution should be distinctly credited to the station sending it, and visitors should be referred by labels and otherwise to any separate exhibit of the station in connection with its State exhibit or that of the educational institution to which it is attached.

(4) The plan should take account of the fact that the stations derive the larger part of their support from the U. S. Treasury. For this reason it seems eminently proper that the collective exhibit of the stations should find a place in the Government building.

(5) The stations, through the Office of Experiment Stations, have definite relations with the U. S. Department of Agriculture, while yet distinct from it in organization and work. An exhibit of the stations in the Government building should therefore be made in connection with that of the Department of Agriculture, but distinguished from it by being in a separate room or rooms, and should include an exhibit by the Office of Experiment Stations. The U. S. Department of Agriculture has included the experiment station exhibit in its estimates for floor space. It also hopes to be able to defray the expenses of the transportation, installation, care and custody, and return of the exhibits, leaving to the stations only the expense of preparing their own contributions, which would remain their property and be largely available for museum and other purposes.

The following is an outline of the plan which is proposed and regarding which suggestions are desired:

A. *The material exhibit.*

To be located in the Government building in connection with the exhibit of the Department of Agriculture, but in separate rooms. To consist of—

(1) An experiment station in operation (to be manned by station workers).

(*a*) The indoor departments (space 80 by 20 feet).

Office: Methods of keeping records, accounts, labor blanks, mailing lists, and of mailing publications, etc.

Library: A select library of technical books; files of scientific and agricultural journals; files of station publications; methods of cataloguing, etc.

Chemical laboratory: General arrangement and construction; special apparatus and methods of chemical investigation; fertilizer, fodder, and milk analysis in progress; chemical and physical investigations of soils.

Botanical laboratory: General arrangement and construction; apparatus and methods of investigation; herbarium; seed testing; mycology; bacteriology.

Entomological laboratory: Arrangement and construction; apparatus and methods; collections; insecticides.

(*b*) The outdoor departments (in so far as feasible).

Greenhouse: Methods of construction and heating; cross-fertilization; water and sand cultures; varieties; grass garden, on small scale; fungicides; insecticides.

Stable: Digestion experiments with sheep; feeding for milk, beef, etc.

Dairy: Milk testing; different processes of chemical control; fermentations of milk; methods of creaming, etc.

Apiary.

(2) An exhibit of the work of the stations. (To occupy a room about 80 by 80

feet, divided into a broad central passage and ten alcoves—five on each side. A large index map of the United States to be suspended near one end of this passage, showing geographical and regional location of each station, etc. Near the other end of the passage a collection of the agriculturally important chemical elements and compounds.)

(*a*) The work of the individual stations. (To occupy the central passage. The exhibits of the individual stations should include statement of geographical location, altitude, hydrographic and climatological relations; pictures, plans, maps, models, etc., showing buildings and equipment; a complete set of publications; chart showing history, relation to other institutions, financial resources, etc.; and an exhibit illustrating the principal lines of work. Here should be located also the special exhibit of the Office of Experiment Stations.)

(*b*) Topical exhibit of the work of the stations. (To occupy the ten alcoves, each alcove to illustrate methods, apparatus, and results pertaining to a special subject or class of subjects; whatever any individual station contributes to be labeled so as to give due credit to that station; reference to be made by labels or otherwise to the operations in progress in the model station, illustrating the subject to which the alcove is devoted, and to exhibits of individual stations in State exhibits.)

The following is proposed as a tentative classification of these alcoves:

Alcoves 1–5, plant production.

Alcove 1, soils:

Origin and formation: Minerals and rocks from which soils are formed; weathering; influence of vegetation.

Physical properties: Specimens of typical soils; state of division; mechanical soil analysis; relations to water, heat, and gases.

Chemical properties: Composition; chemical actions in the soil; the soil as a source of plant food; soil absorption; soil analysis * and its significance.

Microörganisms of the soil: Nitrification and denitrification.

Alcove 2, manuring:

Manures and fertilizers: Yard manure; composition; relations to feed; preservation and handling; barnyards.

Commercial fertilizers: Specimens of fertilizers and their raw materials; methods of manufacture; statistics of fertilizer trade; fertilizer control.

Agricultural value of manure: Field, pot, and box experiments; † drainage and irrigation.

Statistics of manuring: Gains and losses of fertility by the soil; relations of stock feeding and of grain growing to fertility.

Adaptation of manure to crop: Feeding capacities of crops; rotations; pot experiments.†

Alcove 3, crops:

Germination and seed testing: Chemical and morphological processes in germination; influence of heat, light, moisture, etc.; apparatus and methods for seed testing; ‡ specimens of good and poor seeds; effects of frost and of diseases; effect of age; seed adulterations; harmless and dangerous adulterations.

Assimilation: Essential and nonessential elements; water cultures; † source of each ingredient and manner of assimilation; nitrogen supply of plants; carbon supply of plants.

Metabolism: Respiration of plants.

Characteristics of different crops: Variety testing; † synonymy; production and improvement of varieties; † methods of planting, cultivation, and harvesting.

Alcove 4, horticulture:

Production and improvement of varieties: † Effects of fertilizers on fruits and vegetables; methods of grafting and budding. †

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* Reference to chemical laboratory.

† Reference to greenhouse.

‡ Reference to botanical laboratory of model station.

Imported varieties:* Tests of varieties for originators.

Alcove 5, botany, mycology, plant diseases, fungicides, bacteriology:

Collections of native grasses, the rarer forage plants, etc.; collections of weeds classified according to their injurious qualities on some such plan as that suggested by the New Jersey Station; the development of the roots of different kinds of plants; the origin, development, and treatment of certain plant diseases; fungicides, methods of preparation and application.

Alcoves 6-10, animal production.

Alcove 6, animal nutrition:

The Animal: Anatomy, histology, components of body; specimens of chief proximate ingredients.

Composition: Chemical composition of live animals of different kinds; charts, tables, and proportionate weights of the ultimate and proximate constituents.

Digestion: Models of digestive organs of domestic animals; specimens of digestive fluids and ferments; illustrations of their actions on foods; digestion experiments† and appliances for them.

Excretion: Models of excretory organs; diagrammatic representation of manner of excretion of elements, especially nitrogen.

Respiration: Models of respiratory organs; difference between inspired and expired air; respiration apparatus (models or pictures).

Feeding: Maintenance rations; sources of flesh and fat; differences in nutrition of old and young animals; influence of food on composition of carcass; milk production; anatomy of milk glands; influence of food on quantity and quality of milk;† the food of working animals; feeding standards (figures and diagrams); oyster culture; poultry.

Alcove 7, feeding stuffs:

Samples of the less familiar fodders, especially of by-products of manufacturing operations showing sources and processes of manufacture, and of usual forage plants and native grasses.

Composition ‡ and digestibility of feeding stuffs, illustrated by a collection of the chemical constituents of fodders in proper proportions.

Influence of various conditions on digestibility.

Fuel value of fodders; calorimetry.

Forage crops: Yield per acre of crude nutrients and digestible materials by various crops; effects of different methods of planting and cultivation and of time of harvesting on yield and quality; soiling and pasturage.

Preservation and preparation: Losses in hay making; silage; construction of silos, and machinery (models and drawings); samples of silage; chemical changes in the silo and their effect on composition and digestibility of silage; relative losses by drying and by ensiling; relative economy of the two processes; biology of silage.‡

Adulterations: Samples of pure and adulterated fodders and of adulterants; microscopic appearance of the same; methods for the detection of adulterants.‡

Alcove 8, dairying:

Milk: Composition† and variations in composition, illustrated as in case of fodders; influence of food,§ breed,§ period of lactation, and other factors on composition; preservation; adulteration; milk testing;‖ methods of handling milk.

Creaming: Efficiency of different methods;‖ influence of various conditions upon creaming.

Butter: Composition,† illustrated as in case of fodders and milk; variations in composition; composition of butter fat; theory of churning; influence of various

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* Reference to greenhouse.

† Reference to chemical laboratory.

‡ Reference to botanical laboratory of model station.

§ Reference to barn.

‖ Reference to dairy.

conditions upon churning; the butter extractor; quality of butter; influence of food, etc., upon quality; adulteration; detection of foreign fats.

Cheese: Composition illustrated; quality as affected by that of milk; rennet and its action on milk; influence of time, temperature, and quantity; ripening; adulterations and their detection.

Ferments and fermentations in the dairy: Bacteria in milk, cream, butter, and cheese.

Distribution of ingredients in butter and cheese making.

Alcove 9, veterinary science:

Models and preparations showing various diseases and accidents; instruments and methods of treatment; statistics of animal diseases.

Alcove 10, entomology:

Collection of selected insects to illustrate life history and means for repression.

Insects whose life history has been determined by station workers.

Insectcides: Methods of preparation and application.

Apiculture: Methods and processes.

In connection with the exhibit of the work of American stations it is believed to be very desirable to secure, as far as practicable, exhibits by foreign stations, and also a conference of experiment station workers from all countries. Both these things are in contemplation, but it has not yet been possible to make any definite arrangements.

B. *Explanation of exhibit.*

Labels.—A complete and carefully prepared system of labels will be essential.

Descriptive publications.—Small pamphlets, "primers," or "leaflets," explaining the exhibit as a whole and the several parts—one for each alcove—are contemplated. These would serve the visitor not only on the ground but also to take home for further use.

Personal explanations.—It is proposed that members of station staffs, students of the agricultural colleges, or others be detailed by the stations as workers in the model station and as demonstrators to explain to visitors the meaning of the exhibit. It is believed that the educational value of the exhibit and its efficiency in securing public appreciation of the stations will thus be greatly enhanced.

C. *Report of exhibit.*

Monograph on the experiment station enterprise.—The opportunity should be utilized for preparing a detailed report upon the exhibit, with illustrations, and in connection with it a monographic account of the experiment station enterprise, its history, workings, and achievements up to the time of the Exposition. This should serve as a handbook of reference for all interested in the progress of agriculture, an indication to the public of the value of the experiment station and the magnitude of the enterprise, and should also be the mark of an epoch in the history of the station movement and the lasting monument of the exhibit.

It is proper to say in regard to this proposed plan that the committee was well aware that it was impossible for a few individuals to formulate a plan which should be perfectly adapted to all the different conditions prevailing in the several stations. The plan as adopted was intended to be only tentative in its character, and subject to such changes as might be found necessary in the progress of the work. It was intended to be as complete a system of classification as possible, and consequently various subjects were included which it is very probable will not appear in the completed exhibit.

Responses to this letter and circular and to a later letter have been received from nearly all the stations, and in practically every case the committee was assured that the station would coöperate to the extent of its ability. At the same time it became obvious from the very general nature of most of the replies that it would be necessary for our committee to take the initiative to a considerable extent in suggesting to the various stations particular lines of work which they might illustrate.

A meeting of the committee was therefore held in Chicago April 8 and 9, in consultation with Mr. A. W. Harris, representing the U. S. Department of Agriculture, for the purpose of making more specific plans as to the nature of the exhibit in its various departments. After full consultation it was decided to assign the preparation of the exhibit in each of the ten departments or alcoves proposed by the committee to a single specialist in that department, whose duty it should be to organize and bring together the various exhibits provided for. In order to secure as uniform a distribution of the work among all the stations as possible, the committee reserved to itself the final adjustment and arrangement. Some little time was consumed in correspondence with the various gentlemen selected to take charge of the different portions of the exhibit, but by the first of June the positions had all been filled satisfactorily, and the following circular letter was sent to all the experiment stations:

STATE COLLEGE, CENTER COUNTY, PENNSYLVANIA,
June 1, 1891.

DEAR SIR: This committee has received from nearly all the stations very encouraging replies to its circular letters regarding the proposed exhibit at the World's Columbian Exposition. The plan proposed by the committee has met with general acceptance, and the coöperation of all or nearly all the stations seems to be assured.

At a meeting of the committee held April 8 and 9 in Chicago, it was unanimously decided to proceed with the preparation of the exhibit on the plan proposed, with such modifications as to details as experience should prove to be desirable. In order to secure greater efficiency, especially in the preparation of the topical exhibit, it is proposed to put the preparation of the exhibit in each one of the ten alcoves in the hands of a single specialist in that subject. The following gentlemen have kindly consented to take charge of the preparation of the several departments of the exhibit:

Experiment station in operation, the Director of the Office of Experiment Stations.

The exhibits of the individual stations, H. P. Armsby of Pennsylvania.

Alcove 1, soils, E. W. Hilgard of California.

Alcove 2, manuring, C. E. Thorne of Ohio.

Alcove 3, crops, C. S. Plumb of Indiana.

Alcove 4, horticulture, E. A. Popenoe of Kansas.

Alcove 5, botany, S. M. Tracy of Mississippi.

Alcove 6, animal nutrition, W. H. Jordan of Maine.

Alcove 7, feeding stuffs, W. A. Henry of Wisconsin.

Alcove 8, dairying, W. W. Cooke of Vermont.

Alcove 9, veterinary science, P. Paquin of Missouri.

Alcove 10, entomology, S. A. Forbes of Illinois.

It is the hope of the committee, as well as of these gentlemen individually, that they will receive the fullest and most cordial coöperation of all interested, and that every experiment station worker will consider himself a committee of one on the exhibit in his special field, and will communicate promptly and freely any suggestions or criticisms calculated to further the success of the exhibit. The opportunity afforded by the Exposition to acquaint the general public with the scope and aims of experiment station work is unique and only needs to be improved, as it easily can be by united effort, to result in great good to the stations.

H. P. ARMSBY,
Chairman.

Your committee is not able to present at this time any specific report as to the progress made in the various departments. In some, considerable work has been done, while from others no report has as yet been received by the committee. In several cases the formulating of definite plans has been delayed for the purpose of personal consultation at the present convention.

CONFERENCES OF EXPERIMENT STATION WORKERS.

One of the things named in the circular issued by this committee as desirable was a conference of experiment station workers from all countries, in connection with the material exhibit of the work of the stations. Under the direction of the World's Congress Auxiliary of the Exposition arrangements are being made for a series of congresses or conferences designed to bring together, from all civilized lands, representative men interested in the leading lines of the world's thought and work. This organization has tendered honorary membership to officers of a number of the colleges and stations comprising this Association and has made some of those residing near Chicago members of its special committees, including Prof. G. E. Morrow of this committee as one of its committee on an Agricultural Congress.

At the April meeting of this committee, therefore, Prof. G. E. Morrow and President H. H. Goodell were appointed a subcommittee to confer with the Congress Auxiliary.

Frequent informal conferences with the officers of the Congress Auxiliary have shown that they are taking a most gratifying interest in the proposed Agricultural Congress. Its special committee has issued a preliminary address, in which, among other topics named for discussion by the Congress, agricultural education and agricultural investigation and experimentation are given a prominent place. It is confidently believed that, in regard to these subjects especially, any suggestions from this Association will have a controlling influence.

Organized with the approval and indorsement of the Exposition Directory, which will give it financial aid and provide audience rooms for the meetings held under its general direction, it is believed the Congress Auxiliary will be able to accomplish much and that it is advisable to maintain close relations with it.

COÖPERATION WITH THE COLUMBIAN DAIRY ASSOCIATION.

The plan for the exhibit formulated by your committee contemplated among other things a model station, including the outdoor departments so far as feasible. Subsequent developments, however, showed that very little if anything could probably be done in this line in direct connection with the exhibit in the Government building.

By this time the plans of the Columbian Dairy Association for a working dairy and for tests of dairy breeds began to be discussed in the agricultural press, and it was thought that possibly part of what it was desired to show of the outdoor operations of a station could be accomplished by coöperation with that association.

At the meeting of the committee in April, Mr. John Boyd of Chicago, representing the Columbian Dairy Association, appeared before the committee and informally proposed a coöperation between the associated experiment stations and his association in the conduct of the working dairy and in the proposed tests of breeds of dairy cattle during the Exposition. From our conversation with Mr. Boyd it appeared that it was hardly practicable to arrange any method by which such coöperation could be made to illustrate to any considerable extent the *outdoor* work of a station, although the necessary *laboratory* work might be carried on in connection with the proposed model station. The subject was thus in part placed outside the jurisdiction of our committee under a strict construction of the resolutions appointing it, although still having an important relation to one part of the proposed exhibit. The matter appeared of so much importance to us, however, and the desirability of coöperation with the Columbian Dairy Association, under proper conditions, so manifest, that we felt that the Association would sustain us in following up the subject.

A special subcommittee of three, consisting of the chairman of the committee, Prof. W. A. Henry, and Prof. W. W. Cooke, was therefore appointed to confer with the Columbian Dairy Association or its representatives, and the secretary of that association was notified of the action. That subcommittee attended the recent meeting of the Columbian Dairy Association, representatives of the various breeders' associations, and of the Dairy Implement Manufacturers, held at Chicago, July 29, and met with a very cordial reception. There was evident at this meeting a feeling of confidence in the stations and a recognition of the weight which their coöperation and indorsement would give to the results of the proposed tests. This was apparent in the discussions, and took concrete form in the resolutions which were adopted requesting this Association to appoint a representative on the committee to supervise the tests and three representatives on the committee to formulate rules for the tests.

With the presentation of these requests to the Association through its executive committee the connection of our committee with the matter is brought to an end. We desire to say, however, that while we have taken pains to have it distinctly understood that we had no authority to make any promises on behalf of the Association, and while the convention can therefore take whatever course it may deem wise entirely unembarrassed by the action of our committee, we deem it exceedingly desirable that a cordial response should be made to the overtures of the Columbian Dairy Association. We believe the tests are likely to be carried out on a scale and in a manner calculated to yield results of great value. Far more important, however, than the actual results obtained by this coöperation will be its value as a precedent. If the stations are thus recognized as indispensable adjuncts in these important tests, it will do more than any other one thing to establish their standing with the agricultural public. In our judgment, the thing is well worth the expenditure of even considerable time and money.

In conclusion we may add that we think the matter of the analytical work involved can be cared for without serious difficulty as a part of the proposed coöperative exhibit, serving to illustrate some of the simpler laboratory operations of an experiment station.

Very respectfully submitted.

H. P. ARMSBY,
Chairman of the Committee.

MR. ALVORD. I move that the report be accepted, understanding it to be a report of progress. Without recalling the exact phraseology of the motion or act of the convention creating this committee, I have no doubt that it was understood to be virtually a standing committee while this question as to the Exposition should remain pending; and as this committee is one eminently representative of our body and has the matter well in hand, I think that question should now be settled. I propose, therefore, if the first motion is agreed to—to adopt this report as a report of progress—to follow it with a motion for the continuance of this committee as a standing committee of the Association until the close of the World's Columbian Exposition. Having thus entered upon the work and placed it in proper hands, it seems to me that it should remain in the same hands until completed.

Mr. MORROW. As a member of that committee I trust it will be distinctly understood that there is no possible connection between the motion that Mr. Alvord offers and the one which he proposes to offer. While it seems to me that it would be very proper to continue the committee, I do not wish that any one should have his judgment as to whether this report ought to be adopted influenced by Major Alvord's second proposition. That seems to me altogether another question.

The motion to adopt the report was seconded.

The CHAIRMAN. The paper is now properly before you for discussion. It covers a very wide field, and unless it is to be brought up later I should dislike to see it buried at the present time without some careful discussion. The field of work here mapped out is a broad one, and what is done will affect others as well as ourselves. We must consider carefully not only the effect upon our own nation, but also the effect on foreign nations. They will come here expecting to see some of our agricultural experiment stations and colleges and their work, and to see them well represented at Chicago; and now, it appears to me, is the time to discuss the details of this report.

Mr. JENKINS. I am particularly interested in that part of the report which bears on the proposed agricultural congresses, composed of representative agriculturists, in connection with the Exposition, and if it is in order I wish that the chairman of the committee would give us a little further information with regard to the plan proposed in relation to these congresses.

Mr. ARMSBY. The member of the committee who has been specially charged with this aspect of the work is Professor Morrow, who has had exceptional facilities for gaining knowledge of the requirements, from the fact that he is also, as was stated in the report, a member of the committee on agricultural congresses of the Congress Auxiliary, and I may say here—I think the fact is recognized—that he will be very potent in determining the action of that committee. I suggest that Professor Morrow be heard on this subject.

Mr. MORROW. A number of those present will recall an entirely informal but very interesting interview that was held in Chicago, after the close of the Champaign meeting, with President Bonney of the Congress Auxiliary, Vice President Bryan of the Exposition Directory and Congress Auxiliary, and Secretary Butterworth, in which this matter, so far as it was then developed, was discussed. Although I may assume that most of you, if not all, have a general idea as to what we are doing, a brief statement may not be out of place. The organization has adopted what seems to me the happy motto, "Not things, but men," and is composed almost exclusively of men living in Chicago or its immediate vicinity. This is true of the officers with the exception of President Bonney, a most able and enthusiastic man, who is giving very much attention to it. The intention is to have a series of what it has been decided to call congresses, to continue during most of the time during the 6 months of the Exposition, each of them to be allowed from 1 to 2 weeks time. These congresses will deal with general educational and distinctively scientific problems, and with the great labor, social, and religious questions of the day. I say this simply to indicate generally the scope of the work to be instituted and carried on in these congresses. What we are more immediately interested in is a series of agricultural meetings, for which the month of October has been suggested as the most favorable time. The Exposition Directory is taking, as it seems to me, a broad view in regard to the value of these meetings, believing that by pursuing a sagacious business policy they may be made effective in largely increasing the attendance at the Exposition. They will assume the responsibility for a large expenditure in securing audience rooms for all the meetings, possibly engaging even the great auditorium.

It is not intended that the Auxiliary shall take complete control of any meeting unless that shall be desired. The design is that it shall be helpful rather than controlling. The plan is to appoint small committees specially charged with the duty of caring for the interests of the several congresses, and in accordance with this design Mr. Butterworth, so widely known in many lines, and one of the most active officials in any way connected with the Exposition, has accepted the chairmanship of the agricultural committee. As has been so kindly stated by the chairman of the committee, whose report is before you, I have been honored with a place on the agricultural committee, and being intimately acquainted with Mr. Butterworth, and somewhat intimately with President Bonney, my relations have been quite happy, and I may say, personally rather than officially, that I have been delighted with the cordiality with which this Association has been recognized, and I am absolutely confident that it can mold and shape that Agricultural Congress, on both the lines of work that it represents, exactly as in its judgment seems best. Not to prolong this talk, I may state that as yet but little has been done. I have here a number of copies of the preliminary report made by the committee on agricultural congresses, which will afford an outline of the work thus far accomplished. There will be subcommittees on agricultural education, agricultural experimentation, etc., and while I do not speak officially, I am nevertheless authorized to say that this Association will have the selection of the committee, and will thus largely control and direct it. Judging from my own knowledge and that of others interested, I believe that the congresses will be placed on a high plane, and that it will be in every way desirable for us to lend the most hearty personal aid to them, and as an association to maintain as close relations with them as is practicable. For myself I may say that as a member of the Agricultural Congress committee, I shall be most happy to transmit to its chairman and to the auxiliary committee any provisions you may wish to make for the promotion of any action taken by this Association.

Mr. WILLITS. Let me ask Professor Morrow a question. Are these congresses to be international or national?

Mr. MORROW. I thank Mr. Willits for calling my attention to the point. They are to be international.

Mr. WILLITS. Who issues the invitations?

Mr. MORROW. The invitations will be issued in the name of this Congress Auxiliary, which is indorsed really and directly by Congress, and thus is believed to be a fitting medium to issue the invitations as the official announcement of the Exposition Directory. And this leads me to what I had intended to say. It was found necessary to abandon the original plan of inviting to honorary membership in the Congress Auxiliary all those whose aid was desired, it being found that their number was so very large that the honor conferred would be meaningless and valueless. The present purpose as to foreign nations is to secure, so far as possible, in European and other countries, sectional organizations representing the particular interests in question as to their own lands.

Mr. WILLITS. My idea more particularly stated is this: In the Department of Agriculture we are very much embarrassed over that very question, since we have already two delegates from the Department in attendance at international conventions. We were invited by the foreign governments to send them. Dr. Salmon is already in London, and Dr. Smart, our former president, is to go to The Hague. To-day two delegates from the Weather Bureau, Professors Harrington and Abbe, start for Europe to attend the International Meteorological Congress in Munich on the twenty-fifth of this month. They go laden with the hope that we may have the International Meteorological Congress in America in 1893, but we dare not ask for it; we have no authority, although of course we wish to reciprocate. The foreign governments not only invite us, but pay all expenses and appropriate money for excursions and all that sort of thing; but we do not know how to move in the matter. We had thought—and this is just the question—that possibly the World's Columbian Exposition might have sufficient scope, under the authority given it by the Government, to assume a national character and issue these invitations. In Europe everything of this kind is done by government machinery, and what we do in this line here should not have the appearance of a side show. Our plans are not yet fully formulated, and that is why I ask how it is proposed to issue the invitations. While, as I have said, Professors Harrington and Abbe hope that we may have the International Meteorological Congress in connection with the Exposition in 1893, we do not know just how to go about securing it, and I trusted that you could tell me something as to that.

Mr. MORROW. I am glad that Mr. Willits has called attention to this matter. It has been my own hope that the Department of Agriculture or the Government in some way would be able to issue these invitations, but up to this time it has been apparent, from the financial standpoint, that this could not be done. So far as it can consistently, this organization, which will officially represent the Exposition in these matters, will issue the invitations. I do not feel authorized to say that any expenditures beyond defraying the expenses of the congresses while here can be met by us; that is, I do not feel that the Congress Auxiliary is at present authorized to do anything in the way of extending personal courtesies to representatives of other associations and governments, but the Directory, which has, as I understand, formally assumed charge of the meetings, will secure the audience rooms and look after all such matters as printing and that sort of thing.

Mr. WILLITS. The printing is just what I want to know about—not the printing of the advertisements, but of the proceedings; will they print the proceedings? Gentlemen will come here prepared with long reports on certain assigned subjects, and the proceedings of that congress in October will make a volume of 800 pages at least. Now who is to print that?

Mr. MORROW. I am glad that Mr. Willits has brought up that question, for it carries us a step forward, and I am, if you will allow me to use the phrase, in one way a sort of go-between—in no bad sense, I trust. I wish to be able when I get back to Chicago to tell my friends Bonney and Butterworth that this Association is interested in the work and suggests this, that, and the other thing, just as I came here charged by them with an expression of interest in you and desire for your welfare. I do not think that Mr. Bonney or the Directory is at present ready to guaranty publication. I know it is hoped that provision may be made for them, but as yet no formal and definite conclusions have been reached. There are difficulties in the way. Here and there will be an association that will say: "We propose to control the publication of our proceedings ourselves;" while others will say: "We shall be glad to have the Government or some outside association publish our report;" and my own hope—I can use no stronger word—is that a very considerable fund will be available for the publication of the proceedings.

Mr. WILLITS. What I have said was said in no spirit of discouragement. It was only for my own information on that point that I asked the question. I consider the subject one of great importance, and I would say to Professor Morrow and to the Association generally that wherever and however the Department can coöperate with you it will be most happy to do so. As to the matter of expenses, our appropriations are limited not only as to amount, but to specific objects, and the money can not be diverted in any way. However, before the time passes, we may be able to get from Congress, an appropriation that will enable us to help in some specific direction.

The CHAIRMAN. If Secretary Willits will allow me, I would like to ask one question for my private edification. Is there no money in the Department of Agriculture that can legally be diverted to the printing of reports on Agriculture? I mean reports of agricultural meetings; for instance, such as this Agricultural Congress. According to the ordinary way of doing business in the Department, is there no money that can be used for that purpose?

Mr. WILLITS. No, we have a printing fund for our own work and for the results of work done at the experiment stations.

The CHAIRMAN. Can you not make the printing of the proceedings of this congress a part of your work?

Mr. WILLITS. We can not; we are not charged with it, and even if we were, we are limited as to amount. But, as I have said, I hope that before the time comes we may have a lump sum that can be handled in some way or other for the general good. These reports of the proceedings at Champaign, which have just been distributed, we did consider as part of our work, although it is not all our own; I mean to say that it is very largely your work, but we coöperate in the publication of the proceedings of this very Association, because we are charged with the editing, printing, and publication of results of experiments, so that it is very proper that we should publish these discussions; but we can not take in any outside matters over which we have no legislative control.

Mr. MORROW. A single word further. The nature of the report made by our committee and of the questioning thereon has compelled me to confine my remarks almost entirely to the agricultural side of the matter. Many persons interested in different lines are present in this audience, and I wish to call your thought to the fact that the whole realm of science in its various relations, but particularly the natural sciences, will be represented at Chicago in a series of congresses. I bespeak your interest in the matter, and trust that you will endeavor to keep yourselves informed as to what is done in the lines especially attractive to you, giving what aid you can in their direction. To prevent possible misconception, I will add that while we are proud of Chicago and think that the people living near there are fairly good people, it is not the belief of the Exposition managers or of the Auxiliary managers that nobody lives outside a radius of 128 miles from that city; but for convenience of consultation the Congress Auxiliary has had to draw the line so that the men shall be reasonably near at hand. President Bonney honored me by asking me to name the chairman of a most important scientific committee. I named two or three New England men, and although they were admirably qualified he said the one selected would have to be reasonably near Chicago, as otherwise, however valuable he might be personally, he could not do the work which must be done at this time; so that it was out of the question to appoint one of the Eastern men. Finally I had the pleasure of naming the president of one of the institutions represented here, and my suggestion was at once adopted.

The report was accepted.

Mr. ALVORD. I move that the committee on the World's Columbian Exposition be continued until the close of the Exposition. I hope that before my motion is agreed to it will be properly considered.

Mr. CURTIS. I believe some action was taken as to that at the last meeting.

The SECRETARY. I would say that I have just found the resolutions referred to, and will read them. They are printed on page 73 of the Proceeding of the Champaign convention:

Mr. Armsby reported for the committee appointed to consider the advisability of a coöperative station exhibit at the World's Columbian Exposition, as follows:

Resolved, That in the opinion of this Association it is advisable to have a coöperative station exhibit at the World's Columbian Exposition.

Resolved, That in order to formulate and carry out such preliminary steps as are necessary during the year, a special committee, with power to represent the Association, be appointed by this convention to coöperate with the U. S. Department of Agriculture, and to take such other action as may be necessary.

Resolved, That the executive committee be authorized to pay from the funds of the Association the actual and necessary expenses incurred by the special committee above provided for, in the discharge of its duties.

On motion of Mr. Turner, the resolutions were adopted.

On motion of Mr. Alvord, it was ordered that a committee of five station directors be appointed by the Chair to carry out the plan proposed in the resolutions just adopted.

The President appointed Messrs. Armsby, Thorne, Morrow, Tracy, and Henry.

That is all that appears as to the permanency of the committee.

Mr. ALVORD. It was then apparently a committee for the year, and should at least be continued now that its report has been received and adopted, as otherwise it will cease with the adjournment of this convention. Hence, my motion is made to bring the subject of its continuance before the meeting.

The motion was carried.

Mr. ALVORD. For the purpose of accomplishing as much business to-day as possible, I will now make another motion, which is suggested to me by remarks made on the floor this afternoon in regard to this Congress Auxiliary. It seems to me that there should be some action by this Association in connection with the subject presented to us; that it is advisable to have the connection between the Congress Auxiliary and our standing Exposition committee maintained. Such action has already been inaugurated through Professor Morrow. In connection with the adoption of Dr. Armsby's report, I move that a special committee be appointed by this Association to coöperate with the Congress Auxiliary in relation to the agricultural congresses proposed, such committee to consist of Professor Morrow, the President of the Association, and the Assistant Secretary of Agriculture.

The motion was carried.

Mr. WOODS. I move that the program proposed by the executive committee be accepted and adopted as the program of this convention.

The motion was carried.

The CHAIRMAN. It will now be in order to discuss the question marked *a* on the program, which is as follows: Is it desirable to have a collective exhibit of the agricultural colleges in the agricultural building of the World's Columbian Exposition?

Mr. ALVORD. To explain the appearance of this subject upon the program I wish to state that through communication with our standing committee on the Exposition it became known that Mr. Buchanan, chief of the department of agriculture of the Exposition, strongly desired that there should be placed in the agricultural building a collective exhibit of the agricultural colleges, whether those colleges were represented elsewhere or not, and he wished to have the matter brought before the present meeting of this Association. Therefore it was put upon the program, and two gentlemen representing widely separated agricultural colleges were asked to consider the subject and be prepared to open the discussion thereon. Neither of these gentlemen is present. If any will volunteer I think the question should now be taken up, otherwise it might be well to go on to the next topic, reserving this for a later time. The topic next in order is the question as to the weather service, which is of interest to the stations as well as the colleges, and preparations have been made for its consideration at any time this afternoon when it shall come up.

Mr. WILLITS. I would like to have it brought up at once, for I wish to be present when it is discussed, and I desire to return to the Department.

Mr. ALVORD. You wish to have the weather service matter first?

Mr. WILLITS. Yes, if the order can be changed. I do not know that it makes any difference which subject is considered first.

Mr. SMITH of Minnesota. I move that we next consider section *b* of the program, passing section *a* temporarily, to be called up later.

The motion was carried.

The CHAIRMAN (reading). *b*. What coöperation is desirable between the colleges and stations and the Weather Bureau of the Department of Agriculture?

Mr. WILLITS. I did not propose to make any extended remarks. It is desirable that there shall be as much coöperation as is possible and practicable. In my opinion there is really no limit to the desirability; but my short experience since the transfer of the Weather Bureau to our Department has shown me that there are difficult questions with reference to this coöperation. I started off with the idea that we ought to make every agricultural college and experiment station a permanent station of the Weather Bureau, fully equipped. In Michigan I organized the State weather service in connection with the State Agricultural College; that is to say, I was then connected with the college, and was the principal factor in getting the appropriation under the charge of the State board of agriculture, the trustees for the college. My idea was that we should have the weather observations and reports made at the station itself, and that the man who did that work should be enlisted in the work at the college, should be a professor of meteorology, and should take the boys in hand and teach them meteorology.

Now that was my idea. It was not completely realized, but we did have more or less of these observations under the eyes and the study of the students. Now I find as a matter of fact that the Weather

Bureau is a great organization, with its stations located largely at commercial centers, and necessarily so on account of the superior facilities for transmitting intelligence. They must be located where the best means of collecting and disseminating the information are available. That is a fixed fact politically, commercially, and in every way, and I find that the drawing power of a State capital or the great commercial center of a State, with its newspapers and lines of telegraph, is altogether stronger than that of any college can be. But unfortunately for this purpose most of our colleges are located at remote points which afford comparatively small facilities for dissemination of reports, etc. Take the case of Virginia, whose college is away off at Blacksburg, 7 miles, I believe, from a railroad; and so, too, in other States we find them scattered around here and there, and this makes it difficult to carry out the program I have in mind. You may ask why we can not have two stations. Well, there comes in the matter of expense. The money is appropriated for the plan as it exists now, and we can not duplicate the work without doubling the expense so far as the stations are concerned. So I have not yet formulated in my mind, in considering this new sphere of departmental activity, any plan by which the idea I had held could be even approximately carried out.

This, however, is true, that so far as may be the Department of Agriculture wishes to be in communication with these colleges and scientific institutions and to coöperate with them in their studies. It wants to have these institutions as a breeding ground for its observers, wherever they may be placed. It was charged by the persons who advocated retaining the service in the Army that the prestige of the service could not be kept up if taken from under the military discipline. Men enlisted for 5 years and stationed at Pikes Peak or in Arizona had only to obey as soldiers, going and staying until their time was up or until they were relieved—an enforced service. We were told that it could never be done otherwise; that if it were attempted we would find plenty of willing people for the desirable places but none for the undesirable ones, which nobody would take unless ordered to them under the Army discipline. But there are in scientific investigation ties stronger than any orders. A young man who understands botany and entomology and all these underlying sciences will be willing to go into the wilderness, at least for a short time, and study Nature as he finds her there. And so I still have the hope that in some way or other we may become so associated with the agricultural colleges in this work that when young men enter the service as observers they will say, "We are ready," and will take up their studies and go, and not simply to serve perfunctorily. We want observers who know something beyond the mere recording of rainfall, temperature, and wind, acting as automatically as do their thermometers and barometers; we want wide-awake young men, with minds willing to study Nature in all her phases, wherever they may be, and in that sense we hope for greater results.

Some days ago I received a letter from Professor Scovell in reference to his own station. I replied that the subject had been referred to the Weather Bureau, and that I would see to it that the Department or the Weather Bureau should be represented here when this topic came up for discussion. Professor Harrington, as I stated a short time ago, leaves to-day for Europe, and Major Dunwoody, acting chief, will not be here until to-morrow; but Professor Harrington has prepared a paper which I would like to have read at this time. I do not know what his plan is, but I know that he feels very much as I do on the subject.

Mr. A. L. Colton, confidential clerk to the Chief of the Weather Bureau, was introduced by the Secretary.

Mr. COLTON. Professor Harrington desires me to express his regret that he can not be here. He left with me a memorandum to be read here by Major Dunwoody, but that gentleman is absent and will not return until to-night, so that the best I can do is to read this rather brief paper, in which my Chief expresses his views upon the relations between the agricultural colleges and the Weather Bureau.

Mr. Colton read the paper referred to, as follows:

METEOROLOGICAL WORK OF AGRICULTURAL EXPERIMENT STATIONS AND AGRICULTURAL COLLEGES, AND THEIR RELATIONS TO THE WEATHER BUREAU.

The relations which should exist between agricultural experiment stations and agricultural colleges and the Weather Bureau are not easy to define. It is not difficult, however, to state what kind of meteorological work experiment stations and agricultural colleges should perform. For two reasons they should not be telegraphic meteorological stations: First, they are not in a position for sending and receiving telegraphic observations generally. The stations where observations are received and sent telegraphically must be selected with reference to ease of telegraphic communication. The requirements of their selection will not usually admit of experiment stations or agricultural colleges. Secondly, some of the work required of telegraphic stations, which must be done rapidly and at certain fixed and often unusual hours, can not well be done at experiment stations or agricultural colleges.

Again, in general, agricultural experiment stations and agricultural colleges should be located in the open country, and therefore can not be made central stations for State weather services. The latter should be located, where possible, at commercial centers.

Nevertheless, there is a large field of meteorological work which agricultural colleges and experiment stations can very properly occupy and which should be assigned them. They should generally be made meteorological stations of the first order, on the international plan, and their special duty should be climatological research. A station of the first order is, in general terms, one where hourly observations are taken and recorded by self-registering instruments. These observations are especially suitable for climatological work; they should be taken in some quiet place; the observer should have ample leisure to watch his instruments and assure himself of their accuracy, and afterwards the observations should be carefully reduced by the observer. All this requires much time and care on his part. The conditions at experiment stations and agricultural colleges are peculiarly adapted to this kind of work, and moreover this work is of especial interest to agriculture. The observations referred to should be published in full and on the international plan.

To this general climatological work these stations should add some special meteorological investigations, such, for instance, as the relation of forests to climate, reactions of the soil and climate, the influence of climate upon vegetation and the influence of vegetation upon climate, the relation of the stages of plant growth to the season, and similar topics. Such work is already performed by similar stations in the Old World, especially in Germany. As an example of what such stations should do in this class of work, I would suggest the investigations carried on at the station at Munich, in charge of Professor Wollny.

It is difficult to say exactly what the relations of the Weather Bureau to these stations should be. The Bureau should undoubtedly furnish the instruments used at the stations, or at least should ascertain their corrections and certify to their accuracy. The Weather Bureau should also have the instruments and the work inspected from time to time to insure uniformity, and the work at the different stations should be planned after that of the Bureau itself. But it is not easy to say what should be done with the results. Purely meteorological results probably ought to be reported to the Bureau, and agricultural work should probably be reported to the Department. It might be well to place the meteorological work of the experiment stations and agricultural colleges under the more direct charge of an officer who should be at the head of a subdivision of the records division of the Weather Bureau. A temporary arrangement of this sort could be made, and this changed from time to time as appeared to be best, until in the course of time satisfactory relations could be evolved.

I will say, in conclusion, that it would give me the greatest pleasure to coöperate with the experiment stations and the agricultural colleges in the pursuit of meteorological work. Any assistance the Weather Bureau could give them would be gladly extended.

M. W. HARRINGTON,
Chief of the Weather Bureau.

Mr. ROBERTS (Vice President Porter in the chair). It seems to me, Mr. Chairman, that we are traveling in the right direction. The Department of Agriculture at Washington should have entire control of the Weather Bureau, and the work should be done at the experiment stations and agricultural colleges. I am somewhat tired of reading that two tenths of an inch of rain fell at Coney Hollow last week, when by climatic influences the storm swept millions of dollars' worth of fruit out of our State, and no true scientific agriculturist, capable of studying, has any means of knowing what effect the climate has in the case. Last year all our apples and nearly all our other fruit crops failed on account of climatic influences; and every week I read in certain papers a crop of Weather Bureau reports of petty things that mean nothing, as it seems to me, or very little. I am not now referring to the Agricultural Department only. I hope that before this convention adjourns it will pass some resolution which may strengthen the hands of the Secretary of Agriculture, and that this whole business will be placed where it ought to be placed and where it can be of the greatest possible good to the country. If it is necessary to telegraph along the coast that there is a storm coming that can be done by the worker at the station, who understands botany, horticulture, chemistry, and a dozen other things. I have now in mind a station where a carpenter goes out and looks into a tube and sends a dispatch somewhere or other, I don't know where, but I don't believe that it helps the farmer at all; at any rate I can not see that it does.

What I mean to say is that the main work of the Weather Bureau should be to define our climate and get the facts with which to go at this forestry question immediately, for that question, as you know, can not be deferred much longer. I believe that if we were to go at the rate we are now going it would be less than half a century before America would have to import her wheat, oats, and cattle. This subject must come, and that very shortly; so it is high time for the Department of Agriculture at Washington to find out the amount of moisture and the amount of heat and the kind of soil, and so on, throughout the various districts of our country, where we need to reclothe the earth with trees. We have a great American desert. The Weather Bureau will never clothe it with trees. If that is ever done, it will have to be done by the Department of Agriculture. I do not care to offer a resolution, but I feel very deeply upon this subject, and I wish that I knew how to change this whole condition of things so that we might get at our agricultural colleges and experiment stations some facts which would enable us in the near future to cover our hills—yes, and even some of our valleys which are worn out—with forestry, with plants. Certainly we are here to take the initiative and get ahead, not to go on in this eternal train. I hope that you, Mr. Willits, will formulate such a resolution as you wish. Do not be ashamed to father it, and I will second it, and do all I can to get it through this organization, to strengthen your hands, so that you may get hold of this whole subject and manage it.

Mr. WILLITS. I do not come forward with any resolution, but on this climatic question I am a good deal of a "crank." The Smithsonian Institution inaugurated this work of receiving reports of observers recording the state of the thermometer, the direction of the wind, etc., and did a grand work, but of course a large mass of unreduced material was accumulated. After a while the Smithsonian Institution abandoned this and the Signal Service took it up, and these collections made from year to year have never been fully reduced or investigated with the idea of finding a climatic law, but largely for the purpose of predicting storms. Now these predictions of storms are important and should not be neglected. You will find it fascinating and charming to take the report and see a storm start in the West and march in a grand sweep across the continent; but I think I speak the sentiment of the Chief of the Weather Bureau in saying that while we do not desire in any way to impair that service, we do desire to ascertain the relations of climate to vegetation, the different conditions, the different laws, and what modifications come from the lakes, streams, and forests, and all that, and to discover some law by which we can determine what can and what can not be done. The other day when I visited the Bureau I found one professor engaged upon a mass of material covering 25 years of observation. His duty is to find in it somewhere the governing law. Twenty-five years is a pretty good parallax, and if you have a man of sufficient brains he can reduce these observations to a law. That is our great difficulty; we can all see that it ought to be done, and an effort will be made in that direction more emphatic than heretofore. That is the great fundamental agricultural question, and what Professor Harrington means is that you should not be made mere instruments for telling by telegraph that a storm is coming, but your brightest minds in the colleges should be set to study meteorological questions with regard to climate, and he is ready to help you by making your institutions stations of the first order and furnishing the necessary instruments.

I have a letter from Major Dunwoody on the subject, and he states it a little differently from Professor Harrington, who was absent at the time this letter was written. I will read it as giving something of Major Dunwoody's idea.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., August 1, 1891.

SIR: With reference to your communication of the first instant (accompanying the letter of Mr. M. A. Scovell, director of the Kentucky Agricultural Experiment Station, asking for the reëstablishment of the station of this service, formerly at Lexington, Kentucky), in which you request a list of all the agricultural colleges now in coöperation with this Bureau as volunteer or actual stations, and suggesting that some line of policy with relation to the general subject of coöperation between the Weather Bureau and the agricultural experiment stations be outlined with reference to the question under that head to be discussed at the meeting of the Association of Agricultural Colleges and Experiment Stations to be held in this city from August 12 to 18, 1891—I have the honor to recommend that the offer be made, on behalf of this Bureau, to furnish the experiment stations and colleges, at the expense of this service, with standard meteorological instruments; that these be visited by an inspector of this service; that the instruments be properly located as prescribed by this Bureau; and that regular reports be made on blanks which shall be furnished by this Bureau. It is suggested that the advisability be considered of having these experiment stations placed in charge, under this Bureau, of the State weather services in their respective States, where it is found to be practicable and advisable. It will probably be found, however, that the cases where this can be done are very rare, for as a rule the headquarters of the State weather services are now well located. The features of collection of reports and distribution of bulletins, warnings, etc., are of the first importance and should always determine the location of headquarters. While, therefore, it may be of advantage to change the location in some cases, the matter should not be disposed of hastily by the adoption of any general rule, as each individual service requires careful consideration. Certainly this Bureau will do everything practicable to encourage the heartiest coöperation between the Weather Bureau and the agricultural experiment stations and colleges.

With reference to the statement required as to agricultural colleges now in coöperation with the Weather Bureau, either as volunteer or actual stations, it is requested that your Department furnish this Bureau with a list of all agricultural colleges and experiment stations, their location, etc., and report will be made of such of them as are in coöperation with this Bureau.

Very respectfully,

H. H. C. DUNWOODY,
Acting Chief of the Weather Bureau.

HON. EDWIN WILLITS,
Assistant Secretary of Agriculture,
Washington, D. C.

Now, as I understand Professor Harrington, his desire, if we may use that term, is to use these colleges and experiment stations as the right hand of the Weather Bureau in studying this very question of climatology, and the meteorology of the locality and its effect on plants, their growth, etc. In a certain sense we are in the dark, but that is the direction in which we are looking, and if there is anything that we can do under the law, with the money appropriated, which will be for the benefit of agriculture, I think I may say that Secretary Rusk will do it every time.

Mr. SMITH of Minnesota. In order to bring the matter to a terminus, I move that the paper of Professor Harrington, together with the prior and subsequent discussion in regard to this subject, be referred to a committee of three, who shall, after consultation with Professor Harrington and other officers of the Department, formulate a plan of coördination between the stations and the Department, and report to this convention at a later stage.

Mr. ALVORD. I second the motion, and would like, if we have time, to say a word or two more on the subject. After thinking of this matter a good deal I do not quite accept Professor Harrington's objection to doing more in the way of telegraphic service from the colleges and stations. When it comes to the matter of printing and distributing reports it becomes important to be at or near commercial centers with good facilities; but the mere matter of telegraphic communication can be as easily established and as well conducted at and from our colleges and stations as at the busiest towns in the States. While the law transferring this service to the Agricultural Department was being formulated and passed, special pains were taken to show the reason why the transfer should be made and what should be expected as its result. I read the law at that time together with others here present, and also with some not connected with our Association. I wish I had a copy of the law here, but without attempting to quote its language I will say unhesitatingly that in two essential places in the act of transfer, one in the enacting clause and the other toward the close, it is stated that the reason for this transfer was to make the weather service of greater use and benefit to the agriculture of this country, and that it was the expectation that the transfer would result in making such developments and improvements in the service as would make it especially valuable to the agriculture of the country, the aim in providing for additional money, etc., being to develop the utility of the service on that line rather than on a commercial line. Now up to this time in the operation of the weather service the agriculture of the country has had all its weather served to it, so to speak, not only from the commercial centers, but from the commercial standpoint, and the predictions generally issued in the several States that have no State services are based not upon observations taken in the country and telegraphed to the commercial center, but solely upon a single set of observations and a single set of instruments located in a large city, which has no sort of climatic relation to the country surrounding it or to the agricultural districts to which they are sent throughout the State. Take Baltimore for example. I will risk the submission of the statement to experts in meteorology, but as an amateur I will venture to prove that the conditions existing at the only place in Maryland where official observations are made upon which to base predictions is so located that its facts of record are contradicted daily by observations just as good, taken at numerous places within a few miles by volunteer observers, who do not report to that central office more than once a week or once a month. I believe it to be true that in the agricultural districts the weather service predictions have been most generally accepted and have proved most reliable and most beneficial to agriculture where a State weather service has been established, having its ramifications in the country and its headquarters at an agricultural college or State university. I could cite many instances exemplifying the fact that the service of most advantage to the agriculture of the respective States of the Union has been a State service under the auspices and general control of officers of State agricultural colleges or institutions of a kindred character. So that I believe the service of the Weather Bureau itself may be expected to improve by taking in these State organizations, and that an effort should be made on the part of the Bureau to establish closer relations with the colleges and stations; and I think that more than is now indicated by Professor Harrington in his communication can be done in the way of bringing these institutions into active coöperation with the weather service, even as telegraphic stations. But there is another point which has been alluded to by Mr. Willits, and is referred to, if I recollect, in Professor Harrington's letter, that I think worthy of consideration, and that is the establishment of relations between the service and the colleges which will make the colleges the recruiting ground for the force of the weather service itself, and which on the other hand will bring in the weather service to the aid of the colleges in perfecting and adding to their meteorological instruction and in interesting the students in this important branch of science as related to agriculture.

One other view of the subject, and then I am done. I do not believe that those who thought the service could be bettered by transferring it to the Department of Agriculture can realize all that may be done for agriculture by the weather service until its sphere is so enlarged as to include what we may call, for lack of a better term, the meteorology of the soil as well as that of the atmosphere—what is called in foreign countries "agricultural physics." I believe that to take observations and have knowledge of the conditions and changes of the atmosphere, and shut our eyes to the physics of the soil and all of its changes and problems, is simply to throw away the time we spend in agricultural observations, because it is to take but one of two successive steps, and that the one of less importance. I believe we must extend this work of meteorology to the consideration of problems in the physics of the soil, and that that is a proper department and branch of this work, since it largely calls for the same men and the same appliances; at least if the service must be organized anew that is the character of organization now in existence which can best be utilized to accomplish the work. I therefore hope that in considering how the new weather service can be made of greater value to agriculture this branch of the subject will be given attention and brought into the work. I think, therefore, that when this discussion is concluded, it should, as suggested by Mr. Smith, be referred, together with the paper presented, to a special committee to report back to the convention.

Mr. SMITH. The subject is of vital importance in Minnesota, which is the birthplace of the cyclone. It is interesting to study the development of the cyclone. Some of our corps have lately witnessed the agglomeration of clouds which resulted in a cyclone. I am interested in this work, and am glad to have made the motion, which, if carried, will refer the matter under discussion to a committee. I wish that it may be thoroughly discussed, and I am sure I express the feelings of all in saying that we are willing to do anything we can as station workers in developing the service, although I do not think we shall have very much control of the weather after all.

Mr. BATTLE. For 4 or 5 years we have had a State weather service connected with the experiment station in North Carolina; it is the meteorological division of the station. Fortunately both the station and the college are located in the central part of the State, at a commercial center, so that we can very easily disseminate to all parts of the State reports as to frost, cold waves, weather indications, etc. We consider ourselves fortunate in this respect. I will state also that we have always endeavored to manage the weather service in the interest of agriculture. We have in different parts of the State meteorological observers, many of whom are the superintendents of the coöperative field tests, so that the meteorology of the various sections can be studied in connection with the growth of the crops. We publish a weekly weather and crop bulletin, made up from the reports received from different parts of the State, numbering nearly two hundred. In this way we can keep track of the growth of the crops and of how they are effected by the weather. The Weather Bureau at Washington has very kindly coöperated with and aided us in all our work. The Bureau has detailed an observer, who is the meteorologist of the station, and pays him for his time and for his work. Without that coöperation we could not maintain the work, and I wish to acknowledge right here the benefits we receive from it.

Mr. FREAR. I desire to add a word in line with the remarks of Mr. Alvord with reference to the location of the Weather Bureau stations as bearing upon their ability to represent the climate of the country. In the first place we well know that the temperature of a city (even though everything be done that is possible, by means of proper shelters, to protect the instruments from direct radiation) is, especially at night, different from that of the surrounding country, owing to the nature of the buildings of which the city is composed. In a city we can not expect to have the same conditions of temperature or humidity, and consequently of precipitation (frost), that we have in the surrounding country. Again, frequently the centers of population and of commerce are similarly situated so far as the general topography of the State is concerned, and therefore fail to represent large regions which are important from an agricultural standpoint. Take our own State of Pennsylvania for example: We have a weather service observer in Philadelphia; we have one in Erie; we have one in Pittsburg. Some time ago it was desired to increase the number, and to have the central mountain region of the State with its rich valleys—very important in the agricultural part of the State—represented. Harrisburg was finally selected as the place. Now Harrisburg is just 100 miles west of Philadelphia, and is situated in a valley in the eastern part of the State, in a region representing that rather than the central mountain part of the State. Attempts were made to have another location chosen. In that case, however, politics entered in somewhat, and Harrisburg was selected. It does not represent the central mountain part of the State, as our State weather service records will clearly show. The Pennsylvania Station has paid a great deal of attention to the matter of weather observations ever since its organization, as indeed did the college before the organization of the station. We have done what little we could in the coördination of observations and crop development, and I am sure I represent the feeling of the station at large in saying that we have tried to do all we could in that direction, recognizing it as an important function. But we feel, at least I personally feel, that the Department and the Weather Bureau can do a great deal more for us in the line suggested by Mr. Alvord than has heretofore been done, and it was my hope when the transfer was made that a distinct effort would be made in this regard, with proper organization, and under proper direction.

Mr. JENKINS. I would like to say one word with regard to those stations where no meteorological work is done. It seems to me that we are waiting for some central office or competent meteorologist to show us a plan by which we can hope to gain something more by making observations than simply filling up our annual reports with the rainfall, temperature, etc. At present there is no one on the station staff who is competent to digest these observations after they are made and make them of practical use. If there was we should certainly go into the business of making observations. Just now the observations for the Connecticut Valley are made on the roof of a tall insurance building in the center of a city. Five years ago, as a concession to the agricultural interests, a rain gauge was put in the center of the green below, and this was at the mercy of every naughty dog that wished to show his spite against the administration. Now, Mr. Chairman, as soon as we can be assured that our observations will have any permanent value, that is as soon as there is anyone in Connecticut or anywhere else who can take our observations and digest them and make such use of them as shall be of benefit to agriculture, we shall be delighted to take hold of the subject. We are favorably situated, not in the city, but close by it; in communication every hour, day and night, with the telegraph office by telephone; we are at a railroad and commercial center, and we wish to do everything we can which will be of any help to the agriculture of Connecticut, but as things have been in the past we have seen no chance of usefulness in making meteorological observations. As soon as the Department of Agriculture can present a plan which shall make it appear that there is money in it for farmers—that any agricultural use can be made of the results obtained—we shall be delighted to coöperate in every way possible, and I presume other stations are situated as we are or I should not have spoken on this matter.

Mr. DABNEY. I think that the Chief of the Weather Bureau has outlined the principles of organization in the paper presented, and that Dr. Jenkins in his remarks has struck the keynote of the work that is to be done. It is well for us in considering the work to be undertaken by colleges and stations to look to our charges—what are we for? The colleges are to teach the science of agriculture and the experiment stations are primarily to conduct the research in those sciences. One way to secure the work to be done is to try to exclude things that ought not to be done. It seems to me that in the colleges we should avoid everything in favor of the commercial part of this work; that we should not do what can be done by any one else. It is an open secret that the chief reason for the transfer of this Bureau to the Department of Agriculture was to make it do good to the farmers and make it a scientific bureau. The Bureau had gotten into working in a routine sort of way, and while it employed experts in Washington, more were needed in the minor positions. The employés (sergeants, etc.) in charge of the smaller stations being mere routine workers, young men having but limited education were taken up and instructed for a few months in the mere processes of taking observations, and were then put into the service. They were not scientific men in any sense of the word; they were merely mechanical workers, and as such totally unfit to do any really good work. In many cases, having no real sympathy with their work—being mere hirelings required to do work certain hours in the day—they slighted it. I have heard jokes about the way they took observations. They frequently guessed at the facts, frequently misread the instruments, and in various other ways made mistakes to be expected of that class of men—not scientific men. These mistakes were often innocent, but there were wicked mistakes too. We believe that will be remedied and that the Bureau will be made strictly scientific. If so, how can we help the Weather Bureau? That is the question.

The first thing, it seems to me, is the need of scientific work and of scientific men to fill these minor positions. Now, it would seem proper for the agricultural colleges to undertake, as has been suggested, the training of these scientific observers, letting this be a part of their teaching. On the other hand, as has also been already suggested, there is vast need of research. The work of the Weather Bureau has been confined too much to the accumulation of data and the publication of warnings, storms, frosts, and so on. It has given us no law, and a vast amount of the material obtained has not been worked up. To-day we know very little about the climate of our country. When it comes to the climate of any particular section of this country it is almost impossible to get any data whatever by which to formulate opinions to determine what crops can be grown there.; so that we must have the beginning of the work in studying our climate in various sections of the country, and it must be begun as a scientific study. This implies a vast deal of scientific research, and it will be necessary to have in the Weather Bureau a scientific department, devoted exclusively to the consideration of scientific questions underlying these laws. The observers might wisely be located at the experiment stations, so that we might have in connection with them well-kept observing stations, with men in charge who could teach in the colleges while carrying on their investigations, just as our other scientific experts do. If such a grand system of scientific research in meteorology is to be established it should have its center in the Weather Bureau and the Government should furnish the means as well as the apparatus. I, for one, think that our college and station would not like to undertake this work unless there were some provision for men to be employed—salaries, etc. We have all we can possibly do now, and I believe that undertaking to do too much is one of the most common mistakes made by our colleges and stations, especially by the stations; we are trying to do too many things. We can not undertake to make research in meteorology without additional aid; we want an expert when we undertake it in our State, and we want the very best instruments. When these are provided we are ready to begin, but not until then.

The CHAIRMAN. The motion of Mr. Smith, seconded by Major Alvord, is for the appointment of a committee to which shall be referred the whole subject, with power to report to the convention at some later time. Shall I put the question?

Mr. WOODS. Was it the intention to have the committee report to this convention or to the Association at a subsequent convention?

The CHAIRMAN. To the present convention.

Mr. WOODS. Was not the name of a gentleman who sails to-day for Europe included in the names of those with whom the committee were to consult?

Mr. SMITH. Yes, Professor Harrington was named, but I said "and other officers of the Department."

The CHAIRMAN. The communication of Professor Harrington, as I understood the motion, was to be referred to this committee.

The motion was carried.

The CHAIRMAN. The committee appointed will be announced at the evening session.

Mr. ROBERTS. I have a resolution that I would like to present, but not for discussion at this time. It is as follows:

Resolved, That this Association most respectfully urge the honorable Secretary of Agriculture to use every honorable means in his power to secure the passage of a law or laws which shall exempt from sale or preëmption all Government forest lands now unsold, in order that all the Government woods, forests, and underbrush may be surveyed and reported upon with the view of preserving and surveying all wood-lands belonging to the Government.

The resolution was referred to the executive committee.

The CHAIRMAN. The next topic is, *c*. Shall this convention hold an adjourned session at some other place the present year? If it is your pleasure to take that up now for consideration, the matter is before the Association.

The SECRETARY. It seems to me that had better come up in the latter part of our work, when we have some unfinished business. I move that it be deferred to a later time.

Mr. ALVORD. Allow me to suggest that this is one of the few opportunities we shall have for discussion and there is plenty of time before 5 o'clock.

The SECRETARY. I made the motion because something may arise to make us want a meeting in November, although I think we can get through with all our business here and shall not want another session.

The motion was lost.

Mr. ARMSBY. I move that the convention do not hold an adjourned session during the present year. I do not make this motion in any sense as a criticism upon the action of the executive committee in bringing up this question, but partly to bring the matter before us in parliamentary form and partly to express my own opinion as to the desirability of holding an adjourned session.

The SECRETARY. That motion if carried will not prevent a called meeting, I suppose?

The CHAIRMAN. No; the question before the Association is upon the motion that it is the sense of the convention that another meeting of the Association during the present year is unadvisable, unless it be a meeting called by the executive committee.

The motion was carried.

EVENING SESSION, WEDNESDAY, AUGUST 12, 1891.

The convention was called to order by the President at 8 p. m.

The PRESIDENT. The first 15 minutes will be devoted to general business. I will call on the chairman of the executive committee to read the roll of delegates.

Mr. Alvord read the roll as it stood at the time. (For complete list see p. 13.)

The PRESIDENT. The committee on the work of the Weather Bureau will consist of Messrs. C. D. Smith of Minnesota, A. W. Harris of the Office of Experiment Stations, and H. E. Alvord of Maryland.

Mr. ARMSBY. The report of the executive committee, presented this morning, contained a number of important recommendations to the Association upon which no action was taken. I move that a special committee of three be appointed by the Chair to take that report under consideration and report thereon to the convention.

The motion was carried.

The PRESIDENT. The Chair will announce the committee a little later.

The President then addressed the convention as follows:

GENTLEMEN OF THE ASSOCIATION: The great apostle of German materialism was wont to say in his lectures, "Miracles, gentlemen, are like pills, to be swallowed, not chewed." He was dealing with the supernatural and what is contrary to natural law. But in the vast realm of Nature and the investigation of her phenomena, the miracles daily performed before our eyes can not be carelessly disposed of in a moment, swallowed without consideration. The unrolling of the leaf, the budding of the flower, the maturing of the perfect fruit, the wonderful adaptation of parts to specific ends, the differentiation of various organs, as the filaments of certain plants for tactile organs, the lobes for capturing insects, and the glands for secretion and absorption—all these require the most careful and patient observation; all natural phenomena have their physical and natural causes, and to find out these underlying causes is often a morsel of the toughest kind, to be turned and re-turned, again and again before the final act of deglutition takes place and we are prepared to hazard an opinion. And these adaptations of nature are as countless as the sands upon the shore, each one in itself a wonderful physical miracle, only to be interpreted by the patient worker.

We are tempted to exclaim in the words of the magic song where Mephistopheles draws wine out of the table in Auerbach's cellar:

Wine is grapes and grapes are wood,
The wooden board yields wine as good.
It is but a deeper glance
Into Nature's countenance.
All is plain to him who saith,
"Lift the veil and look beneath,
"And behold," the wise man saith,
"Miracles if you have faith."

The rapt seer, looking over the broad field, exclaimed: "Animate and inanimate creation are mountainous and glittering with them. Down into the regions of the infinitely small, whither only the most searching microscopes carry the sight; up into the regions of the infinitely large, whither only mightiest telescopes lift our struggling vision; among the mechanisms of the atomic hosts that people a single leaf and among the mechanisms of those swarming celestial empires whose starry banners sweep our nightly skies, it is everywhere the same"—exquisite adaptations crowding exquisite adaptations; means so exquisitely adapted to the end that every part stands in the most perfect balance and adjustment to the other. What more perfect illustration of this correlation of parts can be presented than in the family of the Vandeæ, where the related positions and shapes of the parts—the friction, viscidity, elastic and hygrometric movements, all nicely related to one another—come into play. Yet all these appliances are subordinated to the aid of insects; for when the retreating insect, having satisfied its quest, gradually worms its way out, the labellum springs back into place, the lip of the anther is lifted up, and the viscid mass from the rostellum, forced into the anther, glues the pollen mass to the insect and thus insures its transportation to some other flower.

Darwins and Müllers, it is true, are not born every day, but every man has within him the same elements of success if he will only use them aright, bringing to bear upon each problem the same patient, intelligent observation, adding link to link, till at last the lengthening chain stands perfect and complete. And yet there will always remain some problems that will baffle the closest scrutiny. "The deeper science searches into the mysteries of nature, the more clearly it evolves the symplicity of the means used and the infinite diversity of results. Thus from under the edge of the veil which we are enabled to lift a glimpse of the harmonious plan of the universe is revealed to us. But as for primary causes, they remain beyond the ken of mortal mind; they lie within another domain; which man's intellect will ever strive to enter and search, but in vain."

The German scholar who after a life of patient study of a single word, the relative pronoun, regretted on his deathbed that his efforts had been scattered and that he had not confined himself to a single letter of the Greek alphabet, is but a type of the labor required in establishing a single fact. Diffusion is weakness; concentration, strength; and the man who with divided energies studies a mass of facts is outstripped in the race by him who confines himself to one. It takes 10 years at least, said President Clark, to establish one agricultural fact, but it is on the aggregation of facts that stable law depends, and although we can not always see the immediate practical value of the addition of a new fact to the fund of knowledge, still no one can ever tell how much vital importance is hidden in it. The boy dallying with the steam issuing from his mother's teapot established the fact of its condensation, and forthwith became possible its application to all the tremendous enginery of modern science. Nor should a fact be despised because of its apparent triviality. The great father and founder of fruitful investigation, Lord Bacon, says: "The eye of the understanding is like the eye of the sense; for as you may see great objects through small crannies or levels, so you may see great axioms of nature through small and contemptible instances."

Not a single physical science can be named that has not been built up by the labors of men who were seeking for truth while those very labors were considered puerile and ridiculous by mere utilitarians. Every scientific truth, it has been aptly said, has to pass through three initial stages before it can be firmly established: First, that of denial and ridicule by the world; second, that of acceptance; and third, that of calm assumption that it has always been so. We are told that Pythagoras, when he discovered that the square of the hypotenuse was equal to the sum of the squares of the other two sides, offered up a hecatomb in grateful recognition of what had been vouchsafed him, since which time whenever a scientific truth has been discovered the oxen have always bellowed. The best scientific results of the present day which have not yet borne fruit—the questions that engage the attention of our scientists—are recounted with the same sneers and ridicule by those who claim to be practically wise as were observations in geology and experiments in electricity a century ago. "Every great advance in practical science in the last half century has been simply the combining or utilizing of materials and results wrought out as isolated products of facts, after long years of careful investigation, by the patient truth searchers in all portions of the world." The studies of Franklin, Volta, Arago, Henry, and Faraday in accumulating facts, discovering laws, and inventing instruments, made the electric telegraph a possibility in our day.

Those men prosper best in this world of universal inquiry who sit silent, watch longest, and accept most quickly each suggestion of change. The thrifty trees hug the earth and rocks with a thousand rootlets, feed on air with ten thousand leaves, and feel everywhere through and through them the throbbing force of life, but who can tell the countless generations through which they have stood, silently drinking in the sunshine of heaven and gathering and maturing their strength.

All theories are open to ceaseless inquiry and correction and we can expect to progress only by the patience, the breadth and the sagacity of our work in uncovering laws and methods of life in themselves very secret and obscure.

The fundamental working conceptions of science change with the changing knowledge of the facts they interpret, but the foundation remains the same, and he interprets best who penetrates most deeply to its heart and questions most closely its workings. The good agriculturist stands in a kind of awe of living things. He is diffident in the suggestions he makes to them, and if the hint is not taken he withdraws it at once. If any predisposition appears, he humors it immediately and is ready to stand a quiet observer in the presence of the putting forth of vital powers.

Variety is the initiatory step of all progress, and we may thankfully accept a score of unimportant foundlings, if after repeated failures we succeed in producing one serviceable one of lasting benefit to the human kind.

But the world is too impatient for results—like the Athenians of old, madly rushing about, ever seeking for something new. Progress is the cry of the age, progressive thought the pet pride of to-day. The charm of antiquity is broken. The historic tales of our childhood have faded into myth before the cold scrutiny of modern learning. The idols of the past are overthrown and trodden underfoot by the iconoclasts of the present. No doctrine is too sacred, no dogma too hoary for the levelers of to-day. Every year, nay every month, witnesses the birth of some new theory, some grand discovery in the laws of Nature, who in her old age seems as prolific of law as a continental congress. New creeds, new sciences, new methods are springing up like the fabled race of heroes from the uncanny sowing of the dragon's teeth, and all under the glorious reign of progressive thought. Well will it be for us if in this universal demand for something new, something strange, something out of the beaten track, we can heed the lesson of the hour and patiently watch and wait—watch though the world deride our waiting; wait till the harvest crowns our watching.

From the "seely wench," who, according to Platt, taught the art of setting corn by accidentally dropping some wheat seeds in holes into which she ought to have dibbled carrots and radishes; from the sowing of potatoes broadcast and the drawing of plows and harrows by the tails of the unfortunate horses in the eighteenth century, to the drilling and the sulky or steam traction plows of the present age, is indeed a great advance. The patient workers in this our chosen field have not been many, at least till we come down to our own time, and too often, alas, to quote the spirited words of another, "like the ancient alchemists have starved in the midst of their golden dreams. Tusser, teaching thrift, never throve. Gabriel Platter, the corn seller, who boasted that he could raise 30 bushels of wheat to the acre, died in the streets for want of bread. Jethro Tull, instead of gaining an estate, lost two by his horse-hoeing husbandry. Arthur Young failed twice in farm management before he began his invaluable tours of observation," and Bakewell, irrigating his meadows and raising four crops in a single season, was compelled to give up his farm, and died in comparative poverty. But each one has lifted the veil a little higher and left the way a little clearer for those who followed him. Tull, experimenting in drilling and horse-hoeing husbandry, all but divined the mysteries of chemistry, which then, as applied to agriculture, were undiscovered. Thaer, applying the natural sciences to agriculture, established a system of farm accounts, placing values on the various farm materials, and introduced the great principle of rotation of crops. Bakewell, discovering the principle of selection in breeding, raised to the highest pitch of perfection his flock of Leicesters. Stock husbandry rose at a single bound and henceforth the "promiscuous union of nobody's son with everybody's daughter" was at an end. Davy, by his chemical analyses and explanations of agricultural processes, laid broad and deep the foundations of agricultural chemistry. Liebig, teaching the applications of chemistry to agriculture and the nutrition and growth of plants and animals, inaugurated the era of progress of scientific agriculture. Boussingault, whose careful analyses and experiments in connection with his investigations into the sources of the elements of nutrition for plants and the value of food rations for animals, led the *Agricultural Gazette* to say of his Economie Rurale that it was the most important and valuable book for farmers the chemists of the present century have produced. Stöckhardt, popularizing agricultural chemistry by his lectures and his writings; Mechi, laying down the rational principles of farm management; Henneberg, unfolding the mysteries of the physiology and economy of feeding farm animals; Ville, teaching the principles of complete manures; Grandeau, teaching the analytic methods of agricultural chemistry; Dehérain, for years conducting exhaustive field experiments; Maercker and Wagner, studying the application of potash, nitrogen, and phosphoric acid to the growing plant; the two Kühns, working in the respective fields of the physiology of cattle feeding and the chemistry of the respiration of animals; Wolff, in food rations, Pettenkofer in respiration; and the lengthening list closes with the name of one whose carefully conducted experiments for half a century have made the estate of Rothamsted a shrine for all true workers in the science of agriculture—a Mecca to which the devout repair as do the followers of the prophet to their holy city.

Fifty-seven years ago Sir John Bennet Lawes, entering into possession of his estate, commenced a few experiments on the effects of different manures upon potted plants and afterwards upon plants in the field. Led by the striking results obtained to carry on the same line of investigation on a broader scale, 9 years later he associated with himself Dr. Gilbert, turned a barn into a laboratory, and commenced that series of patient and exhaustive experiments which have won for him and his work a world-wide reputation. From the few experiments with potted plants of 1835 and 1836, and from a single associate working in a barn used for chemical purposes in 1843 his station has risen in staff and equipment to one of national importance, with its 60 or more broad acres permanently set aside for agricultural experiment; its trained staff of workers, chemists, botanists, veterinarians, computers, and recorders; its laboratory, presented by interested agriculturists in recognition of the importance of his work; its munificent endowment; its collection of over 40,000 bottles, containing the results of thousands of analyses, samples of the various animal and vegetable products, ashes, soils, etc., connected with the various experiments; and last, its manuscript library, a marvel in itself—thousands of pages, classified and indexed, containing a complete record of every ascertained fact; a life history, if we may so term it, of every experiment undertaken; a mass of all conceivable data on a great variety of subjects, tabulated and arranged for ready reference.

The chief work of Rothamsted may be said to consist of the classic investigations on—

(1) The assimilation and sources of nitrogen.
(2) The growth of mixed herbage on permanent meadow.
(3) The growth of wheat.
(4) The growth of barley.
(5) Animal composition and nutrition.

But the work has been by no means confined to these lines, as the following brief analysis of the subject matter of the papers to be found in the Rothamsted memoirs will clearly show. These memoirs consist of nine volumes, primarily having a fourfold division, thus:

(1) Original reports of investigations.
(2) Studies of special questions based on experiments at Rothamsted and

elsewhere; reports to Parliament and other bodies; and polemic articles, especially those written in the controversy with Liebig over his mineral theory.

(3) Abstracts of longer Rothamsted articles.

(4) General reviews and lectures, as for example those delivered at Oxford University, before the British Association for the Advancement of Science, the Royal Agricultural Society, and various farmers' clubs.

Of the nine volumes constituting the memoirs, three quarto volumes of 831 pages contain full reports of the three most celebrated Rothamsted investigations on the assimilation and sources of nitrogen, the growth of mixed herbage on permanent meadow, and animal composition and nutrition; and the remaining six octavo volumes of about 2280 pages are collections of variously printed and separately paged pamphlets.

The authorship in most cases is that of Lawes and Gilbert, either conjointly or separate.

Dr. Evan Pugh, late president of the Pennsylvania State College, was associated with them in the nitrogen investigations. In the more recent publications Mr. Warington's name appears, either alone or associated with those of Lawes and Gilbert. Since the first paper on agricultural chemistry, in 1847, one hundred and twelve have appeared on the following subjects:

Agricultural economy	3	Barley	4
Agricultural science	2	Leguminous crops	3
Agricultural chemistry	5	Turnips	2
Value and utilization of sewage	6	Potatoes	2
Rain and drainage waters	4	Vegetable physiology	6
Nitrogen of vegetation	10	Composition of certain animals used as human food	17
Soils and manures	11	Feeding experiments with sheep, pigs, and oxen	10
Grass	4	Miscellaneous	3
Mixed herbage	5		
Wheat	15		

Rothamsted has from the outset—and for nearly half a century—voluntarily placed itself at the disposition of the advocates and practitioners of advanced agriculture. Scientific and practical problems as offered have been accepted and faithfully and exhaustively worked out, regardless of expense either in time or money. Practical agriculture in all its possible bearings is represented in the publications, and hence the variety of the style of its writings, suited to the education of an audience at Oxford or to a farmers' club. All things have been laid under contribution and made to minister to it. The earth, the air, and the water have in turn given up their secrets. Like the All-Seeing One, the hundred-eyed Argus of antiquity, or Briareus of the hundred hands, it has suffered nothing to escape its close scrutiny and inquiry. From the pure raindrops of heaven to the drainage waters of the earth, and from the capture and imprisonment of the free nitrogen of the atmosphere to the composition, utilization, and value of town sewage, it questions them all, and whether they answer in the tongue of the chemist, the botanist, or the engineer, the answer has invariably been in the direct interests of practical progressive agriculture.

The value to agriculture of the work already accomplished is well-nigh incalculable. Far less can be estimated that of the future, for which, in the will of the generous founder, ample provision has been made. Of its immediate importance, English agriculturists speak in no uncertain terms. The author of the Pioneers and Progress of English Farming, referring to the experiments of Sir John Bennet Lawes and Dr. Gilbert, says: "The triumph of chemistry is summed up in the system of successive cropping without impoverishment, which has been established by them. It is difficult to estimate the enormous influence which their experiments have already exercised upon farming, or to assign limits to the increased productiveness of the soil which England might have witnessed but for the disastrous period of 1873–89."

Gentlemen of the Association: In my feeble way I have endeavored to outline to you the great work accomplished at Rothamsted. I have likened that station to Argus of the hundred eyes, to Briareus of the hundred hands. Those mythic impersonations of power and sight were dependent each of them upon the individual eyes and hands which went to make up their being. In like manner the strength of the station depends upon the individual character and make-up of its staff.

We have with us here to-night an eye and hand of Rothamsted—an eye which has not sought in vain the interpretation of Nature's problems; a hand which has most skillfully assisted the eye in these interpretations.

The President then introduced to the Association Mr. R. Warington, who delivered his lecture entitled The Rothamsted Experimental Station.*

At 9:35 p. m. the convention adjourned until the following evening at 8 o'clock.

EVENING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order by Vice President Porter at 8:15 p.m.

The CHAIRMAN. Gentlemen, it is a little past the hour appointed for our meeting. Before the commencement of Mr. Warington's lecture the executive committee has some business which it wishes to present. We will attend to that first, and then proceed to the lecture.

Mr. ALVORD. I desire first to make an additional report from the committee on credentials as to the list of delegates. If any gentlemen have come in to-day I would be glad to have their names to add to the list as made up last night.

There is a clause in the constitution providing for the special admission to temporary membership in the Association (that is, during the life of one convention) of schools and colleges not eligible to regular membership under the constitution, and some of those institutions are represented here. The committee recommend that the following resolution be adopted:

Resolved, That there be admitted to representation in this convention the delegates present from the Agricultural College of Ontario at Guelph, the Storrs Agricultural School of Connecticut, and the State Agricultural School of Rhode Island.

The motion was seconded.

Mr. MORROW. While I think that we all recognize the fitness of the motion, I wish to express my individual gratification at this timely action of the executive committee, particularly with reference to our friends from across the line, and to say that both yesterday and to-day we have had most excellent help from the gentleman from Guelph, especially in the section on agriculture.

The motion was carried.

The CHAIRMAN. Gentlemen, we most cordially invite you to take seats with us at this time, and to participate in all the meetings of the Association.

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* This series of lectures is published in Experiment Station Bulletin No. 8 of the Office of Experiment Stations of the U. S. Department of Agriculture.

Mr. MILLS. In behalf of the institution which I have the honor to represent, and I may say in behalf of the Government of Ontario, I wish to return my sincere thanks to you, Mr. Chairman, and to the members of the Association for so kindly admitting me to membership in your body. I have thought for some time that I should like to be in some way connected with this great organization, which certainly represents the most important industry on this continent. I have no hesitation in saying that I am particularly gratified at the cordial invitation from this convention.

The CHAIRMAN. I will say to President Mills that himself, his institution, and the work they are performing are not strangers to this Association.

Mr. Alvord read the following communication:

STRAFFORD, VERMONT,
August 12, 1891.

MY DEAR SIR: I have received the finely engraved and superbly framed resolutions adopted November 13, 1890, by the Association of American Agricultural Colleges and Experiment Stations at Champaign, Illinois, expressive of their appreciation and thanks for my early legislative services in relation to the land grant colleges, and in the recent act of Congress for their more ample endowment; and I tender my grateful acknowledgment for the distinguished honor bestowed, and also to you, Mr. Secretary, and to your President for the courteous manner in which it has been communicated. I shall through life feel an abiding interest in the success of each one of the land grant colleges.

With great respect, I am,
Very truly yours,
JUSTIN S. MORRILL.

Major HENRY E. ALVORD,
Secretary of Association of American Agricultural Colleges and Experiment Stations, Washington, D. C.

Mr. ALVORD. Now to expedite business, as we shall not have another general session until to-morrow evening, I move that the president of the Association be authorized to appoint a committee of seven to nominate to the convention officers for the ensuing year.

The motion was carried.

Mr. ARMSBY. I desire to offer the following resolution for reference to the executive committee:

Resolved, That the executive committee elected at this meeting be authorized to appoint three delegates with power to represent the Association and to coöperate with similar representatives of the Columbian Dairy Association and of the various breeders of dairy cattle, in formulating rules for the conduct of the proposed tests of dairy breeds at the World's Columbian Exposition.

The SECRETARY. I have an announcement to make. The members of the Association are invited by Mr. E. A. Von Schweinitz, chemist, to visit the new chemical laboratory of the Bureau of Animal Industry at the Department of Agriculture.

President Goodell has appointed as the committee to take into consideration the recommendations made by the executive committee, Messrs. H. P. Armsby of Pennsylvania, H. B. Battle of North Carolina, and C. H. Pettee of New Hampshire.

Mr. Warington then delivered his lecture entitled The Circumstances which Determine the Rise and Fall of Nitrogenous Matter in the Soil.

At 9:20 p. m. the convention adjourned until the following evening at 8 o'clock.

EVENING SESSION, FRIDAY, AUGUST 14, 1891.

The meeting was called to order by Vice President Porter at 8 p. m.

The CHAIRMAN. There are some matters of business to be attended to in general session before we call upon Mr. Warington for his next lecture. The president of the Association, Dr. Goodell, who, as you are aware, is obliged to be absent on account of illness, has presented the names of the nominating committee. The Secretary will please read them to the convention.

The SECRETARY. The names of the nominating committee are as follows:

F. A. Gulley of Arizona, W. H. Brewer of Connecticut, J. E. Hollingsworth of Texas, E. B. Voorhees of New Jersey, S. M. Tracy of Mississippi, J. W. Hatch of Virginia, and E. A. Popenoe of Kansas.

The CHAIRMAN. The members of this committee will please take notice that it is desired they should meet early in the morning and report at the 2 o'clock session to-morrow afternoon.

Are any of the special committees prepared to report?

Mr. SMITH of Minnesota. The committee to which was referred the matter concerning the Weather Bureau is prepared to report.

Mr. Smith read the report of the committee, as follows:

Your committee having considered the matter referred to it, being the communication from the Chief of the U. S. Weather Bureau and the discussion thereon in the general session of the twelfth instant, and having conferred with the Acting Secretary of Agriculture, as instructed, respectfully reports the following resolutions and recommends their adoption, as the view of this Association upon the subject:

Resolved, That in the future development and extension of the Weather Bureau in the special interests of agriculture, the Bureau should organize and assist in maintaining a study of climatology in its relations to farming, in coöperation with the agricultural colleges and stations, and that the sphere of this work should be enlarged to include the physics, conditions, and changes of agricultural soils.

Resolved, That a special committee be appointed by this Association to confer with the officials of the Department of Agriculture in furthering the object stated and in bringing the same to the attention of Congress.

CLINTON D. SMITH,
A. W. HARRIS,
HENRY E. ALVORD.

It was moved that the report be accepted and that the resolution embodied in it be adopted.

Mr. EMERY. Before the vote is taken I would like to say a few words in regard to some strictures made upon some of the observers in the Signal Service. The strictures made in the discussion the other day were, in my opinion, unjust, and I think that they should be refuted. In the Signal Service there are a number of men, though not a large number, who enlisted from our agricultural colleges. These men have prepared themselves in as many branches of science as many of the men on this floor to-day, and I believe that their ability to make careful scientific observations of a higher order than the mere reading of instruments is as great as that of most of us. Wherever they may be located their work may be depended upon as being well done by men of careful, conscientious habits and real ability.

The motion was carried.

The CHAIRMAN. The motion carries with it the appointment of the committee. How shall that committee be appointed?

Mr. ALVORD. By the Chair.

The CHAIRMAN. I will appoint Messrs. H. E. Alvord of Maryland, A. W. Harris of the Office of Experiment Stations, and W. A. Henry of Wisconsin.

Mr. ARMSBY. The committee to which was referred the report of the executive committee has a very brief report to submit.

Mr. Armsby read the report, as follows:

Your committee, to which was referred the report of the executive committee, in presenting its recommendations, based thereon, desires to express also appreciation of the very faithful and satisfactory manner in which that committee has performed the duties intrusted to it.

It is recommended—

(1) That in accordance with the recommendation of the executive committee, each institution eligible to membership be invited to contribute $10 to the treasury of the Association during 1892, the same to be paid as early in that year as practicable.

(2) That in lieu of making any changes in the constitution at the present meeting, the executive committee to be chosen at this meeting be instructed to take into consideration the question of revision of the constitution, to present to the members of the Association in connection with the program of the next annual convention a statement of any amendments which they deem desirable, and to provide in the program for discussion of and action upon the same.

Respectfully submitted,

H. P. ARMSBY.
H. B. BATTLE.
C. H. PETTEE.

Mr. MORROW. I move that the report be accepted.

The motion was carried.

Mr. MORROW. The illness of Professor Plumb, chairman of the section on agriculture, has prevented him from completing a formal report of the work of that section. He has even been unable to preside at our meetings during the present session. As the President has designated an hour this evening in which agricultural topics can be considered, the section has desired me to say that the subject it will present to the general session for debate is topic No. 5 on the program, How can the results of work be most successfuly presented to the farmer?

The CHAIRMAN. Gentlemen, before entering upon the discussion of this topic, permit me to call the attention of the members to the necessity of observing the standing rule of the Association limiting speakers to 10 minutes. This will be necessary in order to cover the ground in the 1 hour allotted to us, so as not to extend the discussion so late into the evening as to interfere with Mr. Warington's lecture. I believe Mr. Roberts is the first speaker.

Mr. ROBERTS. Mr. Chairman and Ladies and Gentlemen: The time allotted, 10 minutes, is entirely too short to allow me to even hint at what should be done in order to reach the farmer, because that is the objective point. If we do not reach the farmer and interest him we fail very largely in our office. I judge it goes without saying that underneath this question, or reading between the lines, we suppose we have something to say to the farmer in which he is or should be interested; so that possibly it is our first duty to find out whether we have anything to say that is of value, for if not we had better be quiet.

Second, we should understand as far as possible who this farmer is, his environments, and conditions. I take it that the American farmer as a rule is a man who in his youth ceased going to school at 14, 16, or 18 years of age, and that nine tenths of our farmers went no further than the district school, while the other tenth, or a large part of it, went to the academy, and one in five hundred or a thousand went to college. Now these are the people with whom we have to deal. They left school and went to their homes upon the farm. There, with but little knowledge and with strong muscles, they worked many hours a day. They did little in the way of studying and many of them did less in reading. In this land to-day there are thousands of farmers who have not a single newspaper in their homes. Now this is the class of men that we are to approach. He knows a good deal notwithstanding all these conditions. If you or I go out to trade horses with him he will get the best of the bargain. Why I have heard that there are farmers' sons so sharp that two of them could trade horses with each other and make $5 apiece. You go out with one of them to judge a sheep or the yield of a field of wheat, and you will find that his judgment is better than that of the professors of agriculture in the various States; it is more likely to be correct. How did he get this information? He did not get a knowledge of the horse by reading Youatt or by going to a veterinary college, and he did not get his knowledge of the wheat field by conducting a thousand experiments on plats. He got his knowledge by comparison, through the eye. That has been his means of education—the comparison of things with one another, and all through the eye. Of many of these things he does not even know the proper names, and yet he is an excellent judge of many things with which we have to do on the farm. So I say that we must approach this farmer, if we are to approach him at all, through the eye; we must approach him by object lessons, and almost never by abstract reasoning, by which we can do nothing at all with him.

Those who have had the privilege of a liberal education in classical colleges can reason quite as well without the blackboard, the picture, the two lines (one longerth an the other), etc., having a command of language which enables them to choose the right word for the right place and make themselves clear in a word picture. The farmer can not make a word picture, so we must do it for him. Therefore to reach the farmers we must illustrate, using more pictures and less words, more lines of different angles and less figures. I think you will bear me out in the assertion that in order to get a man interested you must attract his attention with something a little novel. Now it may not be very dignified, I will admit, to take a photograph of a pig, old and very lean and an uncouth object, with a man holding on to one end of a rope, the other end of which is attached to the pig's hind leg; but though it may not be dignified, its effect may be powerful. When the farmer opens the bulletin his attention is attracted, and that is what we want, so that he will not throw that bulletin into the waste basket, but will begin to read. So I should say that you can hardly go amiss in illustrating.

Is my time up Mr. Chairman?

The CHAIRMAN. The constitution allows a double ration of time to those who open these discussions. You have 20 minutes, sir.

Mr. ROBERTS. Another thing is this: A man who has been educated in a college where they taught Latin, Greek, and mathematics principally, and where the student all the way through every term had to hold himself down to hour after hour of consecutive mental effort—that man, I say, can pick up a long bulletin, an essay full of abstract reasoning, and feel himself interested. Suppose it is on fruit and he is interested in that, and has had that preliminary training, he will read a hundred pages, figure it all out, arrange it for himself, and be ready to give it to his neighbor. Not so the farmer. He, a busy man, has been used to reading small paragraphs in the paper. So the bulletins must be short. To illustrate that, we have two bulletins in the press, and we are afraid to send out the two in one envelope, although it would be considerably cheaper to do so, saving a good many dollars, so we have decided to send them out in separate envelopes, although ready simultaneously. The idea is that if we send to that poor, tired man, who reads but little and judges everything by the eye, two bulletins at one time, in one envelope, he will probably read neither of them. So I must reach him with just a few leaves. It seems to me that is the way.

Again, I must reach him often. Remember what his avocation is—up at early dawn; work before breakfast; work until dinner; work until night—until 6 o'clock, and at this time of year often until dark. The mail comes home; some one has been to town and brought it back.

He takes up a bulletin that is nearly all solid figures. Now it may be very good, but it is nearly all solid figures, with nothing to break up the monotony of the page. That bulletin is never read. The bulletin must be of such a character that the man who gets it will read it. In the first place it must be respectable, because a farmer likes things that are respectable. The neater it is and the better the paper, the better it will stand up; the more artistic it is in its presswork, the better he will like it. He will pay attention to it. It is just the same with him as it is with the clerk down here at the hotel. You walk up; the clerk looks you over when you ask for a room, and he says, maybe, "You may go in room 999 in the attic." The next man comes in, asks whether he can be accommodated, and is told, "Yes, sir; we have a very fine room down on the lower story." The clerk is entirely unacquainted with the two men. He judges them by outward appearance, and nine times out of ten he judges right. Once in a while, perhaps, he gets a senator up in the attic, but not very often. So you must dress up. If you are going away from home you dress up a little. Dress your bulletin up; it is going away from home. A short time ago I spent nearly all the spare time I had in 2 days deciding whether I should save about $150 by doubling my bulletins over in the wrappers and putting cheap paper around them. I took one of them that has a half-tone print in it. I doubled it up and did it up ready for mailing, and looked at it, and said: "That is a bad expenditure of money; there is that picture that Professor Bailey has taken so much pains with, and I have ruined the whole thing. I will buy 100,000 envelopes and I will not fold that bulletin. I want to have it dressed up so the farmer will see that it is respectable and will think it has come from a respectable place, as it has." All these things have a tendency to interest the farmer.

Now I will inquire as to what kind of thing we shall send him. What shall we send him in order that we may reach him successfully? We must send him a great deal of matter, but the question implies that we are to reach him, attract his attention, teach him, and cause him to act. Are we to send him scientific investigations that are so deep and so abstruse and abstract that he does not know how to bring them together and use them on the farm? Those experiments are probably the most valuable experiments the stations are conducting, but somehow or other we have either got to wait until we lift our audience or until the writers of the bulletins get skill enough to present these facts, that are so difficult to present, but are so valuable, in such a way that the farmer will comprehend and appreciate them. Talking to him in Latin is not of the slightest use, and a great table that is not condensed and that is not thought out for the man is Latin. It is Latin to the average farmer and it is Latin to the average city man, here in this town, in my own town, and in all of your towns. There is only one in ten who can take up a bulletin full of figures not boiled down and not illustrated in some way or other, and understand it. A farmer is no worse in this respect than a laboring man of any other avocation. They are all busy. Then the bulletin must be so short that when the tired farmer comes in from his work in August, July, or January he can read it even before he gets his hands washed and his supper eaten. There is something about that little visitor—it is an unexpected visitor, and is dressed up so nicely—that attracts his attention, and he has read it before he lets his tea get cold, because there is so little of it; and he understands it, and he sticks it in his pocket, and to-morrow you will find him reading it across the fence to the farmer who is his neighbor. I know of bulletins from several stations that have been reported to me as having been carried in the pocket of the man who first received them until he reached the next farmer, and so on, the bulletins being passed on, and on, and on again until one had been read by 20, 30, or 40 farmers; and back came the postal cards to the stations saying, "Send those bulletins."

One more point, and then I am through. Shall we reach everybody? If we were to take a list of the farmers in the State of New York and send each of them a bulletin, and send one copy also to each of the one thousand seven hundred and odd papers in the State, as we are compelled to do by the law, we would not have money enough to do the publishing and do it well. Fifteen thousand dollars will not send twelve bulletins such as we are now publishing to every farmer and every newspaper, besides the few we send to other States and to foreign countries. Now what are we to do? Why, we must use the press, and the press is glad to be used, and probably it is now no secret that in our first bulletins we got out three sets of cuts, knowing, expecting, that we would have to use the press, and that the newspapers would be glad to serve us if we used them right; and so our cuts have been from Ithaca to California, and to Australia. I think that other stations can say the same. I do not know, but I think they have done the same thing, furnishing the cuts, and in some cases furnishing advance copies of bulletins to any papers applying for them, and telegraphing them when they might let the copies go. We know that our first bulletins reached 600,000 interested readers, and how could that have been without the valuable press? And I think other stations have done as well as we have. Now there are lots of farmers who do not want your bulletins at all; they do not thank you for them; they do not believe in you; you part your hair in the middle and get high salaries, and they propose to go right on in the old-fashioned way. Well, I say, let them go; I am not going to worry about it at all. I do not want to send a bulletin to every man, and would not if I had them to send. Such men must wait until the atmosphere is right, and then they will read For the present "Ephraim is joined to idols; let him alone."

Mr. Scott of New Jersey. In the very interesting and emphatic speech with which this discussion has been opened, I think the strongest point made was that the communication should be as direct as possible;

but in all that was said by Mr. Roberts, and I listened carefully, I heard no word as to the personal communication between the farmer and those who are engaged in the work of investigating, and also, I may assume, in the work of instruction, for as I understand it this discussion brings in the college as well as the experiment station. That, it seems to me, is a most valuable part of our work—that personal, hand to hand, eye to eye method of getting at the subject which is interesting to both the investigators and the farmer in common. This, we know, has been begun in various ways by the various stations. I will say but a word in regard to the efforts made in New Jersey. A world of good was done by the late lamented Dr. Cook, who was the director of our station. He did a great work in our State by going from man to man. That work has been continued in his way by those who are appointed professors in the experiment station, and we mean to have it kept up, as it has met with good success; but we propose to have it carried on not only in that individual way, in which the individual strength shall be manifest and bring forth its fruit, but also in a systematic and thoroughly organized way. I have, for example, in looking up this matter in the short time that I have had since I have been particularly connected with these things, sat at the feet of the managers of the Wisconsin school, and have learned very much by so doing. There we have an illustration of personal influence, and work of that sort should be organized everywhere. But I wish to emphasize especially a plan we are at present organizing in New Jersey, which I think will prove of vast value to us and to others who adopt it, namely, university or college extension.

It seems to me that in all the effort that principle is making to organize itself and to do good work, there is no part of it that will be of so considerable value as that which has in view the practical end that agriculture and the kindred arts have. To that end we propose to use a good part, a fair part, of the fund that comes to us by the recent United States grant in employing men not merely as lecturers to talk from the platform, speaking *ex cathedra*, but to go into small groups of men, organize them, bring to them the bulletins and the latest books of practical value to them, showing them the pictures, if you will, and what they all mean, and talking to them then and there, studying their characteristics as a group, and so far as possible those of each man. That, I will admit, is more possible in so compact a State as New Jersey, where, it is said, there is no point on the map where you can put a pin hole more than 7 miles from a railroad. Our State is compact in other ways too: We can easily reach its population of a million and a half, and so far as possible we mean to perfect such an organization in every yart of the State. We have not done it yet, but a year hence I hope to be able to bring you some results; and I would commend to the consideration of this convention personal extension, by organized effort, of the knowledge gained in the schools.

The CHAIRMAN. The subject is still open, but we have only a few moments of time left.

Mr. ALVORD. I would suggest that we pass to the next topic at once.

The CHAIRMAN. The next topic is, The relation of teaching to experimental work, the discussion to be opened by Professor Morrow of Illinois.

Mr. MORROW. I regret to appear before you at this late hour. I may say that the discussion of this topic has been assigned to me, not selected by me, and that I can do very little more than to give a synopsis of the line of thought that occurred to me as I was trying to get at the truth rather than to debate the question with myself. I will read a short paper which I prepared quite hurriedly.

Mr. Morrow read the paper referred to, as follows:

THE RELATION OF TEACHING TO EXPERIMENTAL WORK.

The law establishing the agricultural experiment stations contemplated a close relationship between them and the agricultural colleges. In most cases such relationship has been maintained. Exceptional circumstances may make it undesirable. As a rule intimate relations and cordial coöperation are helpful to both college and station. The ultimate aims of each are much the same. Frequent study of the experiments in progress, and, on occasion, helping in the work must always be helpful to the student. The work in the experiment fields, barns, and laboratories affords some of the best possible object lessons by which to vivify and make enduring the teachings of the lecture room and the text-books. Careful study of the experiments at the station and occasionally helping in planning, conducting, or directing them must be helpful to the teacher in the college. Not alone in religion is "experimental knowledge" best. The teacher who tells only that which he has been taught by others will teach less effectively than the one who speaks or writes of that which he has seen and felt and handled.

Your thought anticipates the admirable illustration at my hand. A chief object of this meeting of our Association is that we may listen to a course of lectures, which we hear with pleasure and profit, not only because they clearly and concisely tell of some of the work done at the most famous agricultural experiment station in the world, but largely because the lecturer has seen much and done much of the work reported. Keeping in mind that the results of his investigations are to be given to others, and, when occasion offers, himself presenting them, not only to other investigators and scientists, but also to the students and the people, by pen and voice, must help the experimenter in his work.

Is it a needless commonplace that the chief object of these Government-endowed experiment stations is not to give investigators an opportunity to pursue their studies, not even to wrest from Nature her secrets for the sake of knowledge itself, but to acquire knowledge for the use of man? Were it practicable the ideal condition would be that in which every teacher should be an experimenter seeking new truth, and every investigator should be the herald and expounder of the results of his own work. This is not practicable because of the limitations of human capacity, which, with the constantly widening fields for investigation and teaching, make a division of labor and specialization of aim more and more necessary. But division of labor may be carried too far. It is a misfortune if the river spreads itself so wide that the boat grounds on the sands, but the results are quite as bad if to secure depth it so narrows itself that the boat is held fast by the banks.

It is a pretty picture, that of the pale-faced, high-browed, fragile-framed scientist, who so earnestly pries into the very heart of nature or is so fired with the desire to teach the truth that he is oblivious of his wife and forgets his dinner; but neither among the college presidents or station directors have I found this man at the hotel where I stop. With fine scorn we denounce the man who fritters away his time and energies in getting a smattering of many kinds of knowledge, but I have not often met him in either college faculty or station staff. No one of us knows too much in his specialty. All of us have felt that we could do our special work better if we knew more along the lines in which our fellow workers are walking. Here, as generally, in the middle way lies safety. Keep the college and the station side by side in intimate and cordial relations, as two helps to one end. Let the teacher carefully study the experiments now in progress as well as those grown venerable with age, and make much use of them as object lessons. Let there be the freest consultation between the teacher and the experimenter, and so far as it is practicable without injury to his assigned work, let each help and work in the other's field.

Mr. ALVORD. Mr. Chairman, I move, and under the circumstances of the evening I trust that this audience will sustain me, that the discussion be closed, and also the business session of the evening.

The motion was carried.

Mr. Warington then delivered his lecture entitled Nitrification.

At 10 p. m. the convention adjourned until the following afternoon at 2 o'clock.

AFTERNOON SESSION, SATURDAY, AUGUST 15, 1891.

The meeting was called to order by Vice President Roberts at 2 p. m.

The CHAIRMAN. What is the business before the meeting?

Mr. ALVORD. We have established a pretty good machine of six little wheels within one big one, and we want to keep it going right. I would like to make two or three general statements once more, as it is perhaps the last opportunity. As to the representation in the convention, the figures now stand at 124 delegates and attending representatives from 38 States and Territories, representing 42 stations and 38 colleges. Every State in the Union east of the backbone of the continent is represented except Georgia and South Carolina, and this is the first time in the history of our Association that we have been able to make this statement. As to the rest of our program for this meeting, it will be noted that it is proposed that the business of the Association shall be concluded this afternoon, but that nominal general sessions will be held on Monday and Tuesday evenings, in order that the remaining lectures by Mr. Warington may be delivered under the auspices of the Association. Although this is our final business meeting, discussion is provided for on Monday evening upon subjects to be reported by the section on entomology, the reason for this being that the officers of that section have not been able to be in Washington until to-day. Any business which sections desire to report may be reported on Tuesday evening, but only for the information of the general Association. Those are the only remaining points of the program for next week. The executive committee now proposes, for the guidance of the Association in the economy of time this afternoon, the following program:

(1) The resolutions already offered and referred, to be reported for the action of the Association.

(2) Business to be reported from the several sections by the officers thereof for ratification or rejection by the Association as a whole.

(3) Report of the nominating committee for action thereon.

(4) The nominations by the several sections of their chairmen for the ensuing year.

(5) Final resolutions that may be offered by unanimous consent.

In order to avoid embarrassment, owing to the fact that the section on entomology has not up to this time been able to transact its business as was desired, I will now move that that section be empowered by this Association to nominate its chairman for next year, the rules to be suspended to allow the section to report its action in this regard to the Association next Tuesday evening instead of this evening.

The motion was carried.

The CHAIRMAN. The executive committee will present resolutions.

Mr. ALVORD. The executive committee reports back the resolution offered by Director Roberts of New York, with some verbal amendments, and recommends that it be adopted, as follows:

Resolved, That this Association most respectfully urge the Secretary of Agriculture to do what he can to secure the preservation of public forests and woodlands, by the passage of a law or laws which shall exempt from sale or preëmption Government forest lands now unsold, and cause them to be surveyed, reported upon, and protected.

The resolution was adopted.

Mr. ALVORD. The executive committee reports back the resolution offered by Director Armsby of Pennsylvania, slightly amended, and recommends that it be adopted, as follows:

Resolved, That in the event of receiving suitable propositions for coöperation from the Columbian Dairy Association, the executive committee of this Association be authorized, at its discretion, to appoint three delegates with power to represent the Association and coöperate with similar representatives of the Columbian Dairy Association and of the various organizations of breeders of dairy cattle in formulating rules for the conduct of the proposed tests of dairy breeds at the World's Columbian Exposition.*

The resolution was adopted.

Mr. ALVORD. The executive committee offers to the Association the following resolution, not heretofore introduced, and recommends its adoption:

Resolved, That this convention hereby expresses its satisfaction with the present organization and work of the Office of Experiment Stations in the United States Department of Agriculture, and especially with the progress made upon the indexing of the literature of experimental agriculture.

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*It was found later that the Columbian Dairy Association had requested the appointment of one person instead of three. The executive committee appointed Director M. A. Scovell of Kentucky.

The resolution was adopted.

Mr. ALVORD. We have nothing further, Mr. Chairman.

The CHAIRMAN. We will pass, then, to business other than nominations from the sections. First we will hear from the section on agriculture.

Mr. MORROW. The section on agriculture beg leave to say that in accordance with the recommendation of Assistant Secretary Willits of the Department of Agriculture, it recommends the appointment of a committee to confer with that gentleman in regard to the exhibit of wheat that he is now collecting for the World's Columbian Exposition, in the matter of identification of varieties, and as to all other matters concerning said exhibit, and recommends the appointment on such committee of Messrs. Hunt of Pennsylvania, Roberts of New York, Vanderford of Tennessee, Plumb of Indiana, and Gulley of Arizona.

Mr. ALVORD. I move the acceptance of the report and the adoption of the recommendation.

The motion was carried.

The CHAIRMAN. I presume the chairman or secretary of the section on botany is present.

Mr. HALSTED. The section on botany has no business to report.

The CHAIRMAN. Chemistry.

Mr. NEALE. The section on chemistry has no business to report.

The CHAIRMAN. We have deferred the report of the section on entomology. Is there anyone here to report from the horticultural section? I hear no response. The section on college work.

Mr. STOCKBRIDGE. On behalf of that section I would say that it held three very largely attended and profitable sessions. There are only two matters of business that the section desires to present to the general session. At the first of our three sessions a committee was appointed to confer with the Secretary of the Interior and ascertain the present status of the payment of the third installment, due under the provisions of the Morrill act of August 30, 1890, and further to confer with the Commissioner of Education concerning a circular letter received from him under date of August 13, 1891, and to secure, if possible, a revision of that letter. The committee reported twice, first a report of progress, and second a final report, made this morning, stating first that under the provision for the payment of installments under the Morrill act no statement was made except that it would be paid early in September, and that the delay was not due in any part to causes emanating from the colleges themselves, but arose from certain conditions in the Interior Department. Concerning the second matter—the provisions of the circular letter received from the Commissioner of Education—the committee reported this morning that their interview with the Commissioner had been attended with complete success, and that they were able to present to the convention and Association a form of report for the treasurers and a second form of report to be made by the president of each of these institutions, these being the two points covered by the communication from the Commissioner of Education. I have these here as adopted by the section on college work, and copies will soon be mailed to all college officials interested.

Mr. ALVORD. We ought to have action upon that now. I move that the recommendation of the section on college work to adopt these forms of report, already approved by the Interior Department, be adopted in the name of the Association. I would like to add to that a proviso that a committee of the section on college work, having this matter in hand, be empowered, in coöperation with the Commissioner of Education, to make any necessary minor modifications of the report before it goes to print.

Mr. STOCKBRIDGE. I second the motion, as it embodies the intention of the section on college work.

The motion was carried.

Mr. STOCKBRIDGE. The second matter is embodied in the following resolution:

Resolved, That the section on college work recommends to the Association that a committee of three on the subject of a collective exhibit at the World's Columbian Exposition on the work of the agricultural colleges, be appointed.

The CHAIRMAN. What shall be done with the balance of the report from the section?

Mr. ALVORD. I move the adoption of this recommendation, with the addition of the words, "with instructions to coöperate with the standing committee of the Association upon station exhibits."

Mr. JORDAN. I move the amendment of that resolution by changing the word agricultural to *industrial*, so that it shall read *industrial* colleges, instead of agricultural.

The motion was seconded.

Mr. PORTER. I think it would be unadvisable to make this change, for the reason that in all our consultations with the Departments we have been endeavoring to conform strictly with the phraseology of the law, and to use the same terms in all our official communications. The term "agricultural college" is so fixed that I believe it is unadvisable to make any change. I believe in retaining the words "agricultural and mechanical colleges."

Mr. MORROW. As bearing upon this question, and following in the line of what Mr. Porter has said, I think it would be helpful to read a letter which Secretary Willits kindly sent to me personally, not having time to present it more formally, from the Chief of the agricultural department of the Exposition, who has introduced the matter, inviting us to make this collective exhibit in that especial way. You will see that he uses the word "agricultural," and gives this particular exhibit a somewhat specific character; and I fear it might lead to some complications as to the particular matter contemplated by this resolution if a change in the phraseology were made. With your permission I will read the letter referred to as bearing upon the subject.

Mr. Morrow read the letter, as follows:

OFFICE OF THE DIRECTOR GENERAL,
WORLD'S COLUMBIAN EXPOSITION,
Chicago, Illinois, July 21, 1891.

SIR: In considering the scope and possibilities of the exhibit in the agricultural building at the World's Columbian Exposition, I have been strongly impressed with the advisability of having in this building an exhibit made by the agricultural colleges of the different States.

To me it seems eminently proper that the agricultural colleges, closely allied as they are and should be to the agricultural interests of our country, depending upon those interests for whatever success is brought to them, should make such an exhibit in the agricultural building of the Exposition as will more closely cement the friendship between the agricultural interests of our country and these colleges, and by this exhibit show to visitors the excellent results obtained by these colleges in the work of giving students practical and scientific education as well as manual training.

I think such an opportunity should not be allowed to pass without being taken advantage of. While it is true that the official classification of the World's Columbian Exposition provides for agricultural colleges, among other institutions of learning, in the department of liberal arts, I feel reasonably sure that if the colleges desire to make their exhibit in the agricultural building, the classification can be arranged satisfactorily.

Will you be kind enough to give me your judgment on this important subject, and if in accord with mine I shall present the matter by letter to the presidents of the different colleges, and see if we can not secure their coöperation in this work?

With assurances of my high regard, I have the honor to be,

Yours very respectfully,

W. I. BUCHANAN,
Chief of the Department of Agriculture.

Hon. EDWIN WILLITS,
Assistant Secretary of Agriculture,
Washington, D. C.

The CHAIRMAN. The pending motion is to substitute the word *industrial* for the word "agricultural."

Mr. JORDAN. I do not wish to in any way upset any plans or do anything that will create a disturbing influence, but I understand that the work of the land grant or industrial colleges in some States is very important along the mechanical lines, and I have supposed—I may be mistaken—that this exhibit is to be an exhibit of the educational work of the land grant colleges. If, however, it is to be merely an exhibit of the agricultural departments of the land grant colleges, there will be no purpose in the amendment I have offered, and I will withdraw it. If it is simply an exhibit of the agricultural relation of the land grant colleges, and has no other meaning, I will withdraw the motion.

Mr. ALVORD. It may be briefly stated, by way of explanation, that the proposition is for any exhibit of the land grant colleges in the agricultural building as a part of the agricultural exhibit at large, the supposition being that it will be the agricultural side of these institutions that will there be put forward; but this need not interfere with any other or further exhibitions the institutions may wish to put elsewhere. The Chief of the department does not propose to afford room for that purpose.

Mr. JORDAN. I withdraw my motion.

Mr. SCOTT of Ohio. I am not quite sure that it is desirable to have the agricultural colleges, or agricultural and mechanical colleges, divide their exhibit. I am quite in sympathy with the desire to have the agricultural part of the exhibit put where the agricultural people of the country will see it, but it is at least doubtful in my mind whether it is desirable either to exclude the mechanical exhibit altogether or to divide the two. Any one of these institutions I should think would be better satisfied if it could present its whole work in one place and not have a part of it here and a part there, and if we can not put it all in the agricultural building it is at least worth while to consider whether it would not be better to place the whole of it somewhere else. I do not say that would be best, but would simply suggest that we ought to be able to make a combined exhibit if we so desire; and it seems to me that it would be quite unfair for us to take such action here as would prevent the colleges from making an exhibit of their other departments.

Mr. BREWER. I would state here that in the discussion this morning it was intended that this resolution should simply place the matter in the hands of a committee. It is evident that this body can not decide the matter. State laws may interfere in some cases. But if it is practicable to have an agricultural exhibit from the agricultural colleges, it can be placed in the agricultural building and there is the place for it. There is no place for it if it is to be an exhibition of all the departments. This resolution is simply to place the matter in the hands of a committee.

Mr. ALVORD. I move a substitute for the pending resolution, viz,

Resolved, That a committee of three, specially representing the colleges of agriculture and mechanic arts, be appointed to consider the subject of a collective agricultural college exhibit in the agricultural building of the World's Columbian Exposition, with power to represent the interests of the Association in this connection, and with instructions to coöperate with the standing committee of the Association upon station exhibits.

The resolution was adopted.

Mr. SCOTT of New Jersey. As it would be well to have this committee thoroughly representative of the Association, it ought, perhaps, to be appointed by the executive committee. I move that this committee be appointed by the executive committee of the Association.

Mr. MORROW. I take pleasure in seconding that motion. I think there is a little doubt in our minds, and the matter is one of very great importance. The executive committee, it seems to me, can give this matter grave consideration and make the wisest selection.

The motion was carried.

[Subsequent to the adjournment of the convention the executive committee appointed the following-named gentlemen to serve on the committee called for by the resolution: Messrs. G. W. Atherton of Pennsylvania, J. H. Smart of Indiana, and G. E. Morrow of Illinois.]

Mr. ARMSBY. I have a matter to present. At the time when our committee was appointed it was the understanding that the proposed collective exhibit should be made in the Government building, in connection with the exhibit of the Office of Experiment Stations. Subsequent developments have made it seem desirable to our committee that the exhibit of the stations should be made in the agricultural building of the Exposition rather than in the Government building, and I will state very briefly the reasons for that conclusion, premising that the proposition has the approval of the Assistant Secretary of Agriculture and indeed is recommended by him. The reasons are in brief as follows: In the first place we shall probably be able to secure a greater amount of space in the agricultural building. The total space allotted to the Department of Agriculture is something over 20,000 feet, to be apportioned among the several divisions of the Department. In the second place, if we put this exhibit in the agricultural building we shall be spared the otherwise inevitable comparison between the large exhibits of the Department of Agriculture and the necessarily smaller exhibits of the experiment stations. It is not possible, for example, for the experiment stations to compete with the Division of Chemistry of the Department in the way of exhibits. That Division is a very much larger affair than the chemical laboratories of our stations, whose exhibits would certainly suffer by comparison if the two were brought into juxtaposition. If we go into the agricultural building we shall avoid that, and further, we shall be placed where the visiting farmers can better see what we are exhibiting than they could if we were in the Government building. Finally, it will be extremely desirable that the college and station exhibits be in connection with each other. I will add that we are assured by the Assistant Secretary of Agriculture that there will be no difficulty whatever in the way of having the Department assume a part of the expenses attending the exhibit if held in the agricultural building, just as it would if we exhibited in the Government building. Your committee, therefore, would be glad to be authorized in some way, either alone or in consultation with others, to make this change of location if on further consultation it is decided to be the proper thing.

Mr. JORDAN. It seems to me that the committee should have a large power to act as circumstances may seem to render desirable, and therefore I desire to offer the following resolution:

Resolved, That the question of location of the exhibit of the experiment stations at the World's Columbian Exposition be referred to the standing committee in charge of the preparation of the exhibit, in consultation with the United States Department of Agriculture and the executive committee of this Association, with power to act.

The resolution was adopted.

The CHAIRMAN. Is there any further business, other than nominations, from the section on college work?

Mr. ALVORD. There is nothing further. Next in order will be the nominations of officers by the several sections.

The following nominations were made by the sections, those of the chairmen being confirmed by vote of the Association:

Section on agriculture: Chairman, C. L. Ingersoll of Nebraska; vice chairman, G. W. Curtis of Texas; secretary, T. F. Hunt of Pennsylvania. Section on botany: Chairman, G. F. Atkinson of Alabama; secretary, L. H. Pammel of Iowa. Section on chemistry: Chairman, M. A. Scovell of Kentucky; secretary, H. H. Harrington of Texas. Section on college work: Chairman, E. M. Turner of West Virginia; vice chairman, C. H. Pettee of New Hampshire; secretary, H. E. Stockbridge of North Dakota. Section on entomology: Chairman, L. Bruner of Nebraska; secretary, F. M. Webster of Ohio. Section on horticulture: Chairman, E. A. Popenoe of Kansas; secretary, T. L. Brunk of Maryland.

The CHAIRMAN. Next in order is the report of the committee on nominations of officers of the Association for the ensuing year.

The committee on nominations, through its chairman, Mr. F. A. Gulley of Arizona, presented the following names to the convention:

For president, W. L. Broun of Alabama.

For vice presidents, C. W. Dabney, jr., of Tennessee, J. W. Nicholson of Louisiana, H. E. Stockbridge of North Dakota, F. E. Emery of North Carolina, W. H. Jordan of Maine.

For secretary and treasurer, M. A. Scovell of Kentucky.

For executive committee, H. E. Alvord of Maryland, H. H. Goodell of Massachusetts, J. A. Myers of West Virginia, W. Frear of Pennsylvania, A. T. Neale of Delaware.

On motion of Mr. Brewer the report was adopted, and the Secretary was directed to cast the ballot of the Association for the persons nominated. The Secretary reported that the ballot had been cast, and the Chairman declared the officers duly elected.

The CHAIRMAN. Final resolutions are in order.

Mr. MORROW. I am not prepared to state in the best words a resolution, which I am sure will commend itself to all, but will offer it as I can:

Resolved, That this Association renew its expression of sincere thanks to Sir John Bennet Lawes for his munificent provision for a course of lectures on the work done at Rothamsted, to be delivered biennially in the United States; and it also wishes to express its sincere thanks to Mr. R. Warington for consenting to deliver the first series of lectures, and its appreciation of the high scientific and practical value of the course to which we are having the pleasure of listening.

Mr. BREWER. I second the motion most heartily. I do not wish to say much here, because we have but little time. The lecture which is to follow will be listened to with much more pleasure than anything

I might say, but I know that this resolution will be most heartily agreed to.

By a rising vote the resolution was unanimously adopted.

Mr. BREWER. I wish to offer the following resolution:

Resolved, That the thanks of this Association be extended to the officers of the Columbian University for their generosity in placing this building and its appliances at our service; to the committee of the affiliated scientific societies of Washington, who have done so much to bring about the success enjoyed by our meeting; to the railroad companies which have granted liberal reductions in rates of fare to those attending the convention; and to the local hotels and newspaper press for their hospitality and kindness to us on this occasion.

The resolution was adopted.

The CHAIRMAN. I take pleasure in introducing Hon. W. T. Harris, Commissioner of Education.

Mr. HARRIS, Commissioner of Education. Anybody connected with the Government feels as if the agricultural colleges were, in a certain sense, more closely connected with it than any other educational institutions in the country, with the exception of the military—the Army and Navy institutions at West Point and Annapolis; and we, of course, in thinking out along these lines of education, and of what the agricultural colleges are doing, naturally think of the introduction of the newest methods of education. To come right to my point at once, my Bureau, feeling interested in your work, wishes to get, if it can, details from members of this Association, or rather from presidents of agricultural colleges, showing your lines of work and educational methods. I suppose that you will report to the Department of Agriculture such details as will give that Department the new experiments you make. The Bureau of Education wishes to get the new methods followed in your work. The old-fashioned class-book system—class recitation, in which the pupil is examined, as it were, on what he has prepared himself upon—may be well enough for undergraduates in the colleges, high schools, and lower schools, but it is set aside in what we call real university work, which gets the pupils into a laboratory or a library and sets them to investigating—which is laboratory work—experiments along that line; or seminary work in the direction of hunting up in books, investigating what is known on the subject, and comparing critically all results. Now I know in individual cases from having conversed with members of this honorable assembly, that many of you, scattered all over the country, are making experiments along the line of seeing what can be done in arousing local interest in your work. Your graduates are used as messengers to carry to and fro your interest to various parts of the State. We all know that the agricultural work represents an isolated class of people living on farms; people who do not strike fire by contact with one another, and who are therefore at a disadvantage when they come into contact with an urban population. All urban populations meet socially from day to day, and develop something humane and spiritual, and the farmers ought to be brought into communion of the same kind. Now in this direction which I am taking the liberty of naming to you—it is an old subject perhaps with most of you—we should like very much to get individual communications, letters, or statements, so that we can print them in our annual report and show the way in which the work from this center—the agricultural college—is done; and I think that is the most desirable center of influence, because it represents the scholastic side—the intelligent, scientific side—of the work of the farmers. It gets hold of their promising young men, and it may organize not only experimental work, but work for the home improvement of the farmer—all sorts of things that will improve his power to grasp the situation.

I do not know but I have said enough for you to see in what line I should like to get information. The Bureau of Education every year undertakes to collect the experience, as it were, of each section, as it were, of the United States, so that each can benefit by the experience of all. We do not believe in centralized power, and do not want any general direction on the part of the central Government, and the Bureau of Education so far as I know has never aspired to be a directive power in that sense—certainly not under my administration; but it does aspire to do what can be done in a country in which local self-government is the principle, that is to collect the experience of all and give it to each. And it is in this line that I take the liberty of mentioning this our wish for an account of your methods of reaching the farmers through your students, in compliance with your kind invitation to meet with you this afternoon. I thank you for your kind attention.

The CHAIRMAN. I would like to ask the Commissioner of Education if there are blanks sent out or questions tabulated, that we may be guided a little in our communications.

Mr. HARRIS, Commissioner of Education. We have not presumed to do that, but if it would be in accordance with your wishes we could get up some tables of questions. The information desired is a little out of the line of ordinary statistical information, and we feel some delicacy in asking questions that may seem impertinent, though I feel that the more we can give which shows methods of work the more useful our report will be.

It was moved that the Commissioner of Education be requested to prepare and send to the colleges for the benefit of agriculture and the mechanic arts circulars containing specific questions to which replies are desired for the information of the Bureau of Education. The motion was carried.

Mr. ALVORD. I move that the business session of the present convention of the Association be now closed, the two remaining sessions of Monday and Tuesday evenings to be devoted to the lectures of Mr. Warington and to such other matters, not requiring the action of the convention, as may be presented.

The motion was carried.

Mr. Warington then delivered his lecture entitled Nitrification and Denitrification.

The convention adjourned until Monday evening at 8 o'clock.

EVENING SESSION, MONDAY, AUGUST 17, 1891.

The meeting was called to order by Vice President Roberts at 8 p. m.

Mr. ALVORD. According to the action taken by our Association on Saturday afternoon the business sessions of the present convention are at an end, but the convention has also voted that to accommodate the officers and members of the section on entomology a portion of this evening might be used by them for the presentation of their report. Moreover, the original program adopted by this Association provided for the discussion this evening of subjects coming from that section. This would give the entomologists a double portion. After consultation with the chairman of that section, and with his consent, I make the proposition that we receive his report for the past year and the nominations of the section officers for the year ensuing, and then pass to the lecture by Mr. Warington.

The motion was carried.

Mr. COOK. I have to report that the section on entomology appointed as its officers for next year L. Bruner of Nebraska chairman, and M. F. Webster of Ohio secretary.

The CHAIRMAN. What is the pleasure of the convention as to this report?

Mr. ALVORD. That was confirmed in advance, sir, by the Association.

Mr. Cook, chairman of the section on entomology, presented the following report:

REPORT OF THE SECTION ON ENTOMOLOGY.

MR. PRESIDENT AND GENTLEMEN: I beg leave to submit the following report from the section on entomology:

Owing to the early date of this meeting, the entomologists can not make as satisfactory a report as they desire, as it is too early in the season to give results, and for this reason not a few withheld their reports altogether. Yet, from expressions all along the line, I can assure you that the work is being vigorously pushed. I believe I can say without fear of contradiction that never before in the history of the country was so much or such good work being done in the direction of applied entomology as is being done to-day.

Of the 44 stations already organized, 35 are equipped for and are doing work in entomology. Six of these employ a man exclusively for station work in this line. In one of these the investigator is employed for only a portion of his time and works exclusively in apiculture, at another a second professor teaches entomology in the college, while in a third the station entomologist will hereafter teach entomology in the college with which the station is connected. Sixteen of the station entomologists teach entomology, and not infrequently general zoölogy and other studies, in the college or university connected with the station. Thirteen of the entomologists have charge of another department of the station also, five of entomology and horticulture, and eight of entomology and botany; seven of these also teach in the institution where the station is located. Five of the stations are making experiments in apiculture and three have insectaries where insects can be reared under natural conditions and yet be immediately under the observation of the investigator.

It will be seen that in a few stations the entomologist is doing only station work, and that exclusively in entomology; others are doing this and at the same time teaching entomology, and frequently other branches; while not a few are conducting experiments in entomology and either botany or horticulture, and several of these have teaching also added to their duties. That the first method has its advantages, appears in the excellent work done last year in Iowa. That the second is the ideal plan, seems not only to accord with reason, but seems further evident from the fact that so many have adopted this course. That station work and college work can be mutually helpful goes without saying. But if this plan is to bring the best success the professor must have excellent assistants. These assistants must have a salary that will make them content and will secure continued service, at least till others may be educated to take their places. This prevents the shock that comes, of necessity, when an assistant leaves in the middle of the season's work. That this suggestion is wise is shown by the excellent work done at the Illinois Station. In some of the stations the assistant has been called away during the working season each year since the organization of the station. Of course it is gratifying to see our men go to higher places, but such frequent changes are suicidal to the best work of the stations, and every means should be employed to prevent them. The plan of uniting two such broad departments as entomology and botany or entomology and horticulture, although so often followed, seems hardly the wise one. Does not the work done at the Wisconsin Station indicate that it may be wiser to let the workers concentrate their efforts, even if some lines of work are neglected or omitted altogether? Is not quality rather than quantity the object to be aimed at?

In considering the work of the several stations for the year, it must be remembered that the researches are still in progress, so that results can not be fully stated; indeed many station workers because of this and the press of work preferred to send no report.

In Alabama the entomologist also has the work in botany and teaches biology in the college. I have received no report from the station.

Arizona has just organized a department of botany and entomology. The professor will investigate in both these lines and will teach in the university.

California has recently secured an entomologist, who will act for the station and teach in the university. Insects attacking fruit are already receiving energetic attention, but as the work has but just commenced no report can be given.

In Canada the entomologist is also botanist of the station, with no assistant. He very reasonably complains of overwork and unsatisfactory results. Nova Scotia and New Brunswick have suffered from cankerworms, bud moths, and leaf rollers. Cankerworms have attacked apple foliage in Ontario and the ash-leaved maple in Manitoba. *Agrotis turris* has proved to be the most destructive cutworm. It worked in Manitoba, Ontario, and Quebec. At Ottawa it was very destructive, and seemed omnivorous. *Agrotis fennica* has proved very destructive to peas and clover; it feeds on almost all kinds of plants. The wheat bulb worm (*Meromyza americana*) worked not a little on wheat and barley; *Cacœcia cerasivorana* and *Hyphantria cunea* were exceptionally abundant, while *Clisiocampa americana* was almost absent.

Colorado organized for work early this year. Experiments will be conducted in apiculture, and the professor will teach biology and apiculture in the college. The special insects of the season—the grape leaf hopper (*Typhlocyba obliqua*), the currant spanworm (*Eufitchia ribearia*), the native currant slug (*Pristiphora grossulariæ*), which is very common and destructive, the pea weevil (*Bruchus pisi*), the tent caterpillar (*Clisiocampa americana*), the cabbage butterfly (*Pieris rapæ*), a flea beetle (*Phyllotreta albionica*), a squash anthomyia (probably a new species) the squash bug (*Anasa tristis*), a bean beetle (*Epilachna corrupta*), a serious beet and potato enemy (*Systena bitæniata*), the gooseberry trypeta (*Trypeta canadensis*), the orchard tortricid

(*Cacœcia argyrospila*), and a box elder tortrix, not yet determined—have all been carefully studied. As many as forty eggs of the pea weevil were found on a single pod, and as many as four larvæ in a single pea. The small grub after eating through the pod wanders over the pea before eating into it. The new *Anthomyia* is a serious enemy of the squash. *Epilachna corrupta* is so destructive that many have entirely abandoned raising beans. *Trypeta canadensis* destroys at least 90 per cent of the currants and gooseberries. The orchard tortricid has been the most serious insect pest of the State. Many plants were entirely defoliated. Those most injured were apple, plum, cherry, gooseberry, rose, and raspberry. The entomologist concludes that Colorado appears to be a rich field for the economic entomologist. The several insects have not only been carefully studied, but experiments have been tried looking to the prevention of injury in the future.

Delaware combines the entomologist and horticulturist in one person, who also teaches in the college. Much time has been given to the dissemination of entomological information by lectures at institutes, granges, etc. Object lessons in destroying insects were made prominent. A new and very destructive corn insect is being worked out. Experiments with the arsenites in destroying the codling moth, plum curculio, and cankerworm are being continued. A careful test with hot water as an insecticide has been made with favorable results, though the kerosene emulsion is preferred. The pyrethro-kerosene emulsion has been used with excellent results. This substance bids fair to take first rank as an insecticide.

In Florida the botanist and entomologist are one. I have no report of his work.

Georgia is doing no work in entomology.

The entomologist in Illinois also teaches entomology and zoölogy in the university. He has several competent assistants, who are paid a good salary, and so are continued in their positions year after year. The station work is so pressing and so incomplete at this early date that no report has been sent to me. Special work in the practical application of bacterial and fungoid germs to destroy insects is being done, and much attention is being devoted to the determination of the life histories of insects. An insectary is included in the station equipment.

Indiana has secured a portion of the services of a professor for station work in entomology, while a second person teaches entomology and horticulture in the college. The following new enemies of the blackberry have been studied: A species of *Coleophora* mines the leaves in April and May. *Blennocampa paupera* oviposits in buds in April. The larva of *Eccopsis permundana* eats into the fruit in May; the pupal stage lasted 12 days, and the adult came forth May 21. *Anomala binotata* fed on foliage early in May. *Trichius piger*, in company with the rose beetle, ate the blossoms. *Ceresa bubalus* destroyed the tomato plants in the garden in June. In May a species of *Lumbricus* destroyed celery in the hotbeds and in the field. Quite a number of grain insects have been described in a bulletin already published.

Iowa has this year changed her policy. The professor in the college is also station entomologist, with a graduate of the college for an assistant. Insects attacking grasses and clover are receiving special attention. Remedial measures are being tried. It is believed that the hopper-dozer, described in Bulletin No. 13 of the station, will prove very helpful in destroying the locusts and other grass insects. Orchard insects and insecticides are being investigated.

In Kansas the professor of horticulture is also professor of entomology and at the same time entomologist and horticulturist of the station. He is provided with assistants in both departments. I have received no report from him.

Kentucky has up to this time employed an entomologist, who has also been botanist of the station. In future he is also to teach in the college. The following insects are being investigated: Grain insects, with special reference to their life history in the latitude of Kentucky; insects attacking hemp and tobacco (crops much raised in Kentucky); insects peculiar to the season; the completion of the life history of the corn root worm (*Diabrotica 12-punctata*), the eggs having been found in the earth this spring. The life history of the strawberry leaf roller is also completed and proves it to be three-brooded in Kentucky. It winters in the larval state, pupates toward spring, and appears as an imago in early spring. Insecticides have been used on various species of plant lice and also on plants, to determine proper and safe strength to be used. The arsenites are a specific for the rose slug, but must be kept from the blossoms. The horn fly, which has this season been common in Kentucky, is easily controlled by use of buhach, tobacco dust, or train oil, or better, by a mixture of one of the powders and the oil.

Louisiana combines the entomologist and horticulturist. Investigations regarding the screw worm have been made. I have no report regarding the progress of their work.

In Maine the entomological work of the station is done by the entomologist of the college, who is really professor of biology. Work is being pushed in economic entomology, but no report has been received.

Maryland reports that no work is being done in entomology.

Massachusetts employs one professor for both the college and the station. He has an insectary, of which he speaks in the highest terms. By use of this he is able to determine the entire life history of an insect, which otherwise would be difficult or impossible. Many have been determined, which often verify the work of others, but in some cases differ strikingly from published accounts. In compliance with a demand for information regarding the most common pests, histories of several have already been published, and those of others are in progress. This is not a compilation, but the result of actual personal observation, even though the facts are well known. In Bulletin No. 12 of the Massachusetts Hatch Station the complete history of the bud moth (*Tmetocera ocellana*) is given, correcting many misleading errors of European entomologists regarding this insect. Very elaborate experiments have been tried with Paris green on apple trees in the insectary. Half of the trees were kept in a dry, cool atmosphere; the others in a hot, damp one. Half of each lot were sprinkled from above, *a la* nature; the others were watered by wetting the earth beneath in which they grew. One pound of Paris green to 130 gallons of water was the strength used. The foliage on all the trees in the hot, damp atmosphere were equally and badly scorched, while the others were hardly injured at all. The showers from above seemed in no way to modify the effects of the poison. Experiments were also tried to determine the amount of poison necessary to kill insects. The tent caterpillar (*Clisiocampa americana*) was the insect treated. The poison was used at the rate of 1 pound to 50 to 100, 150, 200, 300, 400, 500, 600, 700, 800, 900, and 1,000 gallons of water, respectively, at the time of each of the several molts. The age of the larva seemed to make no difference. Every strength of the poison was fatal to the insects, though the more dilute applications did not take effect at once. One pound to 300 gallons of water killed as effectually as did the stronger mixtures, and this is the strength the station will recommend in future. The experiments were tried in cages in the insectary, where the insects could not wander from the sprayed branches, and where all could be watched. Cranberry insects are receiving careful study. The entomologist of the station has also had in charge the expenditure of the $100,000 appropriated by the legislature during the past 2 years for the extermination of the Gypsy moth. The work is in very competent hands, and is being pushed most vigorously.

In Michigan the entomologist has charge of all the experiments, including those of the apiary. He also teaches entomology and zoölogy to large classes in the college. An assistant is provided in each department These, however, are only kept till they become efficient, when some other State calls them away, which is ruinous to the best interests of the station. The entomologist is virtually State entomologist, and often receives as many as twenty letters a day inquring about insects. It is also his duty to lecture before the annual institutes and other State agricultural associations. Experiments have been made to determine the value of the arsenites in fighting the plum curculia. Three separate orchards were treated. One pound of

London purple to 200 gallons of water was used. The application was repeated every 10 days and after every heavy rain. The conclusions agree with those of last year. "The ravages are surely lessened and the insects are poisoned." But if the insects are numerous and the crop light, all the plums may and usually will be stung. We are now positive on these points. We inclosed with cheese cloth six small trees after jarring off all the curculio, picking off all stung plumbs, and spraying one half of the trees with London purple (1 pound to 200 gallons of water). We then put the same number of curculios within the inclosure of each pair of trees. After a week the cloth was removed, the curculios caught, and the stung plums counted. In every case live curculios were caught and stung plums were found, but in every case more were found on the unsprayed trees, and many dead curculios were found, but none except on sprayed trees. I will give one case in detail which was about an average. Each tree had sixty unstung plums, and twelve curculios were placed within the cover on each tree. Twelve plums were stung on the sprayed and twenty-five on the unsprayed trees. Eight curculios were found on each tree at the examination the close of the week, four of which on the sprayed trees were dead. Experiments on peach trees showed that London purple, 1 pound to 200 gallons of water, applied every 10 days, did serious injury. With limewater from thoroughly slaked lime, same proportion, no perceptible injury was done; with Bordeaux mixture, very little. I believe that London purple, 1 pound to 300 gallons of limewater, is entirely safe on the peach. This discovery of Professor Gillette of the value of limewater is a very valuable one. In preparing Bordeaux mixture or limewater great care should be taken to thoroughly slake the lime, else it injures the foliage very seriously.

Experiments seemed to show that both London purple and kerosene emulsion were much more injurious to trees suffering from attack of *Aphides*.

A very large series of experiments were made to determine the maximum strength of kerosene emulsion. Safe on all foliage. A one-fifteenth hard soap emulsion did no harm in any case. The same strength with soft soap did some harm. As this never occurred before in our experience it shows that there is quality in soft soap.

The pyrethro-kerosene emulsion, first recommended by Professor Menke of the Arkansas Station, while more effective than the simple emulsion, was found less injurious to foliage. A one-twelfth emulsion proved safe in every case.

Many experiments were made with London purple to find the minimum strength fatal to all mandibulate insects. The experiments were made on bees, potato beetles (grubs and imagos), two species of oak caterpillars (*Anisota*), and on the cabbage caterpillars. The insects were confined in cages in the laboratory on the sprayed foliage and on branches of trees covered with cheese cloth. The several strengths ranged from 1 pound to 100 to 1 pound to 500 gallons of water. One pound to 200 gallons of water always killed within 36 hours, and usually all the insects died in less than 24 hours. A 300 mixture often kills, but it is tardy and uncertain. Still weaker mixtures were only partially effective. The older larvæ are not so easily poisoned as the younger. Thus our previous experiments, made some years ago, agree with these in fixing 1 pound to 200 gallons of water as the proper strength for all applications except on the peach.

The life history of the terribly destructive peach twig moth was partially determined. Many other species have been studied and many parasites reared. The bud moths and leaf rollers were unusually common and destructive, as were the aphides.

In Minnesota the entomologist is also botanist of the station and professor in the university. Extensive investigations are in progress regarding the locusts, but the early date of our meeting makes a report impossible.

Mississippi asks her entomologist to do work in mycology and horticulture, and to teach in the college. Experiments have been made with the screw worm (*Compsomyia macellaria*). The natural food of the insect seems to be dead flesh and ordure. This suggests burning all organic refuse about slaughterhouses. The insects of the season are being studied. Powdered tobacco is found to be a remedy for the ravages of the cucumber beetle. Kerosene emulsion made by either of the formulas recommended is effective and excellent. *Ægeria pyri* is very destructive to the apple, but not at all to the pear. The borers found at any time in the trees vary greatly in size. Washing the trees in winter with kerosene oil kills the borers. Both of the common lady-bird beetles, *Megilla maculata* and *Hippodomia convergens*, feed on cabbage leaves and do much damage. Other insects are being studied experimentally, especially the chinch bug.

Missouri has no special entomologist, but the professor of horticulture makes experiments in this line. He has a very competent assistant, who resides away from the station. This assistant has prepared and published a valuable Outline of Entomology. The arsenites have been thoroughly tried, and while they are a great success in fighting the codling moth and leaf-eating species, they are of doubtful benefit in combating the plum curculio. Paris green is preferred to London purple as more sure and less injurious to foliage. It should always be mixed with lime-water. Many insects are received from farmers, etc., and are always named and advice given. The full life history of many species previously known only as imagos has been determined. Experiments are being tried with insecticides, especially in the use of fungoid germs to destroy insects.

Nebraska employs a special entomologist with no other duties beyond station work. Insects attacking sugar beets are still under investigation, as are the special insects of this year. A monograph of the *Aphidæ* of the State has been prepared at the station, which gives the food plants of each species.

Nevada requires the entomologist to experiment in botany and teach biology in the college. A list giving the insect fauna of Nevada is in progress. The life history of several species has been determined, with illustrations of the different stages. Investigations are being conducted in the use of insecticides, and special study has been given to the oviposition of the codling moth and the time it takes the eggs of this insect to hatch.

New Hampshire has just organized for work in entomology. The entomologist is professor of zoölogy in the college. His duties in the college have employed his entire time during the past season.

The entomologist of the New Jersey Station is also professor of entomology in Rutger's College. He is making extensive experiments in the use of insecticides. A very thorough study of the rose chafer (*Macrodactylus subspinosus*) has been made and the results published. The squash borer and cranberry insects are receiving special attention. A study of fertilizers and methods of cultivation in relation to insect ravages is in progress. Much time and energy have been expended lecturing at institutes, clubs, etc., on economic entomology. Twenty lectures have been given to farmers in a free course at the college.

Entomology at the New Mexico Station is already well organized and is in charge of the professor of entomology of the college. The vine leaf hopper (*Typlocyba vitis*) has been studied in all stages. Several remedies have been tried, the Riley-Hubbard kerosene emulsion proving the best. The grape flea beetle is very common and destructive, and succumbs to the well-known remedy, Paris green, 1 pound to 175 gallons of water. The following insects are being studied in the field: Peach borer, peach aphis, plum aphis, oyster-shell and scurvy bark lice, tent caterpillar, and green June beetle (*Allorhina nitida*). The latter eats into the fruit. The codling moth has not been observed. A study has been made of the following garden insects: Squash bug, harlequin cabbage bug, cabbage aphis, bean epilonchna, cucumber beetle, and *Diabrotica 12-punctata*, and methods looking to their extermination have been adopted. The indigenous insects destructive to shrubs and trees are being investigated. The department is being well equipped with apparatus and books, and will soon be in excellent condition for the best work.

The entomologist of the New York (Cornell) Station also teaches in the university, where large classes absorb much of his time and energy. The insectary, the first built in this country, gives great satisfaction. Special attention is being devoted to wireworms and milipedes. Very elaborate experiments with insecticides are in progress.

Neither North Carolina nor North Dakota are organized for entomological work.

The entomological work at the Ohio Station has been somewhat checked by the resignation of the entomologist. A new man is on the ground, and the work will soon be conducted with the usual energy. Heretofore the entomologist has also been the station botanist. In future he will have only entomology. The university is separate from the station. Entomology is taught by the professor of zoölogy.

At the Oregon Station the professor of entomology teaches in the college and works in the station. Experiments have been made with the arsenites, mixed with a fungicide composed of whale oil soap and sulphite of soda. Paris green is preferred to London purple, and seems more effective when used with a fungicide. While the latter protects against fungoid diseases, the same treatment destroys the woolly aphis, which is a serious pest in Oregon. A 160-gallon galvanized iron tank, with a heater underneath, and so made that it can be easily moved from a stove or furnace to a wagon, has been used with much satisfaction. The heater makes it possible to keep the insecticide hot while it is being used. The Bean pump, with cyclone nozzle and Vermorel attachment, gives best satisfaction. It takes about 1.5 gallons of the above liquid to treat one tree, which is done at a cost of 7.5 cents. The Pacific coast peach borer (*Sannina pacifica*) is successfully combated by use of the carbolic acid and soap mixture, by the resin compound (full strength) or by wrapping the tree trunk with paper. *Monoxia guttulata* is a serious beet pest. No remedy as yet has succeeded against it. Grain insects are very destructive, but have been easily exterminated by use of bisulphide of carbon as directed in Bulletin No. 58 of the Michigan Station. Kerosene emulsion has proved an excellent repellent of vermin in poultry houses. The hop louse, now a terrible pest in Oregon, is being carefully studied. Tobacco decoction, 1 pound to 2.5 gallons of water proves effective against the flea beetle (*Phyllotreta descipiens*). Cutworms are very destructive. The poison clover traps have been tried against them with unsatisfactory success. Salt has no effect to prevent their ravages. Wireworms are a serious pest, and several attempts to prevent their ravages have been fruitless. The Hessian fly, reported to be in California, has not been found in Oregon. Ducks are said to be killed by eating the bug *Sargus succinctus*, but efforts to get poultry to eat these bugs were an entire failure. Paris green, 1 pound to 250 gallons of water, is found strong enough for the first application against the codling moth caterpillar, and 1 pound to 300 gallons for all subsequent applications. Unless soap and soda are used the last proportion is as strong as the foliage can bear, even for first treatment. Lectures and laboratory practice were given to four students during the past term.

The Rhode Island Station although doing nothing in general entomology, is conducting experiments in apiculture, which are in charge of a well-informed, practical bee keeper.

The South Carolina Station is at present giving no attention to entomology.

At the South Dakota Station the entomologist does duty both in the college and the station. Dipterous insects, insects that attack shade trees, and the insects peculiar to the season are all receiving special study.

At the Tennessee Station the entomologist also teaches in the university. I have no report of either the station or university work.

At the Utah Station the horticulturist is to teach in the college and to take charge of investigations in entomology. No report has been received from that station.

In Vermont the biologist in the university conducts experiments in entomology for the station. This season's investigations relate to the history of the May beetle (*Lachnosterna fusca*) and ways to prevent its ravages.

The Virginia Station unites its entomologist and botanist in the same person. The work reported consists of lectures before farmers' organizations and investigations of insects affecting tobacco. Complaint is made that the work is so heavy that original research is quite impossible.

In West Virginia the entomologist works only in the station and only in entomology. His duties consist of journeys of investigation through the State and lectures on economic entomology before farmers' organizations. The subjects under investigation are, causes of death of spruce trees, insects infesting the locust tree, imported fruit bark beetle (*Scolytus rugulosus*) and its natural enemies, and a study of the family Scolytidæ and the parasites attacking these beetles. Original drawings are made illustrating the species in their several stages. Three thousand and six numbers have been added to the accessions, which include nearly as many species and about 10,000 specimens. A large number of Ichneumon and Chalcid parasites have been bred from the various species of Buprestidæ, Cerambecedæ, and Scolytidæ, which have been studied. Parasitic and predaceous insects found destroying borers in the spruce are thought to be the only hope of salvation for these trees. Three species of parasites were bred from pupæ found in the burrows of *Agrilus ruficollis* which have materially checked the ravages of that Buprestid. Four bulletins, of 30,000 copies each, have been issued.

The Wisconsin Station has organized no department of entomology.

The Wyoming Station has just appointed a professor of entomology in the university, who will also do duty as station entomologist. The department is being well equipped.

Owing to illness and great press of work there is no report from the Department of Agriculture, and so, while I can not speak of their special work, I can speak in the highest terms of their excellent reference collection; of their vigilance in keeping informed of all insect outbreaks and sending special and competent agents to investigate them; and especially of their ever manifest readiness to help us all by advice, by determinations, and by any kind of assistance desired, which is always promptly rendered. In all this they are doing a work of incalculable value, and have richly earned the gratitude and support of us all. Their publication Insect Life is a most excellent and a most helpful contribution toward entomological advancement.

It will be seen by this imperfect report that results at different stations are widely different. This emphasizes the importance of numerous workers and numerous repetitions of experiments not only by each worker but by all the workers.

A. J. Cook,
Chairman.

Mr. Warington then delivered his lecture entitled Nitrification of Soils and Manures.

At 9:30 p. m. the convention adjourned until the following evening at 8 o'clock.

Evening Session, Tuesday, August 18, 1891.

The meeting was called to order by Vice President Porter at 8 p. m.

Mr. Warington delivered his lecture entitled Drainage and Well Waters.

Mr. Alvord. We have just listened to the last of a series of six most interesting and instructive lectures, begun and continued under the auspices of the Association of American Agricultural Colleges and Experiment Stations. It has fortunately occurred that a number of other scientific bodies have successively contributed to the audiences gathered here night after night. The circumstances under which these lectures have been delivered have made it inevitable that there should be more or less change in the personnel of the audiences during the week. The lecturer has had before him, therefore, not only the delegates to the convention of the Association which especially invited him to be here during this time, but also representatives of the Association of Official Agricultural Chemists; other chemical, botanical, and entomological societies and clubs; the Society for the Promotion of Agricultural Science; and finally, this evening, the American Association for the Advancement of Science, of which, I am glad to say, our lecturer himself is now a member. Under these circumstances it seems to me that we must all agree that the occasion has been a happy one for the delivery of this first course of lectures under the Rothamsted trust.

We can hardly conceive of circumstances other than these under which the lecturer could have addressed in successive evenings, as he has done here, representative men, engaged in active scientific work, from at least forty different States and Territories, besides the District of Columbia and Canada. I think therefore that the arrangements under which this first course of lectures has been delivered here in Washington have certainly been amply justified; and while the Association of American Agricultural Colleges and Experiment Stations has already taken appropriate action in regard to these lectures, it seems to me that it would be a mistake for the gathering this evening to disperse without broadening the recognition of the lectures and of the services of the lecturer himself; and so, as a resident of this vicinity and as a member of the general local committee representing these affiliated societies, on their behalf, and I think I may add on behalf of the residents of Washington and vicinity, who have also contributed to the audiences, I beg leave to move that the thanks of those represented by the audiences gathered here night after night be again extended to Sir John Bennet Lawes and to his most faithful and accomplished representative, Mr. R. Warington, for the lectures here delivered, and I move that the vote upon this motion be now taken and by rising.

Mr. BREWER. I second the motion, and in doing so wish to most heartily indorse what has been said. Thirty-four years ago I left Paris to go to Harpenden and it was 2 days before I got there. Some of the experiments detailed here had then been going on for some time. The patience, accuracy, and care which have marked the steps there taken have been such that to-day the success of Rothamsted presents such an example for us that I am especially happy that these lectures should have been delivered where so many who are connected with experiment stations in this country could hear them. With a pressure behind us here by people who wish immediate results and in the hurry on the part of many who are doing the work, I am doubly happy that we have had this course of lectures, representing as they do such a long, accurate, and careful investigation.

The motion was unanimously carried by a rising vote.

At 9 p. m. the convention finally adjourned.

APPENDIX.

MINUTES OF THE SECTIONS.

SECTION ON AGRICULTURE.

MORNING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order at 9 a. m. by Vice Chairman Morrow.

On motion of Mr. Lupton topic No. 10 on the program—What should be the duties of the station agriculturist?—was first taken up for discussion.

Mr. Broun stated that in his college the station agriculturist was also professor of agriculture and that a part of his work was the conduct of coöperative field experiments which were being carried on by thirty or forty farmers throughout the State.

Mr. Ingersoll thought the agriculturist must be a teacher, an investigator, and a popular exponent.

Mr. Smith asked for a definite outline of the special duties of the agriculturist.

Mr. Buckham referred to the fact that station farms are expected to be in some degree model farms, and that the conduct of such a farm must be part of the work of the agriculturist. He referred to the importance of the station agriculturist coming into contact with the best farmers of the country, and the necessity for accuracy in work and in expression, as farmers are quick to detect any carelessness in these respects.

The Chairman at this point called attention to the fact that the discussion was developing three principal lines of duty or relationship which should be considered, (1) duty to fellow workers and director, (2) duty as superintendent of model farm, (3) duty to farmers of the State.

Mr. Roberts believed that the work of the agriculturist must be largely decided by circumstances, and stated that the agriculturist of his station was expected to perform any kind of work, whether in the office or the field, that might be required. He wished to emphasize the point that any station worker should be willing to do anything that needs to be done, whether it happens to lie in his specialty or not.

Mr. Curtis believed that the work of the agriculturist must depend largely upon the man himself and his special tastes and aptitude.

Mr. Jordan insisted that the director must be first and that other workers must carry out his policy.

Mr. Porter urged the importance of continuity of plan. The work should be so organized that it would neither be stopped nor diverted from its course by changes in the personnel of the station staff, from director down. He also insisted that the work of experimentation was enough for one man, and that he should not be required to teach also.

Mr. Alvord suggested that the governing board should adjust the work to the personnel of the station.

Mr. Armsby insisted that the director should be the autocrat of the station; that the governing board should select a man on whom they could lay this responsibility, and that then he should have the widest liberty in the choice and direction of associates. He believed that a wise director in selecting his associates would assign different lines of work to men who had made special study of those lines, and then giving them the widest liberty consistent with a proper coördination of the station's work as a whole.

Mr. Dabney believed that many stations were suffering from too much organization. There were too many committees and advisory councils—too many wheels working within wheels.

Mr. Mills urged that greater attention be paid to continuity of plan, and that greater care be exercised in the publication of results, as crudely prepared work was sure to be eventually detected by the farmer and to react against the station.

Messrs. Emery and Phelps spoke from the standpoint of the agriculturist, and urged that the largest liberty in details consistent with proper coördination of work be accorded to him.

Mr. Plumb believed that the term "agriculturist" is a misnomer; that the work now covered by this office should be further specialized, as few men could be found who were competent to do the best work in each of the fields of cereal culture, live-stock husbandry, and dairying.

Mr. Lazenby supported this view.

Mr. Armsby thought that a greater specialization of stations would be found necessary, as no one station could cover the entire field of agricultural research with present income.

Mr. Myers suggested that the duties of the agriculturist were too ill-defined, but as most stations are at present organized the agriculturist must help everywhere.

A number of delegates having come in during the discussion, it was now proposed to take up the program. The first topic was indefinitely postponed. Topic 2 was postponed until Mr. Gulley should arrive, it being understood that he was on the way. Topic 3 was assigned for the first discussion of the afternoon session. Topic 11 was postponed until the following week, as Mr. Hilgard had written that he would be present then. On motion of Mr. Phelps, topic 7 was taken up and opened by Mr. Whitney in the following paper:

Soil Features that Should be Recognized in all Plat Work.

When a boy on the farm I used to hear, and read in the agricultural journals a great deal about the raising of wheat and clover, the value of grasses and stock for the farm, and the improvement of soils by manures and cultivation. The soil of the farm where I lived was a light, sandy loam, near a river, well suited to peaches, melons, and truck, but quite unsuited to the crops first named. Not knowing that there were different kinds of soils, I was distressed that these crops could not be grown, perplexed at the conflicting advice as to how to grow them, and distressed when the most approved methods did not succeed in making them grow. Even when I noticed that my neighbors who raised wheat and clover had stiff clay lands I could not realize, as is doubtless the case with many to-day, that this was due to the difference in the soils alone; that I could not hope or expect to profit by their experience, or raise their crops, or bring the light soil up in an economic manner so as to compete with them in the crops they grew. It took me still longer to realize that there were crops, and paying crops, to which these soils are far better adapted than are the stiff lands. Later experience and research have confirmed this and shown the reason for it, and it would be well to have this recognized and understood by every farmer and farmer's son; and how much more necessary is it to be recognized by one who carries on plat experiments.

It must be recognized that soils differ in texture according to the conditions under which they were formed; that this difference in texture varies the rate with which water will circulate in the soil and the rate with which it will be supplied to the plant and replace loss from evaporation. It must be recognized that certain crops are well adapted to certain soils, because under ordinary meteorological conditions the soil is able to supply soil moisture at a mean rate required for the crop. From the texture and arrangement the soil may be inclined to be too wet or too dry for the best development of other crops, and to secure such development manure must be used for the soil and not for the crop. If the results of the work are to be of general interest the soil selected should represent fairly well a considerable area, and if possible the texture of the soil be shown by the mechanical analysis. It is not sufficient to describe the soil as a "dark loam" or "light sand." Give the geological formation to which it belongs as carefully as possible, and such other information as to extent, quality, texture, and agricultural character as may enable a reader to form an intelligent idea of the experiment and of the extent and value of the application of the results. I have seen several elaborate investigations laid out on land which was afterwards found to be of purely local extent. The selection of representative soil, of uniform texture and fertility throughout, is probably the most difficult, as it is certainly of the first importance, in plat experiments. Then it must be recognized that it is not the plant which is to be asked whether it would like potash, or lime, or nitrogen, but that it is the soil which needs to be changed. For the evidence of irrigation and of the changing seasons leaves no doubt that with the proper water supply any soil will be well adapted to any crop. I have shown elsewhere the remarkable effect fertilizers have on the rate of circulation of water in the soil. We need go only a step farther to show the necessity of absolute uniformity in the physical treatment of the soil.

There is great meaning in Wagner's observation, that the effect of a footstep on his plats can be seen through a season's growth. The compression changes the structure of the soil and changes the relation to water and to plant growth—an end which it is desired to reach by the use of fertilizers alone. From my microscopic work and the experience in working with soils in glass tubes, I can hardly see how it is possible to secure uniform physical conditions in the field, for in glass tubes a slight difference in treatment may give results out of all proportion to the difference in treatment. The most valuable record that could be given in plat experiments would be a record of the moisture in the soil of several plats and a method to secure such a record is much desired.

Afternoon Session, Thursday August 13, 1891.

Mr. Henry of Wisconsin read the following paper:

Physical Conditions Surrounding Animals in Experimental Feeding, Especially as Relative to Stalls and Mangers.

In discussing this subject I shall hold to practices and ideas as they have crystallized from actual experience.

In feeding steers I do not believe in the practice, quite common in the East, of tying up each animal separately or confining them in stanchions, since it is almost impossible to keep steers clean that are thus confined, and I doubt if they do as well as if given more freedom. The Western farmer long ago broke away from this custom and found better results in feeding in the open lot, and better still in the open shed. Were I feeding in Kentucky or Missouri I would rather use a wood lot for feeding purposes than most of the stables found on the better class of farms in the Northern States.

In Wisconsin, where the thermometer sometimes drops to 30° below zero, I think a small lot with an open shed on one side, in which the food is placed, provided with some litter, proves the most satisfactory feeding pen that can be devised. Each steer can be fed separately, but all run together at all other times. Of course cattle kept in this way should be dehorned. Experience has shown that there is no more need of the steer's bringing his horns into the feeding pen than for a citizen of a well-regulated Christian community going around with arms and dirk knives. A bunch of dehorned steers in a small lot with a covered shed at one side, can be handled at a less expense, are free to take the most comfort possible without worry from any source, and are in just that condition that will permit them to make the best possible gains from the food consumed. I know that in making these statements I shall traverse the ideas of some of the Eastern feeders, who may rightfully claim many more years experience than I have had in the matter, but I believe that the feeders in the great corn belt of the West understand the management of cattle far better than their Eastern brothers, and that we had better look to them for advanced methods rather than to the Eastern farmer.

We usually confine sheep in bunches of five each. The troughs in which grain is fed should have the bottom board not less than 10 inches in width and flaring sides about 2 inches high. The grain or concentrated food should be spread thinly over the surface of this trough so that the animal gathers up the grain with its lips, getting but a small amount at a time, which tends somewhat towards better mastication. In fattening experiments the feeder should not place all the grain in the trough at once, but rather a little at a time, watching the way the animal feeds. As the sheep become satisfied they fall back from the trough one by one, leaving a little food uneaten, which should be removed at once from the trough by tipping it up endwise, sliding all that remains back into a basket. If this feed is at once mixed with that in the feed bin the animals will not object to it at the next feeding time. As soon as the sheep are through feeding the trough should be placed out of the way so that the animals can not get their feet into it or foul it before the next feeding time.

The genuine shepherd delights to stand by and watch his sheep eat their grain, and I do not believe his work should press so much as to prevent him doing so, for there is no better time to study the conditions and needs of his animals than this. Where sheep are fed care must be taken to keep the temperature down. They will stand much cold and thrive, but warm quarters are sure death to them. We have a small lot back of each pen, and in fine weather they are allowed to run in this yard for exercise.

In our hog house the feeding rooms are separate from the sleeping compartments, and the hogs are only allowed to come into them at feeding time. By this arrangement there is the minimum of unpleasant odors about the feeding trough, and I believe the pigs are better satisfied with their food than when the trough is in close proximity to their sleeping places.

With us metal troughs are too good conductors of heat for winter use. I believe there is nothing better than the common wooden V trough, made by spiking a 2 by 10 plank at right angles with a 2 by 12 plank. Over such a trough hangs a swing door. There is no place where food can spill out or waste except at the ends of the trough, and there need be little or no loss there if a strip is nailed so as to close the crack and prevent food dropping down where the pigs can not reach it.

Only in winter are any of our pigs kept in or near the hog house. Experience has shown us that there is no better place for swine than a good open pasture lot. In this pasture lot we confine the animals, when necessary, in pens about 2 rods square, made with movable fence panels. These lots are arranged on each side of a narrow lane, which is closed at the lower end by scales for weighing the animals. Over the scales is a temporary shed to keep off rain. In each lot is a shed to protect the animals from sun and rain. At the entrance to the lane is a house 8 by 10 feet square, in which feed and scales for weighing it are kept. Water is carried from the hydrant in the pasture to the feeding pens by barrels on wheels. A group of five or six animals are kept in each pen.

I believe that in all feeding experiments we should feed each animal by itself. We have adopted this practice with pigs and cows, and I hope to follow it up with other animals in the future. With pigs the matter is very simple. In each lot next to the narrow lane above mentioned, is a system of stalls made of light fencing 4 inches wide and 6 feet long. In the front of these stalls runs a trough, divided so as to hold the feed for each pig separately. At the rear is a sliding door. The feeder places each hog's portion in the proper trough, then opens the doors into the stalls, letting one pig into each. After feeding, the pigs are let out and have the lot in common. Even hogs are gregarious animals, and I believe as far as possible they should run together in groups.

As soon as the lots become foul, which is usually in about 3 weeks, everything is moved to fresh sod. A wagon load of coal ashes is distributed in the lots each time we move, and it is surprising to see how eager the animals are for it. We have followed this system long enough now to warrant the assertion that it is a good one.

In arranging the buildings in which experimental animals are kept, I believe much attention should be given to the exposure. While we have cold winters in Wisconsin, there are a surprising number of bright, sunny days when the rays of sunlight afford much warmth if only the cold air can be kept out and the sunlight be allowed to pour in through windows. We now plan our buildings to run east and west, with the feeding alley on the north side and the experimental pens on the south side of the building, with low windows which will allow the winter's sun to pour in its full strength and strike the animal whether standing or lying. The windows should be hung with hinges or made to slide and should be protected from breakage by the animals on the inside with quarter inch iron rods and on the outside by heavy wire netting. In experiments where some of the animals are on the north side of the building and others on the south side in the sunshine, I do not believe the conditions of the test are equal.

In closing I desire to enter an earnest plea for a more careful study of suitable environments and intelligent attendance upon all animals in our charge for experimental purposes. We have approached the exceedingly difficult problem of animal experimentation from the chemical side, and our solicitude for accuracy and the study of better methods of laboratory work has, I fear, often prevented us from properly appreciating the physical difficulties of the problem. Do we not altogether too much regard our animals as retorts or stills into which certain feed substances may be placed and out of which certain things must come with the same exactness and definiteness as in the chemical combinations of the laboratory? In arranging feeding experiments we begin the list of expenses with the salaries of the chemist and laboratory assistants and the cost of the paraphernalia of the laboratory, and by the time we have come down to the items of the animals to be experimented on, the attendants, and the barn equipments our resources are apt to be so exhausted that but meager facilities and second-rate conditions are possible. If I can have but one side well equipped, give me the best of barns, stock, and food, and the most skillful observing attendants, and let the chemists be more poorly paid, let the laboratory be smaller and have less apparatus.

I believe we should take especial care in selecting the man to whom we intrust the keep of the animals under experimentation. He should have a strong love for animals of the class he is dealing with, backed up by just as much experience and training as possible. The best men, judging from our limited experience, come to us with a natural love of animal life, and will be trained by us at the station. The work is so peculiar and so different from ordinary stock management that I think we will not find our help satisfactory when brought from the ordinary large stock farm. For example, I have had two Scotchmen, highly recommended as shepherds, both faithful and well-meaning, but they could not comprehend or did not have patience to properly carry on experimental work. After dropping these we took up a German, who had no other qualifications aside from good habits, good judgment, and a strong natural love for animals, coupled with a willingness to do as directed in all matters. With these qualifications we are developing him into a first-class shepherd, and in a year or two more we will have a splendid man for a most difficult place.

We should not forget accomodations for the attendants. There should be in each experimental feeding barn a comfortable room, so equipped that the attendant can remain there night after night if necessary. Nor should the skilled attendant be overworked. No man on the station farm carries more responsibility, and reponsibility if well carried calls for a reasonable amount of time in which to accomplish the required work. These men must observe all details carefully and often act quickly. If they are in one eternal grind they can not do so.

Each animal under experimentation in a feeding trial should be in just that condition as to surroundings as will conduce to the most favorable results. We must not hold to the idea that these creatures are passive and plastic in our hands; their natures and instincts are the results of ages of environment and keep, and it is perfectly useless to attempt to bring them to our ideas of how to live and what to eat in a short lifetime.

I would not belittle the chemist's side of our live-stock investigations, but I plead for the uplifting of the physical side of animal experimentation until it is placed on that high plain of intelligent recognition of the needs and conditions of each creature experimented on. Only when this has been accomplished can our feeding trials give results that will stand the test of time.

Mr. Gulley of Arizona presented the following paper:

The Number of Animals to be Used in Feeding Experiments.

The number of animals that should be used in a feeding experiment to secure data that may be useful and approximately reliable, is not easily determined. It is somewhat akin to the question of large *vs.* small plats in field tests with plants, and feeding for gain in weight or production of milk is perhaps more complicated than feeding for simple maintenance. We are, in fact, attempting to secure a scientific solution of a problem with several factors unknown, and at least one insolvable individual variation.

Mr. Webster when asked if he could not take any good Jersey cow and by judicious feeding secure the yield attained by several of his noted animals, is said to have replied, "No, I have handled from first to last several hundred and have found but one of each," mentioning four noted cows.

There is reason for claiming that more satisfactory results may be obtained from small rather than large field plats in testing fertilizers, varieties, etc., on the score of greater accuracy in work, if we are willing to admit that such work has any value more than to verify laboratory tests of plants; but to my mind it is taking large chances when we draw conclusions from results obtained from feeding one, two, or even three animals.

Without citing cases, I shall simply refer to feeding tests reported from this country and from abroad, and call attention to the wide range of variation between animals, and of the same animal at different times. If reports of the entire work of feeding animals at the experiment stations in this country were compiled and an attempt made to summarize results, we would have a mass of contradictory conclusions, of little value to the investigator and of practically no benefit to the economic feeder. Especially is this true of tests for the comparison of breeds, made with one or two animals of each breed. To a considerable extent this is due to a lack of facilities and skill in conducting the work, but greater than all to my mind is the uncertainty of the individual animals used in the tests.

Before going further I desire to state most emphatically that I disclaim any intention of criticising the work of my colaborers. I believe that no body of men in any country have ever shown more diligence and desire to do good and honest work than the experiment station men of this country since the stations were established. We have had many difficulties to contend with, but we are overcoming them.

I would make the minimum number of animals in a feeding test five, and consider this preliminary work, to be followed by a verification test with a minimum number of ten, and then if it is an economic feeding test, arrange with some practical feeder to test the results obtained on a still larger scale under some supervision of the station, with regard to quantities, weights, and other details.

Such feeding tests as I have suggested call for large equipment in plant and attendance, as the same attention must be given to each animal where ten are used as with one. This brings up a fundamental question which we must grapple with and determine wisely, if as a body we propose to utilize our resources to the best advantage.

It is reported that 27 stations are studying meteorology and climatic conditions; 31, soil—investigations of its geology, physics, chemistry, tillage, drainage, and fertilizers; 35, analyses of homemade commercial fertilizers, and field experiments with fertilizers; 39, methods of cultivation, manuring, and rotation, varieties adapted to different localities and purposes, and chemical composition and nutritive value; 24, composition of feeding stuffs, some of them making digestive experiments; 17, silos and silage; 24, feeding experiments for beef, milk, mutton, and pork, or different methods of feeding; 18, dairy work and milk investigations; 35, to a greater or less extent, horticulture; 25, injurious insects; 15, veterinary work; 6, sugar making.

To a great extent one station is the duplicate of another in the line of work adopted, and in three fourths of the stations the means that should be utilized to investigate one question are, to use a sporting phrase, "fired out of a big smoothbore gun with a bell muzzle."

We, as members of this Association, are not responsible for this condition of things, but we shall be if it continues. College boards, local opinion, the demand that each industrial interest must receive attention, in short the necessity of gaining popular favor, has compelled us to spread over fields too large.

As training schools for young men the stations deserve great credit, but looked at simply from a business standpoint, as an investment by the country for investigation, while I believe we have returned to the people more than we have cost, we have not carried on this work in the most businesslike way. We did not have the men to start with, but we are getting them now, and to my mind the time has come for concentration and thorough work.

I have lived too long in the vicinity of the cotton plant to advocate a general control of the line of work of the stations, but I believe the time has come when as a body we should use our influence to concentrate the work of each station.

Nebraska has stepped to the front by appropriating $10,000 of the experiment station funds to one line of work. Suppose that four stations widely separated should for 4 years expend their entire resources in feeding experiments: Who does not suppose that much, yes, very much, more would be accomplished than in the twenty-four stations, where probably, taken together, an equal amount is expended in this work? Will not the same apply to all our work?

It may not be wise to expend the entire energy of the station in one line, but we might by mutual agreement make a beginning in apportioning the work, and then to have each station expend two thirds or probably three fourths of its means in one or at most two lines of work, using the remainder of the fund for such special investigation as may seem desirable.

Without this concentration feeding experiments can not, to my mind, be satisfactorily conducted unless our means are increased.

Mr. Armsby suggested that the factor of individuality might in some degree be eliminated by studying the same animals first through a period of feeding on a fodder having a wide ratio, and then on one having a narrower ratio.

Mr. Curtis remarked that there were often great variations in the same animal on the same food at different periods.

Mr. Morrow called attention to the fact that practical feeders got very contradictory results, as shown by the records of the fat stock shows.

In the general discussion the danger of impracticable work was illustrated by reference to a recently published series of experiments in which several animals were killed by feeding too exclusively on cotton-seed meal.

Mr. Hickman presented the plan of a cow stall recently constructed at his station, which led to a general discussion on the subject of stalls, floors, mangers, ties, etc. The Newton tie was commended by several persons.

On motion of Mr. Hunt, topics Nos. 5 and 8 were assigned to the general session for discussion.

On motion of Mr. Henry topic 12 was made the topic for discussion in this section on Friday.

Morning Session, Friday, August 14, 1891.

Mr. Ingersoll opened the discussion on topic 12, Variety testing in cereals, how can it be rendered more decisive? In this work the question must be studied from the standpoint (1) of the farmer, (2) of the miller, and (3) of the baker or consumer. This was illustrated by the history of the Clawson wheat in Michigan, which was condemned by the miller, though found much more productive than the ordinary sorts by the farmer. Next must be considered climatic conditions and soil variations. A variety may be suited to one climate but not to another and its adaptability can only be decided after a test of several years. To eliminate the disturbance from variations in soil, a preliminary study of the soil under one variety was recommended, as also the duplication of the work on soils of entirely different character and over a series of years. It was especially urged that great care should be exercised in interpreting results.

Mr. Hickman presented the following paper:

VARIETY TESTING IN CEREALS, HOW CAN IT BE RENDERED MORE DECISIVE?

Variety testing of the cereals was discussed at our last annual meeting at Champaign, Illinois, more particularly in reference to the advisability of stations making this a prominent line of their work. Since it seems to be pretty generally decided that this work is a legitimate part of the station work, the next point to be discussed is the subject of this paper, namely, How can it be rendered more decisive?

As the amateur takes up this work he is sure to be disappointed in results because of a failure on his part to make a proper selection of soil upon which to do the work. The first point, then, that I would make as essential to more decisive results is that the selection of the soil should be made with the utmost care. This can not be done by a mere superficial survey before and after the land is plowed, but can be best done by taking a pick and shovel and digging holes to a depth of 5 or 6 feet at some three or four places in each and every acre used for a variety test. The purpose of these soundings is to define the depth of surface soil and to find the conditions of the subsoil—whether its composition is substantially the same throughout, and also to determine if the natural drainage of the land is regular and uniform.

If this first condition is overlooked our work in variety testing will be not only a decided failure, but the results will be wholly misleading. Should we find the natural fertility of the soil uniform and the variations in elevation only slight, the next point to be carefully considered is the drainage. Slight elevations and depressions may cause constant annoyances, but if the land is not by nature well drained, these annoyances will be multiplied tenfold. Therefore it is essential that systematic drainage be made a part of the preparation of land intended for the most decisive results in variety testing.

Having decided upon uniform soil and systematic drainage, the third point is to make the preparation of the land the same in all respects, plowing to a uniform depth, and all as near the same date as possible. Harrowing, rolling, etc., should be done with marked regularity.

The fourth point to be made is regularity in seeding, and this must be done by carefully grading the seed used. With wheat this can be rapidly and well done with a fanning mill such as the Monarch, which will give three grades of wheat, the first of which is quite uniform in size of the berry. This insures regularity in seeding, provided a good grain drill not too much worn be used.

With oats, grains of uniform size and weight can be most readily gotten by running through the fanning mill with a regular blast of wind sufficient to blow over the lighter grains. With corn, experiments have shown that it is not so essential to have the grains of uniform size. Experiments at our station lasting over a series of 4 years have not indicated any decided differences in yield between corn grown from the butts, middles, or tips of ears. Permit me to say here that I am not aware of any experiments being conducted that will prove any different results between using large and small grains of wheat, oats, barley, and other cereals, but until such experiments have been made the use of seed of uniform size is safer. If for no other reason it will insure regularity of seeding, and this is a very essential point in variety testing.

To conduct these variety tests in a single locality in any State will not warrant the experimenter in drawing general conclusions, but he must limit his deductions on some points to results from that particular soil upon which he is working. Then to make our variety testing more decisive it is necessary that duplicate tests be made upon the different soils of the State. These tests should be conducted under the supervision of the stations, in fact by one trained at the station for such work. As I stated in my paper of last year, I believe the proper way to do this is for the stations to rent 8 or 10 acres of land, in as many different parts of the State as the case may warrant, for a series of 5 years, with an option of a further lease of 5 years, and put these lands under the direct management of a station officer. At the end of the first 5 years he may be able to decide pretty accurately what varieties are best adapted to certain soils. In fact not only would the experimenter be able to decide these points, but farmers having the data before them showing the results of the different varieties upon different soils for such a series of years could reduce the work to conclusions for themselves.

The mere fact of difference in yield from different varieties can not be attributed to variations of soils alone, but may be influenced by the crop preceding the one under consideration. It is therefore necessary that a system of rotation be conducted in connection with the variety tests in any locality.

Location may have much to do with the diseases to which the cereals are subject. This is also a point that can be studied only when the varieties are widely distributed and grown under varying conditions of soil and rotation.

To illustrate the point above indicated, namely, the variations in yield from different treatment of the soil, I may say that in a piece of oats grown this year at the Ohio Station there was a difference of 6 days between the ripening of the same variety of oats on plats side by side, one having been in corn last year and the other in barley. As the oats are not threshed yet I am not sure that it will make any variation in yield, but the point of difference in ripening is one worthy of some consideration.

I am of the opinion that when we find it necessary to manure our lands for variety tests it should be done with a manure spreader, because in this way it can be done much more regularly than by any other process.

In all cases our plats should be cut to a line at the ends, either in the fall or spring, and never left until harvest and then squared up with a cradle, because this method leaves room for two sources of error: The first is, we can not cradle to a line as accurately as we can hoe, and the second may creep in by a careless hand putting the cradled sheaves in with the main plat.

The harvesting of the grain in wheat, oats, rye, barley, etc., is a very laborious work, and this can be rendered more decisive only by the strictest personal supervision, trusting only to the coolest heads and having a still cooler head yourself to oversee the work done.

Our present system of threshing and calculating results may be sufficiently accurate, but if some one of our agriculturists would turn his attention to inventions and get up a thresher that would do our work with less labor it would be a lasting benefit to the cause.

There are some perplexing things in variety testing and there are some problems which I have not been able to cipher out.

One of these is: How shall we obviate in our plats longer straw and stronger growth on the edges than in the interior?

Summary.—Variety testing may be made more decisive—

(1) By selecting uniform soil.

(2) By systematic drainage.

(3) By careful, thorough, and uniform preparation of the soil.

(4) By testing on the different soils of the State and comparing results.

(5) By systematic rotation.

(6) By grading the seed used.

(7) By making the outlines of our plats strictly accurate.

(8) By the most careful and painstaking personal supervision, guarding against every possible point of error; and finally in making up data for publication by not trusting too much to the accuracy of a helper nor to yourself. Time spent in duplicating calculations and deductions is time well spent.

The reading of Mr. Hickman's paper was followed by a discussion on points of detail. Attention was called to a small threshing machine in use at Guelph, Ontario, in which the under part of the cylinder is hinged in such a manner that it can be opened for the more thorough cleaning out of the machine. Several gentlemen recommended the so-called "ground-hog" machine for threshing, while others preferred small separators.

The effect of the dividing spaces between plats on the outside rows was discussed. Mr. Blount had noticed that their effect is greater on plats running east and west than on those running north and south. He also stated that the largest grains of wheat are found not on the main stalks, but on tillers.

Assistant Secretary Willits was present during this session, and stated that it was expected that a very large number of varieties of wheat would be exhibited by the Department at the World's Columbian Exposition, and requested the section to appoint a committee of experts from their number to assist in identifying varieties in that exhibit.

On motion of Mr. Henry the section resolved to appoint such a committee at a future session.

The section then adjourned until 9:30 a. m. on Saturday.

Morning Session, Saturday, August 15, 1891.

On reassembling the section proceeded to the election of officers for the ensuing year, with the result that C. L. Ingersoll of Nebraska was chosen chairman, G. W. Curtis of Texas vice chairman, and T. F. Hunt of Pennsylvania secretary.

Mr. Morrow called the President elect to the chair and presented the following resolution, which was unanimously adopted:

Resolved, That the secretary of this section be instructed to convey to Chairman C. S. Plumb the appreciation of the members of the section of his services in preparing for this meeting, and their regret for the indisposition which has prevented him from taking part in its deliberations.

The Acting Chairman named the following gentlemen as members of the conference committee on wheat nomenclature, requested by Assistant Secretary Willits, subject to ratification by the general session: Messrs. Hunt of Pennsylvania, Roberts of New York, Vanderford of Tennessee, Plumb of Indiana, and Gulley of Arizona.

The section then proceeded to the discussion of the first topic on the program, How may fiber plants be studied to best advantage? M . Smith of Minnesota opening the discussion. Mr. Smith stated that the fiber of flax deteriorates unless fresh seed be frequently imported, and that experiments were in progress at his station with the object of determining the best thickness of seeding, methods of culture, causes of disease, etc. He believed that the manufacture of flax must be developed simultaneously with its culture if any advance is to be made.

Mr. Smith was followed by a general discussion concerning present methods of cultivating, harvesting, and threshing flax and other fiber plants.

Messrs. Curtis and Gulley stated that a company now organized in San Francisco sells machines for decorticating ramie, taking a mortgage on the crop for the price of the machine.

Mr. Smith stated that a flax-pulling machine is working successfully in Minnesota.

Miss Charlotte Smith, president of the Woman's National Industrial League, Washington, D. C., appeared before the section and requested statistical information relative to the employment of women in agriculture.

The section then adjourned until Monday at 9:30 a. m., at which hour it adjourned *sine die*.

C. E. THORNE,
Secretary.

SECTION ON BOTANY.

MORNING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order by the Chairman, B. D. Halsted.

Mr. R. Thaxter being absent, Mr. G. F. Atkinson was appointed secretary *pro tem.*

No program was prepared, and the Chairman, on motion of S. M. Tracy, called upon the members for volunteer papers.

Mr. Tracy suggested that it would be a good plan to discuss the preparation of the botanical exhibit for the World's Columbian Exposition. He stated that various subjects had been assigned to specialists at some of the stations and it would be well for workers to call upon others so that the exhibit of each might represent the work of the stations as a whole and not the individual work of the station. Station workers in botany would confer a favor by suggesting other lines of investigation that they were engaged in besides those already provided for. Each should estimate the amount of space their exhibit would be likely to occupy. The Department of Agriculture would probably provide uniform labels and also, probably, uniform size and quality of sheets. Botanists have shown great interest in undertaking the work.

An informal discussion followed as to the proper place for an exhibition of fungicides and spraying machinery. The general sentiment seemed to be in favor of a combined exhibit on the part of other sections so as to prevent needless duplication.

On motion of Mr. Tracy the following resolution was passed:

Resolved, That the section on botany call the attention of the various heads of the entomological, horticultural, and agricultural sections to the desirability of a collective exhibit of fungicides, insecticides, and spraying machinery in a single alcove.

Mr. Alwood made some remarks upon a recent severe attack of a fungous disease upon apple tree leaves in Virginia. Many trees lost from 50 to 75 per cent of their leaves, and the growth of young trees was greatly interfered with. It has increased in severity during the last 3 years. He exhibited specimens of the diseased leaves, and stated that he had not yet worked out the life history of the fungus. Experiment showed that the disease could be successfully checked by application of a weak solution of lime and bluestone when applied to the new growth.

Mr. Brewer exhibited an English walnut and a nut resembling a butternut. The gentleman who sent them to Mr. Brewer several years ago planted some English walnuts. One of the trees which grew where the seed was planted bears fruit resembling the butternut, while all the others bear English walnuts. The question arose as to whether or not it was a cross. In the discussion which followed it was suggested that perhaps the appearance of the butternut tree was accidental.

Mr. Garman presented through the Chairman a paper on A Bacterial Disease of Cabbages. The disease was characterized by a rotting of the interior of the cabbage heads. It was communicated to healthy cabbages by inoculation from the diseased ones. The author concludes it is due to the combined action of two different germs, and that hot weather accompanied by a high degree of humidity favors its development.

Mr. Alwood stated that he had observed the same disease in Virginia.

Mr. Atkinson spoke of a similar disease in turnips in Alabama.

Mr. Halsted spoke of the undesirability of planting cabbages and turnips in succession on the same ground when they were affected by *Plasmodiophora brassicæ*, and suggested that it might be equally undesirable in case of this bacterial disease.

Mr. Brunk spoke of *Cladosporium fulvum* on tomatoes in Maryland. He had treated it successfully with carbonate of copper 3 ounces, carbonate of ammonia 1 pound, and water 50 gallons. This strength does not scald the fruit.

Mr. Jones asked if there were good fungicides other than Bordeaux mixture.

Messrs. Brunk and Alwood spoke of the effectiveness of a weak solution of the Bordeaux mixture—2 pounds of copper sulphate, 2½ pounds of lime, and 25 gallons of water.

In the general discussion which followed the merits and demerits of various spraying machines were discussed.

AFTERNOON SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order at 2:30 p. m.

Mr. Atkinson presented some notes on diseases of the cotton plant, and exhibited several colored illustrations of the various diseases.

Mr. Brunk spoke of the use of the stereopticon in illustrating lectures before meetings of farmers, horticulturists, etc.

Mr. Halsted explained the use by himself of colored charts for a similar purpose.

In the general discussion which followed the feeling seemed to prevail that where possible the subjects should be illustrated both in bulletins and in lectures, and that colored illustrations were superior to plain ones.

Mr. Halsted described the method employed by himself in studying spore germination, using slides with concave ground centers.

Mr. Lazenby suggested the use of common salt cellars in place of the old watch glass. They are on the same principle as the Syracuse watch glass.

Mr. Alwood presented notes on the Artificial Pollination of Wheat. He showed the varieties of wheat artificially pollinated and the resultant crosses, and described in detail the method employed in the experiments.

Mr. Crandall exhibited the fruit of the wild service berry (*Amelanchier alnifolia*), and spoke of tests being made to determine the value and possibility of its domestication.

Afternoon Session, Friday, August 14, 1891.

The section was called to order at 2:30 p. m., and according to adjournment proceeded to election of officers for the ensuing year. G. F. Atkinson of Alabama was elected chairman and L. H. Pammel of Iowa secretary.

Mr. Pammel presented notes upon a Destructive Disease of Cherries by a *Cladosporium*, probably the same species as that found on the plum and peach. Damages reached 25 per cent.

An informal discussion followed upon the germination of seeds of *Vaccinium*; and upon the distribution of plants as governed by character of soil, by heat, moisture, etc.

Mr. Halsted read a paper entitled Notes upon *Monilia fructigena* and Spore Germination. The cherry fungus was collected upon excrescence of plum caused by *Taphrina pruni* in Mississippi. Inoculations were made upon cherries in moist chambers. The inoculations were successful and the cherries kept for checks remained sound. Inoculations also showed that the fungus would grow upon green and ripe tomatoes and upon various other vegetable substances, but more readily upon cherries. Experiments were made to test the germinating power of the spores in presence of a small amount of metallic copper. A thin piece of copper foil of the size of the end of a lead pencil was placed in the water in the cell culture. The spores failed to germinate. When nutrient fluid was added in the form of cherry juice they would germinate. The action of fungicides was further tested. Ammoniacal carbonate of copper compound was used in various strengths, beginning with the strongest, *i. e.* 3 ounces carbonate of copper to 1 quart ammonia. Spores were killed by this; also by the half, fifth, and twentieth strength. Next, 1 part of the fungicide of vineyard strength was added to 99 parts water. Spores would not germinate, but when washed with pure water several times they would germinate. From this study the practical question arises whether far weaker solutions of copper sulphate than now used would be equally successful.

Mr. Atkinson spoke of attempts to germinate spores of *Cercospora gossypii*, Cooke, in a Van Tieghem cell, which had been sterilized by washing with a one tenth per cent solution of mercuric chloride. Care was taken that the nutrient agar-agar on the cover glass did not come in contact with any part of the cell sterilized by the mercuric chloride. In no case did the spores germinate when the cell was sterilized by mercuric chloride, but when sterilized by heat they germinated readily.

Mr. Sturgis of Connecticut spoke of similar experiences encountered by him when making cultures of lichens.

The section adjourned *sine die*.

G. F. Atkinson,
Secretary pro tem.

SECTION ON COLLEGE WORK.

MORNING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order at 9:30 a. m., the section organizing, in the absence of its regular officers, by the appointment of W. L. Broun of Alabama as chairman and H. E. Stockbridge of North Dakota as secretary.

President Alvord, chairman of the executive committee of the Association, presented a letter from the chairman of the section, President Atherton of Pennsylvania, proposing two topics for the consideration of the section, namely, Waste in college work, and To what extent can manual labor be advantageously introduced into the curriculum of land grant colleges? Consideration of these subjects was postponed, and by request President Alvord made a statement to the section of the present status of the Association and the institutions belonging thereto, with regard to the Congressional appropriations under the Morrill law, particularly the third or $17,000 installment, now overdue.

A circular letter under date of August 13, signed by the Commissioner of Education, was presented to the Association, pertaining to the annual reports of college presidents and treasurers called for by the act of August 30, 1890, and due on or before September 1. The conditions adopted by the Bureau of Education as governing the matter and form of these reports gave rise to an animated and very general discussion, eliciting the fact that the conditions imposed, particularly those requiring a "detailed statement of the amount so received and its disbursement," were unanimously believed to be impracticable, and it was thought best that an effort be made towards securing a different interpretation of the law from the Department of the Interior. It was, therefore—

Resolved, That a committee of five be appointed to confer with the Secretary of the Interior in reference to the payment of the installment unpaid and now due, under the act of Congress approved August 30, 1890, and further that this committee be instructed to confer with the Commissioner of Education concerning the revision of the circular letter of this date (August 30, 1891), issued by the Bureau of Education to the presidents and treasurers of agricultural colleges, and also concerning forms for the reports of the presidents and treasurers of these institutions.

The committee appointed in accordance with this resolution consisted of Messrs. Alvord of Maryland, Scott of Ohio, Johnson of Wyoming, Buckham of Vermont, and Porter of Missouri.

The section then adjourned until Friday at 9 a. m. to give the above committee a chance to confer with the Department of the Interior and report.

MORNING SESSION, FRIDAY, AUGUST 14, 1891.

The section convened as per adjournment. President Alvord of the committee made a report of progress, narrating the result of the interview of the committee with the officers of the Department of the Interior and the Commissioner of Education, whereby the information was obtained that the papers for the $17,000 payment to the different institutions named as beneficiaries under the act of August 30 had been drawn and were retained in the office of the Secretary of the Interior, and that the assurance of the Department was offered that the delay in the payment of this installment in no way emanated from the institutions concerned, but resulted wholly from technicalities in the Department itself, and that an early payment, probably during the month of September, was certain.

Following the report of this committee the section proceeded to the consideration of the two subjects proposed by its president. By vote, consideration of the first question, Waste in college work, was postponed for 1 year. The second subject, To what extent may manual labor be introduced into the curriculum of land grant colleges? was then called for, and in the absence of Professor Massey of North Carolina the paper prepared by him on this subject was read by his colleague, Professor Emery, as follows:

MANUAL LABOR IN AGRICULTURAL COLLEGES.

Of late years a great deal has been written and said in regard to manual training, and many people who mean well, but who have not studied the conditions nor had any experience as teachers, imagine that instruction in a college of agriculture should be upon the same plan as that of a mechanical training school. They mistake an agricultural college for a farm-training school, and the profession of agriculture for a handicraft. They go upon the hypothesis that to be a skillful farmer it is necessary for a man to be an expert farm hand in all the farm operations where manual dexterity is important. Even if this were the case, a college is not the place to acquire this dexterity.

Prof. L. H. Bailey struck the keynote in a recent editorial in the columns of the *American Garden*, when he said that a student should be prepared for college before entering, and that these minor operations of plowing, handling teams, mowing, etc., should be acquired before the student comes to college. The attempt to teach these things at an agricultural college usually amounts to a complete farce and a waste of time which could be more profitably devoted to matters more valuable to the student. The practice at some colleges of making field labor compulsory for a certain number of hours daily, and at the same time paying the students for doing it, is simply an acknowledgment that the work is not educational. The plain fact is, if you will pardon the slang, it is simply done for "buncombe," to make a show of doing practical work to be seen of men, and thus to enable the college to get appropriations from the legislature to pay for this perfunctory work, and enable students to pay their board in an institution where tuition is already free. It is in fact pure demagogy, and no one knows it better than the faculties of these colleges if they speak out their real sentiments on the subject.

As Professor Bailey says in the editorial referred to, the manual labor necessary in a college course in agriculture and horticulture is such as can properly come under the head of laboratory work, such as improved methods in dairy management and the manufacture of butter and cheese, the microscopic and chemical work in connection with these, practice in veterinary surgery, the management of plants under glass, their hybridization and improvement, those operations of a like character in the orchard and garden in which manual dexterity and scientific skill go together, and the botanical and chemical laboratories. All these are educational and important, but to have a band of students spending hours daily in the performance of set tasks at which the most unintelligent of farm laborers will always be their equal, and generally their superior, is, I have always insisted, a wicked waste of time and public money. It is not dignifying labor, as so many insist, but a belittling and prostitution of mental culture. Men say, "I want my son to be taught to work." Well, if your son has not been taught to work before coming to college, he lacks the industry to make him successful as a student, for a man who is lazy in one kind of work is usually lazy all the way through, and the kind of work necessary for a student to perform requires a higher degree of industry than that which belongs to a mere "hewer of wood and drawer of water."

"But you will educate the boys away from the farm." This is just what the hoeing, digging, and plowing colleges have been doing, and this is what colleges of real practical agriculture will put a stop to. Statistics show that in colleges thoroughly equipped for their work, and in which the laboratory methodsare used and the minor manual operations merely incidental, a much larger proportion of the students enter agricultural occupations than from the best of those where compulsory and paid manual labor is the rule. Professor Bailey says: "The graduates from the Cornell College of Agriculture, and they are as many as from any bona fide agricultural school in the country, *all* follow agricultural pursuits." And yet the compulsory paid manual labor system has no place at Cornell. I do not want it to be supposed that I oppose the teaching of all farm operations in an agricultural college. They should be taught, but no further than they are educational and necessary for the proper understanding of the subject at the time in hand, all partaking of the nature of laboratory work. Nothing further than this should be attempted. The effort to make skillful farm laborers at such an institution will necessarily result in failure, lower the educational standard of the college, and as a consequence turn out men with a narrow and incomplete education.

The effort in some places to give this purely *practical* character, as it is improperly called, to the college, has already resulted in a narrowing of the course of study, which can not fail to result in a lower degree of education. All languages except English are ignored, particularly the ancient languages. This is contrary to the spirit and intent of the organic law of these colleges, in fact contrary I think to its plain letter. The dead languages are used so largely in all scientific terminology that a student who is totally ignorant of Latin and Greek is fearfully handicapped in his work, and can never make the same progress as one who has the advantage of a knowledge of the structure of those languages; and if he proposes to keep well abreast with modern scientific research, a knowledge of French and German is highly desirable. But with his afternoons rigidly devoted to the perfunctory performance of the tasks which belong simply to the ordinary drudgery of the farm, he has no time for these; while he is out "dignifying labor" he is cheating his mind and narrowing his intellect.

This phrase, "dignity of labor," makes me lose patience with those who are continually uttering it on the rostrum and writing it for the press. Is ordinary intelligent labor the only labor worth "dignifying?" Is there no labor but that of

the hands? Are we to prostitute intellectual labor in order to get it down to the level of the farm hand? Ought we not rather to ennoble the labor of the hand by making it a necessary agent in carrying out mutual training—do for agriculture on the farm what the laboratory does for chemistry? Ennoble labor for education's sake, but for humanity's sake do not debase education for labor's sake.

The paper was listened to with great interest, and was followed by a general and very animated discussion, in which, while the general tone of the paper was commended, several of the opinions and statements made were challenged, among the statements elicited being one showing by actual analysis that the purely agricultural colleges were sending 34 per cent of their graduates back to the farm as actual practical farmers, and that doubtless a larger percentage of the graduates of these institutions followed the profession for which the institutions were maintained than could be claimed for the graduates of the professional schools of any other calling. At the close of the discussion the section adjourned to Saturday morning at 9:30.

MORNING SESSION, SATURDAY, AUGUST 15, 1891.

The section was called to order by the Chairman at 9:30 a. m.

President Alvord rendered a final report of the results of the interview of the committee with the officials of the Department of the Interior, embodying a form of report for college treasurers, which was acceptable to the Department and adopted by the section as the form recommended for use. Mr. Johnson of Wyoming, as a subcommittee, reported the form recommended for the reports of college presidents.

It was voted that the section recommend to the general session of the Association that a committee of three college presidents be added to the standing committee of the Association on representation of the agricultural colleges and experiment stations at the World's Columbian Exposition.

Mr. Alvord called the attention of the section to the ruling of the War Department respecting the detail of officers as instructors in land grant colleges.

No other business coming before the section, nominations for officers for the ensuing year, to be presented to the general session of the Association, were made as follows: E. M. Turner of West Virginia, chairman; C. H. Pettee of New Hampshire, vice chairman; H. E. Stockbridge of North Dakota, secretary. These officers were by vote constituted the executive board of the section, which then adjourned *sine die*.

H. E. STOCKBRIDGE,
Secretary.

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U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

BULLETIN No. 16

PROCEEDINGS

OF THE

SIXTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

NEW ORLEANS, LOUISIANA

NOVEMBER 15-19, 1892

EDITED BY

A. W. HARRIS, for the Office of Experiment Stations

AND

H. E. ALVORD, for the Executive Committee of the Association

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

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* Director.

† President of board of direction.

‡ Assistant director in charge.

§ Acting director.

‖ Chairman of council.

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U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., August 15, 1893.

SIR: I have the honor to transmit herewith for publication Bulletin No. 16 of this Office, containing the proceedings of the sixth annual convention of the Association of American Agricultural Colleges and Experiment Stations, held at New Orleans, La., November 15–19, 1892. The stenographic report of this meeting was made by Mr. S. E. Black, of this Office.

Respectfully,

A. W. HARRIS,
Director.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called The Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association, and to secure to that end mutual coöperation.

MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department, shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture or mechanic arts, who shall attend any convention of this Association, may be admitted to similar privileges.

SECTIONS.

(1) The Association shall be organized into sections upon (1) college work; (2) agriculture and chemistry; (3) horticulture and botany; (4) entomology; (5) mechanic arts. The executive committee shall, upon the request of any ten institutions represented in the Association, provide for the organization of provisional sections at any convention.

(2) Each section shall conduct its own proceedings and shall keep record of the same, and present a synopsis thereof to the Association at the close of every convention; and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the Association in general session.

MEETINGS.

(1) This Association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the Association. Special meetings may be held at other times, upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the program. The section meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them.

OFFICERS.

(1) The general officers of this Association shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer. The president, junior ex-president, the secretary, and four persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

(2) Each section shall, by ballot, nominate to the Association in general session, for its action, a chairman and a secretary for such section.

(3) Officers shall be chosen by ballot at the annual convention of the Association, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the Association, or an officer of an institution which is a member of the Association in full standing at the time of election, shall be eligible to office.

DUTIES OF OFFICERS.

(1) The officers of the Association shall perform the duties which usually devolve upon their respective offices.

(2) The president shall deliver an address at the annual convention before the Association in general session.

(3) The chairman of each section shall make, at the annual convention, a report to the Association in general session of the progress during the preceding year of the subject or subjects appertaining to his section, and such reports shall not occupy more than twenty minutes each.

(4) The executive committee shall determine the time and place of the annual conventions and other meetings of the Association, and shall, between such conventions and meetings, act for the Association in all matters of business. It shall issue its call for the annual conventions of the Association not less than sixty days before the date on which they are to be held, and for special meetings not less than ten days before such dates. It shall be charged with the general arrangement and conduct of all meetings called by it. It shall designate the two sections to present in general session a portion of the subjects coming before them, and shall give notice thereof to the chairmen of such sections at least ninety days prior to the annual convention. It shall provide a well-prepared order of business and a program of exercises, and shall make a seasonable issue of said program. Said committee may fill any vacancy in an office or committee of the Association occurring after the adjournment of the annual convention, such appointee to serve until the next annual election.

FINANCES.

At every annual convention, the Association, in general session, shall provide for obtaining the funds necessary for its legitimate expenses, and may, by appropriate action, call for contributions upon the several institutions eligible to membership; and no institution shall be entitled to representation or participation in the benefits of the Association unless such institution shall have made the designated contribution for the year previous to that in and for which such question of privilege shall arise, or shall have had said payment remitted by the unanimous vote of the executive committee.

AMENDMENTS.

This constitution may be amended at any regular convention of the Association by a two-thirds vote of the delegates present, if the number constitute a quorum: *Provided*, That notice of any proposed amendment, together with the full text thereof and the name of the mover, shall have been given in the call for the convention. Every such proposition of amendment shall be subject to modification or amendment in the same manner as other propositions, and the final vote on the adoption or rejection shall be taken by yeas and nays of the institutions then and there represented.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the program.

(3) Speakers invited to open discussions shall be entitled to twenty minutes each.

(4) In general discussions the ten-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general program shall be closely observed, unless changed by a two-thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION.

ELECTED AT WASHINGTON, D. C., AUGUST, 1891.

President,

W. L. BROUN, of Alabama.

Vice-Presidents,

C. W. DABNEY, jr., of Tennessee;
J. W. NICHOLSON, of Louisiana;
H. E. STOCKBRIDGE, of North Dakota;
F. E. EMERY, of North Carolina;
W. H. JORDAN, of Maine.

Secretary and Treasurer,

M. A. SCOVELL, of Kentucky.

Executive Committee,

The PRESIDENT; the SECRETARY;
H. E. ALVORD, of Maryland;
H. H. GOODELL, of Massachusetts;
J. A. MYERS, of West Virginia;
W. FREAR, of Pennsylvania;
A. T. NEALE, of Delaware.

Chairmen of Sections,

Agriculture, C. L. INGERSOLL, of Nebraska;
Botany, GEO. F. ATKINSON, of Alabama;
Chemistry, M. A. SCOVELL, of Kentucky;
College Work, E. M. TURNER, of West Virginia;
Entomology, L. BRUNER, of Nebraska;
Horticulture, E. A. POPENOE, of Kansas.

Secretaries of Sections,

Agriculture, T. F. HUNT, of Pennsylvania;
Botany, L. H. PAMMEL, of Iowa;
Chemistry, H. H. HARRINGTON, of Texas;
College Work, H. E. STOCKBRIDGE, of North Dakota;
Entomology, F. M. WEBSTER, of Ohio;
Horticulture, T. L. BRUNK, of Maryland.

ELECTED AT NEW ORLEANS, LA., NOVEMBER, 1892.

President,

W. A. HENRY, of Wisconsin.

Vice-Presidents,

W. C. STUBBS, of Louisiana;
E. W. HILGARD, of California;
J. A. MYERS, of West Virginia;
A. Q. HOLLADAY, of North Carolina;
J. F. HICKMAN, of Ohio.

Secretary and Treasurer,

M. A. Scovell, of Kentucky.

Bibliographer,

S. W. Johnson, of Connecticut.

Executive Committee,

The President; the Junior ex-President; the Secretary;
H. E. Alvord, of the District of Columbia;
H. H. Goodell, of Massachusetts;
Jas. Neilson, of New Jersey;
C. W. Dabney, jr., of Tennessee.

Chairmen of Sections,

Agriculture and Chemistry, W. A. Henry, of Wisconsin;
Botany and Horticulture, F. Lamson-Scribner, of Tennessee;
College Work, C. W. Dabney, jr., of Tennessee;
Entomology, L. Bruner, of Nebraska;
Mechanic Arts, C. W. Hall, of Minnesota.

Secretaries of Sections,

Agriculture and Chemistry, W. C. Latta, of Indiana;
Botany and Horticulture, E. S. Goff, of Wisconsin;
College Work, M. C. Fernald, of Maine;
Entomology, F. M. Webster, of Ohio;
Mechanic Arts, F. P. Anderson, of Kentucky.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Alabama:

College: W. L. Broun, president; P. H. Mell, professor of natural history and geology.

Station (Auburn): A. J. Bondurant, agriculturist; N. T. Lupton, chemist.

Canebrake Station: J. Huggins, trustee; B. M. Duggar, assistant director.

Arizona:

Station: F. A. Gulley, director.

Arkansas:

College: E. H. Murfee, president.

California:

College: R. H. Loughridge, professor of geology and chemistry.

Colorado:

College: L. G. Carpenter, professor of physics and irrigation engineering.

Station: W. J. Quick, director.

Connecticut:

State Station: S. W. Johnson, director.

Storrs Station: C. D. Woods, vice-director and chemist.

Delaware:

Station: A. T. Neale, director.

Florida:

Station: J. P. De Pass, director.

Georgia:

College: J. B. Hunnicutt, professor of agriculture.

Station: R. J. Redding, director; Gustav Speth, horticulturist.

Illinois:

College: G. E. Morrow, professor of agriculture.

Station: G. W. McCluer, assistant horticulturist.

Indiana:

College: J. H. Smart, president; H. A. Huston, professor of agricultural chemistry.

Station: C. S. Plumb, director.

Iowa:

College: H. Osborn, professor of zoölogy and entomology.

Station: L. H. Pammel, botanist.

Kansas:

College: G. T. Fairchild, president.

Station: C. C. Georgeson, agriculturist.

Kentucky:

College: J. K. Patterson, president.

Station: M. A. Scovell, director.

Louisiana:

College (Baton Rouge): J. W. Nicholson, president; B. B. Ross, professor of chemistry and mineralogy; H. A. Morgan, professor of horticulture and entomology.

Louisiana—Continued.

College (Southern University, New Orleans): H. A. Hill, president; V. L. Roy, professor of chemistry; W. J. Nickerson, principal of music department; J. M. Henry, professor of mathematics, Latin and Greek; H. Jamieson, professor of agriculture.

Station (Audubon Park, New Orleans): W. C. Stubbs, director; T. P. Hutchinson, assistant director; J. T. Crawley, chemist; F. H. Burnette, chemist; R. T. Burwell, machinist; J. N. Roussell, sugar-maker; Lucien Soniat, trustee.

Station (Baton Rouge): D. N. Barrow, assistant director; R. E. Blouin, assistant chemist.

Station (Calhoun): J. G. Lee, assistant director.

Tulane University: W. P. Johnston, president; B. V. B. Dixon, professor of metaphysics; J. H. Dillard, professor of Latin; R. Sharp, professor of English; J. B. Ficklen, professor of history; J. H. Deiler, professor of German; A. Fortier, professor of French; J. L. Cross, professor of mathematics; B. Ayres, professor of physics; J. M. Ordway, professor of applied chemistry; H. B. Orr, professor of biology; W. Woodward, professor of Greek; J. W. Pearce, professor of Anglo-Saxon; C. T. Gill, professor of Greek; W. J. Cooper, professor of mechanical engineering; W. Von Phul, professor of physics; T. T. Hall, mechanician; W. O. Rogers, secretary; A. D. Hurt, assistant secretary; D. S. Anderson, instructor.

Maine:

College: M. C. Fernald, president.

Station: W. M. Munson, horticulturist.

Maryland:

Station: R. H. Miller, director; H. J. Patterson, chemist.

Massachusetts:

College: H. H. Goodell, president.

Michigan:

College: O. Clute, president; I. H. Butterfield, trustee; H. Chamberlain, trustee.

Station: P. M. Harwood, agriculturist.

Minnesota:

College: C. W. Hall, dean.

Mississippi:

College: S. D. Lee, president; T. Butler, professor of veterinary science; A. B. McKay, professor of horticulture.

Station: S. M. Tracy, director; W. L. McGee, assistant director; E. R. Lloyd, agriculturist; H. E. Weed, entomologist.

Alcorn College: J. D. Burrus, professor of agriculture and mathematics.

Station (Ocean Springs): F. S. Earle, superintendent.

Missouri:

College: E. D. Porter, dean.

Nebraska:

College: C. L. Ingersoll, dean.

Nevada:

Station: N. E. Wilson, chemist.

New Jersey:

College: Austin Scott, president; B. D. Halsted, professor of botany.

Station: James Neilson, acting director.

New Hampshire:

Station: G. H. Whitcher, director.

New Mexico:

College: H. Hadley, president; W. L. Rynerson, trustee.

New York:

College: I. P. Roberts, professor of agriculture.

Station: H. H. Wing, agriculturist.

North Carolina:

College: A. Q. Holladay, president.

Station: B. W. Kilgore, assistant chemist.

North Dakota:

College: W. M. Hays, professor of agriculture.

Ohio:

College: R. H. Warder, trustee; T. F. Hunt, professor of agriculture.

Station: C. E. Thorne, director; J. F. Hickman, agriculturist.

Oklahoma:

College: J. C. Neal, professor of natural science.

Pennsylvania:

College: G. W. Atherton, president.

Station: H. P. Armsby, director; W. Frear, vice director and chemist.

Rhode Island:

College: J. H. Washburn, president.

Station: C. O. Flagg, director.

South Carolina:

Station: J. S. Newman, vice director and agriculturist.

Tennessee:

College: C. W. Dabney, jr., president.

Station: F. Lamson-Scribner, director and botanist; C. F. Vanderford, assistant director.

Texas:

College: W. R. Cavitt, trustee.

Station: G. W. Curtis, director and agriculutrist.

Utah:

College: J. W. Sanborn, president.

Vermont:

Station: W. W. Cooke, director.

West Virginia:

College: E. M. Turner, president.

Station: J. A. Myers, director.

Wisconsin:

College: E. S. Goff, professor of horticulture and economic entomology; F. H. King, professor of agricultural physics; H. B. Dale, trustee.

Station: W. A. Henry, director; F. W. Woll, assistant chemist.

Wyoming:

College: A. A. Johnson, president.

U. S. Department of Agriculture:

H. W. Wiley, chemist; H. E. Alvord, special agent.

Office of Experiment Stations:

A. W. Harris, director; A. C. True, assistant director; E. W. Allen, editor; S. E. Black, private secretary.

Bureau of Education:

J. W. Holcombe, chief clerk.

Visitors:

Mrs. N. T. Lupton, Mrs. P. H. Mell, Mrs. V. M. Fleming, J. F. Merry, N. S. Dougherty (secretary Louisiana Bureau of Agriculture), J. B. Buchanan (of the New Orleans Academy of Science), W. Murray, J. W. Coleman, Mrs. C. L. Ingersoll, Mrs. J. S. Newman, Mrs. J. A. Myers.

CALL FOR THE CONVENTION.

ASSOCIATION OF AMERICAN AGRICULTURAL
COLLEGES AND EXPERIMENT STATIONS,
OFFICE OF THE EXECUTIVE COMMITTEE,
Washington, D. C., August 1, 1892.

By authority of the executive committee, a delegate convention of this association is hereby called to meet in the city of New Orleans, La., on Tuesday, November 15, 1892, at noon.

The headquarters of the association during this convention will be at the St. Charles Hotel.

The program for the sessions and other particulars will be announced later.

At any regularly called meeting of the association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, and the Department of Agriculture shall be entitled to one delegate, but no delegate shall cast more than one vote. Other institutions engaged in experimental work in the interest of agriculture may be admitted to representation in this association by a majority vote at any regular meeting of the association. (Extract from constitution.)

In accordance with the requirements of the constitution, the sections on botany and college work are hereby designated to present a portion of the subjects coming before them in the general sessions of the convention.

The chairmen of the several sections will each be called upon for a report of progress, not to exceed fifteen minutes in the reading, during the first day of general sessions.

Conforming to the action of the Washington convention of 1891 (see Proceedings, p. 61), there will be submitted, in connection with the program for the convention of 1892, such amendments to the constitution of the association as are deemed desirable by the executive committee, and the consideration of this subject will be assigned a place in the program.

For the executive committee:

HENRY E. ALVORD,
Chairman.

PROGRAMS.

PLACES AND HOURS OF MEETING.

All sessions will be held at Tulane University, corner of Common and Baronne streets, two squares from the St. Charles Hotel.

Rooms for the section meetings will be duly designated.

Hours for meetings, 9 a. m., 2 p. m., and 7:30 p. m.

Headquarters for delegates when not in session, St. Charles Hotel, on St. Charles street, between Common and Gravier streets and one square from the canal.

SPECIAL NOTICE.

The chairmen and secretaries of sections are requested to hand to the secretary of the association, well in advance, written announcements to be made on behalf of the sections from day to day; also to preserve such records of the section meetings as will serve for a correct journal of their proceedings.

TUESDAY, NOVEMBER 15, 1892.

10 a. m.—Meeting of the executive committee, at the St. Charles Hotel.

12 m.—General session. Opening exercises and reports of committees.

2 p. m.—General session. Reports from chairmen of the sections.

7:30 p. m.—Meetings of all sections for organization and preliminary business.

8 p. m.—General session. Annual address by the president of the association, William LeRoy Broun, LL. D., president Agricultural and Mechanical College of Alabama.

WEDNESDAY, NOVEMBER 16.

9 a. m.—General session. Miscellaneous business. Report of committee on amendments to the constitution and action thereon.

10 a. m.—Meetings of the sections on agriculture, botany, and entomology; others if desired.

1 p. m.—Visit to the Louisiana Sug Experiment Station, Audubon Park.

7:30 p. m.—General session. Subjects presented by the section on botany, Prof. G. F. Atkinson, Cornell University, chairman. Discussion of the publication of the stations, to be opened by Director A. W. Harris, of the U. S. Department of Agriculture, and Director W. A. Henry, of Wisconsin.

THURSDAY, NOVEMBER 17.

9 a. m.—General session. Appointment of committees. Resolutions considered. Discussion: The Association and the World's Columbian Exposition, with reports of standing committees and incidental business. Upon adjournment of the general session, meetings of the sections on chemistry, college work, and horticulture.

2 p. m.—Meetings of all the sections.

7:30 p. m.—General session. Consideration of resolutions and general business. Annual election of officers. Reports from sections and action thereon. Subjects presented by the section on college work, President E. M. Turner, University of West Virginia, chairman. Discussion: The Relations of the Colleges to the Department of the Interior, with an address by John W. Holcombe, chief clerk, Bureau of Education, representing the Department.

FRIDAY, NOVEMBER 18.

Excursion by special train to Baton Rouge, with visits to the State Agricultural and Mechanical College, the State Agricultural Experiment Station, and several sugar plantations and sugarhouses in operation. Complimentary dinner at Baton Rouge.

Section meetings to be announced. Final adjournment.

SECTION ON AGRICULTURE.

C. L. INGERSOLL, of Nebraska, chairman. T. F. HUNT, of Ohio, secretary.

(1) Number of animals in a feeding experiment. C. S. Phelps.
(2) Individual variation in cows. G. W. Curtis.
(3) What is the live weight of an animal? H. J. Patterson.
(4) Stock-breeding at experiment stations. W. H. Brewer.
(5) Breed tests. W. W. Cooke and E. B. Voorhees.
(6) Mistakes to avoid in dairy experiments. H. H. Wing and W. H. Jordan.
(7) Mistakes in feeding young animals. I. P. Roberts.
(8) Technique in agricultural experimentation. J. F. Hickman.
(9) The establishment of official methods of experimentation. W. A. Henry and F. A. Gulley.
(10) Testing new varieties prior to their introduction. H. J. Waters.
(11) Coöperative field experiments. H. B. Battle and F. D. Gardner.
(12) Grass gardens, methods and purposes. H. P. Armsby and W. M. Hays.
(13) Forage-plant tests, their scope and plan. C. C. Georgeson.
(14) The botany of the cowpea. S. M. Tracy.
(15) Methods of soil investigation. F. H. King and M. Whitney.
(16) The control of soil moisture. D. McLaren.
(17) Methods of irrigation. L. G. Carpenter.
(18) What should the professor of agriculture teach? G. E. Morrow and P. M. Harwood.
(19) Laboratory instruction in agriculture. J. S. Newman.
(20) Details of successful farmer education. W. M. Hays.
(21) The relation of the experiment station to the agricultural college. L. Foster.
(22) The field of bulletins, present and prospective. C. L. Ingersoll.
(23) The press bulletin. C. E. Thorne.
(24) Methods of testing farm implements. J. W. Sanborn.
(25) Fiber production. G. Vasey and C. D. Smith.
(26) The production of beet sugar. E. W. Hilgard and J. Wilson.

NOTE.—This section program is published as furnished by the section officers. The executive committee requests that topic No. 14 be presented in the section on botany, Nos. 18, 19, and 20 in the section on college work, and Nos. 21, 22, and 23 in general sessions, unless a new section should be organized on station administration.

SECTION ON BOTANY.

GEO. F. ATKINSON, of New York, chairman. L. BRUNER, of Nebraska, secretary.

(1) New Jersey peronosporeæ for 1892. B. D. Halsted.
(2) New or little-known weed fungi. B. D. Halsted.

(3) Fruit rots, a study. B. D. Halsted.
(4) The rusts of the cereals. H. L. Bolley.
(5) Résumé of original work in potato scab. H. L. Bolley.
(6) Notes on destruction of some fungi. H. L. Bolley.
(7) Clover in North Dakota. H. L. Bolley.
(8) Some experiments in the prevention of *Cucospora ribes* and *Cylindrosporium radi*. L. H. Pammel.
(9) A ruta-baga rot. L. H. Pammel.
(10) Crossing of cucurbits. L. H. Pammel.
(11) Treatment of grape and tomato diseases. G. McCarthy.
(12) Method for obtaining a pure culture of Pammel's fungus of root rot of cotton. George F. Atkinson.
(13) A new damping-off fungus. George F. Atkinson.
(14) Contribution to the biology of the organisms causing root tubercles of leguminous plants. George F. Atkinson.

LOCAL PROGRAM.

TUESDAY, NOVEMBER 15, 1892.

Opening session.
Addresses of welcome:
On the part of the State, Hon. M. J. Foster, governor.
On the part of the city, Hon. J. Fitzpatrick, mayor.
On the part of Tulane University, Col. W. P. Johnston, president of the University.
Responses.
Business of the convention.

EVENING SESSION.

Annual address of William Le Roy Broun, LL. D., of Alabama, president of the Association.

WEDNESDAY, NOVEMBER 16.

9 a. m.—General session.
1 p. m.—Visit to the Louisiana Sugar Experiment Station, Audubon Park.
7:30 p. m.—General session.

THURSDAY, NOVEMBER 17.

9 a. m.—General session.
1 p. m.—Excursion on steamer *War Eagle* to Chalmette and Southport.
7:30 p. m.—General session.

FRIDAY, NOVEMBER 18.

7 a. m.—Excursion to Baton Rouge, stopping en route at several sugar houses in operation, by the Mississippi and Yazoo Valley Railroad.
1 p. m.—Arrival and dinner at Baton Rouge.
2 p. m.—Visit to the Agricultural and Mechanical College and State Experiment Station.
4 p. m.—Leave for New Orleans.
7 p. m.—Arrive in New Orleans.
The public are invited to attend all the exercises of the convention, and especially those of the first day.

ample in area and admirable in position. Immediately adjoining space has been assigned to Germany and France in which to exhibit what these countries are doing for agricultural investigation and instruction. This fact should be an incentive to every institution affiliated with this Association to do its full share in order that the work of our American colleges and stations may be shown to compare favorably with that of foreign lands. No such opportunity of making this comparison where it will impress the people of this and other countries is likely to occur again for many years.

The work of preparing the coöperative exhibit of the experiment stations has moved steadily forward, and great credit is due to the standing committee of the Association having this matter in charge as well as to the Department of Agriculture for its generous and effective coöperation. A report of progress will be made by Director Armsby, the chairman of the standing committee.

The instructions of the last convention, as shown in the printed Proceedings, pp. 72 and 73. were carried out by the executive committee in the appointment of President Atherton, of Pennsylvania, President Smart, of Indiana, and Prof. Morrow, of Illinois, as the special committee to consider the subject of a collective agricultural college exhibit in connection with the station exhibit already determined upon, and with power to act for the Association in the premises. This committee canvassed the subject and received such encouragement from the various institutions as to lead to the decision to proceed with the work of preparing such an exhibit. President Atherton later found the condition of his health and the pressure of home duties to be such as to necessitate his retirement from this committee. The chairmanship was then urged upon President Smart, but he for like reasons, felt compelled to decline and also to wholly retire from the work. Prof. Morrow was carrying such a burden of Exposition work in Illinois, as to be able to act on this committee only in an advisory capacity. The executive committee keenly felt the loss of the services of these efficient officers in this important undertaking, and as the time for the present convention was approaching it was decided not to reorganize this special committee, but to have the executive committee itself continue the work until further instructions from the Association. This has accordingly been done and a report of progress will be made by the chairman.

The special committee appointed by the Association to coöperate with the Congress Auxiliary of the Exposition in relation to agricultural congresses has been actively engaged, and its work will be reported by the chairman, Prof. Morrow.

After the adjournment of the last Washington convention the Association was invited to send one delegate to a conference arranged by the officials of the Exposition and the Columbian Dairy Association, for the purpose of formulating rules to govern the proposed tests of dairy cows at Chicago. Director Scovell, of Kentucky, secretary of the Association, was designated for this service by the executive committee, and his services in that capacity were most useful and influential. The reception of this delegate and the position accorded him in that conference was a notable recognition of this Association. Still more so is the final adoption by the Exposition authorities of the rules governing dairy tests, substantially as framed by that conference, and which provide that the committee to supervise the tests at Chicago shall have as its nucleus four representatives of this Association.

The executive committee has received from the chief of the department of agriculture of the World's Columbian Exposition formal communications addressed to this Association, requesting it to nominate four representatives of our body, to be appointed by the Exposition authorities to supervise the tests of dairy cows, and also to appoint a committee of the Association to confer with Chief Buchanan regarding a course of popular agricultural lectures to be delivered during the Exposition in the Agricultural Building.

This action throws upon the Association a very grave responsibility, making it virtually the arbiter in the most important and most carefully prepared experiment in comparing the dairy breeds of cattle that has ever been undertaken. Various questions of duty, of expediency, and of ways and means arise in this connection which should receive the serious attention of this convention.

The executive committee has therefore assigned for Thursday morning next the consideration of the subject, "The Association and the World's Columbian Exposition," with all the incidental questions, and all delegates are requested to prepare for full discussion and appropriate action upon this very important matter.

Conforming to the action of the last convention, the executive committee has fully considered the subject of amending the constitution of the Association, and as a result it submits to this convention, in connection with the program for its proceedings, a printed draft of a constitution which is recommended for adoption as a substitute, entire, for the existing instrument. Action upon this subject is assigned for the general session of Wednesday morning.

The Washington convention appointed a special committee of three to confer with the officials of the Department of Agriculture upon the development and extension of the Weather Bureau in the special interests of agriculture. This committee has performed the duty assigned and will report thereon to this convention.

In accordance with the action of the section of college work during the last convention, confirmed by the Association, the annual reports to the Department of the Interior, from the presidents and treasurers of colleges, have been formulated, through the cordial coöperation of the Bureau of Education, to the satisfaction of all concerned. The relations of the colleges to this Department, through the Bureau of Education, as its agency for communication, have been agreeable and free from friction. Yet it is found that the new and arduous duties devolving upon this Bureau under the operations of the (so-called) new Morrill act, have to be performed without special provision therefor, and it is evident that many mutual advantages would accrue from some such additional organization as was made for the stations in the establishment of the Office of Experiment Stations in the Department of Agriculture. This is a subject which seems to be worthy of special consideration by this convention; accordingly a suitable assignment has been made for the general session Thursday evening, and in this connection the special representative of the Department of the Interior has been invited to address the Association at that time.

Other details of the proposed proceedings of the present convention will be found in the printed program, which is now formally submitted and recommended for adoption. It is also recommended that the rules of order which have governed former conventions be continued in force, and that, as heretofore, the executive committee be authorized to receive all credentials and prepare the official roll of delegates.

The contribution of $10 for the year from each institution eligible to membership in the Association, as agreed upon at the last convention, has been very generally paid, and has created a revenue sufficient for the requirements of an economical administration. The principal disbursements the past year have been for the necessary expenses of committees while in the discharge of their duties. The treasurer's report will show a balance from last year of $309.49, to which is added $1,130 for collections, making the total receipts $1,439.49; disbursements in all amounted to $1,022.95, leaving a balance on hand of $416.54 at the opening of this convention. It seems evident that the Exposition work of the coming year will involve additional and unusual expenditures, which the Association should consider and provide for before adjournment.

Respectfully submitted for the executive committee.

HENRY E. ALVORD,
Chairman.

NEW ORLEANS, LA., *November 15, 1892.*

The report was accepted and ordered on file.

On motion of Mr. Atherton the action of the executive committee in assuming charge of the preparation of the collective college exhibit for the World's Columbian Exposition was approved, and the committee was instructed to continue that work.

The report of the treasurer was then presented by Mr. Scovell.

The report was received and referred to an auditing committee, consisting of Messrs. Hadley, Hunt, and Newman.

Mr. SMART. I have suffered much from colleagues in search of information and I feel like making a protest. I have received within the last four months thirteen requests from thirteen different institutions for information about the institution I represent. One book-keeper wants the college accounts to the 1st of January and another to the 1st of July. I think such information ought to be supplied, and that it can be if we make proper arrangements. I move, therefore, that a committee be appointed by the chair to consider the subject of college statistics and to devise means for securing and distributing them.

The motion was carried, and the chair appointed Messrs. Smart, Atherton, and Goodell.

Mr. Alvord, chairman of the executive committee, announced that the convention had been invited through special committees to visit the cotton exchange, the sugar exchange, and the board of trade, and that Mr. Stubbs would furnish permits to visit the large sugar refineries of the city.

On motion of Mr. Alvord, representatives of the cotton exchange, sugar exchange, board of trade, Academy of Science of New Orleans, Tulane University, Illinois Central Railroad, and any other railroads having agricultural interests were invited to sit with the delegates in general sessions and in the sections.

The secretary requested delegates and visitors to register at once and get their numbered badges.

The convention adjourned at 2 p. m.

AFTERNOON SESSION, TUESDAY, NOVEMBER 15, 1892.

The meeting was called to order by the president at 3:40 p. m.

A letter inviting the Association to visit the Southern University was read by the secretary. On motion of Mr. Alvord, the invitation was accepted for Wednesday afternoon.

Mr. Turner, chairman of the section on college work, read his report, as follows:

REPORT OF THE SECTION ON COLLEGE WORK.

In presenting this report an explanation of its incomplete character is due the Association. On October 10 I addressed a circular letter of inquiry to the president of each college in the Association, asking for the information deemed necessary for this report. Replies to that circular have been received from twenty-five colleges. Some of these replies were so general that they could not be used for the purposes of this report. The colleges reporting were Arizona, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New Hampshire, New York, North Dakota, Ohio, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, and West Virginia.

The inquiries submitted were in reference to increase in attendance, graduates, additions to the faculty, new courses of study, new buildings and equipment, and proposed improvements.

In reply to the first question, which was as to the increase of students in 1891-'92 over the preceding year, all the States named except Kansas, Kentucky, Massachusetts, Michigan, New Hampshire, and South Carolina report an increase for the year named, and some of them a still larger increase for the current year. Kansas accounts for a decrease by an increase of requirements for admission, Michigan by a diphtheria scare at the beginning of the year, Massachusetts by a controversy with the Institute of Technology over the Morrill fund. All of them, however, report very satisfactory work and very slight decreases. The South Carolina Agricultural College has not yet opened for work.

In number of graduates all colleges reported an increase except Arizona and Utah, which have not as yet graduated any students, and Illinois, Kansas, Massachusetts, Michigan, New Hampshire, North Dakota, and South Dakota; in some the increase is large, in others very small.

The third question asked for the increase in number of students in agricultural and mechanical courses. In most of the replies the numbers were consolidated so that it is impossible to tell what proportion of the reported increase went to each course. In Illinois, Indiana, and Oregon, where the number in each course is given, the tendency toward the mechanical course is very marked, there being in Illinois a decrease of 11 in agriculture, and an increase of 50 in the other; in Indiana an increase of 15 in agriculture and of 87 in engineering; in Oregon a decrease in the agricultural course and an increase of 20 in the mechanical course. In Kentucky and Nebraska the increase in the two courses is stated as 100 per cent.

Additions to the teaching force and new chairs are as follows: In eleven colleges chairs of mechanic arts, or engineering in some form, have been established, or additional teachers therein provided, namely, in Delaware, Illinois, Iowa, Kentucky, Mississippi, New York, North Dakota, South Dakota, and West Virginia. In addition to these, Delaware, Illinois, North Dakota, South Dakota, and West Virginia have added to their teaching force in agriculture; Kansas, North Dakota, and Oregon in English; and Kentucky, New York, North Dakota, and Tennessee have increased their teaching force in the natural sciences.

Replies to the inquiry as to the organization of new courses of study show that a new course in manual training or in mechanical, civil, mining, or electrical engineering has been established in the following colleges: Delaware, Illinois, Iowa, Kentucky, Mississippi, Missouri, Nebraska, Nevada, Rhode Island, Tennessee, and West Virginia, while existing courses have been enlarged and perfected in Kansas, Michigan, Nebraska, New Hampshire, North Dakota, and Ohio.

Increased facilities in the way of buildings and apparatus show progress all along the line. Probably the best way to indicate what has been done and what is proposed is to state what each college reports in answer to the inquiry on this point.

Arizona reports $8,000 expended in apparatus.

In Delaware a wood-working shop and new recitation hall have been built and $9,000 added in books and apparatus. A new machine shop and foundry will be added during the year.

In Illinois a science building costing $70,000 has been erected and $5,000 expended in apparatus. A new building for engineering is contemplated costing $80,000 to $100,000.

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Indiana reports the completion of an engineering laboratory and equipment costing $50,000, and it is proposed to build an extension to the shops and provide new quarters for chemistry and pharmacy and biology.

In Iowa the new buildings are an annex to the dairy for cheese-making, a new swine house, an office building, a new railway depot, and a new engine room. Additional equipment has been provided in physics, electricity, mechanical engineering, and the stock farm.

Kansas has built an iron shop and foundry, and expended $4,000 in apparatus. Enlarged facilities for instruction and for the library are contemplated.

Kentucky reports a mechanical engineering building and equipment costing $32,000, and equipment in other departments amounting to $5,000.

In Maine there is a new engineering hall costing $30,000, and increase in apparatus in all departments.

In Michigan a new botanical laboratory and greenhouse have been erected, costing 14,500; $6,000 has been expended in books for the library and $10,500 for equipment and apparatus in other departments.

Minnesota has erected a new mechanical shop, with equipments costing $18,000.

In Missouri $50,000 has been expended in buildings.

Nebraska reports a new gymnasium, a new shop and tools for manual training, clay modeling, and drawing. A new library building, to cost $100,000, is in process of erection. Buildings and appliances for the experiment station and departments of agriculture, horticulture, and engineering are contemplated.

New Hampshire is about to remove her college to a new location at Durham, in order to obtain the benefit of a munificent endowment of land and money, amounting to $1,000,000.

New York (Cornell) reports large additions to apparatus and equipment.

North Dakota has erected a $40,000 building and an engine house costing $5,000 and has added to the library and laboratory equipment. In the near future the erection of a dormitory, a chemical laboratory, and farm buildings are contemplated. A geological and library building, a building for mechanic arts, and large additions to apparatus are reported from Ohio. Improvements in the courses in mechanical engineering and agriculture are planned for the future.

Oregon has a new chemical laboratory and a dormitory for one hundred and twenty students and will soon erect a building for a dairy and one for horticulture.

Tennessee reports a new science hall costing $60,000 for laboratories of chemistry, physics, engineering, etc.

South Carolina reports about $150,000 expended in buildings; the college is not yet opened for instruction.

In Utah a new building to cost $80,000 is in process of erection and $20,000 have been expended in apparatus.

In West Virginia a commencement hall and gymnasium costing nearly $20,000 have been completed; a building for mechanic arts and mechanical engineering with equipment has just been opened, costing about $18,000, and a new Science Hall, to cost $40,000, is in process of building. About $5,000 is now being expended for books and $3,000 for equipment in the departments. A new building for electrical engineering is contemplated and $30,000 will be expended in equipment for the various departments.

Summary.

These reports show great activity and enterprise in all the colleges and particularly the stimulating effect of the Morrill act of 1890 in pushing the development of industrial education. What may we not hope for the future of these colleges, when they have become fully equipped and when the annual income provided by this act can be fully devoted to the employment of teachers, thus broadening and deepening the channels of their influence?

I am constrained, however, to call the attention of the convention to one phase of these statistics. Where separate statistics of the numbers in the agricultural and mechanical courses have been forwarded they show a most unequal advance in the agricultural and mechanical courses. What can be done to stimulate young men who expect to be farmers to take an education that will fit them for the best work on the farm? How can they be induced to come to the colleges and get the elements of an agricultural education in the study of physics, chemistry, botany, zoölogy, and mathematics? It seems to me that this is a problem which we have as yet not properly considered. I leave it for your thought.

E. M. TURNER,
Chairman.

Mr. FAIRCHILD. If I may be allowed to add a word to my report for the Kansas College, it is that we have added several instructors in the mechanical department, one in the horticultural, and several in the agricultural department.

Mr. SANBORN. I would like to add a word to the statement for Utah. The first year we had 139 students, last year 296, and at the present time we have more than 400. Two-thirds of the senior class of next year will graduate in agriculture. The faculty has been very much increased and now numbers 19.

Mr. LEE. The report of President Turner brings out a very important fact, and that is that the colleges are not doing the work for the agricultural classes that they should, and I suppose there is no doubt of the fact that the great industry of agriculture has been languishing. I have been impressed, Mr. President, for several years, with the fact that our colleges are sending forth scientists rather than practical men in the industries which the law intended to benefit. There is no doubt of the fact that comparatively few of the graduates of our colleges return from the colleges to agriculture. All of these institutions that have given statistics bearing upon that point show that only a small per cent go back to the farm. I think the Michigan college claims that about 50 per cent of the graduates return to the farm. The Massachusetts college many years ago used to send a good many men back to the farm, but I do not know whether that is being kept up now or not. As far as we can gather Mississippi has sent back from 40 to 50 per cent to the farm.

I think that this convention can not do better than try to find out what the trouble is and what the proper remedy. There is no doubt of the fact that the law of 1862 intended to benefit agriculture and the mechanic arts only by benefiting the classes engaged in them. I think all these institutions have had the desire to maintain a high standard of admission and graduation. That is right and proper, but I think we have gone a little too far in this matter. I think we ought to get nearer the class to be benefited. We ought to be more in sympathy with them, and I think the standard required of students in agricultural colleges is too high. The farmer's boy can not take advantage of them. The North has better common schools than the South. I will state here that in Mississippi and in the adjoining Southern States it is almost impossible for a student to come up to the standard required in the freshman class, low as it is in many of the colleges. If the farmer is rich enough to send his son to the high school in town or some training school he may do it. But these institutions are intended to benefit agriculture and the mechanic arts, and if by putting our standard too high we have made a mistake, so that we send hardly any graduates back to the farm, I think we ought to try in this Association to remedy the trouble. We ought to put the diploma within the reach of every country boy. Let him come here and feel that he can get a diploma and that without being a scientist. There must also be a chance for the boy who wants to be a scientist. Let him take a post-graduate course if necessary.

Mr. ALVORD. As this is one of the subjects to come up before the section on college work and perhaps one of the topics which it will present to the Association, I suggest that we take up the report of the next section.

Mr. Ingersoll, chairman of the section on agriculture, presented the following report:

REPORT OF THE SECTION ON AGRICULTURE.

According to the clause in our constitution making it obligatory upon the chairman of a section to present a report at the annual meeting, I beg leave to present the following:

The period sought to be covered in this report dates from September 1, 1891, or soon after the adjournment of the convention of delegates at Washington, D. C.

Because the chairman, as well as other workers, becomes absorbed in the solution of the problems that are more immediately confronting him, and hence in a great measure loses sight of the whole field of action, and further because it was desirable to present the latest as well as earlier data, it was deemed advisable to address each station by circular letter, in order to obtain, if possible, prompt replies with reference to the work of the sections on agriculture proper in each of the experiment stations.

The letter was as follows:

DEAR SIR: As chairman of the section on agriculture of the American Agricultural Colleges and Experiment Stations, the duty devolves upon me to present a report of progress that shall be of a somewhat general character, yet specific enough to be of value in bringing before the section and the Association the full scope of the work undertaken and aggregate results.

To that end you are therefore earnestly requested to answer and return the following questions promptly, and oblige:

(1) What bulletins has your station issued since August 1, 1891, which are entirely or in part the work of your own department? State number and title.

(2) What work in progress not yet reported in bulletins? State by title briefly and, in a word, the degree of progress.

(3) What work has been undertaken or accomplished by collateral departments, as in soil, physics, meteorology, irrigation, engineering, and the like, which will be of interest?

Do not report work that will be reported upon in other organized sections, as chemistry, botany, horticulture, or entomology.

(4) State, in a short letter, your general condition as a station and in your own department, with interesting side statements.

To this communication I received thirty replies from the following stations, and, substantially, in the following order. It will be noticed that several of those farthest away were among the first to reply.

Kentucky.	Georgia.	Kansas.
Mississippi.	Michigan.	Indiana.
Utah.	Connecticut (New Haven).	Vermont.
South Carolina.	Colorado.	North Dakota.
Oklahoma.	Wisconsin.	Tennessee.
North Carolina.	Ohio.	New Jersey.
Wyoming.	Arizona.	New York.
Massachusetts.	Rhode Island.	Alabama (Uniontown).
Connecticut (Storrs).	Virginia.	Minnesota.
Nevada.	Texas.	South Dakota.

No substantial or descriptive reply was given to the four questions by the following stations:

Maine.	New Hampshire.	Pennsylvania.
Delaware.	Maryland.	West Virginia.
Florida.	Louisiana.	Arkansas.
Missouri.	Illinois.	New Mexico.
California.	Oregon.	Washington.

Several persons corresponded, incidentally, on other matters pertaining to the meeting.

In two cases parties addressed were in Europe, and we were notified of the fact, and in one case the director made a very full and complete reply for the person addressed.

After various vicissitudes in attempts at getting reliable information your humble servant and his clerk made an attack on the station files and found that subjects had been treated, in whole or in part, in all the stations as follows:

3 Farm manures.
5 Soils and waters and tests of air and soil relations.
1 Water and water analysis.
24 Fertilizers, weeds as.
3 Glanders.
11 Potatoes, Irish and sweet.
1 Sulphur-curing of fruit.
3 Food investigations.
1 Nitrogenous plant food.
4 Silage and roots.
9 Sugar beets.
4 Blue grass, hay, and timothy.
1 Electroculture.
1 Sorghum.
11 Dairying.
1 Old and new meadows.
2 Detasseling corn.
1 Patent cattle food.
3 Poultry.
1 Tuberculosis.
1 Cotton seed and meal for hogs.
1 Liver flukes.
1 Maple sugar.
2 Seed and plant distribution.
8 Cotton.
1 Canaigre.
2 Irrigation.
5 Tobacco.
21 Corn, wheat, oats, etc.
19 Cattle and sheep feeding.
1 Ramie plant.
6 Forage crops.
4 Milk tests.
2 Rheumatism in horses, and diseases of sheep.
1 Horticulture.
1 Sugar cane.
1 Comparisons of grain.
? Dehorning cattle.
ı Kerosene emulsion for animals.
1 Inoculation.
6 Dodder, weeds, and rusts.
2 Farm practice with fertilizers to control insects.

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[illegible]."

When it comes to progress in work in which the stations were engaged, the thirty replies were scanned with care and it was interesting to attempt to group them so as to present them, in part at least, in a condensed form.

The following summary shows the number of stations on the lines of work as stated, or some modification of the work:

3 Sugar beets.
1 Sheep-breeding.
6 Steer-feeding.
1 Analysis of wheat seed in various stages of growth.
2 Cheese.
6 Fertilizer tests with wheat, corn, tobacco, and other crops.
1 Coöperative fertilizer cotton tests.
2 Corn *vs.* fertilizers.
1 Apiary work.
2 Plat tests.
1 Farmyard manure *vs.* fertilizers.
3 Experiments with corn.
1 Value of farm manure.
2 Milk tests for variation.
1 Cañaigre.
2 Irrigation.
5 Dairying.
2 Pig-feeding.
3 Coöperative field tests.
2 Digestibility experiments.
3 Sheep-feeding.
5 Tobacco.
3 Digestibility of peas, silage, corn, bran, barley, shorts.
1 Milled products of wheat.
1 Silage *vs.* dry fodder.
3 Variety tests of cotton.
1 Corn on drained and undrained land.
1 Farmyard manure tests.
1 Poultry work.
7 Variety tests of grain.
4 Green manuring.
2 Detasseling corn.
1 Carbonaceous *vs.* nitrogenous food for chickens.
1 Silage preservation.
1 Sorghum *vs.* alfalfa.
5 Soil physics.
1 Scarlet clover.
1 Horses.
1 Milk separator tests.
3 Feeding for milk, and sugar meal, gluten, meal, etc.
4 Grasses and their management.
3 Cowpeas.
1 Sorghum.
2 Potatoes, Irish and sweet.
1 Pea-vine hay.
1 Plant nutrition.
1 Insecticides.
1 Fertilizer map.
1 Sugar cane and rice.
1 Alkali soil.
1 Corn fodder.
1 Forage plants.
1 Tile drainage.
1 Experiments and continuous cultivation of corn.
2 Cross-fertilization.
1 Botanical survey.
1 Chemistry of cotton plant

The most interesting feature of the reports was the reply, in which, often in a single sentence, would be conveyed more information as to the work, the worker, and the station with which he was connected, than in a long report otherwise made.

Several complained of the lack of funds to perform the work they desired. No blame was attached to any person, only it appeared that too much had been attempted for the funds in hand. In some of the States there are indications of other funds being used to supplement the Hatch fund. This aid comes in part from fertilizer work in some instances.

It is pleasing to notice that the workers in agriculture are working along practical lines and at the same time doing their work more carefully and scientifically as they proceed. The men as a rule are not so hasty in their decisions, and do not reach conclusions at one gigantic bounaertakjy as often as in the earlier work of the stations. The matter of haurology, irrigplats on which to experiment—plats on which the factor of individ ed or well indicated—is shown in the work of several stat report work that will be factor of vacant ground next a plat, so that all condiistry, botany, horticulture, or formal, has been followed by others.

(4) State, in a short letter, your questions have been asked at one time and department, with interesting side statey of proof. In our opinion but one or two

interrogations should be put to nature at one time; then try and remove all points of variation except the one sought to be proven, and establish that if possible beyond peradventure.

In this work we must make haste slowly or be obliged frequently to "thresh over old straw" or weave a fabric that to the veriest tyro will be like a sieve. Only a few stations feel the necessity of establishing checks in their work when experimenting with animals or of repeating their work for purposes of comparison. We are pleased to see this being done in two or three instances, and look for valuable results from interpretations of such work.

If it is found that under normal conditions and unchanged food we obtain results which vary as much or more than those found under changed relations, then we are simply unable to put an interpretation that is even approximate upon the compared results.

When, therefore, we received a statement that results in one station would be held for a year in order to compare another year's feeding, and that one of the factors in the work was the continuous feeding of one food to note changes in the milk and butter, we were pleased when we read the next sentence:

"The object of feeding the same food for a long period was to ascertain whether the variations between stated periods might not be as great as the variations when different foods were fed." A broad smile of satisfaction attested our approval of the work of that station. Other stations may be doing the same thing, but we are not apprised of the fact. It is our province to speak of that we have seen and know.

Again, it is a pleasure to see the way in which the agriculturists seize upon those things that seem to be an advantage to their States. Thus, the beet-sugar industry engages the attention of States in the northern belt; cane sugar, rice, cotton, and sorghum, those adapted to the culture of these products; tobacco, and the new method of curing, the States extending from Florida to Connecticut which raise this crop, and likewise a few of the Western States; feeding engages attention everywhere, as all States feed for milk and meat, two standard articles of food; forage plants, including grasses, engage the attention of nearly all the States, and alfalfa is a subject of special study in the West; rape is attracting considerable attention; *Lathyrus sylvestris* has done well in my own State, and merits further trial.

Besides the work in the agricultural sections but properly and intimately connected with it is the work of several stations in regard to meteorology, soil physics, irrigation and a few things like cañaigre in Arizona.

The study of the Yucca plant and the like for fiber is necessarily confined to limited areas.

One station says: "The work of our station is mainly practical, very little purely scientific. The station is doing fairly good work and in the midst of prejudice is gradually forcing its claims to recognition as a valuable aid to the farmers." Another says: "A series of farmers' institutes has been commenced and the continual growth of the mailing list indicates a gratifying interest in the work of the station on the part of the farmers of the State." And what seems to us to be more important than all the facts announced is that there have been no changes in the station force during the year.

Another writes that "the agricultural department has been very successful in the experiments of the year." The students and farmers are becoming more interested. A second edition of one bulletin was called for and the third will soon be issued, with an appendix.

Another says: "The field work has been of long-continued permanence and grows more and more valuable and more and more appreciated by the farmers from year to year. No attempt is made to elaborate, but rather to concentrate and do limited lines of investigation well. The funds of the station permit the employment of intelligent assistants, and the most improved utensils are employed in the work. The development of the agricultural department is satisfactory and the many visitors to the station find this of great interest."

Another says: "The station has a compact organization, everything convenient, and the work economically conducted. In a general way it embraces the field of biology, dairying, animal nutrition, plant nutrition, chemistry, horticulture, entomology, soil physics, and general experiments in plant growth, including tillage."

Another says: "The work of our station is more particularly in the line of dairy work, and we feel fairly well satisfied with its conditions and especially with the relations we have succeeded in establishing with the dairymen of the State. Our connection with them becomes more and more intimate each year, and especially in the matter of testing milk and of paying for milk at creameries and cheese factories by tests. We have reason to believe that our work has been of a good deal of value to them, if we do say it."

Another says: "All the appliances about the college and station, including stock, dairy, vineyards, etc., are used as a laboratory for the students in agriculture in its broadest sense as an 'applied science.'" The amount of foundation work in this station and one other, both new, has been enormous and merits especial mention. In another State students are sent out in charge of special work at substations established. The writer says: "A student put in charge of work thoroughly planned and frequently inspected beats other forms of substation management."

Seed distributions have been made in three or four of the more Western stations where the conditions seem to demand it and are favorable for a just appreciation of its worth.

Coöperation is urged by another, who says: "Not that all can agree, but that small groups of workers could be formed where the conditions were favorable to work on special agreed lines.

"This station is desirous ef coöperating and I believe we are ready to coöperate with some others in dairy work and pig-feeding."

Another says: "We are endeavoring here to do such work as will promote the agricultural interests of our own State and at the same time contribute as much as possible to the advance of genuine scientific investigation," and another speaks of poor soil, much depleted by long cropping, and of the one great problem of how to bring it up and use better animal husbandry with diversified products. He says: "We have had no disaster from moving, fire, or flood." Several others have met one or more of these to their sorrow and temporary disadvantage.

Another says that the work is being appreciated more each year by the farmers. Five bulletins a year are issued. In another instance the general condition of the station is good. Experiments are carried on at six substations or experiment farms, five conducted with and one without irrigation. The superintendent of each farm is controlled by directions sent out from the head of each department of the university. Plans for experiments at all the farms are recommended to the experiment station committee of the board of trustees by the station council. This plan insures uniformity of plan and purpose at all substations and is considered advantageous. Efforts are to be made to establish experiments in stock-breeding, feeding, dairying, etc., at each farm, because of the prominence of stock-raising as an industry.

Another says: "The station force is extremely active and we have on hand much more material than we can publish on account of limited funds. The field covered by the station has become extremely extended and yet we see many problems which need to be investigated. The testing of varieties and field experiments have not so far yielded such wide results as have those which have been conducted in buildings where the conditions could be better controlled than in the field." We agree very fully with this writer and know that experiments of the latter class are more interesting to the worker and will give more positive results; yet if time is taken and the proper checks maintained, and further, if the factor of "individuality" or "personal equation" for each plat be properly looked after and as far as possible eliminated, then we may obtain much satisfaction from plat experiments.

In closing this dissertation I wish to thank those who have responded so promptly to my request for information which for lack of time has been loosely thrown into groups. The tardy ones caused some delay in commencing the work. Perhaps they were too busy to stop experiments long enough to reply but are here and will give us in person what they have failed to send.

C. L. INGERSOLL,
Chairman.

The PRESIDENT. If there is no objection the report will be filed with the secretary. Next is the report from the section on botany.

Mr. TRACY. Prof. Atkinson, the chairman, owing to his duties at Cornell, where he has gone recently, is not present, and has asked me to read his paper.

Mr. Tracy then read the report of Mr. Atkinson as chairman of the section on botany, as follows:

REPORT OF THE SECTION ON BOTANY.

Since the last annual report was presented from the section on botany before this Association the force of botanical workers in the experiment stations has been increased by the organization of departments at the following stations: Arizona, Florida, New Mexico, South Dakota, and Texas, the officer at the latter station being horticulturist in charge of botany.

Several changes have been made in the working force. At the Alabama College Station, G. F. Atkinson retired October 1, 1892. At the Kansas Station, A. S. Hitchcock was appointed January, 1892, to succeed W. A. Kellerman. In Massachusetts, J. E. Humphrey retires January 1, 1893. In Michigan the station work has been reorganized, and C. F. Wheeler appointed botanist. At the New York Cornell University Experiment Station, W. R. Dudley retires to accept a position in Leland Stanford University, and G. F. Atkinson, of Alabama, has been appointed cryptogamic botanist.

At several stations where botanical work is carried on there is no regularly appointed botanist, that work being in charge of the horticulturist or entomologist. Since botanical work has come to my notice from several of these places it has seemed best to include it in the report. In view of this and the fact that several of the botanists have charge also of entomology or horticulture, or are given the titles mycologist or biologist, the official title is placed in parenthesis accompanying each station's work.

Alabama: P. H. Mell (botanist and meteorologist, has charge of phanerogamic botany) is engaged upon a study of the economic grasses and weeds of the State, and is crossing varieties of cotton. Mr. Atkinson (biologist, has charge of plant pathology) has continued his studies of cotton diseases, has discovered a new damping-off fungus, obtained pure cultures of Pammel's ozonium of root rot of cotton in Texas, and is studying the biology of the organisms which cause leguminous root tubercles.*

Arizona: J. W. Toumey is making observations on the adaptability of the native grasses, trees, and shrubs for cultivation.

Connecticut (New Haven): W. C. Sturgis is studying the diseases of tobacco and making experiments in curing tobacco and spraying fruits and garden crops. He is beginning a critical study of the Cribrariaceæ.

Delaware: F. D. Chester (mycologist) is engaged upon studies of Monilia fructigena; diseases of watermelons, muskmelons, and cucumbers, and the winter killing of blackberries. He has reached promising results in treatment of peach rot.

Florida: P. H. Rolfs (botanist and entomologist) has recently entered upon his duties.

* For continuation see Cornell University Experiment Station in this report.

Illinois: T. J. Burrill (botanist and horticulturist) is studying bacterial diseases of plants, raspberry rust, monilia of plum, and economic smuts.

Indiana: J. C. Arthur (botanist) is investigating the normal growth of the potato, and the relation of the number of eyes of a tuber or part of a tuber to the number of stocks produced and to the yield. He is also studying the enzyme in seeds of wheat and oats, the relation of green seed to early maturity, and wheat smuts, and has devised a method of preventing the rust and bacterial disease of carnations.

Iowa: L. H. Pammel (botanist) is studying the life history of *Peziza schlerotiorum*, *Rhizoctonia betæ*, and *Cercospora beticola*. He has experimented on the effect of fungicides upon roots and germination of seeds, crossing of cucurbits, treatment of plant diseases, and is at work on the chromogerm bacteria of the Ames flora, and anatomy of cucurbits.

Kansas: A. S. Hitchcock (botanist) is experimenting with fungicides on seeds and studying the biology of weeds, and economic Uredineæ.

Kentucky: H. Garman (entomologist and botanist) is engaged upon comparative study of foreign plants.

Maine: F. L. Harvey (botanist and entomologist) is making collections of economic plants.

Massachusetts: J. E. Humphrey (vegetable physiologist) has been studying black knot of plum, a violet disease, and a new disease of cucumbers, and is preparing a monograph of North American Saprolegniaceæ.

Michigan: C. F. Wheeler is consulting botanist.

Mississippi: S. M. Tracy (director of station) is making a botanical survey of the State and working on the Gramineæ, Southern tomato blight, and a new disease of the grape.

Nebraska: C. E. Bessey (botanist) is making an exhaustive study of native trees and shrubs, and native and cultivated grasses, and is at work on diseases of the sugar beet.

New Jersey: B. D. Halsted (botanist and horticulturist) is working on diseases of the cranberry, rose, violet, and hazel, and fungi of weeds, and experimenting on treatment of celery and sweet potato diseases.

New York *(*Cornell*): G. F. Atkinson (cryptogamic botanist) is engaged upon a study of winter blight of tomatoes, a botrytis disease of beans, carnation diseases, and damping-off fungi.

New York (*Geneva*): S. A. Beach (horticulturist) is studying the effect of copper compounds in soil on vegetation. He has obtained good results from Bordeaux mixture and selection of seed for anthracnose of beans, and from Bordeaux mixture for Septoria on chrysanthemums. He has also treated apple and potato scab, raspberry anthracnose, gooseberry mildew, strawberry leaf-blight, and celery diseases. He has, in coöperation with D. G. Fairchild, experimented on the effect of rainfall on pollination.

New Mexico: E. O. Wooten (botanist) is collecting plants for a herbarium.

North Carolina: G. McCarthy (botanist) does entomological work, is engaged in seed-testing and treatment of grape and tomato diseases, and is studying bacteria of nitrification.

North Dakota: H. L. Bolley (botanist) has found corrosive sublimate effective in preventing potato scab; is studying the fungus of deep scab of potatoes, making attempts at artificial cultures of Uredineæ, and working on the distribution of root tubercles of the Leguminoseæ.

Ohio: Miss F. Detmers (botanist) is collecting the rusts (Uredineæ) of the State.

Oregon: M. Craig (botanist) is at work on weeds, forage plants, and plant diseases.

Pennsylvania: W. A. Buckhout (botanist) does entomological work, is engaged in

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*The botanical department has charge of the experiment station work in botany, which is intrusted to the cryptogamic botanist.

forestry and hybridization, and is working on the practical side of potato rot and downy mildew of the grape.

Rhode Island: L. F. Kinney, (horticulturist and acting botanist) has reached important results in the treatment of seed potatoes with Bordeaux mixture to prevent potato scab. He is also treating seeds.

South Dakota: T. A. Williams (botanist) is making observations on forage plants suited to varying conditions in different parts of the State and studying plum pockets and a geranium disease.

Tennessee: F. Lamson Scribner (director and botanist) has published a list of the grasses of the State in the form of a popular edition, to be followed by a more technical one.

Texas: R. H. Price (horticulturist) does entomological work and is engaged in treatment of cotton and grape diseases.

Utah: The entomologist acts as consulting botanist.

Virginia: E. A. Smyth, jr., has charge of phanerogamic botany. W. B. Alwood (horticulturist) is engaged in studying apple-leaf diseases and experimenting on weak solutions of copper salts for plant diseases.

Vermont: L. R. Jones (botanist) has made a test of the comparative value of a number of the standard fungicides on potato rot (*Phytophothora infestans*).

Wisconsin: E. S. Goff (horticulturist) is working on apple scab and experimenting on the germination of seeds.

In looking over the work of the station botanists it is interesting to note the number who are engaged in making use of artificial cultures in studying the life histories of parasitic fungi. Not only are the stations through this work constantly making important contributions to the biology of many obscure and little-known organisms, but they are making known many facts which have an important bearing on the treatment of the diseases produced by these parasites. The different habits and appearances of the real enemy are brought to light; its plans of attack are studied; proof of its harmfulness can be established by inoculation, and known causes thus supplant supposed ones. No other feature of botanical work at the experiment stations, in my estimation, is doing so much to lay the permanent foundations for a rational economy in the treatment of plant diseases.

The best work of this kind can only be successfully carried out with the aid of expensive modern apparatus appertaining to bacteriological laboratories. This provides the trained workmen with the means of proceeding rationally and accurately to the desired end. The stations which at the present writing are provided with such cultural apparatus are the following:

Alabama, Connecticut (New Haven), Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts (Amherst), New Jersey, New York (Cornell), New York (Geneva), North Carolina, North Dakota.

Several workers in other stations feel the need of cultural apparatus in their work. It is hoped that another year will find them provided with this want.

Steps were taken to determine the number of volumes in station libraries relating to botany, accessible to the workers. Sufficient data were not received to incorporate anything more than a general statement in this report to the effect that several of the stations, even those remote from the larger seats of learning, are building up surprisingly large and valuable libraries and herbaries.

Respectfully submitted.

GEORGE F. ATKINSON,
Chairman.

The PRESIDENT. If there is no objection the report will be filed with the secretary. Next is the report from the section on chemistry.

Mr. Scovell, chairman of the section on chemistry, presented the following report:

REPORT OF THE SECTION ON CHEMISTRY.

Early in September a circular letter was addressed to the chemists of the agricultural colleges and experiment stations, asking for a brief report of the chemical work completed or under way since the last meeting of this Association. To this letter twenty-three replies were received. It is evident from these replies that the chemists, taken as a body, are considering many subjects covering the field, from mere detective work to purely scientific investigations. Some forty different subjects are reported as having been considered. I would trespass beyond my allotted time were I to consider these various subjects separately, or even give the brief synopses of the reports received, which I have had compiled, and which are appended to this report.

Like my predecessor, I have endeavored to classify the various subjects considered, and for this purpose have adopted in the main his admirable scheme of classification. I have classified the subjects, therefore, under the following principal heads: (1) Detective duty; (2) work directly related to farm management; (3) work having in view the improvement of processes or the development of agricultural manufactures; (4) work of a more strictly scientific nature. Most of the work reported falls under one or more of these classes. It is not always easy, however, to tell under which one some of the work should come, as some reporters give the mere facts without giving the purposes of the work. Take, for instance, the analysis of feeding-stuffs. A number report having made such analyses, without stating whether it was for the purpose of giving the farmers information as to the purity or whether it was done in connection with feeding-experiments. Again, soil analysis might be mere routine work, or it might be an exhaustive investigation which more probably would come under scientific investigations. In the main, however, the reporters have not only outlined the work, but have explained sufficiently to readily classify it.

(1) *Detective duty.*—Detective duty or routine work undertaken to protect the farmer against fraudulent practices in the business world. Under this class is placed the routine work of fertilizer analysis when made for the purpose of verifying for farmers the statements of dealers, or for the discovery or prevention of fraud, either with or without fertilizer control; also the examination of feeding stuffs, dairy products, and other materials for adulteration.

(*a*) Fertilizer analyses: Eleven stations report work under fertilizer analyses, eight assuming fertilizer control. It is evident, however, that some of the stations reporting did not incorporate fertilizer control work, assuming, undoubtedly, that such work was not a matter of consideration here, as the funds for such work come from the State or from fees. [The analysis of fertilizers to detect fraudulent practice seems to be generally undertaken by those stations which are in the fertilizer belt.] None of the stations report that the fertilizer work prevents more important and at least more interesting work being done. One station distinctly states that the fertilizer control work is a source of revenue which materially aids it in other work.

(*b*) Feeding stuffs: But one station reports the analysis of feeding stuffs with the object in view of detecting adulterations.

(*c*) Adulterations of dairy products: Two stations report that they are doing work for dairy commissioners in the analyses of butter, etc.

(*d*) Detection of poison: One station reports a case of poison maliciously given to cows.

(2) *Work directly related to farm management.*—This includes a large amount of chemical work carried on for the purpose of determining or practically demonstrating for the farmer the best methods of carrying out farm operations, including such work as soil tests of fertilizers, feeding stuffs, the test of milch cows and dairy breeds, the preservation of manures, utilization of waste products, etc. All the chemists replying report work under this head as follows:

(*a*) Soil tests with fertilizers: Seven stations have been devoting some of their time to the chemical work in soil tests with the commercial fertilizers.

(*b*) Feeding experiments: Four stations report work in feeding experiments.

(*c*) Composition of plants: Thirteen stations are at work on the analyses of plants. Some of them are doing far more than the mere routine analyses. They are studying individual plants. When such is the case they are also given credit for work under the fourth general class.

(*d*) Analyses of plants at different stages of growth has occupied the attention of four chemists reporting.

(*e*) Analyses of newly introduced plants: The analyses of plants newly introduced when considered locally has been undertaken by four chemists.

(*f*) Test of milch cows and dairy breeds: Eight stations have had this topic under consideration. Some are at work making a comparative test of dairy breeds, others are analyzing the milk of individual cows for the purpose of studying the composition in relation to feeding experiments or for an object lesson to the farmer, showing him the necessity of weeding out the cows in the dairy which do not pay for their keeping.

(*g*) Analyses of manures, waste products, etc.: Eleven stations are giving their attention to the analysis of manures, waste products, etc., some of them devoting considerable attention to this, both as a matter of illustration and for the purpose of determining to what extent the waste materials on the farm and in the factories can be utilized in restoring the fertility of our soils.

(*h*) Soil and water analyses: Twelve stations are at work on the analysis of soils or waters, or both. Some few of the stations are giving a great deal of attention to this topic, and alkali soils and irrigation waters have been very generally considered by our Western stations.

(3) *Work having in view the improvement of processes or the development of agricultural manufactures.*—Under this class may properly come much of the chemical work in our creameries and sugarhouses, and also the study of the sugar beet, sorghum, and cane as to their content, the object being to develop an industry.

(*a*) Test of plants for sugar: Nine of our stations have been studying the sugar beet or the sorghum plant, some stations giving considerable attention to the sugar beet.

(*b*) Dairy problems: Seven stations report work under this topic. It is impossible in some instances to tell whether the work properly comes under this class or under detective duty, as the analysis of milk for creameries, etc. Some few of the stations are entering extensively into the chemical problems involved.

(*c*) Milling: One station reports a study of milling products.

(4) *Work of a more strictly scientific nature.*—Under this head may be placed the comparative study of soils, plants, and foods; analyses for the purpose of studying plant physiology and nutrition; digestion experiments; a study of the food of man; and studies of chemical methods and apparatus, the object being the improvement of methods for the sake of accuracy, saving of time and convenience, or for the development of methods and invention of apparatus in original investigations. At least three stations are taking up the soil question. Three stations are studying the tobacco plant and as many are at work on the cotton plant. The loss of nitrogen in the development of plants has been considered by one station. A number of stations are at work in or arranging to undertake digestion experiments. Thirteen of the stations reporting have been to a greater or less extent studying chemical methods and apparatus.

From the reports it is to be clearly seen that while the chemical work of our stations to a great extent has been, and probably will continue to be, of a routine nature, the value of which should not be underestimated, nevertheless considerable work of a higher nature is being undertaken or contemplated in the near future. The thorough equipment of many of our stations and the additional force being employed gives an opportunity for a more thorough and systematic study of chemical problems.

The time and attention given to chemical methods by nearly all our stations, as evinced by the work reported to the Association of Official Agricultural Chemists, is indicative of progress. When we consider that nearly all of our stations have been organized in the past few years, that many of our workers were necessarily inexperienced in practical work, we can but wonder at the work accomplished and the accuracy of the results obtained. I feel it but justice to say that much of this credit is due to the Association of Official Agricultural Chemists. The uniformity of methods—methods tried by the crucial tests of experience, a great saving of time by the use of such methods, the shortening of the work of our chemical engineers by tunneling through rather than going around obstacles—have enabled our stations to do much thorough, accurate, and comparable work, which never could have had the value it has save for the training and assistance our chemists have had in and by our Association of Official Agricultural Chemists.

ABSTRACTS OF REPORTS FROM STATION CHEMISTS TO THE CHEMICAL SECTION.

C. B. Collingwood, of the Arizona Station, reports that their chemical work has been (1) a study of the character of water used for irrigation and its effect on the soil and on plant growth; (2) the character of the soluble material in the soil and the effect which water will have on it; (3) best methods of curing alkali soils; (4) investigations as to the per cent of tannin in cañaigre. Canaigre is a Rumex indigenous to the arid region, which contains in the green root about 10 per cent of tannin. By cultivation for one year it is found that the same amount or sometimes more tannic acid will be formed. So far the chemical work of the station has been along the line of analysis of waters, soils, and native plants, which may become of economical importance.

G. L. Teller, of the Arkansas Station, summarizes their work as follows: (1) The study of methods of analysis in connection with the Association of Official Agricultural Chemists; (2) a study of the loss of nitrogen during the growth of certain plants; (3) the study of the composition of the cowpea in the different stages of its development; (4) compilation of other experiments in agricultural chemistry, published in Bulletin No. 19.

D. O'Brine, of the Colorado Station, reports work in the following lines: (1) Manure; (2) the loco question; (3) milk, sugar-beet, and soil analyses.

E. H. Jenkins, of the Connecticut State Station, reports of the chemical work of the station, aside from the routine of fertilizer control, fodder analyses, milk tests, and the assistance rendered to creameries in introducing a system of milk-testing: "We have studied somewhat methods of cheese analysis. Our chief work, perhaps, has been the inauguration of experiments designed to extend over a term of years to test the effect of fertilizers on the quantity and especially the quality of the Connecticut wrapper leaf tobacco, the final judgment of quality to be made after the leaf has gone through the fermentation and is ready for the cigar manufacturer."

Mr. C. D. Woods, of the Connecticut Storrs Station, reports that the principal chemical work of the station during the last year has been: (1) Routine analysis in connection with the study of the food of man; (2) feeding experiments with animals; (3) the analysis of crops grown in field experiments.

E. H. Farrington, of the Illinois Station, says: "The chemical work of this station for the past year has been mostly on the analysis of milk, sugar beets, soil, and feeding stuffs. I am making some investigations of Grandeau's method of estimating *matière noire* in soils; also observations on the soil moisture in the first 6 inches of corn land throughout the season." Dr. Farrington reports that he is doing considerable work under the topic of developing analytical methods, especially in feeding stuffs and the use of improved apparatus. He is using a 1-horse power electrical motor for running a Babcock milk-tester; also an automatic pipette for measuring the acid in milk-testing, and reports that it has proved to be efficient and practical when properly constructed.

H. A. Huston, of the Indiana Station, reports that they have been engaged upon work with phosphoric acid and sulphate of alumina on corn, field experiments on the forms of nitrogen for wheat, improvement of the so-called bogus soils—both field and laboratory work—rate of souring milk under different conditions of setting and examination of butters produced, feeding and fertilizer value of pursaline, the study of chemical methods, and other miscellaneous matters.

G. E. Patrick, of the Iowa Station, reports for the chemical work of his station as follows: (1) Effect of feed upon quality of milk; (2) sugar beets in Iowa; (3) sweet *vs.* sour cream butter; (4) chemical work in calf-feeding experiments; (5) soiling experiments; (6) feeding beets and potatoes for butter; (7) soil analyses.

In the chemical laboratory of the Kentucky Station work has been carried on in the following lines: (1) Daily tests of milk in connection with a feeding experiment for butter fat as well as for comparing the milk of different cows, analysis of butter in connection with the above experiment, analysis of feeding stuffs in connection with the above feeding experiment and also for farmers; (2) tests of sugar or varieties of cane grown at the station; (3) analysis of potable and mineral waters, marls, and soils; (4) examination of miscellaneous materials sent in by farmers and others; (5) examination for poison in viscera of a number of cattle (the results of this work aided in the conviction of one person for cattle poisoning); (6) determination of specific gravity of all the varieties of potatoes raised at the farm, with a few determinations of dry matter in the same; (7) work on methods of analysis in connection with the Association of Official Agricultural Chemists, and analysis of a number of honeys; (8) the whole of the work of the State fertilizer control, besides the analyses of several grasses grown at the station, is now in progress.

H. J. Patterson, of the Maryland Station, reports that the work of the chemical department has been chiefly with the tobacco plant on (1) the effect of fertilizers on the composition of the ash and burning qualities; (2) the effect of different methods of curing on the organic constituents; (3) fodder work in connection with the feeding and digestion experiments; (4) analyses of marls, limestones, and fertilizers used in experiments.

C. A. Goessmann, of the Massachusetts State Station, reports that the lines of chemical work have been (1) analysis of licensed fertilizers; (2) analysis of commercial fertilizers or manurial substances; (3) analysis of agricultural chemicals, a refuse material used for fertilizing purposes; (4) analysis of fodder articles; (5) analysis of water; (6) analysis of butter and butter-fat substances for the Massachusetts State dairy bureau; (7) investigations on the effect of the application of different fertilizers on the condition of plants.

H. Snyder, of the Minnesota Station, reports that work in the chemical laboratory of the station has been under the following lines: (1) in dairying, the manufacture of cheese from milks rich and poor in fats, the incorporation of cream into cheese, losses in cheese-making, artificial curing of cheese, and the development of acid in cheese-making. (2) Digestive experiments with milch cows—pea silage and wheat bran; with pigs—barley, barley and shorts, corn, corn and shorts, bran, peas, etc. In these latter experiments complete analysis has been made of the food and in the case of the cows the milk also. (3) Analysis of the beets grown by farmers in the different parts of the State, and tests of varieties of beets and sorghum. (4) The composition of the wheat plant in its different stages of growth, and the analysis of different grains of wheat and all the milled products from the same. (5) Analysis of the main fodder and grain crops of the State. (6) Soil collection and analyses. (7) Analysis of water and milk samples sent by farmers, and other miscellaneous work.

W. L. Hutchinson, of the Mississippi Station, reports that the chemical work for the station during the past year has been on grasses, marls, water, cotton plants, and milk.

F. W. Morse, of the New Hampshire Station, reports that the work pursued in the chemical laboratory of the station has been (1) a study of the effect of feeding upon the composition of butter fat; (2) investigation of maple sap, sirup, and sugar with reference to the season; (3) composition of fodder corn with reference to the amount of seed per acre and the investigation of nitrogen-free extract in the same; (4) development of analytical methods.

New Jersey has been at work on (1) analyses of commercial fertilizers. (2) Analysis of fertilizing materials, manures, waste products, etc., (*a*) for the purpose of giving exact information as to their character and composition; (*b*) to indicate economical methods of buying and using. (3) Analyses of farm crops, (*a*) to determine the character and value of newly introduced plants; (*b*) to determine the effect upon the composition of potatoes and sweet potatoes, of the use of different kinds, forms, and qualities of plants and qualities of plant food. (4) The study of chemical methods. We have tried the Gunning method for the determination of nitrogen both in the presence and absence of nitrates; the Ulsch for nitrogen and nitrates; modifications of the official method for the determination of potash; and the drying of fats in air and hydrogen after extracting according to the official method.

A. Goss, of the New Mexico Station, reports that the chair of chemistry of the New Mexico College of Agriculture and position of chemist to the station have only lately been created, and he has no work to report.

H. B. Battle, of the North Carolina Station, gives the following synopsis of the chemical work done by the station: (1) Analysis of commercial fertilizers; (2) investigations in connection with the analysis of cotton seed and cotton-seed meal; (3) analysis of marls and limestones—work in connection with the development of analytical methods for the Association of Official Agricultural Chemists; (4) identification of ores, minerals, etc.; (5) iron ores; (6) mineral waters; (7) investigations with tobacco with reference to composition; (8) study of the composition of native and wild grasses and various feeding stuffs; (9) digestion experiments; (10) study of sorghum as to its sugar content.

G. L. Holter, of the Oklahoma Station, reports that the station has just been organized and that he has no work to report.

G. W. Shaw, of the Oregon Station, reports that the Oregon Station has been confined to two lines: (1) Work on the sugar beet; (2) an investigation of the Oregon soils.

H. J. Wheeler, of the Rhode Island Station, reports that the chemical work of his station during the year embraces the analyses of commercial fertilizers, factory refuse of agricultural value, fodders, well and spring waters, and a systematic analysis of the algæ which appears on the Rhode Island coast, with special reference to their fertilizing qualities.

M. B. Hardin, of the South Carolina Station, reports the chemical work of the Clemson Agricultural College as being confined to (1) the analyses of feeding stuffs, sugar beets and fertilizers; (2) an examination into the character of phosphoric acid in cotton-seed meal and the ratio of available to the total phosphoric acid, and of the water soluble to the total potash in such meal. Analyses of official samples of commercial fertilizers have also been made at the South Carolina station.

C. W. Dabney, of the Tennessee Station, reports the chemical work done by the station: "We have completed and published a bulletin on the cotton plant. This is a chemical study of the cotton plant and all its parts and all the products of the cotton-seed industry. We have also analyzed a number of feeding stuffs, samples of milk, butter, etc. Most of our time work has been given to a systematic study of the soils of Tennessee. The soils of East Tennessee have been completed, and we are now at work upon the soils of other sections of the State. The station also makes the analyses for the State bureau of agriculture in connection with the fertilizer control."

H. H. Harrington, of the Texas Station, reports the study of grasses and forage crops. The soils of the State have been given attention by this station and they are just beginning to study animal foods under special conditions.

J. L. Hills, of the Vermont Station, reports that the work of the chemical department is largely in connection with the dairy, and has covered about three thousand analytical samples of dairy products; also with the manufacture of maple sugar and sirups, and fertilizer control; together with fodder analyses in connection with feeding experiments, and the study of analytical methods.

R. J. Davidson, of the Virginia Station, reports the analysis of feeding stuffs, fertilizers, and marls, and a special chemical study of the tobacco plant.

E. E. Slosson, of the Wyoming Station, reports that the chemical work of the station has been on the following lines: (1) analysis of sugar beets; (2) analysis of soils; (3) analysis of mineral waters of the State; (4) analysis of native and cultivated grasses.

M. A. SCOVELL,
Chairman.

The PRESIDENT. If there is no objection the report will be filed with the secretary. Next is the report of the section on entomology.

Mr. OSBORN. Prof. Bruner is not present but has sent me his report, with the request that I present it to the association. It is as follows:

REPORT OF THE SECTION ON ENTOMOLOGY.

While there is still a certain amount of ridicule entertained for the "bug catcher" or entomologist, this feeling of apparent disgust on the part of the general public for himself and his "pets" is rapidly disappearing. Consequently it has even been acknowledged, in a quiet sort of way, that some of these misguided mortals are harmless fellows. It has also been asserted on one or two occasions that they are not "bad;" when everything is taken into consideration, they do not differ very much from other people. But—well, no matter.

There has been no great change in the personnel of the entomological workers in the stations and colleges during the past year; hence it has been thought best not to repeat the report of a year ago and that of two years ago. We have had reports on the work being done by different members of the society of station and college economic entomologists from year to year. This year, therefore, I thought it might be well to digress a little from the custom of the past and report on the equipment of the various institutions for this work. I accordingly sent out personal letters to all of the working entomologists of the society, asking for concise statements respecting the equipment of the departments under their respective charge. These letters were replied to by a number of the entomologists addressed, but others have thus far paid no attention to them.

Judging from the reports received, the different institutions in the East are apparently much better equipped for entomological work, both as to reference libraries and apparatus with which to work, than are those in the West. They are also provided with more and better room than we in the western part of the country can boast of. This, when we take into consideration the fact that the East also contains most of the large reference libraries of the country, does not speak well for the institutions of the West. True, there are extenuating circumstances which should be taken into consideration before we criticise too severely. The Eastern States have been settled much longer and are more thickly populated. The insect pests have also had more time to increase and become spread over that region than they have had in the West. On the other hand we in the new West transact our agricultural business on a much larger scale than do our Eastern friends. Our insect pests, while perhaps fewer in number of species, are greater in number of individuals of each species. These must be handled over hundreds of acres, whereas in the East they are dealt with on only a few acres.

Of the thirty-odd workers the country over, it will be seen from a perusal of the following reports that a number of them are provided with special buildings or *insectaries*, with greenhouse attachments, in which to carry on their investigations. Others of our number are without these aids. Some are supplied with ample means for both field and laboratory experimentation against the insect pests of their respective localities, while others have hardly anything in the shape of these aids, and scarcely more than the bare space in one corner of a small room with which to attack the host of insect enemies which they are supposed to control.

As would naturally be supposed, the workers who are best equipped and at the same time well supported by the governing boards of their respective institutions, have been and are now doing the best work. Economic entomology does not mean the mere gathering and pinning away in boxes of a number of miscellaneous insects, as many people seem to think, nor do any of the workers who have been engaged to fill these positions wish to make such their trust.

What we need as workers who are expected to accomplish much in economic entomology, is the following equipment: (1) Good and ample room to work in; (2) first-class reference libraries and collections of typical specimens, along with sufficient apparatus in the shape of breeding cages, jars, microscopes, cameras, drawing tools, materials, etc.; (3) machinery for the application of insecticides in laboratory and field; (4) sufficient appropriations to enable us to carry on our experimental work with insecticides and other methods of insect control on a sufficiently broad scale to insure success. Without support of this kind it is wrong to expect the workers in economic entomology to accomplish great results. Give us an opportunity to prevent the great annual losses sustained by the agricultural and other interests of the country from the ravages of depredating insects, and we will do our utmost to meet this demand.

Standing at the head of the economic entomological work of the country is the Division of Entomology of the U. S. Department of Agriculture. This is in charge of Prof. C. V. Riley. Without this branch of government work to fall back on the various workers in the stations and colleges would be much hampered in their researches in economic entomology. Assisted as he is by so many special workers, Prof. Riley has been able to make the Division a vast storehouse of information on the life histories and habits of most of our indigenous insects. With the good reference libraries and collections at hand any doubtful question that may come up in the several stations of the country can be quickly settled in Washington. It is the Mecca to which all entomologists of the country journey. Recently the building of a typical insectary for use in connection with this Division of the U. S. Department of Agriculture has added to its usefulness. Not only are there a number of workers located in the rooms of the Division at Washington, but there are also a number of field agents distributed over the country, where they are occupied in making special investigations on the insects in the regions where they are located. The equipment of this Division is nearly perfect. No report has been received.

The following reports from the institutions heard from will indicate about the condition of equipment of the various institutions of the country that are more or less engaged in the study of economic entomology:

Alabama, although not having a special entomologist, carries on this line of work in the Alabama Polytechnic Institute. The work here is in charge of Prof. Geo. F. Atkinson, the professor of biology. He reports as follows: "With all this work on hand (pathological and mycological), I can at present do little in entomology, and the comparatively small equipment for insect study would not be worth mentioning." The professor, however, states that his institution is very well equipped for bacteriological and mycological work, his library and collections in that direction being very good. He also states that he has a special hothouse for the study of fungi, etc.

From Arizona J. W. Toumey reports that "the department of entomology at this station has been in operation less than a year. As yet the library is poorly supplied with necessary reference books on the subject; however, we hope to make considerable additions in this line in the near future. We have a reference collection of nearly two thousand specimens, many illustrating species of economic importance. The university being located in a non-agricultural region, but few field experiments have been carried on; however, during the summer I will spend two or three weeks at Phœnix in the special study of the injurious insects of that region. We are well supplied with necessary machinery for the application of insecticides. We have been especially investigating the insects injurious to canaigre (*Rumex hymenosepalus*), a plant the economic importance of which we are investigating as to its value as a source for the supply of tannin."

In Arkansas there is no separate department for the purpose of investigations in economic entomology, although there is engaged at the Arkansas Industrial University a professor, J. F. McNeill, who is an entomologist.

California is well equipped for work in this line, and not only has an experiment station entomologist, C. W. Woodworth, but also a professor of entomology in the College of Agriculture. There are, in addition to these, two special agents of the U. S. Department of Agriculture located in the State. The San Francisco Academy of Sciences is provided with a good reference library, to which the entomologists have access.

The State of Colorado has an entomologist, C. P. Gillett, who is connected with both the experiment station and the agricultural college. He is provided with an assistant. His report reads as follows:

"For apiary experiments there has been erected a good honey house, with storage and work rooms and cellar. I have thirteen colonies of bees and an abundance of furniture and tools to work with in the apiary. The insect collection probably numbers not less than 10,000 specimens, all of which have been taken in the past year and a half, and the number is rapidly growing. We are putting special stress on collecting and rearing insects this year. Our breeding-cage numbers for this year have reached 261 to date, (July 28). I keep an accessions and a species catalogue and a breeding-cage record, with a system of cross references, and as full data as possible are kept of everything that enters the collection. To contain the collection I have 112 Harvard boxes, 75 Schmitt boxes, and 25 other boxes for which I know no name. The section is also fairly well equipped with the various insecticides and pumps and other apparatus for applying the same. I am allowed one good assistant, who devotes most of his time to station work. The station has use of the microscopes, photographic apparatus, etc., belonging to the college."

Connecticut does not report any special work in this line.

M. H. Beckwith, of Delaware, reports that the entomological work of this station is carried on in connection with the horticultural work, and in consequence of not having an assistant the time has to be divided between the two departments, often to the detriment of one or the other of the lines of work.

"The library contains about one hundred and fifty volumes, principally on economic entomology. We have no reference collection except such as I have been able to secure in connection with my routine work. The facilities for breeding and studying life histories are a glass house and breeding cages similar to those illustrated by Dr. Riley in his Missouri report. Various field experiments are carried on to control the curculio, corn weevil, strawberry weevil, peach aphis, cankerworms, codling moth, rose bug, cabbage worms, etc. We are well provided with machinery for applying insecticides, having five Nixon pumps, upon which we use the ½-inch hose, with fittings for the large nozzles. We also have a Japy knapsack pump and several Vermorel nozzles, one Lewis combination pump, and the Brooks hand pump, but we use the Nixon pumps and nozzles in preference to all others in our work. Much of our work is distributed in different parts of the State. Numerous lectures have been given before grange meetings, horticultural societies, and farmers' institutes. *Anthonomus musculus* has been very numerous on strawberries in several localities in the State. I found blossoms infested with the larvæ and have bred perfect insects from them. We are experimenting with *Botrytus tenella* on the white grub."

I have received no report from Florida, but there is entomological work carried on in this State; the name of the station entomologist is P. H. Rolfs.

Georgia, I believe, is without an entomologist, either in the experiment station or in the State College of Agriculture and Mechanic Arts.

The Illinois College and Station work is united under the charge of Prof. S. A. Forbes. The equipment for work is excellent and the results obtained are among the best in the country. The insectary, which is used in the study and rearing of insects, is one of the best equipped in the country. Library, reference collections, and everything else are among the best. Several assistants are provided by the State. Field control of insect pests and the study of bacterial diseases of insects have been leading features of experimenting in this State.

In Indiana there is no station entomologist, but the subject is taught in the School of Agriculture, Horticulture, and Veterinary Science of Purdue University by J. Troop. I have no report of equipment and facilities for teaching from this institution.

The Iowa department of entomology is quite strong, both in the agricultural college and experiment station. The work in both is in charge of Prof. Herbert Osborn, who is provided with an assistant for the station work. He reports as follows:

"Library facilities embrace the college library, the station library, and my private library. As these duplicate each other only in a few cases the aggregate is an excellent working entomological library, containing almost all of the current entomological literature and many works which are out of print and rare. Of special works I may mention Buckton's British Aphides, Piaget's Les Pediculines, Guebel, Epizoa, full sets of Psyche, Canadian Entomologist, Proceedings and Transactions American Entomological Society, and Riley's Reports as among the important ones. The collections are quite extensive, twenty-four glass-top cases 15 by 18 inches, and two hundred or more boxes (Schmitt pattern) belonging to the Station; besides these the full college sets. They are especially full and valuable in native Lepidoptera, Coleoptera, and Hemiptera, while other orders, especially Orthoptera and Neuroptera, are quite well represented. In many cases the determinations are by well-known specialists, and great pains have been taken in all orders to secure correct identification of species. In Hymenoptera the Ichneumonidæ and Tenthredinidæ are well represented. In Diptera some of the families are fairly well represented with determined material. The Hemiptera, including my private collection, contains an extensive series, and of parasitic insects, especially Pediculidæ and Mallophaga, it is perhaps one of the best in the country. In Arachnida (spiders, mites, and ticks) it is fairly well supplied. In all orders biological material is accumulating rapidly, and some special collections showing insects affecting certain crops are already formed or in progress.

"The section owns a first-class microscope, with powers ranging to a one-twelfth inch oil immersion, and various accessories, and has also at command the numerous equipment in microscopes, microtomes, etc., in the college laboratory of zoölogy and entomology. A breeding room, about 25 feet square, is devoted to breeding cages and equipment for tracing life histories, while root cages are provided for outdoor work and space in the station greenhouse is available during winter or at any time when necessary for special conditions. An apiary is kept, at present consisting of half dozen full colonies and two nuclei, one of which is kept in an observation hive for study. Studies of clover insects are in progress, and experiments upon control of Jassidæ in pastures. We have a variety of spraying outfits and nozzles, hopper-dozers, etc., and supplies of various insecticides, which are tested to determine their merit or their adaptability for certain kinds of insects or effects on certain plants, We have numerous queries regarding injurious insects, and much time is devoted to correspondence. My own time is divided between college and station duties."

From Kansas no report has been received, but we know that the entomological work in that State is well taken care of, both at the agricultural college and the State university. At each of those institutions are located well-known entomologists, at the agricultural college E. A. Popenoe and at the university F. H. Snow. The experiments relative to the control of the chinch bug by means of a bacterial disease have become widely known as work being done at the university, while insect pests of especial interest to the horticulturist are being successfully studied at the agricultural college and station. The principal workers at both of the institutions have assistants provided. The equipment at both is good.

Prof. H. Garman, of the Kentucky Station, writes: "At the station I have charge of entomology and botany as one department and have fitted up two rooms on the first floor for work in these lines. One of these is provided with a desk, a drawing table, and bookcases and is used entirely for manuscript work. The other and larger room is fitted up as a laboratory, with tables for microscopic and insect work and with one large table for bacteriological work, this line being pursued both as a branch of entomological work and as a division of botany. In the laboratory are cases for insects and also for plants. The rooms are provided with gas and water and the usual apparatus, such as microscopes, bacteriological sterilizers, setting frames, breeding cages, racks for vials, etc.

"The collection of named specimens numbers in the neighborhood of 1,800 species. Most of my material is not yet determined.

"In the way of books we have the standard works, such as those of Harris, Saunders, Curtis, Fitch, Riley, Lintner, Lubbock, McLaughlan, Buckton, Westwood, Say, Le Conte, etc., and have the more important serials, such as Proceedings Entomological Society, Philadelphia, Transactions American Entomological Society, Canadian Entomologist, Entomologica Americana, etc.

"In the college I have the department of zoölogy and entomology, and teach the latter subject to all students taking the biological course and those for the agricultural courses. These students are required to make a careful study, using the microscope and dissecting needles when necessary, of types of all important orders of insects; and learn the use of analytical keys by determining material furnished them or collected by them. They are required also to become familiar with common injurious species and with approved remedies for their injuries.

"I have one regular assistant, who helps in both station and college work; when more help is required I draw upon students.

"The station is also supplied with the usual apparatus for spraying and for the application of insecticides."

From Louisiana H. A. Morgan writes that "the entomological department has but recently been added to this institution, and that in connection with another very heavy branch of work, namely, horticulture. Until this summer nothing was done in this line except investigation that might go on without much expense. Early this spring breeding cages were procured, a portion of the propagating house set aside as a temporary insectary, and the different field force pumps and knapsack sprayers were purchased.

"We have a collection already of about forty cases; a great many of the specimens I collected while studying at Cornell.

"Our entomological library is by no means the best; however, our board are gradually feeling the pressing necessity of advancing this work and are furnishing us with good works from time to time. The literature we have is very general.

"Our investigations up to the present have been along economic lines, associating as much of the scientific with our work as possible. We have worked with the screw worm fly, horn fly, sugar cane borer, sweet potato borer, corn bud worm (*Diabrotica 12-punctata*), orange dog (*Papilio cresphontes*), pecan and walnut moth (*Actias luna*), cotton worm, bollworm, and to some extent with many others.

"I have found it very difficult to carry on any work, having the two departments without any assistant in either, in both university and experiment station. I have, however, persuaded our board to separate the departments and to give me entomology alone, the separation to take effect October 1.

"I am at present working on the orange scales, and have made arrangements for the importation of the parasites upon the red scale (*Aspidiotus aurantii*), which have been recently imported into California. I have also made arrangements for the trial of the hydrocyanic acid gas treatment.

"For teaching facilities I have been furnished with a number of charts and three Auzaux models, also good microscopes and general laboratory facilities."

The entomological work in Maine is in charge of Prof. F. L. Harvey, who states that "The experiment station has no laboratory, but I use the natural history laboratory of the college and my private quarters at my house for experimental work. I am provided with microscopes, microtomes, and other apparatus usually found in biological laboratories.

"We have a collection of 1,000 species of insects of various groups. The college, station, and my private library include the most of the economic entomological publications. We have no specially fitted breeding apartments. I have to use my library, laboratory, and private workroom for such purposes.

"I have been studying the past season for recreation a species of mite known as the verbena mite. I have studied our Maine species of *Thysanura and Odonata*.

"We have force pumps of several patterns."

E. W. Doran, of Maryland, reports as follows: "You are aware that this is the first year here and that nothing has been done here in entomology before. There were no collections worth mentioning and no appliances or library. There is some spraying machinery, such as pumps, etc., in the hands of the horticulturist that can be and has been used by that department in that line heretofore. We have only about 1,000 species of insects in our reference collection, and the library of entomological works is small. Our breeding facilities are meager. I am getting the matter started. No special line of investigations has been carried on, but the work is such as becomes necessary by outbreaks. I am giving nearly all of my time to teaching and get no salary for services at the station."

Prof. C. H. Fernald, of the Massachusetts College (Amherst) writes, in reply to my queries, that "there are two experiment stations at this place, one, the Massachusetts State Station, supported by the State, and the other the Hatch Station, supported by an annual appropriation from the general government. The State Station has no entomologist. I am acting as entomologist of the Hatch Station in addition to my duties as professor of zoölogy in the college and entomological adviser of the Gypsy Moth Commission.

"We have an insectary here for our work, which consists of a story and a half wooden structure with a greenhouse connected with it. The main house contains a laboratory, office, insecticide room, anterooms, etc., with storeroom, stenographer's room, and janitor's room above. The basement contains a pupa room, heating apparatus, coal bin, etc. The greenhouse is so divided that one part can be run as a hothouse and the other as a cold house. In the office we have a library of about one hundred and fifty volumes on economic entomology, and we are well supplied with pumps, nozzles, and other apparatus for applying insecticides both in the field and in the insectary.

"We are making a card catalogue of the literature of North American insects and this already includes more than 25,000 cards. These are made up from the entomological works in my own library, the library of Amherst college, and also that of the agricultural college. This last is very full and contains many rare and valuable entomological works. This card catalogue is exceedingly useful, for when I wish to look up any insect the card of that insect gives all references to the literature.

"We are making up a biological collection of all our common insects, comprising eggs, inflated larvæ in all molts, pupa, imagos, and parasites, also their work on the plants.

"The work done here thus far has been that which seemed to be demanded, judging from the letters that come in from different parts of the State. The work of experimentation is first done here in the insectary and then repeated in the field."

While I have received no report from Michigan, I know that the entomological work in that State is being ably looked after by my friend, A. J. Cook, in the agricultural college. Judging from the amount of work that he has done and the quality of it their equipment must be good.

O. Lugger, of the Minnesota Station, has not sent me a report of his equipments for entomological work in connection with the experiment station and college of agriculture. Whether his facilities for work are good or not, his work has been of such a character as to make some of the entomologists envious of him.

In Mississippi the entomological work is under the care of H. E. Weed, who writes me as follows: "When I came here the station authorities seemed to think that the entomological work of an experiment station should consist entirely of field work, and that no laboratory or anything of the kind was necessary. I was hence given only a 6 by 6 corner in the general office of the station. In six months I was given more space in a room used also for a library for the station. Here I was until last January, when I was given the room I occupy at present. This room is 20 by 20, with a dark room in one corner used in photography. In addition to this I have a building 10 by 15 feet in which I store my pumps, insecticides, etc., and do a little breeding in jars.

"The library, which is chiefly my individual property, consists of about 200 volumes, and is being added to daily.

"The collection comprises only such material as I collected last season and this, and it is contained in 40 Harvard cases. It is arranged in a duplicate collection, a study collection, and an exhibit collection. This latter is arranged so as to show insects injurious to special crops, along with their work and remedies. This collection was exhibited at several fairs last fall and attracted marked attention. Besides the station collection I have a private collection made before coming here, which is used for reference. It is about the size of the station collection, and is especially good in Coleoptera.

"A Coddington lens is the only microscope of which the entomological department of this station can boast, and when a better one is required it must be borrowed from the department of botany.

"The station is provided with the following insecticidal machinery: A Roach poison distributer, Legget's Paris green gun, orchard and garden pump, aquaject, Eureka knapsack, and Woodason's bellows.

"Especial attention has been given during the year to insects injurious to cotton, stored grain, cabbage, and beans."

In the Missouri Station and College the work in entomology is in charge of the professor of agriculture, C. A. Keffer. No report has been received in reference to the equipment and work of this station.

"The department of entomology in the Nebraska Station and Industrial College is under the charge of myself. No provision is at present made for an assistant in either the station or the college. The equipment here is as follows: We have a good reference collection, embracing about 10,000 species of insects of various orders. These are contained in 200 double boxes made by Stromberg, of Galesburg, Ill., 100 Schmitt boxes, two cabinets of the Schmitt pattern, and about 150 other boxes of miscellaneous make. In addition to these we have some thirty display cases of our common injurious and beneficial insects arranged along with their food plants to show their work, etc. Our alcohol material in preparatory stages, our spiders, and myriapods, are contained in about 1,500 vials. Much of this material is as yet unarranged and unnamed. The library, if we include all the works that are contained in the station, college, and in my private set, will perhaps reach 750 volumes besides a number of smaller papers. We lack, however, such works as the principal miscellaneous publications of Westwood, Curtis, and others, which are of the utmost importance to the economic entomologist. Our library as a whole is quite complete in works on Orthoptera, on the Aphididæ, Arachniæ, and American periodicals.

Breeding facilities are practically out of the question at present, for the entire department, station and college, is limited to a single room scarcely large enough for a comfortable office. This one room serves as office for the station work, library room, private work room, collection room, breeding-cage room, and laboratory for students, of which there are upwards of twenty in different lines of work. Our laboratory equipment for student and private work is fair, there being three high-grade and six good laboratory microscopes in the two departments of the institution. Of wall charts we have all that we desire, as well as other appliances of like nature. These and reference collections with the boxes to contain the latter we have had no difficulty in obtaining; but books and breeding facilities, with machinery for field experiments, though asked for, have not been provided. Consequently, our equipment in these lines is almost entirely wanting.

No special line of investigation is at present under way here. The station work in this line has been almost entirely dropped for the time to give way to teaching. Sugar beet insects have been studied in the field to some extent during the past summer as well as this could be done without funds and appliances. The near future, however, promises to better this state of affairs.

From F. H. Hillman, of Nevada, no report has been received. He is entomologist and botanist for the station and teaches the two subjects in the college.

There does not appear to have been any report from New Hampshire, where the entomology is in charge of Prof. C. M. Weed. That he has the best that can be obtained from the board of control in his State can be relied upon.

A very encouraging report comes from Prof. J. B. Smith, of New Jersey, and reads as follows:

"My laboratory is fully equipped for all kinds of investigation into the structure or classification of insects. The optical aids—lenses, microscopes, and drawing cam eras—are ample in every direction. Dissecting tools, reagents, and apparatus for histological investigation are complete, and as a study laboratory I have little left to wish for The library on the subject is very full. We have not only the leading economic publications, but also all the current periodicals, native and foreign, and have in most cases full sets of each journal, including such as the Annals of the French and Belgian Societies, the Berliner, Deutsche, and Stettiner Zeitschriften, and indeed a well selected and full series of the best entomological works. To this I am adding constantly and have nothing to complain of under this head. I may add that we have all the records and publications of like character.

"The collections are good and growing. At present they fill 150 cabinet boxes, 15½ by 18½, and the same number of smaller book boxes, 9 by 13; in the Lepidoptera we have an excellent general collection; in the Cleoptera a well-selected series, representing the American families; and in the other orders chiefly a collection of local forms. This collection, embracing nearly 6,000 species, has been almost entirely secured by myself during the three years of my connection with the station. There are 33 boxes illustrating the economic insects as treated in the station bulletins. The facilities for raising or breeding insects are poor, and I confine this work to the closest possible limits. The State is small, and nearly all parts of it are readily reached by rail in a few hours, so that it is easy to study the insects in the field, and I feel the want of an insectary less than might be the case otherwise. Of insecticide machinery, we have enough to illustrate and make practical experiments. I have the leading types of nozzles, to exhibit and for use. My method of work is to select some one or more crops which are most troubled by insects, fix upon the most convenient points for their study, and spend as much time in the field as is necessary to enable me to learn all that I consider needful concerning the insects. During the present year insects infesting sweet potatoes and the Cucurbitaceæ are being specially studied."

From C. H. T. Townsend, entomologist of the New Mexico Station, we have received the following report:

"I have secured all the standard entomological, zoölogical, and physiological works. I have also 10 large breeding cages, after the Department of Agriculture style; 2 hand spray-pumps, hose, cyclone nozzles; 1 Woodason bellows; a complete outfit for preparing liquid insecticides; 2 achromatic triplets; 50 insect boxes, from Schmitt; 10 gross assorted vials, with rubber corks to fit; and 40 large glass jars for alcoholic material.

"I have no special line of investigation. Everything here is new, and each receives the same attention. I have already notes on 275 species. I also have a large number of fine alcoholic specimens, about 200 vials. Of the 275 species, probably 100 are named, if not more.

"The office, which is in the basement, consists of only one room, and serves also as laboratory and recitation room combined. It is provided with two tables, a desk, two large upright cases with glass doors, for holding insect boxes, vial boxes, and supplies, a letter press, microscope, etc."

Even if there has been no report received from New York we know that the entomology in that State does not suffer for the lack of equipment and a place in which to do the work. Prof. J. H. Comstock, of the Cornell Station, was the first to erect a special building for the purpose of rearing and studying the life histories of insects. Aside from this insectary the institution is one of the best supplied institutions in the land as to library and reference collection.

No report has come from the North Carolina Station or College.

In North Dakota there is no entomologist either in the station or the agricultural college, but this line is attended to in a limited way by Prof. C. B. Waldron, of the college, who is arboriculturist. No special equipment is provided.

In Ohio the subject of entomology receives attention both in the college and at the experiment station. In the latter it is under the care of F. M. Webster, who also acts as a special field agent for the U. S. Department of Agriculture. He reports as follows: "The consulting entomologist is employed jointly by the station and the Department of Agriculture, has no classes, but devotes his whole time to original work, and also has charge of the entomological correspondence. By agreement he furnishes to a great extent his own library, though the station purchases entomological works when necessary. The station has a fair reference collection of insects, and the entomologist also has a private collection which is used in the regular official work. The station has a microscope, with accessories, and a full supply of the latest improved machines for the application of insecticides. The last legislature appropriated $1,000 to be used for the erection of an insectary building on the new grounds at Wooster, and this will probably be in shape for occupancy the present year. It will be equipped with facilities for the study of the development of injurious, beneficial, and other insects.

"While new facts relative to the morphology of any insect will be secured as far as possible, rather more stress is placed upon such as depredate on field crops. While not for a moment losing sight of the value of purely scientific investigations, the stations will lose no opportunity to make such investigations of practical utility to the agriculturist, in whatever branch of the industry he may be engaged. This it hopes to accomplish by a combination of field and laboratory work. The technical features of entomology will not suffer neglect, and it is hoped that at some future time we may be able to publish an annotated list of the insect fauna of Ohio, which shall be of value not only to this but adjoining States as well. For this purpose specimens and notes are being secured whenever an opportunity is offered."

From the Oregon Station, the entomology of which is in charge of F. L. Washburn, we have received the following report:

"The library contains about 70 bound volumes, and about 60 unbound pamphlets, insect reports, monographs, etc., also files of the American Naturalist, Entomological News, Zoe, Psyche, Insect Life, etc.

"Insecticide machinery.—A large-sized Bean sprayer, bamboo rods, the new Vermorel nozzles, the Nixon nozzle, the new Bean nozzle, a No. 3 Nixon spray pump, Little Climax pump, and a Leggett London purple gun for dry insecticides; also 10 gopher and mole traps, and a tank mounted on wheels.

"Five Packard breeding cages (old style). Breeding jars. The collection contains about 1,200 insects, representing from 500 to 700 different species. Forty-seven insect boxes in case, collecting tools and mounting material."

"In addition to these the department has, in connection with zoölogy, eleven compound and four dissecting microscopes, dissecting tools, etc.

"Some of the work in progress is experiments with the codling moth, including observations on the date of appearance of moth, length of time required for eggs to hatch, date of egg-laying, and length of life of moth; the comparative excellence of several insecticides; study of the hop louse and experiments against it; experiments with potash salts against cutworms and wireworms; and minor experiments against plant lice, flea beetles, and common pests of the garden."

No work in economic entomology is specially provided for in either the Pennsylvania State College or station.

The Rhode Island Station, I believe, is without a special entomologist. The work in Brown University is systematic rather than economic.

The South Carolina Station is without an entomologist and no entomological work is provided for in the college.

In South Dakota the entomological work is in charge of Prof. I. H. Orcutt, assisted by Mr. J. M. Aldrich. The department is united with that of zoölogy in both the college and station. The report from there is very encouraging. They have an insectary and are provided with six pumps of different kinds, breeding cages, etc. The collection comprises much unarranged material, and about 2,000 named species in all orders, chiefly in Coleoptera and Diptera. The library contains most of the economic and some of the systematic works on American insects. Some experiments have been made with kerosene emulsion as a sheep dip for scab. Experiments will be made on cutworm control during the summer and fall. A collection for the World's Columbian Exposition will be made.

Tennessee is without an entomologist in both station and college.

Texas also seems to be without an entomologist at present.

At the Utah Station the entomologist and horticulturist are the same person, Prof. E. S. Richman. He also teaches horticulture and botany in the agricultural college. No report has been received from there.

The entomological work in Vermont is looked after by Prof. G. H. Perkins, who is also professor of natural history in the University and State Agricultural College. No report has come from there.

From Virginia, where the entomological and botanical work are carried on by Prof. William B. Alwood in both station and college, the following short report has been received:

"For teaching and station work I have seven rooms, main office; private office; private laboratory; main laboratory, which is also lecture room; working laboratory for preparation of poisons, fungicides, etc.; and two small storerooms. This comprises entire ground floor of the main building. The library is my private collection of principal American works and of a few foreign. The collections are mostly private, and comprises about 3,000 species, embracing all orders. Breeding facilities are not good, but cages and greenhouse are used. Field experiments are few, made only to decide upon value of methods, etc. Machinery is the very best and well used. We have placed much machinery throughout the State and taught farmers how to use it. I am working especially upon tobacco insects and those affecting fruits. I have this year an artist assistant, one of my students, and am preparing a number of illustrations, especially on the life history of *Protoparce carolina* and *Chloridia rhexia*."

The Washington Station has no special worker in economic entomology and hence no report has been received.

Mr. A. D. Hopkins, of the West Virginia Station, reports in detail, but the equipment of this station can be summed up about as follows:

A single room 18 by 18 feet, fitted up with desk, bookcase, working table, and insect cabinet containing 36 drawers and 27 insect boxes. There is also a shelf at window for microscopic work, office, and other chairs, with the usual fixtures for work. In the library are something over 200 works on entomology. For working, a good high power and a dissecting microscope with material, and for collecting and rearing insects a good line of material and tools are named, while the equipment of insecticidal machinery is quite complete. The records of bred and collected specimens reach 5,686, while he reports 214 card notes and index and 250 pages of unpublished manuscript. In the collection there are contained 15,100 insects and 1,050 specimens, showing food habits. Some 250 unpublished original figures are also mentioned.

Special lines of investigation are, (1) the study of fruit and forest tree Scolytidæ; (2) the study of and investigation of forest and shade tree insects. All of this equipment and work has been accomplished in a trifle over a year.

While there is no entomologist at the Wisconsin Station, there is a teacher of economic entomology in the college of agriculture. Prof. E. S. Goff has charge of this branch along with horticulture.

Prof. F. J. Niswander, who has charge of entomology in the Wyoming Station, teaches entomology and zoölogy in the university and has charge of the experimental farm. He reports as follows:

"The books of reference are Transactions American Entomological Society, Riley's Missouri Reports, Packard's Guide, and Garden Insects by Treat, with such of the Government reports as can be obtained. I have a dissecting microscope and have to make my own breeding cages, etc. The department gets no appropriations from the board. I have one small spray pump.

"The following outline of work has been submitted to the council: A study of the injurious insects of the season and the best means and remedies for their destruction; the answering of correspondence concerning insect outbreaks, with suggestions as to best methods of destruction, and also as far as possible the study of their natural history; the publication of short newspaper articles from time to time, as occasion demands, giving the most approved methods of fighting insects; instructing the superintendents of the experiment farms with regard to collecting and preserving insects and taking observations concerning insect pests; the building up of a collection of Wyoming insects, to become a part of the equipment of this department; and the preparation and collection of material for the World's Columbian Exposition in 1893."

From J. Fletcher, of the Canada Station, who is both entomologist and botanist, this report has been received:

"The collections are small and are such as have been made since the organization of the Government experimental farms in 1887. There is no special insectary, but as there is no teaching all of our (mine and one assistant's) time can be devoted to correspondence and breeding and remedial experiments. The chief apparatus used are Galloway knapsack sprayers, a pump attached to a barrel, and a hand pump (Johnson's aquaject). The investigations made during part of the year, *Gortyna inanis* in hops, *Hæmatobia serrata* on cattle, *Coleophora fletcherella* on apple, *Fenusa melanopoda* on alder, *Nematus pallidiventris* on poplar, *Ellopia* (?) on oaks, and parasites. I have an unlimited supply of jars for breeding, and free scope to try agricultural experiments in the field. I have been without an assistant until this year, and now I hope to get my collection in order and be ready next spring to do more effective work."

L. BRUNER,
Chairman.

The PRESIDENT. If there is no objection, the report will be filed with the secretary. Next is the report of the section on horticulture by Prof. Popenoe, of Kansas.

Mr. FAIRCHILD. Mr. Popenoe is not present nor did he say anything to me of a report to be presented to the Association.

Mr. PLUMB. The question brought up by Gen. Lee was left, as I understood it, to be discussed in the section on college work. As I think it has a wide bearing and many who are interested in the subject would not be able to hear the discussion in the section on college work, I move that this subject be brought before the general session.

Mr. INGERSOLL. There are three gentlemen present to read papers before the section on agriculture on the subject of the teaching of agriculture. I would like to have these papers presented to the general session.

Mr. PLUMB. It seems to me that these papers are technical and should be presented in the sections, but the question raised by Gen. Lee is of general interest and ought to be discussed before the general session.

Mr. HAYS. Prof. Harwood and myself, who are expected to read papers before the section on agriculture on the subject referred to, are of the opinion that if the subject is of general interest the papers might as well be read before the general session.

Mr. HARWOOD. It seems to me that if Gen. Lee's question is taken up now the same thing will be gone over when our papers are read.

The PRESIDENT. It has been moved and seconded that the paper read by President Turner be discussed in the general session at this time. What is your pleasure, gentlemen?

The motion was carried.

Mr. SANBORN. Three years ago, after fourteen years' experience in agricultural education in the New England States and the Mississippi Valley, I was called upon to organize an agricultural college on the Pacific slope. In the several months which I had to think over the subject of organization and the studies to be embodied, I went over the ground very carefully and arrived at some of the following conclusions. In the first place, I read the law very carefully and tried to interpret it for the greatest good to our people. Farmers from ocean to ocean are supplied with agricultural colleges and technical schools of instruction in agriculture. The law under which they exist states that their general purpose shall be to teach the branches of learning—let me emphasize this—that relate to agriculture and the mechanic arts, in order to give a liberal and practical education to the industrial classes.

In organizing our institution we provided five industrial courses, agriculture having a prominent place. At this time I was writing for the agricultural papers throughout the country to interest them in the college. I said, "Agriculture is the leading industry of North America; the law says that we shall teach agriculture, the farmer demands that every effort shall be put forth in his behalf. We shall do everything possible to make agriculture a leading feature in our institution, but after all it will rest with the farmers to determine whether the agricultural department shall be the leading one. If the demand for the mechanic arts should prove stronger, do not say that we have turned the cold shoulder to agriculture."

We have put our money into a fine farm, have erected buildings, and have established classes in mechanics, horticulture, biology, and other special lines. My friends, the trouble is that there is not a demand for agricultural instruction, and the fault lies not with the colleges but with the farmers themselves. A young man came to me a short time ago with a letter of introduction and said that he wished to enter one of the departments of the institution. I said to him, "I suppose you intend to turn your back on the farm and go into the city." He replied, "No, I am going back to the farm." I asked, "Then why don't you take a course in agriculture?" "Why," said he, "I have just come from farming." The farmer does not perceive that agriculture rests upon science and that until he goes to college and studies the science of agriculture he will be unable to do the best work. One reason why young men leave the farm for the city is the want that they feel of mental activity. When they discover that mental activity is of use in farming they will go back to the farm. The demand for agricultural education is increasing and twenty years from now it will be the fashionable education. In less time than that the tide of migration from the city to the farm will set in.

Mr. FAIRCHILD. May I ask Mr. Sanborn a question? I would like to know whether he can tell us the proportion of students taking the course in mining, mechanical, and civil engineering, and agriculture.

Mr. SANBORN. Not definitely. Of the junior class two-thirds of the students are in agriculture, in other classes the number is about evenly divided between that and other courses.

Mr. HENRY. If there are only three or four in a class that is not significant.

Mr. SANBORN. We have sixty juniors and thirty sophomores.

Mr. FERNALD. Twenty years ago it was my pleasure to attend a convention of the American Agricultural Colleges in Washington, and the principal topic at that convention was how to induce young men to study agriculture, and in every convention down to this time that topic in some form or other has been brought up for discussion. I do not know that we are any nearer the solution of the question than we were years ago. I believe that no question more vital to the interests of our institutions will be raised during the meeting of this Association than this one on which I hope to get light. The law requires that we teach the branches of learning related to agriculture and the mechanic arts. It is my observation and experience that when in the same institution you open the doors to mechanic arts and to agriculture, the young men will turn toward the mechanic arts. An effort has been made in my own State of Maine to change this. We desire to see the number of young men taking the course of agriculture increased, but we find that even the students who come there for that purpose, when they see that it is better and easier to take civil or mechanical engineering, drop into those courses in large numbers. We can not help it. If the gentlemen here will point out a way by which we can bring equal numbers into these courses they will do us an important service. A farmer will ask me why we do not turn out more agricultural students—more who go back to the farm—but when I ask him what course he wishes his son to pursue, he says he wants him to take a course in civil and mechanical engineering. The farmers send their boys to college to take the other courses. I expect that the same thing is true in every State. New Hampshire has just received an endowment of nearly a million dollars for an agricultural college. I asked Director Whitcher whether they were going to introduce courses in civil and mechanical engineering. "Yes." Then I said to him, "From the first, there is where your students will be." "Yes," he said, "I know it. We can not help it. I expect the students to go into these courses." And they will. If New Hampshire should shut out the department of mechanic arts, making a purely agricultural college, the difficulty would be avoided.

So long as other doors are open the remedy for it has not yet been found. Whether there is a remedy is the question to which we should address ourselves. We might lower the requirements for admission to agricultural students. We have opened short courses, one for two years, and invited the young men to enter, but they do not want to come. We are proposing to open a short course in dairying by winter lectures. But these are really makeshifts and do not meet the demand for an agricultural course. How shall we induce students to take the four years' course?

But even if our agricultural students do not go back to the farm we need not be entirely cast down. When the course in agriculture is taken what difference does it make how the knowledge obtained is applied? I claim that a graduate in agriculture is doing better service for agriculture as director or chemist of an experiment station, or as editor of an agricultural paper, than if on a farm. So when a farmer asks me why we don't turn out more farmers, I make a long answer and it seems to satisfy him.

Mr. Lee. Eight or nine years ago a gentleman just elected to preside over one of the leading institutions in the Southern States when asked what he was going to do, said, "I am going to establish a department of mechanic arts and a department of agriculture, and I shall endeavor to direct our institution so that it shall be entirely in sympathy with agriculture." [Applause.] I hope I may be excused for making a personal allusion.

Why do graduates from West Point make good soldiers? It is because they are educated to be soldiers. When a boy goes to West Point he sees nothing that is not military. When he goes into the library he sees pictures of Scott, Sheridan, Grant, and other distinguished soldiers, and he sees the shelves covered with military books. While he is there his eating, his drinking, and his sleeping are military.

What is the case with our agricultural colleges? There is no industry so attractive as farming. When a man goes to an agricultural college, agriculture should be presented in its most attractive style. He should see the best cattle kept in the best style, should see plowing done with the best plows and the best teams; when he goes into the orchard he should find the very best fruits, and when he goes into the garden he should see the best vegetables. Make agriculture attractive in every way so that when the boy wakes in the morning he will see beauties in the farm.

It is only too evident often that the colleges are not in sympathy with farming. The Mississippi College is young and can not make a comparison with the Michigan and other colleges in the older States, but I can say that our college is becoming somewhat attractive to the farmer. For four or five years alliance men coming by would turn their heads the other way, but the sentiment has changed all over the State. The prejudice is almost broken down and I feel confident that in five years we shall stand in the same relation to our farmers that the Michigan College holds to hers. We shall not be asked by the legislature how much we want, but how much we can use. We expect to conduct our farming so that when a farmer comes there and compares it with his own work he will see the advantage of scientific agriculture. I believe that the lack of interest in our agricultural courses exists simply because we do not give enough attention to agriculture.

Mr. Sanborn. I would like to ask whether anything is done to keep boys from going into other courses which the law is equally clear in requiring us to teach.

Mr. Lee. Only this. We pay students for labor on the farm, but not for working in the shops. I say that the work in the shops is education only and does not deserve pay, but that work on the farm earns money and should be paid. Our mechanical department has been established this year and about one-half of the boys have gone into that department, but I find that they are now coming back to the agricultural courses in order to earn the money paid for the labor on the farm.

Mr. Smart. The question before us is a very old question and has been discussed in the same old way for many years. I want to contribute the speech I have been making for the last five years. I think a good deal of the blame for this thing is to be laid to the tariff, the farmer, the farmer's son, the farmer's wife, the professor of agriculture, and everybody except ourselves. There are many reasons why we have so few students taking the course in agriculture. They could not be named in half an hour. This is a large question and that is the reason we have to discuss it over and over again. But as to the statement that agricultural colleges are not in sympathy with agriculture, I do not believe it is true and the interest manifested in this Association, year after year shows that it is not true. I believe there is not a man at the head of an agricultural college that is not deeply interested—certainly I am—in seeing the number of agricultural students increased. Each one believes that he is doing just about right now, but I question whether we in Indiana are. I hope that we can spend this afternoon or a good portion of it not in a discussion of ancient history, but in considering, for instance, whether Purdue is doing the right thing. Certainly we are not all doing the same thing, and if one man is doing just right, the others are not quite right. Take the curriculum of Purdue this afternoon and go for it. Knock it to pieces if you can.

While we do not have large numbers in our schools of agriculture, and while we may never expect to have a number equal to those taking the course in engineering, we must not be altogether cast down at that fact. If the students will not come to the colleges the colleges must go to the students. I believe that to be the function of the experiment station. It is a scheme of university extension. The experiment station gives instruction to the farmer by bulletins and by holding institutes, and in this way 20,000 farmers are educated under the direction of the Lafayette station. They seem to appreciate it very much and they doubtless receive large benefits. So every experiment station can go to the farmer as a college and school of agriculture in every county in its State.

We ought not to send out word that this body of college men say that the agricultural colleges are not in sympathy with agriculture. I do not think my friend means exactly that.

Mr. LEE. He certainly did not mean anything offensive, but he did want to call out a frank discussion.

Mr. CLUTE. One gentleman said that he hoped we would not discuss ancient history. It is, however, a fact that by reading ancient history we learn to solve the problems of to-day, and I am inclined to believe that a little ancient history would not be out of place now. The fact that we do not have enough students in agricultural colleges is due in many cases to the fact that the farmers and their wives and friends, from the time a child is born until he is 21 years of age, are continually dinning into his ears that farming is a poor profession. They tell the boy that the farmer works hard and gets small pay, and that he is the tool of politicians, and looked down upon by society. Now all that, constantly drilled into a boy, inevitably leads him to look upon farming as a profession that he should avoid. We have had young men come to us with no intention of becoming farmers because they had been taught that farming was an inferior profession; but four years' training with our excellent equipment, library, and professors, have in many cases brought these young men, who came to us from the farm disgusted with farming and determined not to enter on farming as a profession, into a different attitude toward farming, and many have gone back home to buy farms and become intelligent, capable, and well-trained farmers.

There are social difficulties that must be considered. The farmer lad does not have the social culture which comes to those engaged in other occupations. This is one of the reasons why our schools of agriculture are not better attended. I think much of the criticism heaped upon agricultural colleges is a great error. If we train up men to teach chemistry in all the length and breadth of the land I claim that we are doing magnificent work.

One of the reasons why our schools of agriculture are not more widely acknowledged and attended is this: They are united with great universities having great departments of Latin, Greek, science, and engineering in its various branches, but only a little space for agriculture. The spirit of the institution is against the industrial course, and a young man going to that school is looked down upon by the rest of the students, and sometimes by the professors, for his grimy hands and coarse clothes. The result is that a young man is almost forced into other courses. The agricultural course will never succeed until you make it important and give it money and appliances.

Mr. HENRY. On the shelves of our agricultural grocery we have had the same things for the last twenty-five years. Our custom has passed away and we have a very small trade. Is that not so? Would it not be well now to look these goods over and study the demands of the trade, in order to see whether we may not better ourselves? Get the sort of goods that people want and you will call in custom.

We have in Wisconsin what we call a short course in agriculture, which I believe goes a long way toward meeting the wants of the people. How did we get it? The man who proposed it was Vilas. At a regents' meeting one of the members read the curriculum for the agricultural course by subjects, one after another, including "Æsthetics." Mr. Vilas followed with a speech remarking the subjects embraced in the agricultural course, one after another, until he reached this item. "Æsthetics?" said he, "Great God, gentlemen, Æsthetics!" From this speech resulted our short course.

This short agricultural course is strictly practical and has been fairly successful. We have also a course of twelve weeks in each of two winters. Why did we make the short course? Why did Mr. Vilas want it shorter? He taught in a law school and knew that a high standard of admission tended to keep out students.

I believe that our courses must be put down, down, down. In Minnesota, the school established by Pillsbury has done more than any other in getting the goods before the people that they want. Mr. Hall is here, and I hope that the college presidents will hear how Minnesota has been able to get one hundred men each year. Let me tell you, my college-president friends and trustee friends, you have a great question. Was it the engineers, the manufacturers, who plead that more money should be given for education? It was the farmers, the agricultural papers and colleges. It was in the name of agriculture that the money was asked for. But where is there to-day a school where a boy who wants to learn about sheep can learn as much as he can from a shepherd? What professor of agriculture is there who knows half as much about horses as a horseman?

I think it is a shame that we have in our colleges only one professor for all agriculture. In a law college there may be a dozen professors of law, and in medical schools the same. When the colleges have professorships of horses, of cattle, of sheep, of pigs, they will attract the farmer. John's father will say, "John, we have a hundred sheep, and I think you had better go down to that professor and study about sheep. His whole time is given to sheep."

We have registered at our college over one hundred students for this term, and over sixty names entered for the dairy course. Why? Because it is practical. When boys can learn about sheep, pigs, and cows they will go to college, not before. Let us separate the professorship of agriculture into about a dozen parts.

Mr. ALVORD. On behalf of the executive committee, I wish to announce that the programme provides that the sections shall meet this afternoon and organize for work.

At 6:15 p. m. the meeting adjourned.

EVENING SESSION, TUESDAY, NOVEMBER 15, 1892.

The meeting was called to order by Mr. Alvord at 8:20 p. m.

Mr. Broun then delivered his address as president, as follows:

GENTLEMEN OF THE ASSOCIATION: In the annual address to be made on this occasion, in accordance with the custom and law of this Association of Agricultural Colleges and Experiment Stations, I propose to occupy a portion of your time in discussing the educational features of the institutions here represented and their adaptation to the wants of the people.

Education that looks to culture alone, while attractive and elevating in its nature and refining in its influence, does not of itself qualify the recipient for the active duties of life. It simply builds the piers of the bridge to be crossed. There must be superadded to this culture, when obtained by the fortunate possessor, that technical education which will span the chasm that separates college life from actual life.

Milton's definition of education, "that which fits a man to perform skillfully, magnanimously, and justly all the offices, both public and private, of peace and war," is of too general a character to be of value. For, whatever might have been thought possible in Milton's day, it is beyond doubt impossible now for any one person to be so equally well educated in all departments as to be able to perform skillfully all the offices of peace and war.

In former years the older college systems were especially adapted, with their excess of classical culture, to the professions of law, medicine, theology, and pedagogy.

But long since thoughtful men recognized the defect of a system of education that prepared the youth of the country only for the so-called learned professions.

The fact that of the many millions of our people who were engaged in gainful occupations, about one-half were employed in agriculture, and less than 3 per cent belonged to the class of lawyers, physicians, clergymen, and teachers, showed the necessity of broadening our educational system to include this larger class, for which but little special provision had been made. And, besides this, the changes wrought in the varied occupations of life, by the advances made in science and its many applications to the industrial arts, demanded that provision should be made for a wide diffusion among the people of a knowledge of these sciences and their applications.

It was in recognition of these facts that the Congress of the United States made the liberal donation of public lands to establish the American agricultural colleges.

It is gratifying to consider that wise provision of national legislation through the instrumentality of which there now exists in every State and Territory a college, endowed by the General Government, for the education and elevation of the people by instruction in the principles and applications of science. Our admiration for the far-seeing wisdom of its authors, who in that legislation "builded wiser than they knew," increases the more the subject is considered.

By the well-known act of Congress of July 2, 1862, by which the land-grant colleges were founded, Senator Morrill, of Vermont, built for himself a monument more lasting than brass; for thereby his name will be held throughout our entire country in affection and esteem by the youth of the centuries to come, who shall fill the halls of these colleges in seeking that education which shall fit them to become citizens worthy of the Republic.

It would, therefore, I beg just here to say, be eminently proper that there should be placed in the library of each of the land-grant colleges a bust of our distinguished legislative patron as an evidence of our high appreciation of the great work he has accomplished in the cause of education.

The historic period in which the act of Congress became a law suggests a somewhat parallel instance in the establishment of a celebrated European university.

The historian tells us that hardly had the sound of the Spanish artillery ceased to be heard across the plains of Holland when Leyden decked herself with flowers in honor of the founding of the great university which has for centuries cast the light of science and learning to the remote parts of the earth. While Leyden was founded as a memorial of peace, our colleges were founded in the hope of peace and the preservation of the Union.

Just thirty years ago, when all the energies of our country were being consumed in that terrible internecine struggle; when war, with its consuming blight, was alone the subject of thought and object of action; then, with a wise foresight rarely equaled, with a sublime faith in the future of our country, did Congress set apart and devote a vast portion of the public domain to the several States, in trust for the collegiate education of the generations to come. This act alone will signalize in history the Congress of 1862. A century must elapse before its beneficial effects on the education of the people will be duly appreciated.

As it was only possible once in the history of the world for America to have been discovered, so it was only possible once for the consecration of this large area of the public domain to the cause of education. And as the historian of the future traces the development of civilization in our Republic and investigates the causes which have contributed thereto, the legislation which established these national colleges of science and the arts will be classed as a prominent factor. This affirmation is based not so much on what has been done in the field of education by these institutions as on the promise of the future; on the broad view and purpose expressed in the charter, as given in the act of foundation; and on the fitness of the character of education, designated as the leading object of the colleges, to the wants of the people and to the demands of the age of science in which we live.

At first many of the States, generally from economic considerations, associated these colleges with their State universities; others founded independent institutions. But in recent years the tendency has been in some States to dissociate and establish separate colleges, from a belief that thereby the object of the educational grant could be better accomplished. But whether they existed as coördinate parts of State universities or as independent institutions, one familiar with their history can not fail to have observed that in the early days there existed a widespread prejudice against the character of education proposed to be given. They were in many places regarded as inferior colleges for an inferior class. And possibly in some instances the mistake made in the organization and schedule of study may have furnished apparent cause for the existence of such prejudice.

The function of the college was without doubt often misunderstood, and misapprehension in the popular mind was due largely to the name the colleges bear. By many they were thought to be colleges established for the sole purpose of making farmers of their graduates, that they were professional schools established for the purpose of educating boys to be farmers, similar in that respect to the professional school for educating young men to be lawyers and physicians, and often the college experienced severe criticism if its graduates should prefer to adopt some other vocation. In the opinion of these critics a land-grant college failed of its object just in proportion as its graduates failed to adopt farming as a profession, and its success was considered proportionate to the number of farmers among the alumni.

This contracted view of the object of these colleges has now largely yielded to a more generous appreciation of the object of the grant; to a better understanding of the broad and comprehensive plan of the charter, as contained in the act of Congress; as well as to a more correct appreciation of the relation of technical to liberal education, and to the acknowledgment of the high privilege and right of an American boy to select his own vocation.

The leading object of our colleges is, as expressed in the original act, "to teach such branches of learning as are related to agriculture and the mechanic arts;" and while it also includes military science, it does not exclude classical studies. This is broad, comprehensive, wise, not narrow or contracted. The leading object is to teach the principles and the applications of science, to teach subjects that relate to the useful arts, and while culture, by the study of the classics, is not excluded, it is not the leading object. It were needless before this association to name the different branches that relate to agriculture or the many departments of exact science that relate to the mechanic arts. All these constitute the direct object of the instruction to be given.

In the first years of the history of these institutions attention was paid generally to agriculture and its branches, to the exclusion of the mechanic arts. This resulted not only from economical considerations and from the larger interests involved in agriculture, but also from the inability at that time to teach the elementary forms of mechanic arts as successfully as is now done in the modern method of manual training.

From an experience of eight years in an institution where a well-equipped laboratory of mechanic arts constitutes a part of its educational equipment, I can not express with too strong emphasis my appreciation of the beneficial effects of the modern method of teaching what is known as manual training. All present are familiar with its methods and the educational controversy in regard to its merits as a means of education. Some enthusiastic advocates have probably pressed its claim with too much ardor and demanded that it should occupy too exalted a position among the methods and subjects that are generally recognized as means of education. Be that as it may, its true value is now recognized by educators. It has come to stay, and deserves recognition in the lower classes of a collegiate course, but only as a means of discipline.

Its object is not to make mechanics nor the making of things, but the making of men. Its methods develop order, accuracy, perseverance, and self-reliance, and while imparting manual skill and giving strength to the body its exercises tend, in a very marked degree, to develop the constructive and executive faculties.

Drawing, which gives the ability to express the concept graphically, is also an essential element of a scientific education, universally recognized to be of value. Hence a school of drawing as an adjunct to the school of mechanic arts is a necessary department of a land-grant college; and the manual training received from the series of graduated exercises given in this school, when combined with the study of science as practically taught in the different laboratories, gives an education eminently fitted for the American boy of the nineteenth century. Moreover, the wisdom of the charter of these colleges, in requiring that provision should be made for education in those branches that relate to mechanic arts, is made manifest when we consider their relation to the necessities of civilization.

The studies that relate thereto are studies that relate to active life. The arts by which raw material is converted into food, clothing, and shelter for civilized man, by which towns and cities are built, by which rivers are spanned and roads constructed, and by which manufacturing is rendered possible, these, and all that mark the progress of the present century, are directly or remotely dependent on the applications of mechanic arts.

The relation that technical education has to modern civilization and the benefits to be derived therefrom are apparent to all observant minds. Daily observations show the advantage of skilled and intelligent labor over that which is ignorant and unskilled, and make evident the important part that educated industry has in modern civilization. These facts clearly demonstrate that for a state to equip her youth by proper education for this industrial age, to plan wisely for the future, she must encourage and liberally support technical education.

In view, therefore, of the prominent position mechanic arts now occupy in many of the land-grant colleges and of necessity must occupy, it would seem eminently proper that this Association should also provide a department or section devoted to the consideration of subjects related thereto, where our colleagues in these departments may discuss methods and improvements for the benefit of all concerned.

The relation that technical education bears to liberal education is more generally appreciated now than formerly. In the early history of some of the colleges we represent it is probable that too much attention was paid to mere muscular education, not recognizing the fact that if energy is consumed too largely by muscular exertion there will be but little store for mental effort. There is no true education in drudgery, in mere muscular labor, when the brain is not exercised. Colleges were not founded to teach manual skill, but to teach brain skill, to develop mind and character. And merely learning how to do without learning the why is empirical, a rule of thumb method, which no educator can approve. In education, principle is far beyond practice, and a knowledge of principle is essential to good practice. Hence technical education to be of value must be founded on a knowledge of principles, on a liberal education; and the broader and more extended the base of liberal education which constitutes the foundation, the more symmetrical will be the column of technical education which forms the superstructure.

By the term liberal education as here used we do not necessarily include or exclude the classics. A fair knowledge of Latin is, for obvious reasons, of great advantage to a boy, and its prosecution is always advised if time and circumstances permit. But a comprehensive knowledge of the principles of science is essential to a liberal education and especially to that liberal education which is to constitute the foundation for successful technical instruction.

Education in the principles of science must be insisted on if we hope to attain success in instruction in technics. While this is true in every department, it is pre-eminently true if agriculture be the vocation for which the student is to be qualified. But the test of exact knowledge of the principles of science is the ability to put them in practice; hence the necessity of laboratories and workshops in every department of science in connection with our colleges. We have, or, if not, we must have, in each land-grant college laboratories of chemistry, physics, mechanic arts, botany, biology, and of other sciences, where students may learn things, not words; where they may learn to execute; may educate their brains through their hands: may learn science through their finger tips. But scientific laboratory work has its most comprehensive field in agriculture, in horticulture, and in the dairy, for here successful experimentation exacts tribute from almost every other department of science.

Successful instruction in agriculture demands both theory and practice, a knowledge of the principles of the sciences with which agriculture is directly concerned, and a knowledge of the methods of applying those principles to successful practice. Laboratory practice in the field, garden, and dairy is essential, but it should always be educative in character, should exercise the brain as well as the hand. While *why* we plow is best learned at college, *how* to plow is best learned on a farm.

But the function of the land-grant colleges is not solely to make farmers of their students, and where such an opinion prevails the public mind can not, for the interest of education, be too soon disabused of the impression. To attempt such a rôle must of necessity result in failure. Nine-tenths of the boys who attend colleges in the South, if not in other sections, find when they graduate that their capital on which to begin life is their education alone. On their brains and hands they must depend for success. They can not engage in farming without a farm, and this, as a rule, they do not possess; hence they must begin as wage-earners, as teachers, engineers, chemists, or in whatever capacity their education and environment render possible.

But, should favorable circumstances render it possible for the young graduate to begin life as a farmer, it does not necessarily follow that he will make a successful farmer. When the conditions of land and market are favorable success in farming comes of practical experience, close observation, and executive ability, with untiring energy and good common sense, qualities that no college that exists or may exist can impart. But yet a good science education, such as is given in our land-grant colleges, is the best possible preparatory training for success in this honorable vocation.

We maintain, therefore, that the function of the land-grant colleges is not to make farmers of its students (and in saying this we are simply repeating the well-known opinion of the legislative founder of these institutions), but to make men; men with educated brains and skilled hands, ready and willing to work with both brains and hands in whatever vocation they are best fitted to perform the duties of life.

There is another view, worthy of consideration, which necessitates a broad and liberal curriculum, as required in the act of Congress.

The freedom and possibilities of American life differ from the fixed relations of an older European civilization, where the son is expected to adopt the vocation of the father. American freedom protests against a system that would educate a class of boys for one vocation only. The right of an American boy to carve out his own fortune and to adopt any vocation that his inclination and talent may lead to and his judgment approve, should not be abridged by an educational system designed to prejudge his future and train him for one vocation only. He does not measure his possibilities by his father's attainments. He may be farmer or physician, teacher or lawyer, merchant or mechanic, preacher or president. Hence our agricultural colleges should not be modeled after the plan of the European. They of necessity must be broader and more liberal in their educational schemes in order to adapt themselves to American civilization.

While these views are not new to the members of this Association, still they needs must be in many sections emphasized with insistence, in order to give a just impression of the educational work we are endeavoring to do and are required to do under the law establishing these institutions.

They constitute on the one hand the argument for breadth, for liberal education against narrowness, which is sometimes charged by adherents of the old classical culture, who contend that there is no place for an agricultural college in the American system of education; and on the other hand they furnish the argument for liberal education against the empirical technical instruction that even yet in many sections agricultural friends contend should be the limitations of the educational sphere of the land-grant colleges.

The growth of these institutions, their influence in causing older colleges to modify their courses of instruction, the high esteem in which they are held by men of learning as educational centers of power, the life and energy they manifest in every State, furnish an answer to each class of critics and give assurance of an influence for good that will widen with the years.

Our Association represents not agricultural colleges, but American agricultural colleges; broad institutions, adapted to American civilization, and not imitations of those which exist elsewhere and are adapted to an older civilization where class education is recognized. They are the product of our civilization and of the century in which we live and represent not the old, but the new education, and this so-called new education makes no protest against the old classical system, which has for centuries held the gateways of the temple of learning and trained, disciplined, and refined human thought and expression. It is not revolutionary, but supplementary, and seeks to build up and develop American civilization by making the leading object not linguistic culture, but scientific training.

Our colleges represent the legitimate outgrowth of the progress of science and the demands of the century. They must grow in harmonious development with the age in which they exist and must not cease to grow, for with a college the cessation of growth is the beginning of decay. Their faces are turned toward the future and not toward the past; hence their chief concern must be about the studies of the present and future.

In the former centuries it was not useful knowledge, but polite learning, not the laws of nature, but the laws of language, that were deemed worthy of study.

No one knew a century ago that steam would revolutionize the world and change the methods of human industry. No one knew that it would enable England with its limited area and population to do the work that represents the equivalent of the manual labor of all the able-bodied men of the world, but the fact is it has changed the face of the civilized world, entered every department of human industry, and largely modified our educational systems. It is then no longer a question whether science shall be taught or not. The spirit of the age demands it, and the question now is, in the limited time that can be devoted to education, how much of the old can be retained?

We have reason to be thankful that the colleges represented by this Association have their faces turned toward the future, and that there is established in every State of the Union a college that exalts *useful* knowledge and educates its youth for the future and not for the past.

But some contend, though at present the tendency is to a more liberal view, that education in science is inferior in character and in discipline to the old form of education of the classical colleges. Were this the proper place for controversy we might assume the aggressive and challenge comparison of the results of the centuries of educational work under the classical curriculum with the achievements of the scientific schools of recent times. If fruits are the test of merit, the decision would not be doubtful.

In defense of the discipline that is the result of the study of science, we may briefly say that its study gives thought and tone to the mind, cultivates accuracy of perception, discrimination of judgment, closeness of observation, correctness of reasoning, and imparts a love of truth rather than of victory. And further, by its study of the concrete rather than of the abstract, by its constant looking for the relation of cause and effect, the mind is familiarized with the true spirit of inductive philosophy, the philsophy of daily life, and thus in its educational effect is demonstrated the truth of the definition that science at last is only "refined common sense."

Our contention is that the education given by the scientific and technical schools holds no inferior, but for many vocations, a superior rank. For it gives an educated man power in practical life, gives self-reliance and trains executive ability, gives true manhood, and looks to life in its wider aspect and not to self for culture's sake. Culture is a luxury for education, but science is a necessity, a necessity for all the people.

There is one feature of our colleges that in this brief review should not be omitted. The charter makes instruction in military tactics imperative, and to emphasize the obligation the general government has made provision to furnish to each institution a qualified officer to give the requisite instruction, and thereby we have the excellent instruction of the U. S. Military Academy extended to the thousands of young men of the several States who attend the colleges here represented.

The military instruction and training received makes of the young men citizens of more value to the State and the Nation. They constitute material for the trained military reserve, ready to support the arm of civil authority should occasion require, and hence are an element of power in our midst, which, increasing with the years, tends to conserve our civilization.

That military instruction is required is a mark of the wise legislation that formulated the charter, and fidelity to the trust requires that all its provisions should be faithfully executed. The report of the Commissioner of Education for 1889 shows that 54 per cent of the 10,000 students in the land-grant colleges received instruction in military tactics, a gratifying result, furnishing evidence that the trust is executed in accordance with its requirements.

But this Association represents not only agricultural colleges, but also the agricultural experiment stations connected therewith.

Experience confirmed what reflection anticipated, that agriculture neither as an art nor as a science could be largely promoted by teaching college students the elements of the sciences related thereto.

The agricultural colleges at first largely failed to win the confidence of the farmers, those whose interests they were especially designed to promote. They were criticised for not accomplishing an impossibility.

The unsolved problems of agriculture demand for their solution the profound study of the best scientific experts, and are to be solved only by accurate scientific investigation and experimentation continued through successive years.

The necessity for means and men to conduct this scientific research and investigation of the varied subjects related to agriculture was first recognized by college workers; and public opinion, largely created by their influence, was formulated by Congress in the act of 1887, establishing the agricultural experiment stations. By this act there was made by the general government a munificent endowment for research, and thereby has been established in every State a corps of scientific experts, whose duty is not to teach but to investigate, to investigate scientifically subjects that relate to agriculture.

No government ever before paid a higher tribute to the value of science or made a more valuable contribution to the interest of agriculture, on which all other departments of industry depend. Provision was made both for discovery and dissemination. This important supplement to the agricultural colleges has given to the farmers of every State a corps of scientific officers to work exclusively for their interest, and has wisely provided that the results of the investigations shall be brought home to them in the form of printed bulletins. The investigations have already borne fruit in the discovery of important truths and in the dissemination of knowledge of value to the farmers, and in the coming years benefits of inestimable value must accrue to agriculture.

The officers of the station have a great work before them—one worthy of the best labors of the best men. They have to call forth their best energies, not only the stimulus of devotion to science in the search for discovery, but also the satisfaction of knowing that what may be discovered of value to agriculture will cause its authors to be esteemed in the years to come as benefactors of the human race.

But the growth of these colleges during the quarter of a century of their existence and the progress of science demanded that they should be provided with enlarged and improved scientific equipment, with a larger staff of officers, with better libraries, and improved facilities of instruction. And the Congress of 1890, with marked unanimity, happily under the leadership of the distinguished author of the original bill founding these institutions, passed the act granting an additional endowment, increasing for specific purposes the income of each college.

By this last and third Congressional act, the colleges have a pledge of confidence on the part of the general government of which every incentive that ennobles human nature demands that they should prove themselves worthy.

There should be no steps backward. We must, as earnest Christian teachers, as true students of science, work continuously and earnestly, and execute faithfully the great trust committed for the present to our keeping. It is a great trust for the benefit of the people, all the people and not for any special class.

The admirable form of government under which we live is illustrated in the relation of these national schools of science to the States and the General Government. The colleges, though endowed by the general government, are subject only to State control under conditions imposed on the trust. These conditions inhibit the use for building purposes of the income from two of the grants and permit a small expenditure from the third.

Hence, in accepting the trust each State imposed on itself the obligation to provide for its college all buildings that are necessary to a full realization of the objects of the national grant. The reports show that this obligation has been complied with in a liberal manner, by large donations from the State legislatures and from other sources, the value of the gifts to these institutions in land, buildings, and equipment, being in excess of $5,000,000. By this provision the interest of the State in the college is increased and the endowment is preserved undiminished. It is held by the States in trust, in perpetuity, and cannot be squandered or lost by mismanagement. Hence our colleges are permanent institutions resting on a foundation as secure as the Government itself.

From the last published report of the Commissioner of Education, for the year 1889, we find that the thirty-two land-grant colleges named therein had 700 officers of instruction, with nearly 10,000 students; that they enjoyed an annual income of $1,500,000, with an endowment of $10,000,000; that the value of their grounds and buildings was estimated at $6,000,000, with a scientific equipment valued at nearly $1,000,000.

And further, as significant of the growth of fourteen colleges there reported, in the five years from 1884 to 1889 the number of instructors had increased 30 per cent and the number of students 50 per cent.

It is true that several of the institutions given in this report are State universities, but were we able to present the reports of the fifty-three land-grant colleges established in 1892, limiting the statistics strictly to these colleges and the corresponding departments in the universities, the figures given would not be diminished, but largely increased. Besides the colleges, this Association also represents fifty-one experiment stations, with a staff of over 500 officers and assistants scattered throughout the States and Territories, working for the promotion of the great interests of agriculture.

The number of students and officers of instruction and investigation, the value of the buildings and equipment, and the amount of the endowment and annual income demonstrate the importance of the trust committed to the officers and trustees of these institutions. They have long since passed the experimental stage and are now recognized as important factors in advancing education and promoting civilization in America.

Our duty is to make the work of these colleges and stations known to the world. And the opportunity presented in the World's Columbian Exposition at Chicago should be improved by presenting, in the most efficient manner, the methods used and the work done. Faithfulness to our trust, as well as the interest of the institutions we represent, demand this. But to make the exhibit worthy of the institutions will require a large additional expenditure of energy and money. That our governing boards are authorized to direct this expenditure, appears evident from the educational nature of a representative exhibit and the wide diffusion of useful knowledge that would result therefrom.

Especially does it follow that an appropriation of funds for this purpose is legitimate, since the diffusion of useful knowledge is named in the act of Congress as one of the objects of the grant. With means available and proper energy there can be made, and should be made such an exhibit at Chicago as will challenge the admiration of visitors, American and foreign; such as will show the beginnings of the great work to be accomplished by the national schools of science and the agricultural experiment stations for the education and upbuilding of our whole country.

In presenting to you these views I beg you to consider the relation you hold to the present and future well-being of our country. You are scientific investigators, working for the improvement and promotion of that industrial art which directly concerns the well-being of the largest portion of the human family. You are observing, noting, comparing the methods of nature's action, in order to discover what promotes or retards plant or animal life. And, whether working with retort, microscope, or pruning or dissecting knife, you are working to ameliorate the conditions of human life, and by showing how better to subdue the earth, to bring increased prosperity and happiness to the homes of the people, you are working not for self, but for the good of humanity.

We are teachers, having under our charge thousands of the youth of to-day, those upon whom the future destiny of our country will largely depend. Let us duly appreciate the magnitude and importance of the great trust committed to our care, its weighty responsibilities as well as its immense possibilities; let us faithfully and zealously execute its provisions, educating the youth entrusted to us so well and so thoroughly in the principles and applications of science that they will show in their lives that love of work, that love of truth that comes from an imbibition, by science study, of scientific method and scientific spirit; let us, looking to the future with an earnest love for our whole country, faithfully work to make the national schools of science here represented the best schools, best in their adaptation to the demands of American civilization, best in their harmony with the spirit of the age, and best in the wide diffusion of a patriotic and Christian spirit among the youth of our country.

Mr. Alvord distributed copies of the revised constitution as reported by the executive committee and announced that it would be considered at the morning session of the following day.

Mr. Curtis, for the program committee of the section on agriculture, announced the following program for the section on agriculture:

Wednesday (1) Details of successful farmer education; (2) What should the professor of agriculture teach?—G. E. Morrow and P. M. Harwood; (3) Soil investigation, E. W. Hilgard (prepared for the chemical section); (4) Relation of the experiment station to the agricultural college, for open discussion. Thursday (1) The field of bulletins, present and prospective, C. L. Ingersoll; (2) The establishment of official methods of experimentation, W. A. Henry and F. A. Gulley; (3) Mistakes to avoid in dairy experiments, H. H. Wing; (4) Forage-plant tests, their scope and plan, C. C. Georgeson.

Mr. Turner announced that the section on college work had requested Mr. Fairchild, of Kansas, to present to the general session a paper on the relation existing between technical and general courses of study, and moved that this paper be presented at once.

The motion was carried and Mr. Fairchild read as follows:

The Relation of Technical to General Courses of Study.

The methods of training for active life have varied from time to time with the ideas of the leaders among educators. The swinging pendulum of thought is found everywhere, and perhaps is nowhere more evident than in the effort to train to most usefulness in the least possible time.

The trend of earnest effort at all times toward special training is natural, for several reasons. It saves time in gaining a living. The specialist can pay his way from the start. Further, it makes haste towards usefulness. One who, saying, "This one thing I do," can do the least of useful things, seems doing well and fills a niche in somebody's plans.

The great advance in division of labor everywhere reveals the fact that such division is profitable, both to the actor and to the world for which he acts. The whole trend of civilization indicates that a little done repeatedly brings perfection in that little. And the whole mechanism of production and exchange tends toward economy in the little perfections. To seek some niche to fill, and fill it well, as speedily as possible, is the end which every youth has set before him in the practical lessons of life.

Moreover, the bulk of human knowledge in our day overwhelms the thoughtful youth and compels him at once to acknowledge the hopelessness of universal information. To expect, like Milton or Bacon, to compass all of science in one's education would be simply preposterous. A mere glance at elementary facts reveals the uselessness of such attempts. Even when one is exhorted to broaden his view of the world by extending his search into the grand humanities, the question instantly arises, which humanities? for every field of study calls for whole libraries and for almost numberless laboratories, with the ever present suggestion of more to follow. Thus the necessity for choice of culture is as evident now to the mere tyro in knowledge as it once was to the philosopher. Indeed the very general discipline of our youthful days through Roman classics and Greek poetry has now become a special training; and that which opened to the view of us elder thinkers a world and a history must now present to our children only the details of a few lives or must occupy a lifetime in searching for the ever-wavering influence of such thoughts in the world.

We must expect, then, the absolute necessity of special thought and special training for all who would maintain their part in this world of active thought. And yet the dangers from attention to a single field of thought are the same now as ever. These dangers are both individual and social. To an individual mind occupied with a study of facts, however numerous those facts, the view of nature becomes narrow; occupied with few relations, the indefinite detail in those relations seems a universe—yes, even the universe—and other minds are read by the same little signs. The growth of reasoning power is thus limited almost to mere empiricism. The association of fact with fact in a single rut of thinking makes this one rut in the law of nature paramount among relations. Almost no estimate of truth is genuine, for such a mind, held within its narrow confines, so magnifies the nearer objects as to obscure their relation to the rest of nature. Such a view of our universe and its ever-increasing activity becomes shortsighted. Repetition after repetition of the same set of facts seems to make up both time and eternity, and instead of growth and expansion to meet the opening vistas of infinity the confine of the well-worn path occupies all energies. With such habitual views an overweening conceit is most natural and most frequently realized. Nothing so fully sets a man above his fellows, in his own opinion, as excessive familiarity with a few particulars indefinitely applied. The fact that such an individual often finds himself out of sympathy with his neighbors, misunderstanding them and misunderstood by them, too often only exalts his opinion of himself and makes even more exaggerated the tendency to narrowness, unreasonableness, unfairness, discouragement, and self-conceit. Such a result leads, naturally, to conflict in the social life of individuals. All mutual understanding between two persons implies, of course, a common place of thought. Two extreme specialists in different lines have no such common place, lack appreciation of one another's personality, and must fall back upon the simplest talk of weather and crops. A lack of common wants brings partisanship, and argument, for lack of common place and clearness of reasoning, becomes bickering and vituperation. Misrepresentation is inevitable, both as to abilities and needs; and too often the social world is all awry to the several eyes mistrained in observation of a single class of facts.

The world is full of examples. City and country vie with each other in furnishing expert instances, and the ignorance that is hardest to combat is the self-conscious knowledge of a narrow-minded routine worker with a single range of thought. These real dangers it is the part of true education to meet and destroy. No student of educational methods can be willing to be restricted to the laws of the one object of study he selects. His problem is to find a remedy for every evil tendency and yet lose none of the trend of nature in the growth of humanity toward its perfection of accomplishment.

The remedy of our earlier days for the narrowing tendency of technical training was to divide all growth between two periods: one of discipline, in which the range of knowledge is the mere gymnastic field for youthful energy of mind, and the other of training in the chosen profession through application of the wider range of particulars implied in discipline. This assigned all technical courses to a university where, by assumption, only disciplined minds were gathered. The long preliminary course of purely general knowledge was followed by a brief training in technical application. And yet the whole was far too slow in perfecting the work of the best minds and wholly inadequate in adaptation to growth from mediocrity into superiority. Too often the ardent earnestness of youth for accomplishment was wholly quenched, and multitudes became mere timeservers in vain speculation about the universe, while knowing nothing of the details of life and learning. The exhortation, not uncommon, to await developed powers before selecting applications for such powers, was quite like the ludicrous maxim, "Never go near the water 'till you have learned to swim." The actual swimmers in our earlier days in the seas of actual life were chiefly those whose necessities compelled daily application of ingenuity in details as a means of accomplishing discipline of mind in the general course of study.

The later remedy, and the better, for extremes in specialization, employs a unity of ideas, both special and general, concrete for the abstract and abstract in the concrete, embracing, if possible, all activities at once. This must recognize all knowledge sought in relation both to self and to humanity. "Truth for its own sake" means, in this connection, truth for its importance in the range of possibilities. Each step in advance is made upon the foundation laid in past activity. And yet the broader views of older students or of teachers are the constant stimulus to greater activity. All knowledge has its meaning with reference to some line of active expression, and that expression is its meaning in relation to all humanity. This implies that each student shall find by natural contact with the things about him the line of ingenuity which shall make him most useful to his fellow men. Instead of regarding his trade or his profession as simply a means of living, he naturally finds it a means of giving a larger life to his fellow men. Philanthropy is from the start a stimulus to exertion, because the active energy is made to illustrate the united interests of society, a nation or a world. With proper teaching the ingenious youth is led to find a blending of all sorts of relations through a great variety of studies adjusted here, there, and everywhere to his particular energy, and may grow continuously in breadth and in power. His world is an unlimited world, though self-centered, and he quickly outgrows the conceit of superior ability, by finding almost everywhere his need of equally important abilities in his neighbors.

I believe that the practical methods of training of our day may accomplish a truer growth than the extended courses of the past; but they must seek to do more than to simply perfect in dexterity and to foster the special ingenuity of students. It is possible in a course of four or five years in the common schools to embrace the the essentials of a good education. It will lead to the arts of life and bring actual results, but will at the same time give those liberal views of human nature in the midst of outer nature which insure freedom of thought, clearheadedness, and practical wisdom. I would have such a course embrace the commonplaces of knowledge with actual service at each step in the common life of humanity.

To furnish the commonplaces, I would be sure, first, of accurate speech; and that because humanity needs it and each needs it to understand humanity. Second, such a system of reckoning as will cover all possible problems, but illustrated continually by the everyday problems of training. Third, systems of reasoning, inductive and deductive, not simply illustrative, but used in every phase of duty and accomplishment. Fourth, as complete an analysis of the universe as elementary statements and questionings can bring. Mathematically, the student should, as a friend of mine expresses it, see into space. Mechanically, he should test matter by all the senses and with many contrivances for producing and estimating mass and motion. Physically, he should experience force and comprehend conservation of energy at every turn. Chemically, he should experience order in the lines of his daily thought; the precision of manipulation should give him accurate conception of the universal law of atomic order. Organically, the world should touch him by enough of the animal and vegetable kingdoms in everyday surroundings to reveal the laws of growth, structure, and function in infinite variety. Intellectually, he should find himself the representative of all past experience, still reaching after a richer experience and to a fuller comprehension of the universe. Morally, he should find duty chief, and rights a consequence of rational effort to be of all possible use to fellow beings. This analysis does not require the history of thoughts about such problems, the pros and cons of controversy, or the quibbles of detail and description, but it requires ingenious application of the actual facts of daily life.

I would add as full an acquaintance with the world's experience—industrial, literary, and political—as will add to rather than detract from the interest in every day's experience. The very elements of knowledge embraced in the general range of the sciences can furnish suggestive materials, and well-stored libraries will arouse curiosity and incite to constant research.

All these commonplaces of knowledge may find their application in the so-called common life of humanity. The food supply, the shelter, and the mechanism of art touch every man's being and afford no end of illustration of the growth of knowledge and the power in wisdom. See to it that students have to do, by actual exertion, such parts of the world's tasks as concern most of the race. In this daily adjustment of tasks they may find that knowledge is not a garment worn for show, but their weapon of warfare against want, against weakness, or against brutishness, or their means for climbing to the summit of enjoyment.

Technical ingenuity, thus developed gradually among general ideas of usefulness in purpose, is not narrowing, but broadening, liberalizing, while it opens the way to perfection in the arts of life. It gives a real choice among pursuits that add to the welfare of the race, with less chance of bias from mere whim or curiosity. It builds character and power together.

Now a word as to details, and for these I can do no better than to outline in brief the plan pursued for the past dozen years at the Kansas State Agricultural College. An itemized statement of principles may suffice.

(1) Admit directly from the common country schools and if possible without a preparatory class. A college for the people must go to the people in its plans.

(2) Give as early as possible, with English and mathematics, an introduction to nature through drawing and botany, with mechanical training in simple construction applicable to every kind of life.

(3) With chemistry and mineralogy apply science in agriculture, horticulture, economic entomology, and household economy, with practice in all.

(4) With mathematical mechanics, agricultural chemistry, and physics, give a training in surveying—the basis for our title to our homes—and common engineering, suitable to all sorts of construction, exercising ingenuity in the same problems upon the farm and gardens, and in the shops for wood and iron work.

(5) Enlarge the scope by more general problems in thinking and reasoning, illustrated still by everyday facts in plant life, animal life, geology, and history and social economy, with technical trial in the arts of construction and production.

(6) Keep students thinking all along the line of the industries which employ the race and give our civilization.

(7) Make the faculty a unit in their sympathy with the purpose and methods of the college in training for the various pursuits of life.

(8) Interest the body of students in the object sought, and arouse a pride in their own institution as a foster mother in the useful arts, showing results worthy the praise of the people.

(9) Bring the college work to the people by institutes, by lectures, and by every means of direct contact between faculty and patrons, with especial care to bring to the front, in interest and useful effort, the graduates and former students whose good work and growth are proof of accomplishment of the grand purpose of the college.

(10) Cultivate the interest of absent alumni in the growth and advancement of their alma mater.

Mr. FERNALD. I am not quite willing to admit that the efforts along the line of agriculture have been unsuccessful. There are different methods of judging success. In the State which I represent there is great interest. There were 1,200 visitors—farmers, their wives, sons, and daughters—on our campus on the 15th of last June, and they went away friends of the institution.

Even though the majority of students do pursue the engineering courses, I do not believe that we are not accomplishing the purposes of the act of Congress. The State of Maine is fast becoming a manufacturing State, and we may be performing our duty, even though not so many as we would desire follow courses of agriculture and become farmers. The point I wish to make is that we can not, under the law, conduct only the branches relating to agriculture and shut out the mechanical branches.

The question remains how can we induce a reasonable number to study agriculture? I think there is great difficulty in doing this. I do not say it is essential that we do this, but in view of the demand that exists in all of our States that we turn out more farmers, I am anxious to know how it can be done. I want to know how, when the different courses are put side by side and young men are allowed to choose for themselves, we can induce them to take the agricultural course in preference to others. According to my observation, the tendency is the other way. Can a remedy be recommended by this Association.

Mr. TURNER. This question suggested itself to me when reading the reports of the different colleges. It is a very important question for the institution which I represent. We are just establishing a department of mechanic arts and for the first time have a separate course in agriculture, but the difficulty that Prof. Fernald refers to has already suggested itself to me: how can we make the agricultural course attractive to students? It seems to me that the intent of this law is to give students a liberal education, including the branches of learning that underlie the art of agriculture, and not simply the practice of it. In order to attract students to the agricultural course must we abandon the sciences which underlie agriculture and teach only empirical science? It seems to me that that is the question.

Mr. JOHNSON, of Connecticut. My theory has been, and my practice is, to have a fundamental course which underlies both agriculture and the mechanic arts. Our course does not separate the two. We have instruction in greenhouses, laboratories, shops, and barns for all young men who take agriculture, horticulture, shop training, and mechanic arts as a basis for growth. In the last year only do we allow any departure from this, but we provide in the post graduate courses for special training along the lines developed before. We have not as yet found the least thinning down, though our State is rapidly developing in manufactures.

Mr. CURTIS. The agricultural section has on its programme a paper from Prof. Harwood on this very subject, and I suggest that further discussion on this matter be postponed until after the reading of that paper.

On motion of Mr. Alvord the meeting adjourned at 10:15 p. m.

MORNING SESSION, WEDNESDAY, NOVEMBER 16, 1892.

The meeting was called to order at 9:20 a. m.

Mr. Alvord submitted the new draft of the constitution prepared by the executive committee.

The PRESIDENT. The report before you is a substitute for the present constitution and will be read by the secretary by articles.

The secretary then read the first article:

I.—NAME.

This Association shall be called the Association of American Agricultural Colleges and Experiment Stations.

The PRESIDENT. If no amendment is proposed we will pass on.

The secretary then read the second article:

II.—OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association, and to secure to that end mutual coöperation.

The PRESIDENT. The secretary will read the third article, if there is no objection.

The secretary read the third article:

III.—MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department, shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture, who shall attend any convention of this Association, may be admitted to similar privileges.

Mr. HADLEY. I rise to ask for an explanation. In section 2 I read, "The same delegate may represent both a college and a station, but shall cast only one vote in general sessions." Does that mean that an institution having a delegate from the college and one from the station will have two votes, and that an institution having but one representative for both college and station will have but one vote?

Mr. ALVORD. That is the intention. The longest discussion at any convention of this Association, in my recollection, was upon that point, and the rule as it stands was settled finally by a large vote. The committee did not feel disposed to interfere with that decision of the Association made three years ago.

Mr. HADLEY. An institution situated near the place of the convention is likely to have two representatives, and therefore two votes; but an institution very far away from the place of meeting may be able to send but one delegate to represent both the college and station, and will therefore have but one vote. Is this fair?

Mr. ALVORD. I do not wish to reopen the discussion of three years ago, but in a very few words I can give some of the reasons which led to this rule. First, it was thought best to keep the proxy system in any form out of the constitution. Second, it was hoped that the rule might induce the various colleges and stations to send a full representation.

The PRESIDENT. There must be some motion made to make a change.

Mr. TURNER. I move to substitute for the clause "only one vote in general sessions" the clause "a vote for each institution."

Mr. HADLEY. I second that motion.

Mr. NICKERSON. I suppose the words should be permissive and not mandatory.

Mr. WOODS. There has never been a time in the history of the Association in which any matter, however important, has ever called out all the votes. If we extend the right of suffrage to two institutions represented by one member, shall we not be obliged to extend it to the institutions not represented at all?

Mr. FERNALD. Another point to be considered is that this Association meets in different parts of the country, so that the proximity of different institutions will about even up, year after year. I think the provision should remain as it is.

Mr. HADLEY. I suggest this form for the amendment: "And may cast one vote for each institution in general session by him represented."

Mr. HUNNICUTT. I suggest that it read in this way: "The same delegate may represent both college and station by vote in the general session."

Mr. SCOVELL. I think the provision is better as it is because it gives us a larger attendance at the meetings. I am inclined to believe that many boards of control would send but one delegate if he could represent both the college and station in voting.

Mr. FREAR. I think it desirable to enforce that point. I know personally of many institutions which would be represented if only the wishes and judgment of the officers in charge were acceded to. Sometimes those who hold the purse strings are not in accord with the officers of the stations, and unless pressure from the outside is brought to bear will rely upon their own judgment rather than upon that of the officers of the station. It seems to me that the clause should stand as it is.

Mr. ARMSBY. While I am in favor of the provision as it stands, it occurs to me that it might be subjected to a slight modification. The clause as it stands and the whole practice of the Association recognize the stations and colleges as in a sense distinct institutions, on account of the different character of the work undertaken by them. It seems to me right that if an institution, either a college or station, is not sufficienty interested in the work of the Association to bear the expenses of sending a delegate, it is not entitled to a vote in the convention. If this phrase is modified, I would suggest that it be made to read "that no delegate may represent more than one institution," meaning by institution either college or station.

Mr. HADLEY. I wish to say one word in the matter of illiberality. Some of you are probably not aware that every time a meeting of this Association is held it costs New Mexico from $200 to $300 to send a delegate. Last year we sent two delegates to the convention. So you see it is a matter of money, but hardly a matter of illiberality.

Mr. ATHERTON. I recognize the force which the point made by Mr. Hadley must have from his point of view, but in the majority of institutions which belong to the Association it does not apply. It seems to me that it would not be well, in the present condition of the Association, when it is wielding such a power among the institutions, and from the outlook promises to wield still more, to jeopardize its strength by changing the constitution so as to lessen the attendance at the meetings. I hope therefore the section will stand as reported by the committee.

The PRESIDENT. I will put the motion to vote. The motion is lost. Is there any other amendment to article 3? If not the secretary will read the next article.

The secretary then read the fourth article:

IV.—SECTIONS.

(1) The Association shall be organized into sections upon (1) college work, (2) agriculture and chemistry, (3) horticulture and botany, (4) entomology. The executive committee shall, upon the request of any ten institutions represented in the Association, provide for the organization of provisional sections at any convention.

(2) Each section shall conduct its own proceedings and shall keep record of the same, and present a synopsis thereof to the Association at the close of every convention; and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the Association in general session.

Mr. PATTERSON, of Kentucky. I think we ought to add to the sections one on the mechanic arts. These colleges by the terms of the law are mechanical as well as agricultural, but the mechanical side, so far as I am aware, has never found recognition in this Association. In many of the land-grant colleges a department of mechanic arts is well organized, well manned, and should be recognized by this Association. I hold that it was the purpose of the act of 1862 to educate skilled artisans as well as scientific agriculturists.

The trend of capital is toward the towns. Of the great number of millionaires found by the last census, I suppose that nine out of ten live in towns. The tendency is toward the vast accumulation of wealth in the cities, and the trend of population in the same direction is equally strong. In 1790 it was estimated that the ratio of rural to urban population was 30 to 1; and now it is 4 to 1. You will all agree with me that a large part of the population of the towns live from hand to mouth. The mechanics, artisans, and skilled laborers constitute the explosive element of the country. It is easy to see that in the not distant future this will be a danger to republican institutions. I hold that it is the business and the bounden duty of this Association to make abundant provision for the education of mechanics and skilled artisans. Teach them their responsibilities, duties, and rights. How can that be done more effectually than by providing in the land-grant colleges for the liberal education of the industrial classes? I move you that a section of mechanic arts be provided for.

Mr. ALVORD. Mr. President, I hope that this motion will not prevail, and for this reason: In spite of repeated invitations to take part in this Association, the professors of mechanic arts instead of joining with us have endeavored to start an organization in a measure rival to this one. The constitution provides for additional sections, and if professors of mechanic arts come here and ask that a section be organized, it will certainly not be refused them; on the contrary, as past action shows, they will be heartily welcomed and granted the same courtesies and opportunities given to other specialists.

Mr. SCOTT. I desire to support the proposed amendment on the very ground on which the chairman of the executive committee has made his argument. We have just been exerting pressure on these institutions to bring representatives here, and certainly we should do more than to invite them. While I would not abate one jot or tittle of our interest in agriculture, I think the name that we bear is a misnomer, and we should follow as closely as we can the organic act which is for the benefit of agriculture and the mechanic arts. It may be that the gentlemen representing the mechanic arts feel hurt because we have given to agriculture an improper prominence. It certainly can do no harm and it may do good to adopt the suggestion of my friend from Kentucky.

Mr. DABNEY. I also desire to support the motion of President Patterson. I know from a conversation with the gentlemen who want to establish a section on the mechanic arts that they proposed to establish a separate association because they felt that they were not wanted here. I was somewhat disappointed and even pained to hear some gentlemen last evening express the opinion that the agricultural colleges were even in a measure a failure. I had hoped that our institutions had taken the broader view of the act of 1862, the view so admirably expressed in the address of the president of this Association. I believe that as long as we take the narrow view that these institutions are nothing more than professional schools of agriculture we shall never satisfy the people. I am thoroughly convinced of this. The law did not intend to establish merely agricultural colleges. Our name is, therefore, a misnomer, and our constitution is one-sided. At the best, this constitution fails to represent properly two-thirds of our institutions. A large majority have mechanical departments, and a great many have extensive literary departments, including classics, modern languages, etc., which are in no way interested in the work of this Association. So we have been working with hardly one-half of the interests involved represented, and I sincerely believe that the time is coming when we shall make this Association influential throughout the country. How can we do that except by bringing in interests of every kind. Let us begin by bringing in men interested in engineering, later on those interested in other sciences, and, if possible, literary men, as work is provided in the classics and not merely economic science, There is no reason why in time we should not have sections of interest to men in all classes.

I would like to ask President Patterson to have this section include civil and mining engineering as well, because nearly all institutions have these departments.

Mr. HADLEY. I suggest that the motion should include a change in the name of the Association. Why not have it read American Colleges and Experiment Stations, or American Agricultural and Mechanical Colleges.

The PRESIDENT. Gentlemen should address themselves to the motion. The motion before the house is to insert in article 4 a fifth section devoted to mechanic arts.

Mr. HUNT. This is very interesting and I dislike to interfere in the general discussion, but a meeting of the section on agriculture is called for 10 o'clock, and at 10 o'clock I propose to move that we adjourn.

Mr. NEILSON. I think it is eminently proper that we should recognize the mechanic arts. The appropriations for the colleges are equally for agriculture and the mechanic arts, and it seems to me therefore but fair that we should recognize mechanic arts in this association.

Calls for the question.

Mr. DEPASS. What I wanted to say has already been said. Only this I will add, that the very caption is in my judgment wrong.

The PRESIDENT. I must confine you to the motion.

Mr. DEPASS. I wish only to call the attention of the Chair to the fact that I intend to make a motion on this question and will not detain the Association at this point.

The motion was carried.

Mr. WOODS. The hour for adjournment, in accordance with the rules, having arrived, I move you that we do now adjourn.

Mr. ALVORD. I simply wish to say that it will be impossible to bring this question before the convention again. I would cheerfully move to adjourn in ten minutes.

Mr. Woods withdrew his motion.

The PRESIDENT. If there is no objection we will pass on to the next, Article V.

The secretary read Article V.

V.—MEETINGS.

(1) This Association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the Association. Special meetings may be held at other times upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the program. The sections' meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them.

The PRESIDENT. If there is no objection we will pass on to Article VI.

The secretary read Article VI.

VI.—OFFICERS.

(1) The general officers of this Association shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer. The president, junior ex-president, the secretary, and four persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

(2) Each section shall, by ballot, nominate to the Association in general session, for its action, a chairman and a secretary for such section.

(3) Officers shall be chosen by ballot at the annual convention of the Association, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the Association or an officer of an institution which is a member of the Association in full standing at the time of the election shall be eligible to office.

Several asked what would be the duties of the bibliographer.

Mr. ALVORD. He is to keep watch on the literary world in which this association is interested, and furnish bulletins calling attention to books or articles of interest to those connected with this association. We have an offer to publish these bulletins in the magazine, Agricultural Science.

Mr. TURNER. I wish to know whether the bibliographer is to be a salaried officer.

Mr. ALVORD. The officers of the association have equal salaries.

No changes were proposed to Articles VII, VIII, or IX, which were read in order.

Mr. DABNEY. I move that we reconsider the action by which the title was adopted.

The motion was carried.

Mr. DABNEY. I move that the name of the Association be changed so as to read The Association of American Agricultural and Mechanical Colleges and Experiment Stations.

Mr. SMART. I move to amend the proposed title to read The Association of National Colleges and Experiment Stations.

Mr. DEPASS. I move that we lay that amendment on the table.

Mr. SMART. I would like to say that it strikes me that National is a wiser term than American.

Mr. DEPASS. I withdraw my motion.

Mr. HADLEY. Does not national include all kinds of colleges organized under acts of Congress? Are they not national institutions?

Mr. DABNEY. Would this not include West Point and other colleges of that sort? They are all supported by appropriation.

Mr. ALVORD. I suppose this motion will pass, but I want to call attention to the fact that to change the name of a child when it is just becoming known is of no advantage to it. A single word more. This name was adopted after a full discussion. When you say agricultural college everybody knows what you mean. In the public journals the institutions here represented are known collectively as "agricultural colleges."

Mr. HADLEY. If the name is to be changed at all I do not like the term mechanical. Wherever I hear that term it seems to lack euphony. If the name be changed, I suggest Association of American Colleges of Agriculture and the Mechanic Arts.

Mr. SCOTT. I think that the closer we keep to the organic act the better. The act said "for the benefit of agriculture and the mechanic arts;" the whole system has been built up on that. We do not like the word mechanical. I certainly do not like the motion proposed that the colleges be called national. Our institutions are established under State authority. They are American, not national.

Mr. NEILSON. I agree with Dr. Scott. I think this question involves more than a mere name. We have had difficulties in New Jersey and I think probably throughout the country from misapprehension as to the scope of our work. I think the proposed change of name will have a good effect. It is not changing the name of the child, for all know it now by the proposed name.

Mr. Smart withdrew his motion.

Mr. SCOVELL. Mr. Chairman, I hope that the name will not be changed. I have a great deal of correspondence with colleges and treasurers of colleges and I have been advised by several that there would be no difficulty in getting dues if our name were shortened. I do not wish to inflict on my successor any more name to sign to vouchers. Our Association is becoming known under this name, and I hope, for the sake of the Association and for the sake of members we have, that it will not be changed.

Mr. Dabney. The motion is that the title shall read American Colleges of Agriculture and Mechanic Arts and Experiment Stations. I think the old name has caused much trouble and has retarded the progress and development of the college.

Mr. Rynerson. I was in favor of the motion adopted providing for a section on mechanic arts, but I can not see any advantage to be derived from changing the name of the Association.

Mr. Cavitt. There seems to be something in the name of an institution. Why did Congress put "Agriculture and Mechanic Arts" in the bill? Was it not that both industries should be benefited? We represent mainly the agricultural department of these institutions, but I think we should be liberal enough to extend to the mechanic arts the honor of mention in the title. I am opposed to changing the name from American to National. I am a believer in reciprocity. Let us extend the hand of fellowship to South America, Central America, and Canada.

The motion was lost. Ayes 23, noes 37.

Mr. Myers. I move that we now adopt the constitution as a whole.

Mr. Alvord. I will ask unanimous consent for a verbal amendment. After the word agriculture in section 3, Article III, add the words, "Or mechanic arts," and the same in section 4.

The constitution was then adopted as a whole.

Mr. Alvord. Carriages will be waiting for us at the St. Charles Hotel at 1 o'clock this afternoon to visit the Sugar Experiment Station at Audubon Park and the Southern University on the return trip.

Mr. Buchanan, representative of the Jefferson Club, was introduced, and stated that he was instructed to extend to the members of the convention the privileges of the club during their stay in the city. The invitation was accepted.

The convention adjourned at 10.40 a. m.

Evening Session, November 16, 1892.

The meeting was called to order at 8 p. m.

The following resolutions were reported from the executive committee:

Resolved, That a committee of nine persons be appointed by the chair, to consist of members of governing boards of colleges and stations, to act as an advisory board in connection with the standing committees of this Association upon the coöperative exhibit of the colleges and stations at the World's Columbian Exposition.

Resolved, That the portions of the annual address to the Association by President Broun, which relate to the Exposition of 1893, be referred to this advisory board for its consideration and action.

The resolutions were adopted.

Mr. Neale, of Delaware, offered the following resolution.

Whereas this Association has received a request from the authorities of the World's Columbian Exposition to nominate four persons to be appointed members of the commitee to supervise the tests of dairy cows during the Exposition at Chicago; and whereas this is a subject of such importance as to require the most careful consideration, with a view to appropriate action: Therefore,

Resolved, That a committee of five be appointed by the Chair to consider this subject and to report to this convention the names of four persons suitable for members of the said testing committee, and to also report what further action is advisable in the premises.

Mr. Alvord explained that this resolution had already received the consideration and approval of the executive committee and that he was authorized to report it back to the Association for consideration in general session.

The resolution was adopted, and Messrs. Neale of Delaware, Atherton, Myers, Henry, and Gulley were appointed to consider the subject and nominate the supervising committee.

It was decided to reverse the order of the evening as printed and call first the discussion on Numbering Station Publications.

The PRESIDENT. The discussion of the evening was to have been opened by Director Harris, of the U. S. Department of Agriculture. As Director Harris is not present I will call the next speaker, Prof. Henry, of Wisconsin.

Mr. HENRY. This matter was brought before the executive committee, I believe, through letters asking whether station publications could not be made more uniform in numbering. I wish to direct attention to that point at this time. I need not tell you, who have to do with getting together the sheets from our stations, that they are very irregular in size; that, further, some are numbered regularly and that others are indicated by letters and numbers. This works serious detriment to persons trying to keep track of them. I think that if we could stop a moment we would get straight. The farmer don't care whether the bulletin he is getting is a special bulletin C or bulletin 713. He will throw away nine out of ten after reading. But when I have just received bulletin 93 and find I have already had bulletin X, I am in confusion. Has bulletin Z been issued? If so, where is bulletin A? I have a complete set up to 99. Shall I file lettered bulletins with them? Again, one station issues fractional bulletins. Now 17½ is received. Will 17¾ or 18 be the next one?

Now if we bear this point in mind I think it will be easy to solve the question. The farmer don't care about the number; the person keeping a file does care. Let us have this in mind when we do it. We want to have in the station library a history of the doings of our stations numbered consecutively. A simple numbering would have saved me perhaps a week's work, and in the next ten years perhaps two or three months' work trying to track out these sheets.

How shall we bind it? Why not issue bulletins in pamphlet form of the same size. Again, a number of bulletins have been exhausted and reprints made of them. One station has already republished five bulletins numbered for publishing a single bulletin. It has occurred to me that in Wisconsin we have failed to have the stations get bulletin No. 2. Why could we not, if we could not afford the expense of having type set up, have mimeograph copies made of them and send a copy to each of the stations? Of course it is better printed if we have the money. Now, we will help you in getting a set of the publications of our station.

I think, Mr. Chairman, it would be well to have a committee appointed to look over the subject pretty carefully in regard to this matter and make some report if possible. I feel that we are wasting too much time on small things, and to bring the matter before the Association I move that a committee of three be appointed by the chair. I see Director Harris is here and I will give up the floor.

Mr. HARRIS. It is not my purpose to enter into any extended discussion in regard to the publications of the experiment stations, but to confine myself to a narrow question in which it seems to me easy to work a great improvement without making great changes.

The Office of Experiment Stations is making elaborate and costly efforts to abstract, arrange, and index the publications of the stations. Much of this work for its highest value requires that the stations and many of the workers shall possess complete sets of station publications, and that these sets be so arranged that any publication and any place in any publication may be found readily, easily, and surely. Unfortunately peculiarities in the methods now used by the stations for naming and numbering publications make this extremely difficult. Two-thirds of the stations number their bulletins consecutively, using the natural numbers. The first bulletin published is numbered 1, and the twentieth, 20, the bulletin next before the twentieth, 19, and the one next after it, 21. This method has many advantages. For instance, when I take bulletin 20 of a station numbering in this way, I know that it has printed at least nineteen other bulletins. I know that these are earlier than this bulletin. I know that it has published only nineteen earlier than this bulletin. If I wish to refer to the tenth I need say bulletin 10 and no more.

These stations, as a rule, publish in addition to their bulletins an annual report, and it is customary for them to print one annual report in each and every year. Thus each year's publications consist of four or more bulletins and an annual report. One-third of the stations depart from this simple method. It will be sufficient to enumerate a few of the peculiarities. Some stations count the annual report as a bulletin. This raises the question, shall we say that the station has printed seven bulletins and an annual report, or six bulletins and an annual report, or seven bulletins and no annual report; or shall we say, clumsily, as I suppose we must, that the station has printed seven bulletins of which one is the annual report? It is at least a cumbersome marking for a bound volume. Sometimes the annual report is printed as a part of the annual report of the board of agriculture of the State, and not printed separately. "Special" bulletins are in some cases lettered instead of being numbered, so that bulletin 20 is to be followed by bulletin Q, and the lists will read bulletins 11, 12, F, G, 13, H, I, 14, 15, 16, J, K, L, etc. This is bad enough at present, but what will happen when Z has been printed? Again, regular bulletins are both numbered and lettered, and we have 81*a*, 81*b*, and 82. Sometimes publications are arranged in volumes, the numbers beginning anew with each volume. Occasionally a bulletin is numbered with a fractional number. In only too many cases we have one or more series. Doubtless these peculiarities are often convenient to those who understand them, but to the caretakers in the many libraries in which these publications are preserved, to the students who use them and to bibliographers, that is, to all who care anything about the numbering of publications, these peculiarities must prove a weariness of the flesh. It seems to me that fairness to each other and to the public interest demands that we sacrifice personal and local convenience to the general good. In passing it is well to remember that to the farmer this question of numbering has little interest, his attention being confined to the contents of the bulletin.

In conclusion I wish to present the following resolutions which I will ask the secretary to read.

The Secretary read as follows:

Resolved, That it is the sense of this convention that, in so far as possible, the publications of the colleges and stations represented in this Association should be named, numbered, and dated according to an uniform method.

Resolved, That a committee of five be appointed by the chair to devise a system to be reported if possible to this convention for its action, or if not, to the executive committee, who shall then distribute copies of the plan to the institutions entitled to membership in the Association.

The PRESIDENT. Under the rules these resolutions will be referred to the executive committee.

Mr. NEILSON. I would like to say a word about the lettering of bulletins. Our station has been in the habit of lettering bulletins for this reason. For instance, a special interest is manifested in a bulletin. With us the cranberry interest has occasionally been the object of a bulletin. Now, we do not want to send to all a bulletin which affects the cranberry growers only. Now, if the bulletin is sent to cranberry growers only and it is regularly numbered, when the next bulletin is issued farmers from all over the state will begin to write asking why they were passed over in the distribution of that bulletin.

Mr. JOHNSON, of Wyoming. I favor this movement, and I want to speak of the method we have adopted in our station. Our bulletins are numbered—our annual reports are not. When we print our bulletins, we lay aside a thousand copies for binding with the annual report at the end of the year. This binding together we find very convenient for reference and not costly, as the expense is only that of paper and presswork. I should like to see such a plan adopted by all the stations.

Mr. JOHNSON, of Connecticut. My station some time ago had occasion to issue a bulletin on the modification of the Kjeldahl method of determining nitrogen, of interest to chemists only. This bulletin was numbered in the regular order 112, and bulletin 113, one of general interest, contained a statement on the title page to the effect that bulletin 112 was of interest to agricultural chemists only and had been distributed among station workers alone. It was only necessary to issue a small edition of that bulletin, so that it was a great saving of expense.

There are some other points I wish to call attention to if in order. I have lost a good deal of time and have been worried and vexed in attempting to file the publications of the experiment stations. It is very important to my mind that each station should distinctly announce in print upon the bulletins the system which it follows in so far as it is peculiar. At the Connecticut station we issue our bulletins numbered consecutively from the beginning and ever since we have had funds to do it we have printed them in uniform octavo style. Some of our earlier bulletins were gotten up in any kind of shape that we could manage because we run the station three months without any funds and were always in arrears and always trying to accomplish a modest amount of work on a very, very limited amount of money so that our earlier bulletins were all sorts and sizes, some printed by sending the manuscript to an agricultural paper and getting proofs which were furnished us at the cost of press work. Any expedient to get material into shape and distribute it. Ever since we have been able to do so, since we have been getting $8,000 per year to work with, we print our bulletins in good shape, in a legible form and endeavor to make them pleasant to the eye. We have always followed the plan of printing an annual report and including in it everything worth publishing. Our bulletins may be lost. Notwithstanding, our annual reports contain everything worth preserving. It is of great advantage to us also in that it enables us to revise our work, to reëdit it and present it in its most attractive form. The stations ought to furnish every facility, so that the student can readily master the contents of publications. There should be an index of the bulletin on the front page, so that he may see at once what is of the most importance to him. If I get a bulletin of ten, fifteen, or twenty pages and have to spend ten or fifteen minutes in finding out what is in it, I am disposed to lay it aside and take it up when I have leisure, which I never have, and the contents of that bulletin pass, as far as I am concerned, into oblivion, and can only be rescued by the valuable endeavors of the Office of Experiment Stations. If that furnishes me a suitable index of this literature I may make it available. The amount of matter published in this country and in foreign countries is so immense that without every facility placed at the disposal of the student it becomes simply impossible to keep track of them. It is of the utmost importance that every single paper have a special table of contents, unless matter of simple sort, for without that it is difficult to take advantage of the information, however valuable, which is published.

Mr. REDDING. I rise to insist upon some of the changes in numbering bulletins which I have offered. I have adopted the plan of filing away not less than two hundred copies of each bulletin. So far I have included two years in one volume for the reason that the publications have not been voluminous. At the end of this period I have an index prepared to the volume and sent to the printer for binding. I send a copy to the director of each station, and, I think, to each college also. I find that it is of great advantage to me to have the bulletins bound in that way, and I believe it would be to others. I would be glad indeed if I could get bound volumes of the publications of each station. It seems to me that the stations would appreciate the work of other stations better in that form.

Now another point. In order to prevent our correspondents from calling for bulletins which we did not intend them to have I used the simple expedient of half numbers. A special bulletin I called 17½. If a man gets 17½ he knows it is intended for him to read. Now, my next bulletin is 18. Now, when the farmer gets 18 he will not know that such a bulletin as 17½ was issued. On the other hand, I issued a bulletin intended for the farmer only. It is not on any subject of investigation, but simply a notice to farmers, informing them of the organization of the station and other matters not of importance to other stations. I called that 12½. Perhaps some of the stations got that bulletin. I got no requests for 12½ and few for 17½. I think that solved the question without any difficulty at all.

There was one other question that troubled me. I wrote to Maj. Alvord as to what matter should be included in the annual report of the station. If you will read the law closely you will probably understand it as I did. It was not the intention of the law that we should make a detailed statement of the results of experiments in the annual reports. It requires that we should send so many copies to the Secretary of the Treasury and one copy to each of the stations. It makes no provision for sending them to farmers at all.

Mr. HARRIS. May I ask a question of the last speaker? Director Redding is one of the most exact and systematic of men, and if we all kept records as he does any system would work. But this bulletin—17½—does it have any relation to 17?

Mr. REDDING. None whatever.

Mr. HARRIS. There is the danger. Suppose you have a second edition of 17½, with some additional matter, what would you call it?

Mr. REDDING. I would call it "17½, second edition, revised and corrected."

Mr. HARRIS. We know that if Director Redding is going to send out bulletin 17½ we will get it. But you will remember that there came a time in Egypt when they knew not Joseph, and there will come a time when we know not Redding, and I venture to say that that man will not send out 17½. Now, how do we know that we will get 48½?

Mr. REDDING. The bound volumes will contain every bulletin issued by the station.

Mr. HARRIS. How often do you issue that bound volume?

Mr. REDDING. It is issued every two years. Our bulletins are fourteen or fifteen in number, of twenty-eight or thirty pages each, and it was for my own convenience that I put two years together. But, if this association thinks it desirable to have bulletins for a year bound together, I will gladly make the change.

The PRESIDENT. There was a resolution passed at an earlier session of this convention by which the chair should appoint a committee of nine persons to act as an advisory committee to the standing committees on the coöperative college and station exhibits at the World's Columbian Exposition, consisting of members of the governing board of colleges and stations. I will appoint on that committee Messrs. Henry Chamberlain, of Michigan; W. R. Cavitt, of Texas; James A. Beaver, of Pennsylvania; H. B. Dale, of Wisconsin; Hart Gibson, of Kentucky; R. H. Warder, of Ohio; Daniel Needham, of Massachusetts; William L. Rynerson, of New Mexico; and John Cameron, of Mississippi.

Another resolution requiring the appointment of a committee by the chair was for supervising dairy tests at the Chicago Exposition. I will appoint as a committee for nominating four persons suitable for members of this committee Messrs. Neale of Delaware, Atherton, Myers, Henry, and Gulley.

Mr. HENRY. I do not think that the stations ought to feel that any bulletin ought not to go into the libraries of other stations. If you issue a bulletin to farmers, giving information in regard to your stations, that is a part of the station work and other stations should have that to bind up in the history of the work of your station. I do not think that kind of a fellow feeling ought to exist. Then, again, by inserting a paragraph on the title-page of the bulletin informing the farmer readers that the previous bulletin was not for general distribution, but could be obtained on application, you would be able to number bulletins uniformly and save all trouble.

Mr. SCOTT. Gentlemen of the association, President Broun has been called away and has asked me to take the chair.

Mr. Fairchild. I wish to emphasize what Dr. Johnson has said in regard to the contents of bulletins. I hope the committee will take into consideration especially the whole matter of title-paging, showing the contents of bulletins in addition to consecutive numbering. It seems to me we ought to be able at a glance to tell what a bulletin contains.

We have, I am sorry to say, followed two methods in issuing our bulletins, but not with reference to numbering. We have numbered them consecutively from the beginning. We did attempt for the first two years to republish all important matter for preservation in an annual volume, but we found that a very expensive way of presenting to the public what we thought important for them to have. We have therefore adopted the plan of inserting a notice in each bulletin that the bulletins for that year, beginning with number so and so, will be indexed in the annual report for that year. We also reserve a thousand copies for binding ourselves, and if any station worker desires a bound volume we shall be glad to furnish it.

I should like to present to that committee, when appointed, a title-page of one of our bulletins, to see if there are any suggestions in that which they can adopt.

Mr. Hadley. I have been extremely interested in this discussion and I like very much the remark of President Fairchild that the matter of title-paging should be taken under consideration by the committee.

There is one other point I would like the committee to consider: The best method of handling these bulletins after we get them. We are getting bulletins from nearly 50 stations. What is the best method of filing these while unbound. The matter of indexing, as Mr. Fairchild has spoken of, on the outside page is a matter of very great importance, but I think, however, it is generally adopted at the stations. I think most bulletins have an index on the front page. I had the honor of making a motion to that effect two years ago at Champaign. I think, however, it should be considered by this committee.

Mr. Clute. In making up our publications for binding I have observed a difference in size. If we could adopt a uniform size for a page, print on a page so many inches wide and so much margin, then one could bind these publications into a volume and they would appear more orderly and systematic on our library shelves than where of different sizes. It would be very easy for the stations to adopt a uniform size if the committee would recommend it.

I had my clerk make out a list of all the duplicates we had and forward that list to each of the stations with the statement that we would furnish these numbers to those applying for them as long as they lasted, and I am glad to say we furnished a good many to stations. I want to acknowledge the kindness of these stations in sending to me missing numbers asked for.

Mr. ROBERTS. The difficulty in getting the bulletins uniform in size rests in the fact that many annual reports and bulletins are published by the State printer, and you might as well try to move the earth as to change a State printer or his methods. Those stations like Cornell, who print their own bulletins, can easily change, do what they please, but I know in the case of our State station their bulletins are a different size from ours, and we can't get them to change. This is a very great inconvenience to us in binding our annual reports and bulletins.

I trust that the committee will see that there are no more half numbers and no more A, B, and C bulletins, if that can be done without seriously discommoding the stations.

The PRESIDING OFFICER. Is there further discussion? If not the chairman of the executive committee will make a report.

Mr. ALVORD. The resolution seems to embody what is desired and I therefore report it back to the Association with the suggestion that it now pass. Before reading let me add a word. It seems to me that if all the stations would evince the same spirit as the Georgia station, simply say that whatever the Association agrees to the station will do, the question would be easily solved. The resolution, as given above, as offered by Mr. Harris, was again read, and adopted.

The PRESIDING OFFICER. I will appoint on that committee Director Harris, of the United States Department of Agriculture, Directors Johnson, of Connecticut, Johnson, of Wyoming, Henry, of Wisconsin, and Redding, of Georgia.

The PRESIDING OFFICER. Is there any further business?

Mr. ALVORD. The regular order is the consideration of subjects coming from the botanical section.

The PRESIDING OFFICER. We will take the regular order then. The first thing in order is a paper on the treatment of apple scab by Prof. Goff, of Wisconsin. Ten minutes to present paper.

Mr. Goff then read the following paper on the "Treatment of Apple Scab."

NOTES ON THE TREATMENT OF APPLE SCAB.

During the past seven years the writer has made applications intended to prevent damages from the disease known as apple scab, due to a fungous parasite known to science as *Fusicladium dendriticum* Fck. So long a period of experiment appears to warrant certain conclusions that might have been very unsafe from one or two seasons' experiments. It is not my purpose to present here a statistical report of these experiments, but simply to mention briefly some of the facts that seem clearly brought out. Of many materials tried the copper compounds have proved most efficacious. The carbonate of copper, used in suspension in water and also dissolved in ammonia, the arsenite of copper, or Paris green, applied in suspension, and the sulphate of copper applied in compound with lime, as in Bordeaux mixture, have all proved efficacious in certain seasons, but the degree of their relative efficiency has been far from uniform, a result that seemed rather difficult of explanation until the experience of the past season. A comparison of the meteorological conditions of the different seasons in which these copper compounds have been tested, with the results secured, taken in combination with observations upon the length of time the different compounds have remained upon the foliage, appears to warrant the general conclusion that the three copper compounds named, viz, carbonate of copper, Paris green, and sulphate of copper combined with lime, are efficacious in preventing damage from the apple scab nearly in proportion to the length of time that they remain upon the foliage. In the summer of 1891, in which very little rain fell in central Wisconsin after the middle of June, Paris green applied in suspension with lime proved even more efficacious than either the Bordeaux mixture or the carbonate of copper. The past season, when the month of June was exceptionally rainy, and spraying had to be performed between showers, the Bordeaux mixture proved decidedly more efficacious than either Paris green or the ammoniacal carbonate of copper. The reason for these variable results appeared to be in the great adhesiveness of the Bordeaux mixture to the foliage. In every case where this compound has been used, though it has not been applied later than the middle of July, it has remained visible upon the foliage throughout the season, and the effect of the applications made in July, 1891, were still distinctly visible upon the branches and trunks of the trees to which it was applied in October, 1892, fifteen months after the application. It thus appears that the adhesiveness of this fungicide is so great that it can be depended upon to hold its place even through abundant rains.

I may add that this compound appears to be as efficacious when used at half the strength of the original formula, *i. e.*, when 3 pounds of copper sulphate and 2 of lime are used in 22 gallons of water, as when made of double this strength.

From what has been said, it is clear that the Bordeaux mixture must be regarded as the only fungicide thus far tested that can be recommended with confidence to prove effectual against the apple scab, although under favorable circumstances either the carbonate of copper or Paris green appears to possess equal fungicide properties. Unfortunately, this compound has the objections of being somewhat difficult to spray, of requiring more or less stirring to keep it in suspension, and of losing its efficacy as a fungicide if not used promptly after it is prepared, but until we can find a preparation that is equally adhesive to the foliage and has fewer objections, we can do no better than to employ it.

Our experiments indicate that it is important to make the first spraying before the opening of the flowers. The number of applications it is necessary to make to accomplish the best results is yet to be determined. In Wisconsin the weather during and after midsummer is apt to be rather dry, and hence sprayings after July 1 are of rather doubtful value.

I may add in conclusion that a fertile soil and frequent breaking up of the orchard are found to greatly reduce the damage from apple scab, and also that certain varieties appear to possess a decided resistant power to this disease. While the use of the spray pump in the orchard will doubtless, in the long run, prove eminently profitable both in the quality and quantity of the fruit it will enable us to secure, the wise orchardist will supplement it with plant food and cultivation, as well as by the selection of varieties that experience has shown are well able to cope with this destructive enemy of our apple trees.

The PRESIDING OFFICER. Are there any remarks on the paper? If not in the regular order we will have a paper by L. R. Jones, of Vermont, on the "Comparative tests of fungicides in checking potato blight and rot."

Mr. TRACY. In the absence of Mr. Jones I have been requested to read his paper.

A Comparative Test of Fungicides in Checking Potato Blight and Rot.

This is the fourth year in which Bordeaux mixture has been used at the Vermont Station in checking the ravages of *Phytophthora infestans*. This work has been uniformly successful. Probably every one who uses this mixture, however, wishes that a cheaper and more conveniet substitute could be found. Such substitutes have been used in work upon grape and orchard diseases. In fighting this potato disease, however, we have to meet not only a different fungus, but also somewhat different conditions of development. *Phytophthora* differs most strongly from most of the orchard and vine fungi in that it does not begin its attack at the beginning of the season and spread slowly, but instead gives no external sign of its presence until the latter part of the summer. At this time, when the plants reach proper maturity, and suitable conditions of heat and moisture prevail, the rapidity of the development and spread of the disease is something almost incomprehensible to one who has not witnessed it. Your attention is called especially to these facts as explaining in part the surprisingly poor results obtained from the use of certain fungicides which in the vineyard and orchard work have gained a good reputation.

In the summer of 1891 we undertook experiments to test the comparative value of, (1) ammoniacal copper carbonate; (2) glue mixture; (3) Bordeaux mixture, half strength; (4) Bordeaux mixture, full strength. The results as reported in the publications of the Vermont Station were decidedly in favor of the Bordeaux mixture, and showed the ammoniacal solution and the glue mixture to be of little value, under the conditions of that experiment. We felt, however, that the conditions might not be such as to give these remedies a fair trial, although it was evident that they were inferior to Bordeaux mixture.

This summer (1892) a comparative test was made of twelve of those fungicides which appeared most hopeful. The work was carried on in two different fields, one a clay loam, the other a lighter, rather sandy soil; the plots were so arranged that all the fungicides were given a trial on both medium and on late potatoes; five standard varieties of potatoes were included in the experiment, and in all plots the relative value of two and of three applications was tested.

Following is a list of the fungicides tested:

First: Copper soda solution: Copper sulphate, 13.3 ounces; sal soda 20 ounces; water, 5 gallons.

Second: Copper acetate solution: Copper acetate (verdigris), 8 ounces; water, 5 gallons.

Third: Bordeaux mixture and molasses (copper-lime saccharate): Copper sulphate, 13.3 ounces; lime, 13.3 ounces; molasses, 13.3 ounces; water, 5 gallons.

Fourth: Ammoniacal copper carbonate: Copper carbonate, .55 ounces; aqua ammonia, one-third of a pint; water, 5 gallons.

Fifth: Bordeaux mixture, full strenth: Copper sulphate, 1¼ pounds; lime, eight-ninths of a pound; water, 5 gallons.

Sixth: Bordeaux mixture, "5-5—50," formula: Copper sulphate, 8 ounces; lime, 8 ounces; water, 5 gallons.

Seventh: Bordeaux mixture, very weak (about one-eighth strength): Copper sulphate, 2.6 ounces; lime, 2.6 ounces; water, 5 gallons.

Eighth: Copper and ammonium carbonate mixture (Dr. Chester's formula): Copper carbonate, 1.06 ounces; ammonium carbonate, 3.2 ounces; water, 5 gallons.

Ninth: Glue mixture (Dr. Galloway's formula): Copper sulphate, 2 ounces; sal soda, 2.4 ounces; Le Page's liquid glue, 1.6 ounces; water, 5 gallons.

Tenth: Modified Eau Celeste: Copper sulphate, 7 ounces; sal soda, 9 ounces; aqua ammonia, one-third of a pint; water, 5 gallons.

Eleventh: Copper carbonate in suspension: Copper carbonate, 5 ounces; water, 5 gallons.

Twelfth: Copper chloride solution (Cornell Station formula): Copper chloride 0.66 ounces; water, 5 gallons.

Each year of work upon this potato disease leads me to appreciate more strongly the fact that the greatest value of the fungicide is not in protecting the tubers from the rot, but rather in preserving the foliage from the blight. When the foliage is thus preserved the tubers come to full size and maturity, and the gain in yield, from prolonging the life of the vines three or four weeks in the fall, is very great. Such being the case, the relative values of the fungicides can be better judged from the appearance of the foliage of the treated plants than from the yields. On the other hand, the absolute gain from the use of any fungicide must, of course, be judged by the increased yield of tubers resulting from its use. I, therefore, send some photographs with this paper, which will enable you to judge of the relative values of the fungicides better than any array of figures stating the varying yields. The full yields will be published later, and I will now select from the figures before me only enough to enable you to judge of the absolute gain from the use of some of the better fungicides. There were two rows of potatoes in each plot in the field shown in the photographs. Two of the photographs (the 8 by 10's) show some of the plots as they appeared September 10. These show clearly the effects of both Bordeaux mixture (plot 7) and weak Bordeaux and molasses (plot 4). No less interesting will be the appearance of plot 5 (ammoniacal copper carbonate), as shown in one of these photographs. It was found impossible to bring out with equal clearness the less marked differences between most of the plots by photographs, and, therefore, instead of attempting to include the entire plot in the photograph, an average hill was photographed from each plot. This explanation will, I trust, be sufficient to enable each who chooses to examine the photograph to do so understandingly.

The gain from spraying this year was unusually marked, owing to the prevalence of the disease. This can be judged from the following statements of yield of those plots shown in the 8 by 10 photographs:

	Bushels per acre.
Plot 4 (weak Bordeaux mixture and molasses) at rate of	330
Plot 5, ammoniacal copper carbonate	99
Plot 6, untreated	97
Plot 7, strong Bordeaux mixture	246.5

These experiments, supported also by data of last season's work, lead me to the following conclusion as to the relative values of the fugicides for the potato blight:

(1) Copper soda solution (plot 2) has merits, but is not at all equal to Bordeaux mixture.

(2) Copper acetate solution (plot 3), a fairly good fungicide, but so injurious to the foliage as to exclude its general use.

(3) Weak Bordeaux mixture and molasses (plot 4). Good results. Probably more valuable than same without the molasses.

(4) Ammoniacal copper carbonate (plot 5). Unquestionably the weakest fungicide tested, being but little better than nothing. (I should feel less confident in this verdict did not all the results agree so perfectly in all my experiments. I am convinced that I do not underestimate its value for this work).

(5) Strong Bordeaux mixture (plot 7) leaves but little to be desired in the results obtained.

(6) Weaker Bordeaux mixtures (plots 8 and 9) were not equal to full strength Bordeaux mixtures, as can be seen from following yields:

(Field A was of medium early potatoes, which blighted badly when not protected. Field B was of late potatoes and on lighter soil, hence not so badly diseased.)

[Bushels per acre.]

	Plot 6 (untreated).	Plot 7 (strong Bordeaux mixture).	Plot 8 (Bordeaux mixture, 5-5-50).	Plot 9 (Bordeaux mixture one-eighth strength).	Plot 11 (untreated).
Field A	97	246½	155	145	119
Field B	108½	189½	177	122	91½

Owing to certain conditions of soil I think the above figures in Field A would underrate the value of Bordeaux mixture "5–5–50" formula, but I am convinced that this formula does not give as good protection as does the strong Bordeaux mixture. While the very weak Bordeaux mixture had greater fungicidal value than many others tried it did not have enough to recommend it for general use.

(7) Copper and ammonium carbonate mixture (plot 10) was of some value, but not enough to be recommended for general use.

(8) Glue mixture (plot 12) ditto.

(9) Modified eau celeste (plot 13) gave best results of any of the soluble fungicides, and although not equal to either of the stronger forms of Bordeaux mixture it is the best thing to recommend where a soluble fungicide is desired.

(10) Copper carbonate in suspension (plot 14), of considerable fungicidal value, though not enough to recommend its practical use.

(11) Copper chloride (plot 15), of still less value than the last.

I would therefore rank them as follows in order of fungicidal value:

1. Bordeaux mixture, full strength.
2. Weaker Bordeaux mixture and molasses.
3. Bordeaux mixture, "5–5–50" formula.
4. Modified eau celeste.
5. Copper soda solution.
6. Verdigris solution.
7. Bordeaux mixture, very weak solution (one-eighth strength).
8. Copper carbonate in suspension.
9. Copper and ammonium carbonate mixture.
10. Glue mixture.
11. Copper chloride solution.
12. Ammoniacal copper carbonate.

The first four did good enough work, so that I feel justified in recommending them for use by practical potato-growers. The others are none of them to be recommended, in my judgment.

Bordeaux mixture in some of its forms remains, then, as the most valuable fungicide of this work. The addition of a cheap molasses to the weaker mixture appears to increase its value by rendering it more adhesive.

The PRESIDENT. You have heard the paper read by Mr. Tracy; is there are any discussion on it? If not, we will take up the next paper, "A Study of Fruit Decays," by Byron D. Halsted, of New Jersey.

Mr. Halsted presented the following:

A STUDY OF FRUIT DECAYS.

The speaker's attention was called to the subject of fruit decays by a quince-grower, who complained of a destructive rot in his orchard. Upon investigating the trouble a decay was found that was due to a fungus of the genus *Sphæropsis*. The same orchard contained apple trees, with decayed fruit, and also pears. The apple decay was due to *Sphæropsis malorum* Pk. Circumstances aroused the suspicion that the quince decay was caused by the same species of fungus. Cultures and inoculations were next instituted in the laboratory, and it was proved that the Sphæropsis of the apple would grow upon the quince, and that the quince upon the apple. In like manner the same relation was established between the quince and apple Sphæropsis, and the one upon the pear. In short, the three fungi are probably the same, and in the complete eradication of the one, the others need to be destroyed, or else the trouble will spread from one kind of fruit to another. A worthless overburdened apple tree may, through neglect, shorten the crop of quinces by being a propagation bed of decay.

A systematic study of the probable relationship of the anthracnoses of fruits was led up to by the above investigation. Under the term anthracnoses are included the members of the two nearly related genera, *Glœosporium* and *Colletotrichum*.

They differ from each other somewhat in general appearance, but chiefly by the presence of stiff dark hairs in the spore spots in the colletotrichums—they being absent in the glœosporiums. A very large number of species have been established in each genera and the list is increasing yearly. Many kinds of fruit are attacked by them, as well as other parts of plants.

The laboratory experiments consisted chiefly in transferring the virus from an affected fruit to one in health. The common apple ripe rot, or "bitter rot," is a familiar example of the anthracnoses, and bears the botanical name *Glœosporium fructigenum* Berk. Spores of this were transferred to several other kinds of fruit with success, thus producing artificially the disease similar to that of the apple. Previous to this series of experiments the Division of Vegetable Pathology at Washington had shown that this "bitter rot" of the apple was the same as a certain decay of the grape fruit.

At this point in the treatment of the results a chart was shown by means of which the facts established were presented in a graphic manner. The following fifteen fruits, representing widely different orders of plants, were represented as arranged around an oval, as follows: Apple, peach, banana, pepper, bean, persimmon, lemon, watermelon, quince, citron, grape, tomato, eggplant, pear, and squash. The successful inoculations from any fruit to another were shown by lines and arrows, the lines being in fact the arrows. Thus, if the fungus was a *Glœosporium* a dotted line was employed, and if a *Colletotrichum* a solid line was used. The apple has native to it a glœosporium as above mentioned. The chart showed dotted lines running from the apple to the peach, banana, pepper, bean, persimmon, lemon, quince, grape, tomato, eggplant, and pear; in fact, to all that were inoculated. The pepper has a *Glœosporium* (*G. piperatum* E. & E.) This was successfully taken to the apple, as also to the grape, and to the banana, bean, persimmon, and pear. This is strong evidence that either *G. fructigenum* Berk and *G. piperatum* E. & E., have both a much wider range of hosts than supposed, or else are the same fungus. The differences in size of spores and filaments do not warrant specific distinction. In like manner the tomato has a species, *Glœosporium fomoides*, Sacc. recorded upon it. This was easily taken to the apple, banana, bean, grape, oggplant, and pear, thus suggesting that this is the same as the one with which the experiments started on the apple.

It is not necessary to go further, the chief point of the paper being, first, that the anthracnoses of fruits are probably fewer in species than supposed, and a few may cause all the damage attributed to many. This closer relationship of these decays suggests the still greater importance of not letting one decaying fruit serve to propagate the disease for another. Lastly, the graphic method of showing the whole work of inoculation at a glance was offered as possibly useful for illustrating other similar results of laboratory investigations.

The PRESIDENT. Is there any discussion on the paper? If not, the next is a paper on breeding of fruits, by N. E. Hansen, of Iowa.

In absence of Mr. Hansen, the following paper was read by Mr. Pammel, of Iowa:

NOTES ON THE BREEDING OF FRUITS.

This subject is one of great practical importance to the Northwest. The wonderful results attained by crossing and hybridizing in improving our flowers, grapes, and some of the small fruits, lead us to expect that similar results can be achieved with the orchard fruits. Comparatively little work has been done in this line, because results are not so speedy, and we have been satisfied with chance seedlings, allowing insects and the wind to do most of the work for us. But the peculiar and severe climate of the Northwest requires that we should endeavor to originate new varieties better adapted to this vast region. The indiscriminate sowing of seeds is an expensive lottery. Breeders of animals select the parents;

why should not breeders of fruits do the same? I regard crossing and hybridizing as a method of abridging the process of evolution by introducing new elements of variation. The primitive types peculiar to each region should be used, if necessary, for one side of the cross, to impart hardiness, because they have as a rule become fully adapted to their environments by ages of natural selection, resulting in the "survival of the fittest." The theory we generally follow is that the pistillate parent is more apt to transmit hardiness, and the staminate parent size and quality of fruit.

Extensive series of experiments in this line were inaugurated at the Iowa Agricultural College in 1886 by Prof. J. L. Budd, and have been continued up to the present time. The results so far are very promising.

It may be of interest at this time to note some of the results of our work and the most promising lines of work in improving our fruits.

In bulletin No. 14 of the Iowa Experiment Station, Prof. J. L. Budd gives a summary of results attained in breeding orchard fruits. It is shown that seedlings obtained from crossing Russian apples, or from crossing Russian with American apples, are much superior in leaf, tree and habit of growth to seedlings of purely American apples, descendants of west European varieties. The same relative superiority was noticeable the past season. The seedlings in leaf, bud, habit of growth and hardiness follow the mother, and the few specimens of fruit obtained to date show modifications due to the male parent. It is evident so far that these seedling apples, of partly or wholly Russian parentage, inherit the scab-proof characteristic of the Russian race of apples (see Bulletin 18 Iowa Experiment Station) and we hope that among them will be found desirable additions to the fruit lists for our northwestern prairies. The aim of the work has been to secure iron-clad varieties of high quality for all seasons, and the work will be continued.

In crossing pears the object has been to cross the hardiest of the east European varieties with those of the highest quality of west European parentage.

In crossing cherries, the aim has been to cross the hardiest sour cherries from east Europe with the best sweet varieties, also to improve the native *Prunus pumila* and *P. pennsylvanica*. In the present year we failed in our work with the two latter species, but the work is not abandoned.

In improving our native plums the object has been to obtain high quality by using as the staminate parents the best European and Japan plums. If the cross proves so violent as to affect injuriously the productiveness and hardiness, the same method will be followed as in improving the grape, viz: to use the pollen of these hybrid varieties on our wild plums, thus securing a smaller infusion of foreign blood.

Some seedlings of De Soto crossed with a large blue plum grown in Oregon, show important modifications in foliage and fruit, and are of interest in this connection.

In the work of improving our cultivated grapes the aim has been chiefly to use Worden as the best member of the Concord family, for earliness, hardiness, and productiveness, and to use varieties of partly *Vitis vinifera* parentage to obtain high quality. This is because the history of Rogers' and other hybrid grapes show that to use a variety of purely European blood makes the cross too violent for the best results as to hardiness and productiveness, and it is hoped that better results will be obtained by using a smaller proportion of foreign blood. Hence Worden and other early Concord seedlings have been crossed with Agawam, Salem, and other Rogers' hybrids.

The same method should be followed in improving our wild grape. The Northwest greatly needs a grape of good quality that is early enough to ripen even in North Dakota and Minnesota, and is perfectly hardy without winter protection.

The past season our wild grape has been crossed with Empire State to determine the effect of using a variety considered to be of purely native parentage. Worden has also been crossed with our wild grape.

In crossing grapes I found that the caps and stamens could be removed with much facility by using the tips of the fingers as well as the pinchers. Also that pollenizing could be performed to good advantage by taking clusters of bloom just opened and fastening them with string and fine wire in close proximity to the emasculated clusters. This is much easier than gathering the pollen and applying it with a camel's hair brush. Paper sacks were used until the grapes were well set, then mosquito netting.

Our native hazelnuts, walnuts, hickorynuts, and chestnuts, all merit our careful attention, as they are no doubt capable of vast improvement by crossing and selection. Especially promising is our wild hazelnut, as it probably would soon rival the best filberts.

Our native gooseberries crossed with some large English varieties would likely yield valuable results. The past season we have crossed a hardy gooseberry from the Amur Valley in Asia with the Industry. The object is to obtain a hardy, mildew-proof variety with fruit rivaling in size and quality the best English gooseberries.

The Northwest needs a good variety of raspberry hardy enough to bear well at the North without winter protection. With this end in view, we have this season crossed a wild red raspberry from the Black Hills with the Shaffer's raspberry.

Similar work remains to be done with our indigenous currants, juneberries, blackberries, dewberries, strawberries, and other fruits. This may well be termed fundamental work in horticulture, and deserves the most careful attention of our experiment stations.

While not properly coming within the scope of this paper it may in conclusion be of interest to note that we are endeavoring to originate a new race of hardy double roses. Several varieties of *Rosa rugosa*, imported from Russia by the Iowa Agricultural College, have proven perfectly hardy without winter protection, have large fragrant flowers and are perpetual bloomers, but the flowers are single. The past season we have crossed them with a member of choice double roses, such as General Jaqueminot, American Beauty, Magna Charta, Madam Masson and Triumph de Exposition, and now have fully 20,000 seeds put away for spring planting. Some work has also been done with other primitive species, including our native *Rosa blanda*.

The PRESIDENT. You have heard the paper of Mr. Hansen; is there any discussion on it? If not we will proceed. The last paper of the evening is "The Crossing of Cucurbits" by Prof. Pammel, of Iowa.

Mr. Pammel then read the following paper:

THE CROSSING OF CUCURBITS.

In 1891 the writer read a paper * before one of the horticultural societies in Iowa in which the statement was made that melons and cucumbers do not mix, nor do pumpkins and melons. He was vigorously assailed by horticulturists for teaching doctrines which were heretical. Many claimed to have observed from actual experience that they do "mix." Nearly every one with whom the writer conversed had one opinion in this matter; that they would cross. I have not endeavored to get the opinion of seedsmen on the point. In conversing with Prof. Barrows, who has had considerable experience, I am informed that he has never known them to "mix." My brother, who grows many cucurbits, believes that pumpkins and squashes and cucumbers and melons will mix.

To settle this matter, so far as the writer was concerned, a series of experiments were undertaken. In this paper nothing more than some preliminary statements can be made, inasmuch as it will be necessary to grow the curcurbits another year

* The effects of cross-fertilization in plants. A paper read before the Northern Iowa Horticultural Society, December, 1891.

before conclusions can be reached. This paper must be considered as supplementing the excellent work of Naudin,* Bailey,† Sargent,‡ and others. To Naudin belongs the credit of having thrown much light on the subject of *Cucurbitaceæ*. During many years he experimented with a large number of varieties from different places. He found that the species did not "mix," and that when hybrids were produced they yielded either no seed or sterile seed.

Bailey remarks: "Many careful hand pollinations have been made between these two classes of fruits (*C. maxima* and *C. pepo*) and in no case have seeds been procured. Sometimes the fruit will develop for a time, and in two or three instances a summer crookneck pollinated by a turban squash has developed till half grown and has persisted until the end of the season, but it was seedless. All our experiments show that *Cucurbita pepo* and *C. maxima* do not hybridize." M. M. Vilmorin-Andrieux § says: "And we may remark that we do not know any form of gourd that should necessarily be considered a hybrid between any two of these species." But Thomas C. Gentry‖ speaking about hybrids between *C. pepo* and *C. ovifera* says: "Here it is evident, is a case of hybridism brought about through the agency of bees, whereby a cross between two closely allied species has been effected in an eminently successful manner, if the size, quality and profusion of the fruit are any criterion."

To insure if possible a perfect intermingling varieties of the following melons, cucumbers, pumpkins and squash were planted: *Citrullus vulgaris, Cucumis melo, Cucurbita maxima, Cucumis sativus, Cucurbita pepo,* gherkin, and dipper gourd.

This plan gave excellent facilities for the varieties of *Cucurbita pepo, C. maxima, Citrullus vulgaris, Cucumis sativus,* and *C. melo* to grow together. This was done to test the point frequently made by many that watermelons taste like pumpkins when growing close to them. I was also told that hand pollination would not give as good results as the natural method. But there is by no means unanimity on this point by growers of melons. Some believe the effect is seen the first year, while others believe that it can only be detected the second year.

Our experiment was unfavorable in some respects, due to a late season and the destruction of most of the melons by boys, but such as remained showed no traces of pumpkin. The Perfection Gem (*Citrullus vulgaris*) grew right among the pumpkin vines, Sweet Sugar pumpkin and Perfect Gem squash (*Cucurbita pepo*), and the two species tested were considered excellent, with no foreign taste. Montreal Improved (*Cucumis melo*) growing in with the vines of Sweet Sugar pumpkins (*Cucurbita pepo*) had an excellent flavor.

So far as the work has been carried out two questions only can be discussed: (1) Immediate effects of crossing; (2) prepotency of pollen. In all of the varieties grown in the field, while fertilization was affected by insects, no immediate effects were observed. But some of the varieties showed great variability, especially of *Cucurbita pepo* and *C. maxima*.

In the nest-egg gourd (*C. pepo*) many had of course the shape of an egg of a dirty white color. Others were flattened on the "blossom" and "peduncular" end, with the greatest circumference in the middle of a transverse section. Others were mottled with green and white, elongated in shape, narrow at the "peduncular" and "blossom" end. In the Perfect Gem, also, great variability was found. Some specimens were two or three times the normal size, flattened at the "blossom" and "peduncular" ends, having the greatest circumference in the middle of a transverse section. Still others were barrel shaped. Still others were more or less conical at the "blossom" end. In the Long Warted, some resembled the pumpkin, showing no warts; some were shaped like a crookneck, but without warts. In the Vegeta-

* Annales des Sc. Nat. Bot., 4th series, Vol. VI, 1856, p. 5.

† Third annual report of the Cornell University Exp. Sta., 1890, p. 180.

‡ Memoirs sur les cucurbitacees, 1826.

§ The Vegetable Garden, p. 251.

‖ American Naturalist.

ble Marrow (*Cucurbita maxima*) some were marked with green and yellow and some almost entirely green, others a creamy yellow. In all of the cases, these peculiarities or deviations were traced to plants arising from distinct seeds and in no case were any immediate effects of crossing observed. About four hundred hand pollinations were made by the assistant, Mr. Stewart, and myself, assisted by two students, Messrs. Brown and Carver. Out of these quite a number set and produced perfect fruit. Only a few will be recorded here.

Common pumpkin on Perfect Gem (*Cucurbita pepo*) no indication of the common pumpkin. Nest-egg gourd (*Cucurbita pepo*) on Perfect Gem, no indication of gourd. Two specimens of common pumpkin on Long Warted (*Cucurbita pepo*), no indication of pumpkin. Marrow* on Long Warted; no indication of Marrow. Three common pumpkins on Perfect Gem (*C. pepo*), no indication of common pumpkin. Italian Striped on Sweet Sugar (*C. pepo*), no indication of Italian Striped. Four common pumpkins on Nest-egg gourd (*C. pepo*), no indication of common pumpkin. Two Hubbard (*C. maxima*) on Nest Egg gourd (*C. pepo*), no indication of Hubbard.

This is sufficient to indicate that there is no immediate effect on the fruit. Prof. Bailey says: "It is commonly said that it occurs in pumpkins and squashes also; but it certainly does not. There has never been any immediate influence whatever in any of our crosses, except such as were due to imperfect development caused by an insufficient or impotent pollen. In other words, the effects of the cross are seen only in the offspring of the fruits."

Many interesting experiments have been made to show that in many plants self-fertilization does not occur. *Trifolium pratense* has perhaps received more attention than most plants, and many interesting experiments have been made, which show that self-fertilization does not occur.† But many other plants have been experimented with and very positive evidence has been obtained to show that there are cases much more pronounced than this.

Experiments have been made with cucurbits. Halsted‡ covered ten muskmelons, and in no case did fruit develop. Bailey§ has also reported some interesting cases.

Our own experiments are not numerous but they are decisive in every case. Quite a number of muskmelons were covered and left to self-fertilize, with no development.

Can hybrids be produced between *Cucurbita pepo* and *C. maxima*?

Out of fifteen hand pollinations made only two reached maturity. Whether we have here two real hybrids can not be said until the next crop. It may be doubted, however, as we often found beetles in the flowers covered with bags. The chances are against the specimens being hybrids.

Do different varieties of *Cucurbita pepo* cross?

Out of fifteen hand pollinations made the majority set and matured.

In addition to these, others set but did not fully ripen, or grew for some time, and then rotted and dropped off. Others did not develop.

Can perfect fruit be produced between *Cucurbita pepo* and *Citrullus vulgaris*?

In only a single case did fruit develop till half ripe between Mountain Sweet and Sweet Sugar pumpkin, but here again there are grave doubts as to its having been fertilized by the pollen from pumpkin, as beetles were so commonly found in the bags.

Can fruit be produced between *Cucurbita maxima* and *C. pepo*, and between *C. melo* and cucumbers?

In this experiment in many cases reciprocal pollen was used, and there are excellent indications that these distinct species do not "mix." This experiment did not

* Sold to us as Mammoth Chili, but according to Vilmorin appears to be a Marrow, a true *C. pepo*.

† See Darwin: Cross and Self-fertilization of Plants. Beal: Grasses of North America.

‡ Bul. Dept. Bot. Iowa Agrl. College, 1886, p. 39.

§ Bul. Cornell Agrl. Expt. Station.

show the results in closely related garden varieties of the same species. The matter of crossing cucurbits is not easy. It should be remembered that of the enormous number of pistillate flowers produced on a single plant but few squashes develop. Early in the season with some varieties like Italian Striped, few of the pistillate flowers, although fertilized, developed. The fruit invariably rotted; some withered on the vine when half grown. This was true also of such forms as Golden Bush, Long Warted, Turban, and common pumpkins. So that our failures are not to be wondered at. These failures were more common early in the season than later. For this there are two causes. When the work began there was considerable rain and great liability to rot, especially pronounced in varieties with a great deal of foliage like Italian Striped.

In crossing we chose the afternoon as being more convenient, but experience soon taught us that early morning was the proper time. Aubert, who has done some crossing with melons, states that he found that the morning gave him best results.

From this work I think we may fairly conclude that under natural conditions the different species of cucurbits will not cross. The several cases in which fruit has been produced may be due to the accidental carrying of pollen by insects, especially by the striped cucumber beetle, which gets in the bag.

The SECRETARY. The section on agriculture will have a meeting just before the convening of the general session to-morrow morning.

The meeting then adjourned.

MORNING SESSION, THURSDAY, NOVEMBER 17, 1892.

The meeting was called to order in the lecture hall of Tulane University at 10 a. m.

MR. ALVORD. Mr. Chairman, I have an announcement to make. It should be noted that all sections will have an opportunity of holding meetings directly after the adjournment of the general session this morning, and it is requested that all sections should be prepared to report their organization for the next year at the general session this evening, and also to present to the general session all matters of business on the part of the sections which require confirmatory action of the Association in general session. The regular program of the convention provides for sessions of all the sections this afternoon, and, so far as I know, there is no disposition to change that feature of the program, but there is from the local committee an invitation to all members to participate in an excursion on the river to Chalmette and Southport, which starts at 1 o'clock.

It is desirable that sections having programs to announce should announce them now. I will repeat the statement made last night that the college section, which meets on the adjournment of the general session, will listen to a discussion on "Waste in College Work," to be opened by President Smart, of Purdue University.

President Nicholson, of the Louisiana State University and Agricultural and Mechanical College, desires to make a statement.

MR. NICHOLSON. I wish to say to the convention that I will have to leave for Baton Rouge this afternoon and will take this opportunity of saying that the most cordial invitation is extended to all the delegates here to come to Baton Rouge to-morrow. It is understood that a special train will leave here to-morrow morning at 7 o'clock. It is contemplated that you will stop at one or two of the principal sugarhouses on the way, and you will probably reach Baton Rouge about 12 o'clock, or, perhaps, a little later. We will give you dinner there, but inasmuch as you will only be there about four hours we do not propose to make it a social dinner, because we want to show you something else. On the return trip the train will leave at 4 o'clock, in time for you to catch the evening trains here. Should you desire not to come back to New Orleans you can leave just as well from Baton Rouge as here. I observe that there are about one hundred and forty delegates here. We shall expect all of these one hundred and forty delegates to-morrow at Baton Rouge.

Mr. LEE, of Mississippi. I make a motion that a committee be appointed to designate officers for the Association for next year.

The motion was carried.

Mr. LEE, of Mississippi. I desire to present the following resolution:

Resolved, That this Association approves the recommendation of its president as contained in his annual address, and suggests to each institution receiving the benefits of the land-grant act of 1862 that there be placed in its library a bust of the author of that law and of the supplementary act of 1890—the Hon. Justin S. Morrill, of Vermont; that this subject be referred to the executive committee of the Association for appropriate action.

The PRESIDENT. Without a motion this will be referred to the executive committee.

The SECRETARY. Mr. Chairman, I have a telegram from Washington:

WASHINGTON, D. C., *November 16, 1892.*

A. W. HARRIS, for the Convention of Colleges and Stations,
New Orleans, La.:

Regret I can not leave. Reports are being prepared to the President of both the Department and the Exposition, to be presented this week. I wanted very much to look into your faces once more, officially, and to feel the inspiration of your work, but other duties intervene.

EDWIN WILLITS,
Assistant Secretary.

Mr. ARMSBY. I desire to offer a resolution:

Resolved, That the representatives of this Association upon the supervising committee for the Dairy Test at the World's Columbian Exposition be instructed to confer with Chief Buchanan in regard to editing and publishing the detailed records of said tests and to coöperate in making available to the experiment stations and the public the scientific and practical results.

The PRESIDENT. If there is no objection this will be referred to the executive committee.

Mr. ALVORD. I move, individually, that a committee of three be appointed to consider the courtesies extended to delegates to this convention during its session and to report appropriate resolutions thereon to the evening session of this Association.

The motion was carried.

The PRESIDENT. Is there any other miscellaneous business?

Mr. SANBORN. I offer the following:

Resolved, That it is the sense of this convention that the programs for future conventions be confined mainly to administrative and experimental questions that occur in the work of the colleges and stations, to the end that errors in methods of research, teaching, and administration may be eliminated and that the best methods growing out of common experience may be introduced by the several colleges and stations of the country.

This resolution was reported adversely by executive committee and was not adopted.

The PRESIDENT. If there is no other miscellaneous business we will proceed in regular order. We will now have a report by Director Armsby, of Pennsylvania, on the collective station exhibit at the World's Columbian Exposition.

Mr. Armsby submitted the following report:

REPORT OF COMMITTEE ON COÖPERATIVE STATION EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Your committee is glad to be able to report substantial progress and to express the belief that, if the contributions which have been promised are forthcoming at the proper time, we shall have an abundance of material for a most full and creditable exhibit of the work of the American experiment stations.

At the outset of our report it seems proper to call attention to the fact that we are reporting upon one aspect of a coöperative work. The initiative in this matter, it will be remembered, was taken by the U. S. Department of Agriculture, and it was the presentation of the subject by Mr. A. W. Harris, director (then assistant director) of the Office of Experiment Stations, at the convention of 1890, that led to the appointment of this committee. The resolution under which we were appointed recognized these facts and directed us to coöperate with the Department. These instructions have been strictly complied with and there has been the fullest and freest coöperation at every step. Whatever success the exhibit may meet with will be very largely due to the generous financial aid of the Department of Agriculture and to an even greater degree to the personal interest and counsel of its officials, especially of Assistant Secretary Willits.

Relations to the college exhibit.—It will be remembered that at the last convention of the Association a committee on a coöperative college exhibit was appointed and that the committees were instructed to coöperate. It was the understanding of both committees that the purpose of the Association in this action was not to set up two separate exhibits side by side, but to make the special work of each committee an integral part of a single combined exhibit of the twofold work of instruction and experimentation carried on by the institutions represented in the Association. There has, therefore, been the fullest coöperation and harmony between the two committees at every stage of the work, and, indeed, in all matters pertaining to the exhibit as a whole they have practically acted as one committee. While, consequently, this report relates specifically to the exhibit of the stations, it will necessarily include some references to points relating to the college exhibit.

Since its last report your committee has held meetings jointly with the college committee as follows: at Chicago, October 27 and 28, 1891; at Washington, September 15 and 16, 1892; at Chicago, November 12, 1892, and during the present convention. The chairmen of the two committees also had a conference with Chief Buchanan, of the agricultural department of the Exposition, and with the U. S. Department of Agriculture on January 27, 1892, at which time a definite assignment of space was made for the exhibit. It does not seem necessary to go into a detailed report of these various meetings. In place of that we desire to present a brief, general statement of what has been accomplished up to date.

Scope of the exhibit—As was explained in the former report of our committee and in the various circulars which it has issued, the exhibit is to be a "coöperative exhibit," showing the work of the institutions as a whole, rather than the complete work of any one institution. As intimated above, it is to be a unified exhibit, showing upon one side the experimental work of the stations and on the other the teaching work of the colleges. Between these two, and forming a connecting link, there are to be located such exhibits of the equipment and lines of work of the individual institutions as can be made by means of pictures, charts, etc., and also the working laboratories, showing the equipment for investigation and instruction, respectively, and exhibiting some of the simpler and more striking operations in each. It is also regarded as essential that competent demonstrators shall be in attendance to explain the exhibit. This it is hoped to provide for by a loan from the various stations of the services of one or more of their assistants for a limited time. This subject was before the general meeting of the two committees at Washington in September last, and the following resolution was adopted as expressing the judgment of the committees on this point:

Resolved, That, in the opinion of the committee, each college and each station should be requested to provide one attendant, who shall remain at the Exposition one month as demonstrator, his expenses during that time to be defrayed by the college or station sending him.

Location.—A vote of the Association at its last convention referred the question of the location of the experiment station exhibit to this committee in consultation with the Department of Agriculture and with the executive committee of the Association. At a joint meeting of the college and station committees in Chicago in November, 1891, this question was carefully considered and a change of location from the Government building to the Agricultural building was decided upon. The principal reasons for making the change were: First. That the college exhibit could not be made in the Government building, and the change was, therefore, necessary in order to combine the college and station exhibit into a whole. Second. That it was found possible to obtain considerably more space for the exhibit in the Agricultural building than was available in the Government building. Third. That a location in the Agricultural building would bring the exhibit more directly and effectively before the farmers of the country. The position assigned to the exhibits is a very advantageous one in the southwest corner of the Agricultural building, on the main floor, and immediately adjoining the exits leading to the colonnade connecting the Agricultural building with Machinery Hall and also the entrance to the Assembly Hall. The total amount of space assigned is 8,599.5 square feet, or nearly one-fifth of an acre. This is exclusive of the exterior aisles, varying from 10 to 18 feet in width, which surround the whole space. In this connection we desire to express our appreciation of the interest in our exhibit manifested by Mr. W. I. Buchanan, chief of the Department of Agriculture, especially as shown in this very liberal allotment of space, which, it should be added, was made considerably in advance of most other assignments in order to enable the committee to carry on its work to the best advantage.

Securing exhibits.—The main work of the committee, of course, has been the securing of exhibits typical of the work of the stations in their various departments. For this purpose, as explained in a former report, the preparation of each of the several departments of the exhibit was put in charge of a specialist under the general authority of the committee. These gentlemen and others whom they have associated with themselves have contributed freely of their time and ability to the work, often at considerable personal inconvenience, without other recompense than the satisfaction arising from the sense of contributing to the general welfare. Some changes have been necessary during the year, certain gentlemen finding it impossible to carry the work. Prof. Paquin, in charge of the veterinary portion of the exhibit, has severed his connection with experimemt station work. His place was filled by the appointment of Dr. W. L. Williams, of Purdue University, who in turn finds himself unable to continue the work, and Prof. E. A. A. Grange, of Michigan, has been requested to take charge of it. Messrs. Cooke and Thorne have felt obliged to resign the charge of the dairy and fertilizer exhibits, respectively, on account of very great pressure of work, and Messrs. H. H. Wing, of Cornell, and M. A. Scovell, of Kentucky, have been appointed in their places. All those in charge of specific departments of the exhibit have been appointed special agents of the Department of Agriculture, so that the expense of postage has thus been provided for. The committee has received full reports from all but one of these gentlemen. These reports need not be gone into in detail, but in general it may be said that in nearly every case the contributions promised are sufficient to insure a most interesting and typical exhibit of the work of the experiment stations in these several departments.

Work still to be done.—As will appear from what has been said, your committee feels that it has good grounds for confidence in the success of the exhibit. At the same time it is the part of wisdom to face fairly and fully the fact that abundance of time still remains in which to make a most disastrous failure. The buildings of the Exposition will soon be open for the reception of exhibits. With all the work which has been done your committee is yet able to put its hand upon very few exhibits that are actually prepared and ready for shipment. We have plenty of promises and we have every reason to believe that they will be honored, but it will not do to ignore the fact that very much still remains to be done.

Your committee is fully alive to its own responsibility in this particular. It has received, as already stated, detailed reports from most of the gentlemen in charge of the different departments of the exhibit, showing what exhibits had been offered in their several departments and the amount of space and size and style of cases desired, and it also expects similar reports from the others in the immediate future. At its meeting last week in Chicago, it also, in company with the director of the Office of Experiment Stations, representing the Department of Agriculture, and with numerous delegates to this convention, visited the Agricultural building and conferred with Chief Buchanan. Having all these data in hand, it is the purpose to proceed at once, in coöperation with the Department of Agriculture, with the designing and construction of cases and the arrangement and coördination of the exhibit as a whole. This work will be pushed forward as rapidly as possible, and we hope to have ready in ample season all the cases, etc., needed for the installation of the exhibit. But here our power ends. We can put the cases on the floor of the Agricultural building, we can arrange them and label them and decorate them, but we can not fill them.

We desire to impress upon every delegate present the importance of prompt action in the preparation of exhibits. Those of us who have visited the Exposition grounds and have seen the immense buildings begin to realize the enormous amount of material which will be brought in there during the next six months. Very thorough arrangements as to the shipping and receiving of exhibits are being perfected by the Government board, and we shall share in their benefits, but at best the proper installation of the exhibit under such conditions will require considerable time. It can be accomplished at all only by having all the material ready for shipping early, so that it may be on hand promptly when needed. The success of the exhibit, in our judgment, depends more upon this than upon any other point.

We hope we may count also upon the interest and the support, moral and material, of governing boards and of those in control of the financial affairs of the various institutions. While the committee has, in general, met with a hearty and encouraging response to its requests, it has been surprised and somewhat disheartened by the apparent indifference of some institutions and the direct refusal of others to give any material aid or encouragement to the exhibit. Such instances have led us to fear that the importance of this undertaking and the advantages sure to flow from it, if successful, as well as the very serious consequences of a failure, are not even yet fully appreciated. We believe that a reasonable contribution to this coöperative exhibit is both the duty and the privilege of every station. The United States is now appropriating nearly $700,000 annually to these stations. We believe it has a moral, even if not a legal, right to call upon them, through the Department of Agriculture, to improve this opportunity of showing to Congress, to the people of the United States, and to the world what use they are making of the most magnificent public provision for agricultural experimentation which the world has yet seen. The various State governments, too, are appropriating annually about $150,000 more. They, too, have a right to expect a good showing from their beneficiaries. If we make a meager, discreditable exhibit, the people who pay the taxes will hardly fail to draw the conclusion that the stations are failing to properly administer their trust.

Nor is it our own people alone whose judgment of us will be largely affected by this exhibit. Foreign visitors will be even more influenced in their estimate of us by our exhibit, since they have scarcely any other means of judging. It is anticipated that the agricultural congresses will draw to the Exposition agricultural experts from abroad, who will be specially interested in experiment station work. Moreover, the fact mentioned in the report of the executive committee that our exhibit is to be immediately adjacent to that made by the French Government of methods of teaching agriculture, as well as to that of the Rothamsted Experiment Station, showing the results of fifty years of work, and that in all probability the German experiment stations will make a similar exhibit in our immediate vicinity, brings us into direct competition with these nations. If we fail, we fail before the eyes of the world.

On the other hand, a good exhibit, such as we can easily make by united effort, one which shall properly set forth the range and variety of our work and its economic importance, will, we believe, do more to strengthen each station, even with the people of its own State, than any similar effort otherwise put forth. The occasion presents a great opportunity and a great public duty. There is a tide in the affairs of stations as well as of men. Shall we take it at the flood?

Respectfully submitted.

H. P. Armsby,
W. A. Henry,
Chas. E. Thorne,
S. M. Tracy,
G. E. Morrow,
Committee.

Mr. Dabney. I am glad indeed to get the information contained in this paper. It contained a great deal that we wanted to hear. The gentleman who prepared the report mentions the fact that some governing boards of institutions have been slow to act in making provision for the exhibit. If we have been, it is wholly from the want of information. This report supplies a good deal of information needed. To illustrate by our own case, I will say that we have never fairly understood exactly what part our station would take in the collective exhibit. They were laboring under the impression that the exhibit would be taken care of by the Department of Agriculture as a portion of the exhibit of the U. S. Department of Agriculture. While we have been preparing our exhibit so far we have made no provision and I do not think the trustees contemplate making a provision for the expense of taking care of the exhibit after it reaches Chicago. Our board meets in December and it is desirable that we should know what expenses we are expected to provide for, and as it will be the last meeting before spring I would like to have a little more information along that line. What is expected of us, financially?

Mr. ROBERTS. Will you allow me to remark that there is another report which will explain what Dr. Dabney wishes to know?

The PRESIDENT. I will now name the committees appointed. The committee to propose proper resolutions for courtesies extended the convention, Messrs. Morrow, Scott, and Wiley. The committee for nominating officers for the ensuing year, Messrs. Lee of Mississippi, Goodell, Thorne, Neilson, Hadley, Loughridge, and Wing.

We will now have the report of the committee on the collective college exhibit.

Mr. Alvord submitted the following report.

REPORT OF THE COMMITTEE ON THE COLLECTIVE COLLEGE EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

After the resignation of Presidents Atherton and Smart from this special committee as originally appointed, its duties were assumed by the executive committee, and the work since done is now reported upon for that committee.

Early in September an office was opened in Washington city and active operations begun to interest the trustees and executive officers of the various colleges and other institutions receiving the benefits of the act of Congress of July, 1862, and August, 1890, in the proposed collective exhibit by these institutions, in the Agricultural Building of the Exposition. While the U. S. Department of Agriculture is unable to directly recognize this effort on the part of the colleges, it has shown much interest in the subject and has in various ways materially promoted the same.

This committee has coöperated with the one in charge of the exhibit of the experiment stations and shares with the latter in the general space assigned by the chief of the Department of Agriculture of the Exposition. The laboratories for illustrating work in chemistry, botany, and zoölogy and the veterinary alcoves will occupy space to some extent common to the college and station exhibits and represent instruction and the facilities for instruction in those departments, as well as investigation therein. Adjoining the zoölogical laboratory and veterinary alcove, a rectangular space 30 by 34 feet has been assigned for the department of college instruction in agriculture and horticulture. Just across the central aisle, four apartments or divisions are laid out, to be occupied respectively by (1) chemistry, (2) civil engineering and drawing, (3) domestic and fine arts (mainly women's work), and (4) mechanic arts and engineering, including electricity. The first three named have each a floor space about 17 feet square, and the last one a space 22 by 40 feet.

It is proposed to ask the various colleges to loan for exhibit in these different departments models, apparatus, and other material showing the facilities they possess for giving instruction in the several lines named, and also material in objects, illustrations, or data, showing the results of such instruction. It is believed that the preparation of the material can be accomplished without burdensome labor on the part of the colleges and that it can be arranged to transport the same to Chicago, install and care for the exhibits, and return the property without direct cost to the contributing institutions. It becomes, virtually, a loan exhibition, the several contributors being at some trouble, but very little expense, in suitably preparing the articles for exhibition.

Every article or part of the exhibit will have proper labels attached, indicating what institution is the owner and contributor. It is not expected that any one college will largely contribute to any one department, but hoped that the colleges will generally be found ready to be represented in several different sections or departments.

The committee in the course of its work thus far has found a general desire on the part of the presidents and professors of colleges to have their institutions participate in this exhibit, but in many cases much misconception of the plan in detail and of the labor and expense involved. A greater obstacle to progress is the feeling on the part of a number of boards of trustees that they cannot afford the necessary expense and that, if they could, such use of their funds is inexpedient, if not illegal.

Your committee recommends that this subject be thoroughly discussed at the present convention, with a view to obtaining a consensus of opinion as to what the several land-grant colleges can do and what they ought to do in regard to this exhibit, including the views of college trustees, in order that the same may be formulated for the information and guidance of all concerned.

Attention is also called to the fact that this college exhibit matter is now in the hands of the executive committee which ceases to exist with the adjournment of this convention. Suitable provision should therefore be made for continuing the work.

Respectfully submitted.

HENRY E. ALVORD,
Chairman.

The PRESIDENT. We will next have the report of the committee on the World's Agricultural Congress.

Mr. MORROW presented the following report:

REPORT OF THE COMMITTEE ON THE WORLD'S AGRICULTURAL CONGRESS.

The committee of conference with the authorities of the World's Columbian Exposition, as represented by the World's Congress Auxiliary, concerning the Agricultural Congress to be held during the Exposition, take pleasure in reporting that the plans for that congress are so far perfected as to assure its marked success.

The Congress will be held during the last half of the month of October, 1893, in the new and magnificent Art Palace in Chicago, in which is provided a large number of audience rooms with seating capacity of from 300 to 3,000. If desirable, sessions of the Congress may be held in the assembly hall of the Agricultural Building on the Exposition grounds, near the collective exhibit of the colleges and stations.

As the Exposition Authorities, through the Congress Auxiliary, assume full responsibility for the congresses in the matter of providing meeting places, printing, and distributing announcements and programs, and hope to provide for the publication of the proceedings, the arrangements for each congress rest with this auxiliary, a control committee of which, mainly made up of persons living near Chicago, is appointed for each congress. There are also special committees for each division of the different congresses.

Still further, there are advisory councils composed of persons especially eminent in the department covered by the congress and honorary members of each congress.

This Association has been recognized in these committees and will be very prominently represented in the advisory council and honorary membership.

The Congress Auxiliary also invites the appointment by this Association of a committee of coöperation with the committee of the Auxiliary.

The plans for the Agricultural Congress provide for sessions of the congress as a whole, for addresses from the official representatives of agriculture in different nations, and other addresses of general interest; also for meetings of the following divisions:

(1) General farm culture; (2) animal industry; (3) horticulture (in August); (4) organization and legislation; (5) education and experiment.

So far as may be advisable the different divisions will also subdivide for sectional meetings.

Agricultural education has been assigned a place in the educational congress to be held in July, and this Association is represented on the committees for that congress.

The committee desires to express its hearty appreciation of the cordial interest shown in the Agricultural Congress by the Congress Auxiliary, through its president, Hon. C. C. Bonney, of Chicago.

The chairman also desires to express his appreciation of the aid given him by Assistant Secretary of Agriculture Willits, and his regret that it was found impracticable to frequently confer with the other member of the committee, the honorable president of this Association.

The committee has had a constantly increasing appreciation of the importance of the great series of world's congresses, of which that devoted to agriculture forms a part, and, in some sense, a climax; of the thoroughness of the plans and organization of the Congress Auxiliary and the abundant provision made for places of meeting, publication, etc., and of the widespread interest taken in many of the congresses. It records its conviction that the Agricultural Congress will be the most largely attended and most important meeting of the kind ever held, and that the extraordinarily favorable connection of this Association with the Congress makes it a duty, as well as a privilege, for the Association to exert itself to the fullest extent in utilizing this unprecedented opportunity for widening the influence of the institutions of which it is composed, not only by participation in the division of the Congress in which there is the most direct interest, but equally in each of the others.

The committee recommends that this Association, officially and through its membership, give the heartiest coöperation to the World's Congress Auxiliary of the World's Columbian Exposition, in preparing for the Agricultural Congress to be held in Chicago the last half of October, 1893.

That a committee of coöperation, consisting of five members, be appointed to aid the committee of the auxiliary, having the Agricultural Congress in charge, and also to give such assistance as may be necessary in having a suitable recognition of agricultural education in the several educational congresses to be held in July, 1893.

As it is believed it will be most advisable that the annual meeting of this Association for 1893 be held at Chicago in connection with this Congress, in which case it is important that the officers of the Association should be in intimate relations with the Congress, it is recommended that the appointment of the committee be left to the executive committee.

It is further recommended that the members of the Association nominate to the agricultural committee of the Congress Auxiliary the names of suitable persons to be placed on the advisory council, and also those best entitled to recognition as honorary and corresponding members of the Congress.

G. E. Morrow,
Chairman for the Committee.

A full discussion followed, participated in by a number of delegates, regarding the subjects presented by the three reports preceding, and the work of the colleges and stations in connection with the proposed exhibits.

Mr. Morrow. As this question involves finance, I will ask if it will not be a matter to refer to the executive committee.

The President. Each of these reports will be referred to the executive committee, if there is no objection. They are so referred.

Mr. MORROW. In accordance with the request of the World's Congress Auxiliary that this Association appoint a committee to coöperate with the committee on the Agricultural Congress, and owing to the important relation in which this committee stands, it should be appointed by the executive committee. I will therefore move that the recommendations of this committee be approved.

The motion was carried.

Mr. MERRY (agent of the Illinois Central Railroad). I desire to make the announcement that a special train will leave at 7 o'clock. The railroad schedule is not quite so flexible as the time for convening of the Association. It will therefore be absolutely necessary that every member of the convention who desires to make the trip shall be at the Illinois Central depot at 7 o'clock.

The Association then adjourned at 12 o'clock.

EVENING SESSION, THURSDAY, NOVEMBER 17, 1892.

The meeting was called to order by Vice-President Dabney at 8 o'clock.

The PRESIDING OFFICER. The program for this evening calls for the consideration of resolutions and general business.

Mr. Alvord here presented the program of the evening slightly changed.

The PRESIDING OFFICER. The executive committee have arranged the program as follows: First, the report of the committee appointed to confer with the Weather Bureau, Mr. Harris, chairman.

Mr. HARRIS. I am not chairman of that committee, but am requested to present the report. It is as follows:

REPORT OF COMMITTEE ON COÖPERATION WITH THE UNITED STATES WEATHER BUREAU.

MR. PRESIDENT AND GENTLEMEN OF THE ASSOCIATION: Immediately after the close of the Washington convention your committee called upon the Assistant Secretary of Agriculture and the Chief of the Weather Bureau. Secretary Willits expressed his hearty sympathy with the Association and paved the way for numerous interviews with Prof. Harrington. He received us most cordially and declared his desire to aid us.

In order to gather together the information already in existence in regard to the relations of agriculture and meteorology, he asked your committee to suggest to him subjects which should be studied and the names of persons qualified for this work. These suggestions were promptly adopted, and as a result the Bureau has published two bulletins, with which the members of this Association are already familiar. They are: By Prof. Hilgard, on Relations of Soils to Climate; by Prof. Whitney, on Some Physical Properties of Soils in their Relation to Moisture and Crop Distribution.

Prof. Harrington has also furnished to the Office of Experiment Stations a bulletin on Meteorological Work for Agricultural Experiment Stations.

Much has also been attempted for agriculture in the regular work of the Bureau.

Cotton region service.—The Bureau has continued to render important information to cotton-growers. After consultation with the observers in charge of the several centers and upon the urgent requests of the commercial exchanges, the time for taking and reporting the observations was extended. These are now made from April 16 to November 30 of each year. Many requests for the establishment of new stations have been received; but it has been only practicable to open two. In order to establish nine stations of a somewhat similar character in the sugar and rice growing districts, and to keep within the appropriation, it was necessary to discontinue nine of the less important cotton region stations.

Flood predictions.—There are now in active operation 166 special river stations and 59 special rainfall stations. These are arranged in groups or sections under the supervision of central stations. The river observers record the rainfall also. River bulletins are issued at 22 places. Stage predictions of some of the principal rivers are made daily at Washington and local predictions are made at many points.

State weather service.—State weather service work has been carried on to a much greater extent than heretofore; and the results accomplished prove the usefulness and importance of this branch of the Bureau. The entire territory of the United States with the exception of Alaska is now covered by local weather services, the last organized being that for Idaho. The regular monthly reports now contain important tables, and it is possible now to obtain the special features of the climate of every section of the country. Thus farmers, and all others have a means of securing detailed information.

Besides the National Bulletin, all the States and Territories, except Nevada and Idaho, issue local bulletins during the season of planting, cultivation, and harvesting of crops which form a most important feature of State weather service work. Such has been the demand for the National Bulletin that the edition has been more than doubled and yet the demand increases. The text of the bulletin is telegraphed by the press associations and is reproduced either in whole or in part in many papers.

The distribution of forecasts, frosts, and cold-wave warnings has greatly increased during the past year, but has been hampered by inadequate appropriations for telegraphic purposes. The increase in the number of stations supplied by telegraph at Government expense with the daily forecasts, as compared with the number supplied on June 30, 1891, is over 200 per cent, and on the 1st of July, 1892, our lists show a total number of 1,888 receiving a daily telegram at the expense of the Weather Bureau.

A large number of applications could not be favorably considered, as the allotment of the telegraph appropriation would not admit of any increase over the number already supplied. One hundred and thirty-six stations have been established under the auspices of the National Grange of the Patrons of Husbandry, many of which were supplied with flags by the Weather Bureau, while others disseminated the forecasts and warnings by means of steam whistles.

The railroad telegraph and train service, as gratuitous means of distribution, are largely utilized, and nearly 3,000 places receive the forecasts daily in this manner, and over 1,000 points are supplied by mail or a free telegraph or telephone service.

The PRESIDING OFFICER. What will you do with the report, gentlemen?

The report was accepted and placed in the hands of the executive committee.

Mr. ALVORD. If there are no other matters of special business to be brought up the executive committee is ready to report back the resolutions referred to it for the action of the convention.

Dr. Armsby's resolution is somewhat modified and recommended for adoption in the following form:

Resolved, That the representatives of this Association upon the supervising committee for the dairy tests at the World's Columbian Exposition be instructed to confer with Chief Buchanan in regard to editing and publishing the detailed records of said tests, and to coöperate in making available to the experiment stations and the public the scientific and practical results.

The resolution was adopted.

Mr. ALVORD. The following resolution is offered by the executive committee as covering a subject that has not received the attention of the convention up to this time:

Resolved, That the communication from Chief Buchanan of the Department of Agriculture of the World's Columbian Exposition, in relation to a course of popular lectures in connection with the agricultural exhibit be referred to the executive committee with power to coöperate in this project at the discretion of said committee.

The resolution was adopted.

The resolution offered by Mr. Lee is reported back somewhat modified with recommendation for its adoption as follows:

Resolved, That this Association approves the recommendation of its president as contained in the annual address and suggests to each institution receiving the benefits of the land grant act of 1862, that there be placed in its library a bust of the author of that law and of the supplementary act of 1890, the Hon. Justin S. Morrill, of Vermont.

Resolved, That this subject be referred to the executive committee of the Association for appropriate action.

The resolutions were adopted.

The executive committee offered a resolution as to the annual dues of institutions.

Mr. ROBERTS. When the constitution was adopted I ran against the word institution, and it was not defined there so that I could understand it. Many stations are added to a college and are not institutions in any sense of the word—they are departments of institutions; so it seems to me that a little explanation is necessary in this resolution—at least it took me a considerable time to get through my head that wherever the word "institution" occurred in the constitution, and in this resolution it means a college or an experiment station, and that the dues will be $10 for each college and $10 for each experiment station.

The SECRETARY. I think the point well taken. I am frequently written and asked whether that means for the whole institution.

Mr. HAYS. I move that the resolution read, instead of "each institution," "each college and each experiment station."

The executive committee accepted the amendment, and the resolution was adopted, as follows:

Resolved, That for the ensuing year the annual dues for each college and each experiment station entitled to membership in this Association shall be $10; and

Resolved further, That in view of possible extraordinary expenses, the executive committee be authorized to call, if necessary, for additional contributions from each college or experiment station, in which case the needs and purposes shall be fully stated.

President Turner, of West Virginia, offered the following resolution, which was handed in directly to the executive committee. The committee submitted this with the recommendation that it be referred to the new executive committee:

Resolved, That hereafter the annual sessions of the Association shall continue at least four days; and there shall be but one general session each day and but one session of each section each day.

The reference recommended by the committee was ordered.

The following resolution was offered by Mr. Sanborn:

Resolved, That it is the sense of this convention, that the program for future meetings be confined mainly to administrative and experimental questions that occur in the work of colleges and stations to the end that errors in methods of research, teaching, and administration may be eliminated and that the best methods growing out of common experience may be introduced by the several colleges and stations of the country.

The committee sympathized with the spirit of this resolution, but believed the desired object could be attained by a strict construction of the constitution without further legislation and therefore recommended that this resolution be referred to the new executive committee.

The recommendation of the executive committee was adopted.

The executive committee recommended that when the present general session adjourn, it should be to meet the next evening at Parlor P, of the St. Charles Hotel, with the understanding that nothing but the usual closing business of the convention be then transacted—acknowledgments of courtesies and so on—and that the special committee appointed on that subject be then called upon to report.

On motion the recommendation of the executive committee was adopted.

ELECTION OF OFFICERS.

The PRESIDING OFFICER. The next thing, gentlemen, according to the program is the election of officers. We will now have the report of the nominating committee.

Mr. LEE, of Mississippi. The committee submit the following names for officers for the next year:

President, W. A. Henry, Wisconsin.

Vice-presidents, W. C. Stubbs, Louisiana; E. W. Hilgard, California; John A. Myers, West Virginia; A. Q. Holladay, North Carolina; J. F. Hickman, Ohio.

Secretary and treasurer, M. A. Scovell, Kentucky.

Bibliographer, S. W. Johnson, Connecticut.

Executive committee, H. E. Alvord, District of Columbia; James Neilson, New Jersey; H. H. Goodell, Massachusetts; C. W. Dabney, jr., Tennessee; the president, junior ex-president, and the secretary and treasurer.

The PRESIDING OFFICER. Gentlemen, you have heard the report of committee. What will you do with it?

Mr. ROBERTS. I move that the report be accepted.

Carried.

Mr. HAYS. I move that the secretary be instructed to cast the ballot for the Association.

Carried, and the secretary was instructed to cast the ballot for the Association.

This being done, the nominees reported by the committee were declared to be duly elected.

The PRESIDING OFFICER. Next, reports from sections. I will call them in no particular order. The Section on College Work.

Mr. Turner reported the following nominations for officers of that section: Chairman, President C. W. Dabney, of Tennessee; vice-chairman, President George T. Fairchild, of Kansas; secretary, President M. C. Fernald, of Maine.

Mr. ALVORD. I move that the nominations for chairman and secretary be confirmed. We have nothing to do with the vice-chairman.

Carried.

Next, the Section on Agriculture and Chemistry.

Mr. HUNT. Mr. Quick was expected to make the report. I will say that the nominations were as follows: Chairman, W. A. Henry, of Wisconsin; vice-chairman, W. C. Stubbs, of Louisiana; Secretary, W. C. Latta, of Indiana.

Nominations confirmed.

Next, Section on Horticulture and Botany.

The secretary read the nominations submitted as follows: Chairman, F. Lamson-Scribner, of Tennessee; Secretary, E. S. Goff, of Wisconsin. Nominations confirmed.

Next, Section on Entomology.

The secretary said that he had been requested by Mr. Osborn to state—

That, as only two entomologists were present at the time for organization of that section and as neither of the officers was here, it was deemed best not to organize the section, and consequently no nominations were ready. And to ask that the Association elect officers for the coming year, as it is probable that there will be a better attendance and it will be desirable to have a report of progress in that line.

Mr. SANBORN. I move that Mr. H. Osborn be made chairman of the section.

The PRESIDING OFFICER. Is this regular; can it be done? I think under the constitution a section must elect its own officers.

Mr. DEPASS. I think we are equal to the occasion.

Mr. TRACY. I think the constitution says the old officers shall hold over.

The PRESIDING OFFICER. The officers will hold over.

Mr. LEE, of Mississippi. The Section on Mechanic Arts reports the following nominations: Chairman, C. W. Hall, of Minnesota; secretary, F. Paul Anderson, of Kentucky.

Nominations confirmed.

The PRESIDING OFFICER. I believe there is a committee to report at this time on the Test of dairy cows at the World's Columbian Exposition.

Mr. NEALE, of Delaware. The following resolution was handed to your committee for consideration:

Whereas this Association has received a request from the authorities of the World's Columbian Exposition to nominate four persons to be appointed members of the committee to supervise the tests of dairy cows during the exposition at Chicago; and

Whereas this is a subject of such importance as to require the most careful consideration, with a view to appropriate action: Therefore,

Resolved, That a committee of five be appointed by the Chair to consider this subject and to report to this convention the names of four persons suitable for members of the said testing committee, and to also report what further action is advisable in the premises.

Referred by the president to Dr. A. T. Neale, of Delaware; Dr. G. W. Atherton, of Pennsylvania; Dr. J. A. Myers, of West Virginia; Prof. W. A. Henry, of Wisconsin; Prof. F. A. Gulley, of Arizona.

The committee to which was referred the above resolutions respectfully reports the names of four gentlemen, viz: M. A. Scovell, of Kentucky, chairman; I. P. Roberts, of New York; S. M. Babcock, of Wisconsin; H. P. Armsby, of Pennsylvania; and respectfully suggests that the executive committee of this Association be authorized to provide, on consultation with the above-named gentlemen of the testing committee, for the payment of the necessary expenses incurred by said gentlemen in supervising said tests, funds to be secured in such manner as may be found to be most expedient.

A. T. NEALE,
GEO. W. ATHERTON,
W. A. HENRY,
JOHN A. MYERS.

The report of the committee was adopted.

Mr. SMART. The committee appointed to consider the question of compiling intercollegiate statistics has held a meeting to consider the subject as fully as possible under the circumstances. The committee finds itself unable to report a plan for permanent adoption, and it therefore has prepared a resolution which will cover the ground for the present and suggests that a committee be appointed to consider the subject further. President Atherton will read the report.

Mr. ATHERTON. The committee have had the subject under consideration and make the following recommendation:

(1) That a committee of three be appointed, whose duty it shall be, by conference with members of the Association and by such other means as they may find advisable, to prepare a form of blank which will present in the most simple and complete manner such statistics of the resources, income, expenditures, and activities of the colleges forming this Association as are likely to be most generally desired, and to gather, collate, and distribute such statistics as early as practicable.

(2) That the said committee shall report to this Association at its next convention a plan for the permanent continuance of such work.

J. H. SMART.
GEO. W. ATHERTON.
HENRY H. GOODELL.

If it is the proper stage of the proceedings, I move the continuance of the same committee on this subject.

Mr. SMART. I suggest that Mr. Atherton be made chairman of this committee as he has agreed to do the work, and it is proper that the circulars should go out in his name.

Adopted.

Mr. ATHERTON. May I make a single request of the college and station men present. That before leaving the city or immediately after, they mail me at my home a statement of the things they desire to be included in these statistics, and when we get up a blank it will contain all suggestions from all quarters.

The PRESIDING OFFICER. Anything further.

Mr. FREAR. I move that the executive committee be instructed to coöperate with the director of the Office of Experiment Stations in the preparation and editing of the proceedings of this convention for publication.

Carried.

Mr. ATHERTON. I have one more matter that I desire to bring before the Association, which I think is of importance. In the report of the Knoxville meeting on p. 96 it will be found that the Association took action previous to the incoming (present) administration at Washington for the purpose of impressing upon the President, then elect, and upon the Secretary of Agriculture to be appointed, the importance of keeping the scientific work of the Department as closely as possible under his own control and direction, so that the Secretary in his administration of the Department should so far as possible be able to coöperate with the Association. The President-elect and the new Secretary of Agriculture very cordially responded to that suggestion and the whole policy of the new Department was based especially upon the suggestion of the Association in that respect. I now suggest to the Association considering the present turn of things, a new administration coming in, whether it is not expedient and feasible that the same step should be taken? With that view I have taken up the two preambles of the resolution then adopted, which I will ask leave to read, accompanied with another preamble and a short resolution:

Whereas the Department of Agriculture has become one of the important scientific departments of the executive branch of the Government of the United States, and in reality a great experiment station in itself, its various divisions being managed in most cases by men of recognized ability and scientific attainments; and

Whereas recent years have rapidly developed the character of this Department, which, if the system of State experiment stations be included, now exceeds in magnitude any other scientific work of the Federal Government; and

Whereas this encouraging development and satisfactory condition of the scientific work is largely due to the broad-minded and enlightened policy which has been pursued for several years past of administering these branches of the Department upon a thoroughly nonpartisan basis, securing permanency in position of their officers and assistants; therefore

Resolved, That the executive committee be, and hereby is, instructed to take such steps as it may deem expedient for calling this entire subject to the attention of the President-elect, and respectfully urging upon him the continuance of the same policy; and

Resolved, That the executive committee be instructed to coöperate with the said Department, in every way possible, in advancing the character and stability of its scientific work.

The preamble and resolutions were adopted after some discussion.

The SECRETARY. I call attention to the fact that the auditing committee has not reported as yet.

Mr. HUNT. Mr. President, your committee to which was referred the report of the treasurer has carefully examined his accounts and find them correct. Vouchers are on file for the amounts paid out, all of which have been properly approved and receipted.

The report was accepted.

Mr. FAIRCHILD. May I ask for information at this point on an entirely different matter? When the reports of presidents of colleges was called for two years ago, the first report of presidents of colleges under the act of 1890, it was announced that the United States Government would consolidate, edit, and publish those reports. I would like to ask the executive committee if anything has been done or why it has not been done? The suggestion was made at the time the report was called for, that it be sent to the Commissioner of Education, the requirements being that reports of the president be sent to the Secretary of Agriculture and the Secretary of the Interior.

Mr. ALVORD. The chief clerk of the Bureau of Education is here and would probably be a better person to answer that question, and he may allude to it presently. I think I may say a word, however. I know that the Department of the Interior has the manuscript now ready for the press.

Mr. FAIRCHILD. May I ask still further on the same subject as to the law requiring these reports be distributed to colleges, a copy is to be sent to each college, I believe, but as yet we have never received such reports. What ought to be done by us in the premises?

Mr. HADLEY. In New Mexico we have the same difficulty that President Fairchild speaks of. We have just received from the printer both of our reports and they are now ready for distribution.

The PRESIDING OFFICER. The time has come when we should take up the discussion of the evening. Under the new Morrill act the colleges have been brought closer to the Bureau of Education than ever before. In view of this the Association has asked the Bureau to send a representative to discuss this matter. Further, we have made this Bureau a regular member of this Association. We have with us Mr. J. W. Holcombe, chief clerk, and I have the pleasure of introducing him for the discussion of the relations of the colleges to the Department of the Interior.

Mr. Holcombe then read the following paper:

The Relation of the Agricultural and Mechanical Colleges to the Department of the Interior.

With so rich a program before the convention it is my duty to be brief and, in connection with the present topic, merely to suggest some of the points for discussion under "the relations of the colleges and the Department of the Interior," presenting a view of those relations from the side of the Department, and giving an opportunity for expressions of opinion to the men who administer the institutions themselves which receive the benefits of the several acts of Congress in aid of colleges of agriculture and the mechanic arts.

The first of these acts, that of 1862, which made the grants of land to the several States, can not be said to have established any relations with the Department of the Interior, as nothing more was required of that Department than the clerical duty of issuing patents and scrip for the location of the land. Even the requirement that an annual report be filed with the Secretary of the Interior has not been insisted upon by the Department and was generally lost sight of by the colleges. The act of 1887 for the encouragement of experiment stations makes the Department of Agriculture an efficient auxiliary and unifying influence in the work of these useful institutions, but gives the Interior Department no connection with them whatever. The act of 1890 appropriates certain sums directly out of the Federal Treasury, limits the application thereof strictly to certain specified subjects, and goes far beyond the previous acts in the definiteness and its requirements respecting the making of reports, their contents, and the time of filing them. By implication at least, if not directly, it requires a strict accounting to the Federal Government for the use of the funds received. Such implication is found in reading together the mandatory limitations upon the uses to which the fund shall be applied, the mandate that the Secretary of the Interior shall ascertain each year and certify to the Secretary of the Treasury respecting each State and Territory whether it is entitled to receive a share of the fund for that year, and the further mandate charging the Secretary of the Interior with the proper administration of the law. What facts can the Secretary ascertain upon which to decide whether a State is entitled to a payment? Surely no other than whether the funds already received have been applied only to the subjects named in the act of Congress. And how can he make certification to the Secretary of the Treasury, and otherwise properly administer the law, unless he can demand from each State full and complete reports, as detailed, as specific, as inquisitorial as may be necessary to satisfy his mind and conscience; that is, to satisfy the Federal executive power? A great and radical step beyond previous legislation must be recognized here. The land grant of 1862 amounted to an absolute gift. If the institutions established did not teach agriculture or military tactics (and many of them did not do so for years,) the President and his Cabinet and the entire judiciary of the United States might whistle to the winds for redress. But this last act establishes, to put it plainly, Federal control and supervision over the use of the fund created. If any dangers, therefore, lurk in the possibility of Federal interference and Federal dictation, the beneficiaries of this last Congressional grant are liable thereto.

Do we not remember, my hearers, a Will-o'-the-Wisp which led many a vain dance for a dozen years, the steps of which are marked by preambles and resolutions of national and State educational associations, county institutes and other teachers' meetings, religious conventions, synods and assemblies, and gatherings together of every character and description? Do we not all remember it, a delusive phantom now at last happily laid to rest forever: Federal aid to education in the States, familiarly known as the Blair bill. The Blair bill is dead, but this act of 1890 contains some of its features and other features of control which must in time have been added to any measure of Federal aid. What Congress would not do in reference to the general educational systems of the States it has done in reference to a limited field of the higher education. The cordial acceptance of such a measure by the legislatures of all the States surely indicates that there is no real danger from Federal interference and that jealousy of the Federal power on that score has disappeared. At any rate we need not expect ever to see United States deputy marshals stationed in your class-rooms of economic science to note whether you teach protection or free trade.

But that there is a possibility of Federal dictation in this act is proved by the fact that our distinguished Commissioner of Education, a man who is most emphatic in his belief in State and local autonomy, was yet of the opinion that the words, "the legislature shall propose and report to the Secretary of the Interior a just and equitable division of the fund," gave the Secretary the power and made it his duty to sit in judgment respecting such proposed division. Thus the Secretary could oppose his opinion of justice and equity against that of a State legislature, and in one case the funds of a State were unfortunately withheld till a special act of Congress directed their payment.

But in this connection, let me say I deem it very fortunate that the Secretary of the Interior committed the administration of this act to the Commissioner of Education, rather than to a force of routine clerks in some division of the Secretary's large office. Thus was secured an inauguration of the act from, I may say, a sympathetic point of view with a comprehension of the conditions and needs of the colleges and of the new institutions which were called into being by the act of Congress. The Commissioner and his assistants in the Bureau hailed it as a step which would bring the Bureau of Education into vital relations with these valuable and growing institutions which have been justly called, and doubtless are, the true American universities of the future. It is hoped that the relations thus established may prove more and more helpful to the colleges as the years go by. In this hope the Secretary of the Interior, on the advice of the Commissioner of Education, has sent me to represent them both at this convention, to express their cordial interest in your work, their profound faith in the future of the American colleges of agriculture and the mechanic arts. The action of your association in providing in its constitution that a representative of the Department of the Interior shall be a delegate to your conventions with full rights and privileges of membership will be recognized by them with pleasure as a response in like spirit to their friendly advances.

There are two definite points to which I beg leave to invite your attention. One is the time at which treasurers' reports are to be filed. The law says September 1. Strange to say a few institutions did not have their reports in on time. Some wrote asking if a delay would make any difference, some offered one apology, some another. But, the language of the law being explicit on this point, the Commissioner will have to submit the question to the Assistant Attorney-General before venturing to recommend that any State where such failure has occurred be certified as entitled to the next installment of the fund.

The other matter is the form of the schedules for the treasurers' reports. This form, you will remember, was devised by a committee of this Association, in August, 1891, and was agreed to by the Commissioner of Education. But its sufficiency has been questioned by a number of treasurers themselves, and an experience of two years in handling the returns and conducting a correspondence about them has led me to doubt whether the present form of accounting for the expenditure of the grant of 1890 would stand a crucial test, which might be applied to it some time in the future. I will not go into particulars, as these are well understood by you, but will here leave the subject to be dealt with by the wisdom of the Association.

Mr. Scott. I suppose the paper is open for discussion. I have an engagement this evening, but am very anxious to say a word or two on the point last presented by the reader of the paper. In fact I may say that was one of the main purposes of my coming here at this time. Last year at the convention this matter of a form of schedule for the reports of presidents of colleges to the Secretaries of the Interior and Agriculture seemed to me to be a matter of gravest importance and therefore in the section of college work I urged very strongly that the matter be taken up and that it be given into the hands of a committee then appointed for another purpose. This committee brought this matter, as has been stated by the reader of the paper, to the attention of the Secretary of the Interior, but it seems to me that the result is very unsatisfactory. The representative of the Interior Department has so expressed himself in his paper and I suppose he gives the official sentiment from that source.

I came here for the purpose, let me frankly say, Mr. President, of moving that a special committee be appointed to confer with the proper authorities at Washington for the revision of our form of schedule. No doubt we have begun our books in accordance with this schedule, but already the report comes from the Department that it is unsatisfactory to them and it certainly is to us. I therefore move, Mr. President, that a special committee of three be appointed to consider with the authorities at Washington the advisability of revising the present form of schedule for returns from treasurers of colleges.

The PRESIDING OFFICER. Gentlemen, you have heard the motion. Are you ready for the question?

Mr. ALVORD. I merely rise to ask whether this closes the general discussion. It only covers one point.

Mr. FAIRCHILD. I should like to have Mr. Scott go a little more into particulars and to designate what his idea is with reference to that schedule since the probability is that he will be chairman of that committee.

The PRESIDING OFFICER. We are all interested in this question.

Mr. SCOTT. Of course we wish to conform to the views of the Department first of all. The representative of that Department has not gone into details, and therefore I could not forestall any suggestions that should come from the Department. The motion, if the gentleman will recollect, is that the committee consider the advisability of revising; the Department will pass upon it. There are many particulars that might be stated here. It is most difficult in our bookkeeping to separate the articles. There has never been an official statement as to what is "stock," "materials," "apparatus;" so that it seems to me that this ought to be considered by this committee, that the proper classification should be made to conform exactly to the spirit and letter of the law, and a better classification covering the same ground covered here. I have no special schedule prepared.

Mr. PORTER. President Scott will remember that this question was fully discussed before the commissioner at the time, and all these questions were put to him specifically as to what they meant and a strict interpretation as to their acceptation. Maj. Alvord was there and probably remembers the conversation. Unfortunately these answers were not put in an official form.

Mr. FAIRCHILD. I wish to express hearty sympathy with the idea of making a more exact report coming from the treasurers, that it be as accurate as possible in the statements as to what we have done with the money, and I wish to second heartily anything to enable institutions to meet the requirements of the law.

Mr. DEPASS. If I understand properly the motion of President Scott it is this: It is on the premise that the Department of the Interior has the right to say what kind of a report should be made, and that this is simply a committee appointed by this body to advise with the Department. The Department at last will decide on the schedule. This is a very reasonable request, and I hope the question will be put and we will let Mr. Scott keep his evening engagement.

Mr. ATHERTON. I would like to ask what especial difficulty Dr. Scott finds. There has been none with us, but I can readily understand where it might arise. I would like to ask Dr. Scott as to how the committee is to get at any judgment in consultation with the officers at Washington which will be any more likely to represent the interests of those present; that is to say, how will this committee when agreeing on something know that they are meeting the views of the Association? I do not see how we are to get any benefit from that plan. It may be just as unsatisfactory. I would like to suggest another plan. Why not submit the question to the executive committee? It seems to me that we should first have a consultation among ourselves and see where the difficulties lie and submit them to the Department. With all respect to Dr. Scott, and a desire to further this idea, I do not see where we will gain anything by this method.

Mr. SCOTT. The object is first to meet the views of the Department, as here expressed, that the schedule on which returns are now made is unsatisfactory. Let us have a committee to consult with the Department and inquire as to its views, and then have the committee obtain the opinion of the treasurers of the different institutions on the proposed form.

I apprehend the very difficulty before was that it was done in a hurry. Mr. Porter states that it was done after full consideration. We did not even think of it ourselves until the motion had been passed in the Section on College Work and the committee instructed to do certain work. It was upon a reconsideration that this matter was brought up at all. That being the case, I assume, further, inasmuch as the result has not proved satisfactory to the Department, that it was done without due deliberation. We have now had the experience of two years. The Department thinks it is not a proper schedule. I think gentlemen of the Association will agree with me that it does not fully answer our purpose. I therefore move that a special committee be appointed, for, as the reader of the paper has pointed out, in these relations which we sustain to the Federal Government, it is all important that the matter of finances be properly adjusted in these relations. I brought no schedule here, nor do I think that this Association should do this in a hurry. It seems to me that it ought to be done by a committee specially appointed for this purpose to consult with the Interior Department and lay their judgment before the Association.

Mr. CLUTE. In view of the remarks presented by Mr. Scott, I am inclined to think that some action ought to be taken. I would suggest that the executive committee take charge of this matter supplemented with another name which I have mentioned. I move therefore to amend the motion of Mr. Scott, that the words "special committee" be struck out and the words "executive committee" be inserted, to which should be added the name of Mr. Scott.

Mr. ROBERTS. May I ask would it be in order for the chief clerk to give us some light on this subject as to the specific reasons why the reports are not satisfactory, if not out of order, so that we may understand more fully the difficulties met with at his office?

The PRESIDING OFFICER. We will be pleased to hear from the gentleman from the Department of the Interior.

Mr. HOLCOMBE. In this discussion I had proposed avoiding going into particulars or details, but I am able to give a few points. First of all I would say that dissatisfaction with this form of schedule was brought to our notice at the office by the treasurers themselves. I remember several very excellent letters from treasurers on this subject, one from Ohio, one from Nebraska, and a number of others which I do not recall at this moment. Treasurers generally find the difficulty mentioned by Mr. Scott in the proper classification of particular articles, which seems to show that these schedules are not adapted exactly to any convenient system of bookkeeping.

Now Mr. Porter referred to a conversation between the Commissioner of Education and the committee of which he was a member. I would beg the convention to remember that at this time the subject was entirely new to the Commissioner as well as to the consulting committee, and the Commissioner should not be held strictly to anything he said at that time. Most of the points which were brought out in that conference, however, the Commissioner committed to writing and printed in various circular letters sent out from time to time.

Let me say that in my opinion this form of account would not stand the test if applied by higher authority of the Secretary of the Interior himself. I mean that the act of Congress requires a detailed statement of expenditure. Now some Secretary with less confidence in the Commissioner of Education than the present one might appear on the scene and call for an exhibit of these reports and say, what articles do you suppose have been purchased under this head, stock and material, what articles under machinery and apparatus, and so forth and so on?

The Commissioner of course will have to say that that matter is left entirely to the treasurers and presidents of the institutions. That may not satisfy the Secretary of the Interior at all and there might possibly be some trouble on that account. I suggest this as possible, though I scarcely think it probable. Yet it would seem that there must be some tribunal to whom to refer questions as to what are proper expenditures. The Commissioner of Education has received many inquiries of that kind. Some interesting matters have come up in these reports, some rather amusing ones. Some gentlemen wanted to know why the Commissioner spoke of mistakes in statements in one of his circular letters. It was from the fact that a board of trustees of a certain college insisted upon purchasing a piano from this fund. The Commissioner held that he did not consider a piano a facility for instruction in any of the subjects enumerated in the act. The president of the institution had been of that opinion beforehand and expressed great satisfaction that the Commissioner of Education took that view of the matter. This is merely an illustration. Suppose the president of that institution, instead of corresponding with the Commissioner about the piano at all, had merely in his innocence said a piano is a facility for instruction in physics under the head perhaps of acoustics, the Department would never have known anything about the purchase of the piano. But if in any way the matter had become known, it would have caused trouble. These are merely illustrations of the point taken by the Bureau of Education, and I feel more at liberty to bring the subject before you from the fact that so many treasurers have expressed dissatisfaction with the present form of schedule.

Mr. HUNT. I would like to suggest to Mr. Atherton a point against referring this to the executive committee, and I do this because the secretary of our board of trustees would be here to-night if there was not a meeting of the board of trustees in Columbus to discuss this very question, and he asked me to present his views. I will have to speak frankly about it. There is need of a great change in this matter. Mr. Holcombe has mentioned receiving a letter from me on the subject. This question should be discussed by bookkeepers. A committee should be appointed of men making a special business of these matters and it seems to me that some such committee should be appointed, and I will say that if Mr. Scott had not made this motion it was my intention to do so. There are men in many of the institutions who have been there for the last twenty years and doing nothing else but making these accounts. They see things often that the college presidents overlook, and I think they would make more suggestions to the Bureau of Education because of this very fact. Our secretary wished me to make these suggestions to the convention.

Mr. ALVORD. There are two points to be considered in this question. In the first place when the present schedule was adopted, both sides in the conference between the Bureau of Education and the committee agreed that it should be decided what was meant by the word "detailed" in the law, and there was unanimity of opinion and perfect accord on that point. There were present at that conference men who were thoroughly conversant with the system of accounts of college treasurers in every detail, and experienced in keeping such accounts. So much for the committee that brought the matter into this present shape. Now in regard to the revision. While I can speak only as an individual, the executive committee, gentlemen, has enough to do without seeking any further employment. If this motion prevails, I want to call attention to the fact that Presidents Broun and Goodell, and Director Neilson (who is treasurer of Rutgers College, of which Mr. Scott is president), are members of the executive committee.

Mr. ATHERTON. A word merely. I have no thought but the best way of getting at the desired result. If we feel as Mr. Hunt, that the committee should consist of bookkeepers, I would be glad to have the bookkeepers bring the result into the Association. My only thought is to get at the consensus of opinion so that when we make a change we will make a well-considered one. My individual judgment about such matters is that it is better to keep things of this kind in the hands of one committee, for the double reasons that we get the accumulated results of their experience, and secondly, officers of the Government come to recognize certain men as having a continuous representative quality and so deal more freely with them. You know how it is when you meet a man the first time—you take his measure as to how you will deal with him. I think it best to keep this in the hands of the executive committee with the understanding that the committee is to proceed very slowly and give results by correspondence or otherwise before taking any definite action.

Mr. TURNER. I think we may get a little practical information on this matter as we go along. The law requires that we should send a detailed report to the Secretary of the Interior. I would like to know whether the Department contemplates that when I give to a professor of chemistry $500 for books used in his department every book is to be itemized in his report. Is that contemplated? I suppose there are 2,500 or 3,000 volumes in our library this year. If every book is itemized, and of course that is the only way the Department can know about the items, it will be an enormous work to be printed. I would like to know if it is to be carried to that extent. I will state how we do it. I have assigned to each professor so much money and each one sends in a list of books desired. The list is carefully revised and any book not coming under the scope of this bill is struck out. The list is marked and sent to the purchasing firm, and this list is returned so that there is no chance of a book being charged to the wrong account. But if all these should be itemized, it would be an enormous work.

Mr. NEAL, of Oklahoma. Another point I would like to make. I suppose our legislators when framing the bill organizing the college were not very well posted in college matters. They have made a board of directors without assigning to the president of the board any salary. We have no funds except what we get from the Morrill bill, and have no salary to pay him. Another thing, we have a secretary and treasurer to be paid out of the Morrill fund. Where in the schedule shall we place their salaries?

Mr. HADLEY. I have been trying to get to say substantially the same thing. I suppose we will all consider that the prerogative of preparing forms for this report belongs to the Department of the Interior. The Department of the Interior is responsible for the distribution of this fund and I think it is equally clear from what has been said this evening in our own individual experiences that there is a difficulty in satisfactorily filling the blanks as now constituted. Therefore it seems to me that the proper thing for this body to do is simply to appoint a committee who shall stand in readiness to represent this Association in conference with the Department of the Interior if their services are invited, but not otherwise. That is just the way I feel about it.

Mr. WASHBURN. The Department of the Interior understands this matter to a certain extent and our executive committee is amply able to explain all these points. Therefore I move you that this be put into the hands of the executive committee.

The PRESIDING OFFICER. The motion is to refer this matter to the executive committee and have them take charge of it.

The motion was carried.

The question is now upon the original resolution.

The resolution was adopted and the matter left in the hands of the executive committee.

The PRESIDING OFFICER. The general subject is still before you— the relations of the colleges to the Department of the Interior.

Mr. SMART. I was a member of the committee to confer with the Department, and it was a most fortunate thing, gentlemen, for us that the Secretary of the Interior placed the matter in the hands of the Commissioner of Education. Perhaps Mr. Alvord has told you of it, but I will tell you again. It took a great deal of time and a great deal of pains to assist us, and I believe that the Commissioner of Education and his chief clerk are both entitled to our hearty thanks. I will not make a motion. I know that the mere suggestion of it will raise a response in the minds of those who know anything about it to give them our hearty thanks for what they have done. [Applause.]

Mr. FERNALD. I desire to make an inquiry. Under the act of 1862 we are in duty bound to make a report and send to the Department of the Interior. My question is, whether that covers the requirement upon the president of the college, or whether he should write out a separate report of the same matter to satisfy the provisions of the act of 1890, taken from the published reports.

Mr. HOLCOMBE. It is a close point, but I should say that one report is amply sufficient. Each separate act requires that the report shall be presented to the Secretary of the Interior, but one report would certainly be sufficient.

Mr. ATHERTON. Yet the Commissioner calls upon us for a second one.

Mr. SMART. This Morrill act requires a report of experiment work. It is a difficult thing to make a report covering experiment work practically duplicated in the station report to your Department. I want to ask whether or not the station report may be sufficient, whether that will be accepted or not.

Mr. FAIRCHILD. The law of 1862 requires that we report to the governor of the State and send to the Commissioner of Education two copies of that report. Then the law of 1890 requires that we report directly to the Secretary of the Interior and to the Secretary of Agriculture before a certain date. Now, most of us are required to make an annual report to the governor according to the laws of the States before the date on which we report to the Secretary of Agriculture and the Secretary of the Interior, the 1st of September.

I would like for this committee in conference with the Secretary of the Interior to determine this point. We have found the reports accumulating upon us from year to year, and it is almost impossible to keep track of them. Last year I made a full report to the Secretary of the Interior as to the expenditure of experiment station funds. I had already reported from the experiment station in full, according to the Hatch act of 1887, and was notified in last March or April that no report had been received in regard to the expenditure of experiment station funds. Of course it was my fault. I should have sent that other report at the same time. If they can take that into consideration I should like it very much.

I move, Mr. President, that the executive committee be requested to confer with the Secretary of the Interior with reference to a complete arrangement of the required reports of all the departments of the college, including the station.

The motion was carried.

The PRESIDING OFFICER. Is there anything further on the question? It is still open for discussion.

Mr. HADLEY. Inasmuch as we want to leave early to-morrow morning, I move that we adjourn as soon as the necessary announcements have been made.

Mr. ALVORD. I have a resolution which I am instructed by the executive committee to offer at the close of this discussion. Before doing so, I beg leave to say a few words on this general subject. I will simply refer to the cordial relations which have existed all along between the Secretary of the Interior and the Commissioner of Education in our mutual work under the act of 1890. Yet there has been one point on which I have radically differed with the decisions of the Department and shall continue to do so, and believe the time will come when the decision of the Department on that subject will be reversed. The Department has declared under the act of 1890 that it was its prerogative to determine the division of funds under the Morrill act whenever under that law they were to be divided in any State. That has been the ruling, and under that ruling the act has thus far been administered. As a result, one State in this Union has not received any benefits under that act. The State of South Carolina, true to her general principles, believed that it was her prerogative to decide as to the division of the funds under that act, and has never reached any agreement with the Secretary of the Interior; consequently it has received no money under the Morrill act and has been so reported to Congress. In this one instance (and I desire to emphasize this) I believe South Carolina to be right in the position she has taken. I sat in the gallery of the Senate of the United States on a certain Monday morning prior to the passage of the Morrill bill. During a very close discussion, and just before the vote was to be taken, the Senator from Louisiana, Mr. Gibson, asked of Senator Morrill: "Do I understand, sir, as a result of this compromise, that it is left to the legislatures of the several States to determine how this fund shall be divided, if it is divided within the State, under the provisions of the act?" Mr. Morrill replied, "That is the amendment which I now offer to the bill." Then about an hour's discussion followed upon verbal amendments to the bill. When they were just about to take the final vote on the bill, Senator Cullom entered the Senate Chamber for the first time that day. He asked the stage of proceedings on the bill, and when told turned to Senator Morrill and asked almost the identical question put by Senator Gibson—whether the ultimate disposition of this fund rested with the Secretary of the Interior or the legislatures of the several States. Senator Morrill replied that it was left to the legislatures of the States respectively. Senator Cullom said, "That is not as I would have it, but I will interpose no objection now." The bill was then passed. Turn to the Congressional Record and you will find this substantially as I have said. There is no question as to the intention of the Senate of the United States and the point was not raised in the House. I believe that the ruling of the Secretary of the Interior is wrong, and I believe that the act entitles each State to decide under the act of 1890, and I trust the time will come when the act of 1890 will be interpreted in this respect as liberally as the act of 1862. While I have held adversely upon this point, I nevertheless have recognized that the best thing was to get the act generally into operation as soon as possible.

Mr. HOLCOMBE. I would like to call Maj. Alvord's attention to the fact that a special act has been recently passed by Congress authorizing the Treasury to pay to South Carolina the three installments due, notwithstanding the ruling of the Secretary of the Interior. The decision of the Department of the Interior has therefore been reversed on that matter.

Mr. ALVORD. I now offer the following resolution from the executive committee and move its adoption:

Whereas we recognize the great and increasing usefulness of the Office of Experiment Stations of the Department of Agriculture, in promoting the interests and efficiency of the experiment stations, under the act of March 2, 1887; and

Whereas a large and increasing burden has been placed upon the Department of the Interior and the Bureau of Education in consequence of the act of August 2, 1890, known as the second Morrill act;

Resolved, That while we recognize the cordial efforts of the Secretary of the Interior and the Commissioner of Education to administer that law so as to secure the highest benefits to the institutions affected, we earnestly request Congress to make adequate provision for the best administration of the additional duties placed upon the Department in consequence of the passage of this act.

Adopted.

Mr. ALVORD. It is understood under action already taken no more business shall be transacted at this general convention except to hear and act upon the report of the committee on acknowledgments and courtesies to-morrow evening.

The Association then adjourned at 10:20 p. m.

EVENING SESSION, FRIDAY, NOVEMBER 18, 1892.

The meeting was called to order at 8:40 o'clock by the chairman of the executive committee in Parlor P of the St. Charles Hotel.

On motion of Mr. Armsby, Mr Alvord was elected to preside over the session.

Mr. Stubbs introduced Mr. Higgins, proprietor of one of the large rice mills of the city, who cordially invited the members to visit his mills on Saturday morning before leaving the city, stating that it would not take over an hour and a half, allowing plenty of time for the early morning trains.

A census being taken as to the number desiring to go it was found that there were twenty-five. Mr. Higgins then said that he would be glad to have carriages at the hotel to take those desiring to go to the mills.

Mr. Atherton moved that the hour be 8:30, prompt, so that they would have time to catch the 11 o'clock train.

Carried.

Mr. Atherton then made a few remarks expressing the thanks of the Association for the many courtesies shown by the organizations of New Orleans, referring especially to the Southern University, and moved that a vote of thanks be extended to the officers of that institution.

Carried.

The presiding officer then called for the report of the committee on acknowledgments and courtesies.

Mr. Morrow reported the following resolutions:

The number and variety of the courtesies shown the Association which have made this meeting one of the most enjoyable in its history, make it impracticable to properly characterize and particularize each, and your committee can only make a bare mention of them.

It therefore reports that the thanks of the Association are due and tendered to the following transportation organizations:

The Trunk Line Association; the Central Traffic Association; the Southern Passenger Association; the Boston Passenger Association; the Chicago and Alton Railroad Company; and the Illinois Central Railroad Company for reduction of fare to delegates, and especially to the Illinois Central Railroad, to Capt. J. F. Merry, and others of its representatives, for the excursion to Baton Rouge, and personal attention in many ways.

Also to the local committee of arrangements, and citizens of New Orleans, for the excellent arrangements, especially mentioning the chairman of the committee, Prof. Stubbs. To the officers and faculty of Tulane University for the use of its halls and facilities for the meetings of the Associations. To the Literary and Social Clubs and Commercial exchanges of the city, and to President Nicholson and the faculty and officers of the Louisiana State University and Agricultural and Mechanical College for their hospitality at Baton Rouge. To the press of the city for its unusually full and accurate reports of the proceedings.

To Mr. Higgins for the cordial invitation to visit the rice mills of the city.

To the proprietors of the various sugarhouses visited on the excursion to Baton Rouge.

G. E. Morrow,
Austin Scott,
H. W. Wiley,
Committee.

Mr. Smart, on behalf of Purdue University and other Northern institutions, extended an invitation to the Southern delegates to make them a visit on their way to or from the World's Fair.

The secretary then presented the following communication from the Iowa Agricultural College inviting the Association to hold their convention at Ames, Iowa, next year.

Secretary Association of Agricultural Colleges and Experiment Stations:

The faculty of the Iowa Agricultural College and the experiment station instructed their delegates to invite the Association to meet at the Iowa Agricultural College in 1893.

Respectfully,

Herbert Osborn.
L. H. Pammel.

The communication was referred to the executive committee.

The following resolution was offered by Mr. Goodell and seconded by Mr. Harris. Mr. Atherton made a few remarks, calling on the members of the Association to extend their support to this journal. The resolution was as follows and was unanimously adopted:

Resolved, That this Association, recognizing the importance of having a means of publishing nonofficially and promptly the results of agricultural investigation, and appreciating the value of "Agricultural Science" to all interests in that field, desires to commend that journal to the cordial support of all members of the Association and to the public generally.

Mr. Harris. I would like to say that the great delay in sending out card indexes prepared by the Office of Experiment Stations has been on account of difficulty in getting the cards printed. This difficulty I believe is about to be surmounted, and I expect in the very near future to send the cards out quite rapidly. As soon as we receive the first batch from the Government Printing Office I expect to issue a circular in regard to the sale of the cards.

Mr. Cavitt, secretary of the board of trustees of the Texas Agricultural and Mechanical College, on behalf of that institution extended to the Association an invitation to hold their next meeting in Texas.

Mr. Miller, of the Maryland station, presented the regrets of President Silvester, saying that he had expected to come up to the last moment, when he found it impossible.

Mr. Alvord stated that several communications of like nature had been received by the executive committee from President Northrop, of Minnesota, President Stockbridge, of North Dakota, and President Walker, of the Massachusetts Institute of Technology.

It was then moved that the meeting adjourn *sine die*.

Mr. Alvord said that before putting the motion for adjournment he wished to express his gratification at the attendance and the work accomplished by this convention. It was the most successful in the history of the Association.

The motion being put, the Association adjourned *sine die*.

APPENDIX.

MINUTES OF THE SECTIONS.

THE SECTION ON AGRICULTURE AND CHEMISTRY.

The section on agriculture and chemistry held four sessions, as follows: At Tulane University, 7:45 p. m., November 15; 10:30 a. m., November 16, and 8:30 a. m., November 17; and at St. Charles Hotel, 6 p. m., November 17.

The first three sessions were presided over by Chairman Ingersoll and the last one by Chairman-elect Henry. There were seventy persons present at the second session, sixty at the third, and fifteen at the fourth.

On motion, Mr. Curtis of Texas, Mr. Gulley of Arizona, and Mr. Cooke of Vermont were appointed a committee of three to take charge of the program during the meeting.

On motion of Mr. Cooke, of Vermont, the section on chemistry was invited to meet with the section on agriculture.

On motion, Mr. Quick of Colorado, Mr. Thorne of Ohio, Mr. Georgeson of Kansas, Mr. Vanderford of Tennessee, and Mr. Roberts of New York were appointed a committee to report nominations for chairman, vice-chairman, and secretary.

The committee reported as follows: Mr. Henry, of Wisconsin, chairman; Mr. Stubbs, of Louisiana, vice-chairman; and Mr. Latta, of Indiana, secretary.

The report was accepted and referred to the general association for confirmation.

The following papers were read before the section:

Grass gardens—methods and purposes. By W. M. Hays.

Advances in farmer education. By W. M. Hays.

What should the professor of agriculture teach? By G. E. Morrow.

What should the professor of agriculture teach? By P. M. Harwood.

Grasses for the semi-arid region. By C. C. Georgeson.

The field of bulletins, present and prospective. By C. L. Ingersoll.

The physical tests of soils. By R. H. Loughridge.

The establishment of official methods of experimentation. By F. A. Gulley.

On motion of Mr. Scovell, of Kentucky, the paper by Mr. Loughridge was referred to the Association of Official Chemists for a comparison of the methods therein discussed.

On motion, it was decided that persons having papers prepared, but who were unable to present them on account of the lack of time, should hand them to the secretary for transmission to the committee on publication.

The following papers were thus received and referred:

What is the live weight of an animal? By H. J. Patterson.

Stock-breeding at experiment stations. By W. H. Brewer.

Methods of irrigation. By L. G. Carpenter.

The press bulletin. By C. E. Thorne.

Fiber production. By Charles R. Dodge.

GRASS GARDENS—METHODS AND PURPOSES.

By W. M. HAYS, *of North Dakota*.

The purposes of grass gardens on experiment farms may be named under several heads:

(1) The teacher who has students interested in agriculture, and can have their attention while grasses are growing and fruiting, needs small plots of all the economic grasses, clovers, and other forage plants, where he can require each student to make himself familiar with their economic and botanical characters. Not a little of the much needed concrete teaching of practical things can be accomplished along this line by the energetic teacher. Such work as requiring each student to keep notes on one or more plats of grasses or clovers during one or more seasons would be of use to the boy when he becomes a farmer. The student who learns to compare the yields, time of ripening, fighting proclivities, methods of seeding, and other economic features of the most useful grasses of his State, by observing them in adjacent plots and especially by systematically recording notes on them, has a most useful fund of information. It is a kind of training almost as hard to get by means of lectures and text books alone as it would be to become a chemist without laboratory practice. A student thus trained is able to treat field conditions on the farm from the standpoint of technical knowledge. At the north there is a serious obstacle presented to the above plan. The plants in question nearly all flower and mature while the students are away from the colleges during the summer vacation. Students should all be expected to preserve botanical specimens of all economic forage plants suited to their State and garden plots will greatly assist them.

(2) Whoever carries that part of the teaching which relates to the cultivation of crops, their rotation, management and thus keeping up the fertility of the fields needs to have charge of and require himself to keep notes on plats of forage crops. The teacher of general agriculture in those Western States where mixed farming is practiced and much live stock is kept especially needs to keep himself posted along this line. The teacher who will do this work and by traveling, inquiring, answering questions and in every possible way try to become expert in the management of pasture and meadow crops, will be able to make himself as well appreciated as the professor who, by becoming an expert in live stock, gains the confidence of the stock-raisers.

(3) The grass garden furnishes the place and methods for testing foreign or new varieties of annual and perennial forage crops in a less expensive way than would be possible in field plats. Promising things alone need be taken to the field to give them actual trial in the economy of the farm, or distributed to farmers and others who will coöperate.

(4) Preliminary tests of grass mixtures can be carried on in comparatively small plats. These can be planted in duplicate and thus tested under the different conditions furnished by sowing at different times in the season, in different seasons, on different soils, on lands differently prepared, sowing with or without another crop, covering the seed in different ways, with and without top dressing. Under all these conditions the power of each perennial variety can be studied as to its length of life, its power to hold its own in competition with all others, the amount of and proportion of forage produced by each plant in the various conditions, and in the various

mixtures. The lessons the careful experimenter will gather while systematically keeping notes of a series of plots are without number. He may get many weights of products which will give him a basis for formal reports, and he will learn the general facts and laws governing rational practice in the region for which he labors. The most successful plans can be extended to field and coöperative tests or possibly recommended for trial by farmers.

(5) Probably the most important work to be carried on in the grass garden is that of the improvement of the standard grasses and clovers which are of such immense importance in our agriculture. No one thinks strange that pansy fanciers and propagators go to the trouble to improve pansies that they may have rich and novel combinations of colors. But who has even carefully studied out the variation in the plants of timothy or red clover or other varieties upon which so many of our people depend for sustenance and means of obtaining the enjoyments of life. Who can tell us as to whether material improvements can easily be obtained by simply selecting the best plants of timothy for a number of generations. Who among us is really reaping for the farmers the fruits of the seed sown and the harvests of fame made possible by the great work of Charles Darwin. He showed us how by crossing plants carrying distinct blood lines yet close enough to unite that we could increase productiveness and by selecting desirable variations we can secure sorts which better suit our needs. We are not keeping apace with our horticultural brethren who are cross-fertilizing apples, grapes, strawberries, and many other classes of plants.

A few other facts as to methods of work in the grass garden may be classed as follows:

(1) The size of plats to lay out for varieties must be determined by the purpose in mind. Plats 1 or 2 yards square with alleyways 2 to 3 feet wide are suited to the purpose of the botanical study of species, and on these small plats many practical questions as of annual or perennial habit, ability to withstand the encroachment of neighborly species, or the time of season when the main growth of pasturage is produced. Plats 20 by 20 or 20 by 40 feet, in which 1 or 2 square rods can be harvested without taking the border, is a good size to study yields, as weights can then be at once taken on portable scales. All plats for this purpose must have duplicates, the number depending upon the uniformity of the land, care in producing and planting the seed, etc. Plats of this size will also do for experiments in comparing grass mixtures, though larger ones for all but preliminary trials are advisable. Perennial plants should be so distributed in the plots that those nearly alike are not on adjacent plats, as mixing will thus be a less vexatious matter. Planting in close rows instead of broadcast is conducive to economy, ease of weeding, and ease of keeping from mixture of kinds where not desired. This plan is sometimes objectionable, as it gives the plants unusual conditions.

(2) Where sown in drills small plats can be weeded as long as is needed the first season. Where sown broadcast all but very rank growers can be insured a better chance than they would have in field practice by mowing the weeds occasionally at a height of about 3 or 4 inches. For some purposes it is wise to sow the plats to wheat or other grain and then seed the grass before or after the last harrowing, or in early spring with winter grain, as is the custom in field practice. Some stubble, aftermath, or even weeds, is ofttimes a good winter snow gatherer and protection.

(3) A complete history should be kept of the plat. Source and quality of seed, previous treatment, preparation and character of soil, time and manner of planting and amount of seed, time of coming up and fullness of stand, and favorable or unfavorable weather, are all parts of the plat history to be recorded the first month or two. Changes in stand of plants and their cause of decrease, development as observed at stated times, time of flowering and seeding, when large enough for pasture in spring, whether annual or perennial, time harvested, green weight and dry weight per acre, time aftermath is ready for pasture, relative amount of fall pasture, time it succumbs to frosts as compared with some standard as red clover, etc., etc. I have

kept grass plat records by giving to each plat one or more pages in a note book and write into this the notes as made in the field. The facts are then all in chronological order when the plot has run its course, or at any time they are needed for study or report. Having the previous history before the eye at the time of making additional notes is a help. Note books of tinted paper are less severe on the eyes for taking notes in the sun.

(4) The first thing to be done in taking hold of a variety to improve it is to study the plant's method of reproduction, as to whether close fertilized, its variation in such economic features as size, earliness, yield of seed, ability to spread rapidly by stooling, if a grass, as to whether long or short lived in those like clover, which are little better than biennial in habit. I have a variety of timothy started with which I am much pleased, both because it promises to be good foundation stock upon which to work by means of selection in the production of larger yielding varieties, and because the distinguishing mark found in the sport I started with seems easy to perpetuate and fix as a permanent variety mark. The spikes are branched, having on either of two sides several spikelets which stand out one-quarter inch or more, being that much longer than the other spikelets. I have also white flowered *Trifolium pratense* raised from the white sports often seen in fields of red clover which promises to serve as an excellent foundation stock from which to develop varieties of clover by selecting for intrinsic qualities, at the same time making the unusual color a distinguishing mark. In the case of clover cross fertilization and selection can be taken advantage of as well as improvement by selection alone. Timothy flowers are rather small for the patience of the ordinary man to try to cross them artificially, though not impossible.

Advances in Agricultural Education.

By W. M. Hays, *of North Dakota.*

The country district school furnishes the bulk of the school education of the rural youth. By attending for a year, more or less, at our excellent city high schools, academies, colleges, and universities many of those who continue to reside on farms receive further school education and culture and gain many technical facts useful in their lives and business. Our whole systems of secondary and higher institutions of learning are in fact doing an immense work in educating farmers as well as other classes. The influence of the literature of books and periodicals and of public speaking and of private discussion are wonderful factors in moving forward the powerful mind forces of our agricultural people.

Technical farmer education took on form in periodicals and in speech making and with the land grant of 1862 in schools. These journals have grown into hundreds of general and class papers, with the fifty experiment stations making copy for them. They have also a constituency of agricultural specialists, who supply a never-ending stream of useful facts. We may have too many papers; but, as with cattle, when there is a surplus it is the scrubs which must go, even if by means of score card and record the farmers must find means of making a division. We need more editors and more publishers who have an agricultural college education. All here have little need of a recital of the way most agricultural colleges started with their course of study more scientific than was found in literary colleges, and with a minor amount of agricultural subject-matter. The science was generally well taught and was popular with the students in these colleges. Most of the men who taught agriculture had never learned the business of teaching in these lines, and whether they were scientists merely, simple practical men of farm affairs, or even in some cases where they had good qualifications, as things then were, in both science and practice, they pretty generally found a great load to carry, or even could not see far enough to find the load that should be carried. In too many cases students found that agricultural subjects were not taught in a manner to fully satisfy them.

The agricultural technique in these early attempts was often left to one man, as much through his fault as that of the teacher of mathematics, who may have had a needed assistant. The poor professor of agriculture struggled on, carrying instruction in live stock, dairying, soils, crops, horticulture, forestry, veterinary, and if really unlucky he consented to take botany and entomology also. The man who tries to carry even a few of the most allied of these lines has not the highest success in really educating his students. The plan being carried out by the Wisconsin, Michigan, and other schools, where there is a specialist in each of the several divisions, of what the professor of agriculture was formerly expected to teach, seems wise and brings results when practiced in school work and in station work as well.

These colleges have been successful scientific institutions from the start, but their evolution into schools of agricultural technique and practice has proven a longer and more painful operation than was dreamed of in the start. Some institutions are on a better basis than others, in that they have one or several successful features worked out under their own experience, and in their own way. Since the experiment station fund increased the study of the technicalities of practical farm affairs, there has been a general division of labor and increased interest, which has resulted in much experimenting and upbuilding along the lines of arrangement of course study, and of the subject matter taught by teachers in lines generally allotted to the agricultural department or division in the colleges. There is a strong disposition and effort everywhere to not only thoroughly prepare a lot of men well equipped for professional agricultural men, but to secure students who will return to farms, and to give them a training for their future business that will simply lead them on and not away from the farm. We have no one institution to which we can point as a model for other States, or even for its own State. We can, however, point to some rather new features in various institutions which are apparently very valuable experiments, often successful ones. We have new arrangements of courses of study, like the dairy schools of Wisconsin are, in Minnesota and other States. Short winter or farmers' lecture courses, the school of agriculture, as in Minnesota and Missouri, and doubtless other rearrangements more or less supplemental to the original straight four years' college course. These experimental courses and schools have grown up to meet a demand coming from the people, or a dire necessity on the part of the institution to accomplish something, and are of far greater moment than many experiments in our stations.

The agriculturist's work, so far as what he shall teach, and how he shall teach it, depends much upon the class of students he has, and what they are expected to do with their training. It is not the main duty of a college and its professors of agriculture in a given State to make, by encouragement and special instruction, a lot of agriculturists, dairy teachers' and live-stock instructors for the home institution and those of other States, though that is a very important secondary line. The main great duty from this on of the division of the work his department represents is, I believe, to educate young men who will farm and become models for their neighbors and teachers of others. Thirty per cent of those who enter is enough to have choose other professions than farming. These colleges of necessity had to educate men to be teachers and experimenters during their earlier history, and greatly to be honored are these States which have sent out in other States so many useful men. The production of these men must be continued, but hardly as the over-topping object of each institution. These men who are fitted as specialists are largely a means to the two ends of teaching and experimenting, and we must depend upon this class largely for the men who, by experimental research, shall develop and broaden the sciences of agriculture.

The other purpose of the college is to give to the would-be farmers education in the farming business. I realize that I have taken radical ground, but the change wrought in Minnesota by a school experiment heroically tried there has converted me into this belief. Dr. Porter, who helped start the idea and movement there, has so much faith in it that I see he is developing a similar school in Missouri. The two years' school of agriculture course in Minnesota, instead of degrading education, has become the pet of the farmers of the State; and the faculty and students of the collegiate department of the university of which it is a part are also proud of it. It is a school to meet a certain purpose, and it fills the place for the young man who will be a farmer much as does the high school, the business college, or even a law school for the general business man or the lawyer. So the dairy course and the farmer's winter course fulfills each its distinctive purpose for some dairymen and farmers who want to attend the school only for a short time, as does also the college course meet the wants of the young man who wants the broader culture of a college course before taking up the management of his farm, or the one who wants to pursue the professional work in agriculture.

To really carry out the suggestions above made, that we come down from our high perch and teach the farmer what he wants, not a little depends upon the several men who teach the division usually distinguished as agriculture, including, of course, horticulture. Young men who have grown up into practical farmers, who keep in touch with the work at home during vacations, and who are at the school largely as a business venture, count largely upon what they get in this division to help them in their work when they go back to the farm, and many of our former short-course students have confirmed the truthfulness of the above assertion by so stating a few years after their return to their business. There is great inspiration, too, to the teacher who gets close to these boys' lives and purposes in the questions and pointers they will give in class and when working at practicums; also when they return after a year or more on the farm since leaving the school.

We have no one institution to which we can point as a model for others to follow. What would be best in one State would hardly fit any other. But we now have ample examples of successful features of various colleges from which any institution not in satisfactory condition can select patterns with which to add to or reconstruct an almost model institution in each State; and further experiments that must result when we supplement the four years' course will add more successful features from which each institution may select. True we have not had enough men who have had successful experience in the various technical lines to man so many model institutions with model teachers, but these men are rapidly being made. The raw material comes generally in full stature from the farm, and are being molded by special courses and secondary courses, dressed by collegiate and graduate courses, and kiln-burned to a finish in the useful function of assistant college and station workers. Some of them stop underdone; others come out overcooked, cracked, or warped, but there will be sufficient of the true-rounded cylindrical-shaped who will fit together, and through which the clear, filtered stream of agricultural thought will run from the soil to the spring where the farmer can drink from the crystal fountain of knowledge.

A review of the present development and differentiation is in order. Colleges like that in Wisconsin have grown from the one-professor idea to a position where a dozen or more men work in as many lines which apply to practical agriculture. These men leave to other college or university departments the general fields of science. Even the lines of agricultural chemistry and agricultural physics are there being more or less divided to separate men, and two or more men represent as many parts of dairy manufacturing, and as many more dairy stock. Close division of labor all along the line is absolutely necessary. These close specialists are bound to make their work go. They will evolve text-books, methods of practicums, and other indispensable machinery of farmers' educational work.

The several purposes now being looked at in one or all the many colleges may be classed under the following heads:

(1) The general education of men, because they are men.

(2) The advancement of sciences which underlie industrial education. The Government assisted the States to make provision for these general classes of work

elsewhere. Agricultural college funds are nowhere sufficient to carry even agricultural work and that in mechanics, which rightfully belong to these institutions. If we can get talent to profitably use the funds to help people, part of whom will return to their industries, there is where most of the money belongs. Much, however, has been done along these wider lines of education.

(3) Technical science, the object of which is to amass facts and develop appliances and men who shall work along industrial lines, I place in this class.

(4) In the fourth class I place special schools, as of dairying, practical mechanics, veterinary, domestic economy, etc.

(5) In the fifth class I place the schools of agriculture and short courses, which are adapted to the wants of the young men and young women who want an education of the high school, academy, or business college grade before settling down on the farm. These last-named schools fit most of our business men for life, as do the schools of medicine prepare doctors; and schools for farming, not necessarily schools for professors, will likewise fit our farmers to keep up with the agricultural procession of their generation, and it is nearing the two-minute gait.

(6) In the sixth class I place farmers' institute and allied work as a most valuable part of the college. Here facts can be given the farmer interested in the broader, more complete work of the school courses.

(7) Possibly some organized attempt would attach rural district schools in some way to schools of agriculture. This might allow of some agricultural lessons to be taught in country schools, and some stimulus to make the country school prominent as a stepping stone or leading string into these agricultural schools of a secondary grade.

If we fill up our schools of a secondary class and there present a course of study of which the returning farm boy will speak in the highest terms to his neighbor youths, we will find plenty of students interested in getting on a better basis before settling down at farming. You might even get so many of these short-course graduate students that those who would continue in the college course, plus those who snow enter from high schools, would far outnumber your present number of college students and graduate students. You thus increase the popularity of the college course and besides do the work that farmers would now at once demand you must do if they thought you could do it. That boys can be taught much of how to live in a two-year course, as well as much technical knowledge, I have seen as clearly demonstrated in the case of students in Minnesota as I have learned that many colleges lead from the farm.

INTRODUCING NEW FEATURES.

So far as the immediate school education of the to-be farmers was concerned, our colleges of necessity began at the wrong end. They did not well know what was wanted. The farmers generally agreed that schools as thorough as any needed by professional men must be supplied to farmers' sons, who of all men need and are worthy of a knowledge of many things. The school men who had charge of affairs naturally were ambitious to have high collegiate courses of study. In getting ready teachers and experimenters and in developing the science and education, they have done wonders. Several have made an especial effort to get as many men in other stations as possible, not always regarding quality as much as should have been done. It strikes me forcibly that we now have reached the point where a strong push can be made to turn part of these developed forces into channels which will bring hundreds of thousands of the future farmers into the popular systems of instruction in schools of agriculture.

The force of inertia, where conditions exist which seem stable, is the greatest obstacle. Votes and personal work of farmers have been tried successfully in some States. Should Prof. Henry, here, get into position to show and tell through the papers that he has 1,000 students in his short courses and that he had been asked by the State to put up more buildings to accommodate more sons of the constituents of the State legislators, the farmers in other States would find it out and would see that similar plans were followed in their own institutions. The more natural way will be for the people in authority to master the new ways of doing things in the various institutions and adopt as rapidly as things adapted to their several States prove themselves of merit, or even really promising. Every college ought to be trying one or more of these experiments, and we would soon solve the great problem of how to have farmers who are educated in their business.

The things needed to make these ventures successful are faith, plans, courage, money, equipment, and men. Most of our colleges need double or treble their present income to make their work successful. Beet-sugar factories are not successful on a small scale. They must have a capital of $200,000, so that all parts can be built up in the most approved and best way. A few professors with a small equipment can not satisfy students, unless quality makes up for quantity. I once had a pet idea that a number of agricultural schools in each State would be far better than one college, but experience teaches that a large equipment is necessary.

Wisconsin and Minnesota stand very low in the record of the number of station workers and teachers they have turned out. But if you want to see the kind of men farmers want our colleges to turn out, go to Mower or Renville counties, in Minnesota, and find some of the graduates of the school of agriculture. If you want to see the kind of butter and cheese makers the farmers want produced to manufacture their dairy goods, go into many factories in Wisconsin and find men who have been at Madison. You will be able to find in the homes of this same class of farmers model wives, educated in the domestic-economy schools of agricultural colleges. What other class of institutions can or will take up the development of farm women's technical education, as well as domestic science for all classes of women? Science has been more tardy in helping agriculture than any other great industry, and even yet more tardy in helping woman in her work.

MINNESOTA'S EDUCATIONAL SYSTEM.

As there is no representative here of the School of Agriculture in Minnesota, I have been requested to make a statement of its plan. The agricultural college is a part of the university. While the university was struggling along during the earlier part of its history, there was little demand for the college course in agriculture. The wheel horses at the head in its management lost faith in the possibilities of agricultural education, and as every dollar told in other lines there was for a time a tendency to let the work sleep and not even have the one professor of agriculture. Pressure from without and a constant demand for separation caused the authorities to hunt for something practical to do. Prof. Porter was called to the institution and started a summer school of practice, but wanted something better. State Supt. Kerle, *ex officio* a member of the board of regents, was sent on a tour of inspection to the most successful colleges and university departments. Some things were learned at Guelph, Canada, as well as at other schools.

The farm in the city by the university had become very valuable real estate and was sold. A better farm 3 miles out and some good buildings were the returns from the sale of the first farm. On this farm the station corps was located, and a school of agriculture was started the same year, providing for a course of two winters of six months each. This was afterwards extended to three winters of six months each. The farm boy can do but little in Minnesota during the long, cold winter, and he can go there as cheaply as he can attend the local high school or go in society at home. Forty-five students were enrolled the first year. The next year we had 75 students, as I remember, and agriculture, horticulture, veterinary, dairying, live stock, and carpentry formed a large part of the instruction. The school, now in its fifth winter, will register considerably over 100, and would have been much larger if the employment of a greater number of teachers had made the instruction better along technical lines, more practicums provided, and other improvements earlier made. This school has now settled down to the plan of about one-half the students' time being occupied with common and high school studies and the other half the lines named above. Where a student is well up in general studies, he devotes his whole time to technical subjects and sooner completed the course. Great credit is due the principal, Mr. Pendergast, and his assistants, professional high-school teachers, who have taught the general studies and, living with the students in the dormitory, fostered the school and farm spirit, the spirit to make the school prepare for the farm life and work.

These young men are enthusiasts over the school. Most of them do not expect to go to the university, and, though bright, are boys most of whom would not be led through the usual high-school channels to get into the university or other college courses. They are mainly boys who have fully decided to make farming their business. Half a dozen of the fifty or sixty students who have finished this course have entered the college course, to which they are barely prepared to enter upon graduation from the school. Probably all but one of this number will hold to agriculture. All the other graduates, with possibly a few exceptions, have gone back to the farm or into an allied branch of farm business, as creamery management, nursery management, etc. The greater number of students who entered the school and took one winter's work, more or less, selecting out a lecture course, with possibly one or more other studies, have practically all returned to the farm. Of the agricultural college students, one is a junior, two are sophomores, and three are freshmen. They enter the freshmen university classes with somewhat less training than do the high-school graduates from Minnesota's excellent high schools, but with a prestige of practical acquirement and industrial importance that makes of them peers of their literary and scientific fellow students. These young men tell me that they are consistently and respectfully treated by all students. These men are all taking the agricultural, though others now in the school are expecting to enter the excellent mechanical college of which my friend here, Prof. Hall, is dean. They can enter any university four years' course from the school of agriculture.

The entire instruction of the students in the school is provided at the experiment farm, part by general teachers employed for that purpose alone and the technical part by the experiment station workers. The students in the four years' college course have all their general science, literature, etc., in the city in the regular university classes. Four terms, when they can best leave the regular classes, they move out to the experiment farm and spend their whole time receiving technical instruction from the experiment station workers. These college students, having gone through the school, have a great interest and pride in doing it every possible service and help to keep up the farm spirit. The policy of the teachers on the farm has not been to make any special effort to induce graduates of the school to take the college course. Occasionally a young man who seemed especially fitted to professional work was advised to take the advanced course with that in view.

ADVANTAGES SECURED.

Several things have been accomplished in Minnesota. First and best, expert farmers, horticulturists and dairy workers are put out as leaven in the State. Second, the farmers are interested, aroused and desirous, and more hopeful for more farm school education. Third, the institution has gotten into good repute, entirely revolutionizing public sentiment, and surely can secure money more freely. All this was helped by Supt. Gregg's farmers' institute. Fourth, the whole institution is alive to making agricultural education successful. The school of agriculture has brought the course in agriculture right down where the farmer boys can enter even from frontier counties, where school facilities have been meager. It has enabled the college to raise the collegiate standard for entrance, thus bridging over the gap between country schools to even a higher point than can be reached in the colleges in the older States, where students come better prepared than in the West and South. It thus makes it possible to raise the standard of that important course which makes teachers and experimenters.

Several classes of students are here provided for. The man who wants a winter lecture course can select from the school of agriculture. Students who need to unite general school work and technical instruction can take part or all of the school course and even continue and take part or all of the college course.

Those who want to take up professional work take the school course and then the college course, thus putting in six years, not being able to get through without being well prepared, so far as school work can prepare a man to teach or experiment.

The Bulletin, Present and Prospective.

By C. L. Ingersoll, *of Nebraska.*

In opening a discussion of this subject it is done with hesitation, as I fear I am treading on ground that is dangerous; that some sensitive worker upon some of our stations will imagine that some well-directed remark was intended for him or for his station. However, the present bulletin of the average station may, to our notion, be much improved for the average farmer reader. We must remember first of all that of each issue quite a large number will very likely read a bulletin for the first time; therefore, as the first proposition, I would have—

(1) Simplicity: Let the whole description be clothed in simple language, and, when necessary to use a technical term, then in parenthesis give a very plain explanation for the benefit of all. Some bulletin-writers seem to have forgotten after two or three are prepared that they are progressing rapidly by their constant association with and study of experimental work, and that their constituents do not from the very necessities of the case go nearly so fast in the matter of improvement and education. This caution will apply to nearly every person who prepares bulletins.

(2) Completeness: Each bulletin should, in our opinion, be complete. Do not refer in a bulletin to three or four previous ones in a set. These bulletins may fall into the hands of those who only have the one before them or they may not have preserved the previous numbers. If necessary to completeness then, explain in as few words as possible the point alluded to, so that the reader may not turn away disappointed, having lacked in finding that which possibly gives a clew to the correct interpretation of all the rest.

(3) Graphic illustration: Whenever possible it is of great advantage to show relative values, yields, etc., in graphic form, so that at a glance one may see the general results, without searching through long tables of figures The same matter may be presented in other forms in the conclusion. The value of this arrangement can not be overestimated. Then, too, illustrations in the way of photo-engravings of matters of interest add very much to the accuracy of the information conveyed, as well as being of more than a passing interest to the reader.

(4) The conclusion: By all means have a well-digested conclusion, with the important points and figures well grouped, so as to make them easily remembered. The busy man has no time to look into the detail, but he will look over the conclusions you have reached and agree or differ with you in thought quickly. It is his way of doing business. The farmer, who, weary with his day's labor, sits down for a half hour in the evening, is in no mood to take up anything that needs much application; he soon tires of it, nods, and sleeps. But the brisk and brief conclusions of an experiment in which he has an interest he will read, and this may arouse a degree of interest sufficient to induce him to lay away the bulletin for more careful study and possibly for preservation. He may even caution the family not to touch that bulletin when they look for material with which to start the fire. All of these things have a bearing. Let us then spend time to make a careful and interesting digest of points grouped under the heading "Conclusion."

PROSPECTIVE.

Will the persons receiving bulletins become educated so that the standard may be raised soon? We believe not. If we look in advance a period of ten years we do not believe that the average reader of bulletins will become educated so that the writer may use technical terms in chemistry, botany, horticulture, physics, and geology *ad libitum*, but we must constantly be on our guard, remembering for whom we write, for whom we labor.

The temptation of the scientist is to do something which will give him a name and a place in science, a reputation. It is a laudable ambition and we admire it; but at the same time it does not hinder our putting things in plain terms for the masses. Reserve our technical papers and researches for our associations for advancement of science, for the scientific magazines, and for our brother scientists generally. There are a few, however, who take the other side of the argument, and say that, if we make our bulletins simple and plain, ourselves and our work will be judged accordingly, but, if we put out learned bulletins, the people, not understanding the full purport, will rise up and say en masse: "What a smart man and what a learned production!" Persons may be found fulfilling all the conditions named and still others. These illustrations will suffice.

Of minor points we suggest a few, by way of emphasis only. The outside of the bulletin should have printed upon it the title, date, station, and all other data necessary for one to note at a glance all the facts connected with the issue.

For ourselves we would prefer to see the writer of the bulletin named upon the outside and not the director, president of the college, or other officer in charge. The station staff can be published on the last leaf or inside the cover. Then, too, the matter of numbering should be uniform. It has become beautifully diversified at present. It seems to us that if any one thing should come under the purveyance of the Department of Agriculture it should be the numbering and arranging of these in some uniform manner for future finding and reference, and the year 1893 would be an excellent time in which to begin the work. The form has not been uniform in size and shape, and the volumes, when bound, will present a heterogeneous collection. But these matters have been urged upon us from time to time, so that one need not go astray. The difficulty arose in the first place from each station starting out in its own way, and then each desired the others to come to its way of doing things.

The quality of paper in many instances is poor, and this detracts much from the value to the recipient. If it is on good paper, put up in good form, and is neat and attractive, it is liable to be preserved. If it is sent out on cheap paper, is poorly printed, and otherwise like a very cheap newspaper, it will be treated as all cheap circulars are treated; it will go to the waste-paper basket with scarcely a passing notice.

In conclusion, let us study carefully the problem of how to present the work of the stations in order to do the most good. The workers are as a rule conscientious, energetic, and are doing a large amount of work in the aggregate, in which 65,000,000 of people are interested. Nearly one-half are directly interested as agriculturists, stockmen, horticulturists, and gardeners. The others are indirectly interested in seeing the first half prosperous and happy.

Remembering this fact, then, gentlemen of this Association, let us strive earnestly to improve upon the work of the past; let 1893 be a year of marked progress in the bulletins of our agricultural experiment stations.

WHAT SHALL THE PROFESSOR OF AGRICULTURE TEACH?

By P. M. HARWOOD, *of Michigan*.

The position of the professor of agriculture is unique and is an extremely difficult one to fill. Not only is he called upon to perform the threefold duties of professor of agriculture, superintendent of the college farm, and agriculturist of the station, but the ground he has to cover in teaching is so large and of such diversified nature that it can be treated only superficially at best and is more properly the work of several men, each an expert in his own department. Then, too, he has to deal with a class of young men who, as a rule, come to the college but poorly prepared to take up the work and carry it on successfully. Indeed, it is extremely unfortunate that agricultural colleges are obliged to teach so much that is merely fundamental in its nature, much that might be far more economically obtained at home in the common and high schools; but, taking agricultural colleges as they are, some located in dairying sections, some in grain, and others in cotton growing States, some well-endowed and equipped, large, strong, independent institutions, others parts of universities, where they are more or less overshadowed and restricted in their influence, it is hard, nay, well-nigh impossible, to say what the professor of agriculture shall teach and have it apply to all cases. Representing, as I do, one of the oldest, largest, and best equipped of the agricultural colleges of the country, it is, perhaps, but natural that I should look at this question somewhat in the light of future possibilities, and, at all events, in the light of an all-around agricultural college.

What shall the professor of agriculture teach? My answer, in one word, is agriculture; in two words, practical agriculture, and never, under any circumstances, anything else. Specialties like dairying, cotton-growing, grain-raising, and the like will each take precedence naturally in the localities where they belong. But in a college like the one in Michigan no one line will at present take a long lead over another, but the whole ground has to be covered, so far as the agriculture of that region is concerned. Already the duties of the head of the department are those mainly of an executive officer, whose duty is to superintend and direct instruction rather than to teach; also to superintend the farm management and the agricultural experiments at the station. In the matter of teaching, we first separate the great subject of agriculture into its two natural divisions—vegetable economy and animal industry—and each of these subjects is taught by an assistant, who is a specialist. As the department grows, as it is certainly destined to do, subdivisions of the above will have to take place and other assistants will have to be employed, and thus the work done in the department will develop and improve in value as time goes on and more money becomes available for the work. The ideal instruction towards which we are all working, I believe, will be given only when there has been a perfect division of labor and each and every branch of agriculture is taught by experts.

I have said that the professor of agriculture should teach practical agriculture. I want to emphasize that. This is a practical age. Education is for the development of the mind. Agricultural education is for the development of the mind along agricultural lines. Our object is, or should be, to turn out practical farmers, not in any narrow sense, but men with all the advantages of trained minds and trained hands, to fill honorable places in life and withal to be prepared to compete successfully and creditably with others engaged in the same calling.

The college graduate ought, with these advantages, to get more out of life and above all out of his business than he otherwise would. If we fail to turn out such men, we fail in the prime object for which our agricultural colleges were established and for the maintenance of which many thousands of dollars are being spent annually. Science is all very well, but unless scientific truths can be taught and the practical application made clear so far as turning out practical agriculturists is concerned they would better not be taught at all. No professor of agriculture is a success until he makes these applications clear to his students. We expect also in our agricultural colleges that the professors of botany, chemistry, entomology, physics, veterinary science, etc., will teach their branches with an inclination toward agriculture rather than toward developing scientists.

The agricultural department must be the leading department in the college, otherwise it will suffer by comparison. The sooner this idea is appreciated and this policy adopted by those in authority everywhere, the better it will be for our agricultural colleges and the clearer will the professor of agriculture see his way to success.

One of the first things to do in building a house is to clear away the rubbish. As the average student comes to us from the farm there is liable to be some rubbish in his mind that needs removing. Possibly he holds too roseate a view of farm life, a sort of "bed of roses" theory, such as public speakers sometimes deal out to farmers, or, what is more likely in these times, the possibilities and real advantages of farm life is not fully appreciated. The "calamity howler" has got in his work; may be it has been dinned into the boy's ears from the cradle up. These extreme ideas should be cleared away and in their place the agricultural situation should be presented as it is; its advantages, its opportunities, its difficulties candidly weighed. Then go ahead on that basis and build up enthusiasm and love for the work by teaching the boys how to apply intelligence to labor, and see that they do it.

It always seemed to me that the logical place to begin in the teaching of agriculture was with the soil itself and from that point build up. Practically, however, we are unable to do this, in Michigan at least, for the reason mainly that our students are not sufficiently well grounded in scientific knowledge to take up this work to best advantage in their freshman year. Therefore we give, as our first instruction in agriculture, breeds of live stock. We study their history and characteristics. We illustrate so far as possible with living specimens and it is the policy and practice of our college to keep a large variety of specimens on hand. Where this is not possible a visit to neighboring herds would suffice. We have a complete set of herd books of all the pure-bred horses, cattle, sheep, and swine, and each student is required to trace the pedigree of one or more animals in each and to write an essay upon some one breed. Passing to the sophomore year we give instruction in soils, fertilizers, drainage, crops, how to cultivate them, advantages of leguminous plants in developing nitrogen in the soil, etc. We familiarize them with and instruct them in the various implements of the farm. In the junior year we give instruction in the breeding and feeding of live stock and the relation of the stock to the crops of the farm. This is necessarily quite scientific and yet our attempt is also to make it thoroughly practical. In the senior year specialties in farming are taught. All instruction is given by lectures, copies of which, containing reference notes, are distributed among the members of the class, thus avoiding the necessity of their taking notes.

Everything is illustrated so far as possible by seeing the actual thing itself and often by using it, or, if it is a piece of work, by doing it. Thus we teach the student some knowledge, and what is of equal importance, "how to know." One thing is left and that is, "how to do."

This brings us to the matter of student labor, one of the most difficult problems with which the professor of agriculture has had to contend. How can it be utilized to advantage? There are innumerable obstacles in the way. Well, the first thing to do is to cut entirely loose from the old idea that there is dignity in labor because it is labor or that labor is of any use whatever, except as a means to an end. It is valuable for what it brings. Most good things that come to us come through hard work. Indeed, this is true of all that we prize most highly. Labor for an object, good hard work, doing one's level best, is edifying; it strengthens character; it builds up manhood. Work for the sake of work soon becomes drudgery, is discouraging, and tears down rather than builds up. This is just as true of a student as of any one else. Possibly we have forgotten this. Take the student, then, on the assumption that he is somebody, that he is more than an average being, which he is, and treat him accordingly. If he is given a hoe and told to go out with Patrick to dig potatoes or stumps, placed on a level with unskilled labor, at half pay at that, is it any wonder that the boy does not like it? Is it any wonder that he kicks? He would not be much of a fellow if he did not kick. Students under the old system are troublesome and mischievous simply because they hate the system. A better policy, and one that I am happy to say is now in successful operation at the Michigan college, is to take the student to one side and say to him: "We have a certain piece of work to do and we want you to do it. It will require both mental and manual labor. We can lay the plans and set Patrick to carrying them out, but we are morally certain that he will spoil something when our backs are turned. Now, you are a student, interested in this work, possessed of both intelligence and ability, and we want you to lay out the plans under our counsel and do the work, and we will hold you responsible for its success or failure." Suppose, by way of illustration, that it is an experiment with potatoes to determine the comparative value of different depths of planting, we say to him further: "This is to be your experiment; you are to read up all the bulletins and other literature that you can find upon the subject, post yourself thoroughly, prepare the ground, plant the potatoes, cultivate them, destroy the weeds, and keep off the bugs, and when through dig and weigh all the potatoes. Make full notes of your work and the condition of the crop from the beginning to the end of the experiment, and record the results in a book, which we will furnish for the purpose. This will be filed in our office and will serve not only as a memento of your labors, but if your work has been well done it will add one more item to the constantly accumulating fund of agricultural knowledge." What have we got now, a shirk, a drone, or a troublesome fellow? No. He is now interested, eager, enthusiastic, and instead of being a source of annoyance to us he has become our helper, our coworker, our pride. Each man can be furnished work according to his ability. That which is purely educational and of no benefit to the department is not paid for-that which is of benefit to the department is paid for. But all labor is thus educational. Now the student has not only learned "how to know," but he has learned "how to do." He has learned how to do one piece of work that required both thought and action and he has learned to do it well. This lesson is now a part of himself. It will abide with him forever. The experiment station has done double duty this time. It was one of the reasons why the stations were located at the colleges, that this might be done; that the student might learn (presumably it was thought that this might be accomplished by observation) something of experimentation. In the light of experience we are inclined to think that our benefactors builded more wisely than they knew.

To summarize: The professor of agriculture should teach, through his department, practical agriculture, or, in other words, should lay special stress upon the practical application of scientific truths concerning agriculture. He should divest the student's mind, through precept and example, of all false notions concerning agriculture. He must replace these with correct ideas, and at the same time lead him to become interested and enthusiastic in the work. Just what he teaches will depend considerably on where he is located. How he teaches it is of far more consequence. His great object should be to turn out successful agriculturists, who will go back upon the farms and make success in practical life. From those thus sent forth will come ample numbers of young men thoroughly competent, with a few additional years of post-graduate work, to fill positions in our agricultural colleges and experiment stations as teachers and investigators.

What a grand and noble work this is, the lifting up of the agricultural masses through the medium of our young men. It is a worthy ambition to be a professor of agriculture. The influence he exerts can not be measured. He has many difficulties, many trials, many discouragements, but all these vanish like mist before the sunlight of the great good he can do when his duty is properly performed.

Methods of Irrigation.

By L. G. Carpenter, *of Colorado.*

Irrigation may be practiced for two quite distinct objects: in one the water is valuable as an element necessary in plant growth, in the other as a manure for the substances it holds in suspension or solution. In the one case water is needed in comparatively small quantities, for the absolute needs of the plant are small; the application is discontinuous for short periods of time; other things being equal, the shorter, the better.

As a manure, water as it is found in nature is very dilute and when applied for this purpose it needs to be applied in large quantities. In cases it has been known to be so much that if the year's waterings were applied at once the plant would be submerged to a depth of over 200 feet by the water absorbed, or over 1,400 feet by that applied. Irrigation with large quantities is applied to meadows; it may be carried on in winter when the water is above the freezing point, and may be continued for days at a time, when if applied in small quantities injury would result to the character of the herbage.

The two cases I have mentioned differ in more than the quantity of water applied; there seems to be a different interaction between the sod and the water and its contents.

The limits of the two types are fixed somewhat by climatic considerations. When plants need watering there is usually a scarcity of that element, and irrigation with large quantities, as here meant, is not possible. Hencè, as a general rule, dry and hot countries use less water than cold and wet ones. In the former all or most crops need irrigation; in the latter only forage crops are watered.

In practice there are insensible gradations, with variations too numerous to classify, leading from one type to the other.

In the United States we have been reluctant to practice irrigation except when compelled by necessity; our irrigation type consists in the use of small quantities of water, though the quantities may sometimes be considerable. These exceptions are few and isolated.

This type of irrigation we may divide into three methods, which may be subdivided indefinitely according to the plan of distribution adopted.

Before irrigation of either type can be practiced water must be brought to the land, which is done where possible by canals. Pumping is too costly except for low lifts or for exceptionally profitable crops. The irrigation canal differs from the navigation canal in that it seeks the high levels, so as to command as much land as possible. It may vary in width from 1 to 100 feet and in length from a few rods to 100 miles and over. It may water a few acres or hundreds of thousands. The greater canals cost hundreds of thousands of dollars for construction, frequently requiring long tunnels, expensive flumes, and large reservoirs. The expense may be borne directly by those interested or first by a company. The first cost is usually from $5 to $15 per acre.

From these principal canals secondaries are again built, which may be themselves of considerable size. These are usually constructed by separate corporations composed of those directly interested. These may again be divided, until finally the water is brought to the bounds of the undivided farm. It is only then that the farmer can complete his own system of ditches. The method he will adopt will depend upon various circumstances, the character of the soil and crop, the subsoil, the slope, the amount of water available, the amount of capital. Where mixed cultivation is practical it is essential that the method be applied to different crops, so that the same arrangement of ditches may be used for a series of years.

All methods are designed to accomplish the same object, which is to apply the water uniformly to the whole surface of the field, however irregular or uneven it may be. If more water is applied in one place than in another, unevenness in ripening or growth takes place; if it stagnates, then killing may take place, or in meadows, aquatic plants will appear. The minor inequalities are frequently leveled, but as yet extensive gradings are rarely attempted here, as is common for permanent meadows in Italy and France.

As before mentioned, irrigation in the United States is of the type with a limited amount of water. We may recognize three methods: (1) By submersion, (2) by flooding, (3) by infiltration, better known as the row or furrow system.

These may be again indefinitely subdivided according to the arrangements required for special classes of circumstances.

(1) *Submersion.*—In this case the farm is divided into compartments or basins by dikes of earth, 1 or 2 feet high. These are filled with water, which is allowed to stand until enough has been absorbed by the soil. Its convenience is that after once the ground is prepared it requires no skill in irrigation. The first cost is greater than with other methods. It is not well adapted to ground of a slope more than 20 feet to a mile, though sometimes used to 40 or even 60 feet. It is almost the only method which may be used for lands of less than 20 feet slope to the mile, hence its practice is largely confined to level countries. In Egypt it is successful with a slope of 6 inches to the mile. It has been practiced in Kern County, Cal., quite extensively. It requires large quantities of water so as to fill the compartments quickly, hence it is likely to go out of use on a large scale. The method is also used by the Mexicans. This method is used where water contains a valuable sediment and gives use to the system of Colinatage, as in the sterile plains in southern France.

(2) *Flooding.*—This method is that almost universally followed for cereals and meadows, and is the most elastic of methods, and capable of being infinitely varied in plan to suit the local needs. It may be used equally well with small or large supplies of water and with slopes from 20 feet per mile to the steepest. In this method the attempt is to cover the ground with an even sheet of flowing water. Temporary ditches, usually plow furrow, are needed to assist in the distribution. More skill is needed in the irrigator than in the other methods. The water is turned out from the laterals by small dams or cuts in the backs, and then the skill of the irrigator is required to distribute the water uniformly. By small dikes or a few sods the water is deflected to the higher places first; the low ones will take care of themselves. One important thing is never to allow the water to stagnate. This method is the general favorite. In some soils, as adobe, which are inclined to bake on drying, it has to be applied with caution, and sometimes the next method is used.

(3) *Infiltration.*—This is generally known as row irrigation, but there are some varieties which may be included in infiltration methods, and yet are not properly row irrigation. This method is that applied primarily to hoed crops which are planted in rows or need hilling, as corn, potatoes, beans, etc. The method consists in running the water between the rows, and for a time sufficient for the water to soak through the intervening space. It might be used for very steep grades, but precautions may then be necessary to prevent washing, as also in the case of flooding. The danger of this may be lessened in both cases by the direction the water is allowed to run along the slope. It is wasteful to make the rows long, though in one case when the rows were one-half mile long irrigation was given with a depth of 4 inches, which, as irrigations go, is economical. The question is almost invariably asked, "How much water is needed?" It may briefly be said: That it requires both favorable circumstances and skillful irrigation to make a uniform irrigation with depth less than 3 inches. The quantity varies according to crop, soil, and subsoil. The amount applied in retentive soils by skillful irrigators in Colorado amounts with the rain during the irrigating season to from 27 to 32 inches. Experiments in New Mexico give about the same result, and considerable unpublished data from the southern end of the San Joaquin Valley, California, do not vary far from the same average.

Grass or forage crops will evidently take much more than grain crops.

In attempting to study our irrigation on any side one can not but be impressed with the little systematic knowledge we possess, and I can not forbear suggesting to our Western stations the importance of the problems connected with this practice which is the basis and the limit of the agriculture of the arid West. The whole field needs to be traversed; such experiments as those of Mangon, in France, thirty years ago, need to be repeated and extended. We need to know more of the methods, their limitations and capabilities, the amount of water needed, the sources of loss, whether by plant-growth, transportation, evaporation from soil, or passage through subsoil. Our ultimate extent of agriculture in the extreme West depends on the economy we can make of water, and the ultimate economies will need to be pointed out by the experiment stations.

Another second remark I would like to make in regard to the East. There is a growing interest in the East, if one may judge from the correspondence that comes from there regarding the practice. I think the conclusion of every one who becomes acquainted with the practice in the West is that it would be profitable in the East wherever the conditions are favorable. Often the loss from drouth in a single year would more than pay all the expense of a system of irrigation, and there are few years when it would not increase the value of the products by several dollars per acre. The more I have become acquainted with irrigation the more have I become convinced of its desirability for the East, and the belief has become more settled, if possible, after studying this summer the irrigation of the valley of the Po, in northern Italy. This is too well known as the classic ground of irrigation in Europe to need description in that particular, and its fertility is proverbial. But coming from the West, where nothing grows without irrigation, and here seeing little difference between crops irrigated or not, the first question that struck me was, "Why do they irrigate?" The cereals are rarely irrigated, and all crops do well as a rule whether irrigated or not. The rainfall exceeds 30 inches, and is about the same as Michigan and central New York, and is as well distributed throughout the year. The important thing is, they do irrigate, and though they began it by degrees, six or eight centuries ago, they are so well satisfied with it that the area has doubled within the last thirty years, and they are willing to expend far larger sums in bringing water to the land than we in the West; as a rule, it is only the irrigated communities which are prosperous and which do not feel the presence of American and Indian competition.

The prosperity which comes with it is too well known to need remark. The influences of our experiment stations, which are interested in increasing the agricultural wealth and prosperity of the community, and improved methods, might find an additional line of usefulness in demonstrating by an object lesson at very small expense the applicability of irrigation to the East. The progress in the Eastern communities in this respect is apt to be slow, but, I think, it is known where the practice begun has been abandoned.

Forage Plants for the Semi-arid West.

By C. C. Georgeson, *of Kansas.*

By the semiarid West I mean in a general way the western half of Kansas and Nebraska and eastern Colorado. The boundaries are not sharply defined. There are years when the rainfall is sufficient to raise good crops of all kinds over the greater part of this area, and again on the other hand it frequently happens, as in 1860, 1874, 1881, 1887, and 1890, that the dry area is carried eastward almost to the Missouri River. This vast region, covering upwards of 100,000 square miles, presents some features which must always have an important bearing upon its agriculture. Thus the altitude increases steadily as we pass westward from the Missouri River. At Kansas City the elevation above sea level is only 763 feet; at Manhattan, 118 miles distant, it is 1,042 feet; at Ellis, 302 miles from the Missouri River, it is 2,135 feet; and at Monotony, a station but a few miles from the Colorado line, 3,741 feet. With rise in elevation there is a corresponding fall in the mean temperature. Spring is later by two or three weeks in the western part of Kansas than in the eastern part, and the fall frosts set in two or three weeks earlier. In like manner the rainfall decreases as we pass westward. At Leavenworth, Kans., the average annual rainfall is 38 inches; at Topeka, 68 miles from the Missouri River, it is 32 inches; at Salina, about 197 miles from the river, it is 29 inches; at Hays City it is 22 inches;

at Wa Keeney it is 19 inches; and at Fort Wallace, near the Colorado line, it is but 13 inches.

It will readily be seen that the agriculture of this region must differ in many essential points from the ordinary practice followed in the East. It is preëminently a stock country, and while it was settled only by nomadic stockmen who drove their herds in there for the summer season, the native buffalo grass answered all the demands for feed. But this condition no longer obtains. The once unbroken prairie is now dotted with improvements of permanent settlers, who must of necessity still make stock raising a prominent feature of their agriculture. In the valleys along the water courses, where irrigation is practicable, all farm crops succeed. But it is different on the uplands, where the settler must depend upon the meager rainfall. The small grains, wheat, rye, and in most seasons barley and oats do well there; but Indian corn, the great American forage crop, is a failure, or at least it fails so often that it is never safe to calculate on more than a crop of fodder. With them it is therefore a serious question what to grow in the line of forage plants. They must place their dependence on other crops than corn, but the question is, what shall it be? It is part of the duty of the Kansas Experiment Station to aid in solving this problem, and to this end we have experimented with a large number of forage plants. The station, however, is barely on the edge of this belt. It is located at 96° 40′ west longitude, and the annual rainfall is about 30 inches. Manifestly many things would succeed with us which would be failures farther west, although we fail to grow satisfactorily most of the grasses so highly esteemed in the East. We can raise fine crops of red clover, and orchard grass is the surest of the tame grasses. But corn is frequently only a partial success. All of these fail in the semi-arid West. The United States Grass Station at Garden City, located in about 101° west longitude, has done some excellent work in testing forage plants suitable to that region. And I am indebted to Prof. J. A. Sewall, superintendent of the Station, for a list of the plants which he has grown successfully. He writes as follows:

"From the results of experiments of 1892, I can confidently speak of the following as profitable and practical: *Bromus inermis* (most excellent every way), *Panicum virgatum*, *Agropyrum glaucum* and *A. tenerum*, *Avena elatior*, *Festuca elatior*.

"Of the forage plants, the following have proved very successful: *Anthyllis vulneraria*, *Galega officinalis*, Alfalfa (*Medicago sativa*), Sainfoin (*Onobrychis sativa*), Red Kaffir corn, Jerusalem corn."

All of these, with one or two exceptions, have also been grown successfully at the Agricultural Experiment Station.

The sorghums, both saccharine and nonsaccharine, are grown with a measure of success in the West. The Early Amber and a few other sugar-bearing varieties are often sown broadcast and cut and cured for hay. It is a reasonably sure crop on the uplands, and furnishes a good article of feed. Of the nonsaccharine sorghums, the leading sorts are Red Caffir corn, White Kaffir corn, Millo maize, Jerusalem Corn, and the so-called Egyptian Rice Corn, all of which are grown for the seed as well as for the fodder. We have tested upwards of one hundred and fifty varieties at the experiment station during the last three years, and the above named sorts take the lead. For the production of grain the Red Kaffir corn is the best of all. We have raised as much as 71 bushels seed per acre of this variety, and it matures early enough to escape injury from frost in ordinary seasons. The variety called Jerusalem corn was introduced only a few years ago, but has already gained favor with Western farmers. Prof. Sewall states that he has raised 30 bushels per acre with a rainfall of only 5.06 inches from sowing until harvest. The seed is not only good feed for cattle, but furnishes a fair article of human food.

Next to these, alfalfa is the most widely cultivated forage plant in the West. It grows to perfection on the lowlands, along streams, especially when irrigated, and it also does measurably well on the uplands, where it generally yields at least two cuttings, the second crop being frequently allowed to go to seed. While it can not supply the place that clover occupies further east, it comes nearer to it than anything else so far brought into general culture. Many other forage plants have been tested, both at the United States Grass Station and at the Agricultural College Experiment Station, and among them are some of great promise. Of the grasses the one of greatest promise is *Bromus inermis*, a grass of comparatively recent introduction. It has done well at Manhattan during the last two years, and I concur with Prof. Sewall in pronouncing it "most excellent every way." It makes a close sod, and furnishes a thick growth of foliage of good quality, which is all that can be asked of any grass under those trying conditions. The other grasses mentioned by Prof. Sewall as eminently successful at Garden City have also been tried at Manhattan, where they did fairly well, but their growth has not been remarkable. And the same may be said of sainfoin, which Prof. Sewall recommends as excellent for sheep pasture at Garden City.

We have grown certain varieties of the Soy bean very successfully at Manhattan during the last three years, and it gives promise of becoming a very useful forage plant for the semi-arid region. It produces a highly nutritious feed, and it has the ability to withstand drought better than most farm crops. We grew this year a little over 6 acres of Soy beans, in four varieties. The season was dry and hot during July and August, yet they did not appear to suffer. A portion of each variety was made into ensilage, which is now being fed to the dairy cows. The silo was opened only the day before I left, and I am therefore unable to report results. The seed was distributed to many farmers over the State for trial the past season, and the following letter is a fair sample of the reports I received from the experimenters:

"WHITE CITY, KANS., *November 11, 1892.*

"DEAR SIR: Yours of the 29th at hand. In regard to the Soy beans received from you, would say that I planted them June 3. Owing to wet weather, the ground was plowed too wet, and consequently dried lumpy and hard. Jack rabbits ate about half of all the plants that came up. I raised, however, about a bushel and a half of beans from 2 pints of seed. They certainly are great drought-resisters. Dry weather don't seem to hurt them as it does other plants. I think them a boon to farmers in this western country, as a fodder and fertilizing crop.

"Yours truly,

JOHN HOLT."

I could produce many other similar reports, but this sample is sufficient. From the success thus far attained, I am encouraged to believe that the Soy bean is destined to play an important part in the agriculture of this semi-arid region.

The plants here mentioned comprise all that so far give promise to be of value for this region.

THE ESTABLISHMENT OF OFFICIAL METHODS OF EXPERIMENTATION.

By F. A. GULLEY, *of Arizona.*

In assigning this topic, I suppose it is the design of the committee to discuss the advisability of attempting the establishment of official methods of experimentation, something on the plan adopted by the Association of Official Chemists.

First, as to the possibility:

Official methods of chemical analysis are much easier to formulate than official methods of conducting the great variety of experiments undertaken by the stations.

The chemist deals with matter which may be separated, measured, placed under control, all that is added or eliminated known and estimated, and the final product definitely determined.

In an experiment which deals with animal or vegetable life we have a problem which includes many unknown quantities. We may keep a record of our operations, and we may measure what we supply in the way of nutriment, or perhaps it would be more accurate to say what we place in reach of the subject experimented with; but with all our skill we must confess that our actual knowledge of the subject at the start, of the effect of the treatment given, and of the final result, is so limited that our conclusion is pretty largely guesswork. As yet we can only judge superficially, owing to our lack of knowledge of principles. It would seem, therefore, that before we can attempt to formulate official methods of work, we must be prepared to do better work in many of the stations.

It was, perhaps, necessary in beginning, to do work, the result of which would satisfy the people in general that we were accomplishing something of value, work that had a practical application; but we are coming to the end of this class of investigations, and we have stumbled against a few rocks below the surface that must be grubbed out before we can go on.

It may be possible to adopt a uniform plan for conducting certain operations, but if the premises on which we base our work are uncertain or unknown, we can hardly hope for similarity in results.

Take for instance fertilizer and plant tests. Recent work in soil physics would seem to indicate that certain factors connected with the soil not yet understood may, under certain conditions, directly or indirectly influence plant growth to a greater extent than plant food as ordinarily supplied. Until we know something more of the mysteries of the soil, scientific manuring is a misnomer and results obtained misleading.

Our experiments have carried us but little farther than the general knowledge obtained by the practical farmer without our assistance, which may be expressed by saying that, generally speaking, land that is well fertilized and well cultivated will, as a rule, but not always, produce a good crop; and some soils and crops respond to certain kinds of fertilizers better than others, but not uniformly so.

In his report on Physical Properties of Soils to the Agricultural Department, of the present year, Prof. Whitney says the practical farmer can judge more correctly of the condition of the land and what it is best fitted to produce, from its general appearance, than the agricultural chemist can from a study of its chemical composition.

The agricultural chemists, or at least some of them, may not admit this to be the fact, but it may not be far from the truth.

The results we get from experiments in stock-feeding are as unsatisfactory as those in plant growing and fertilizer work.

We have obtained some general knowledge of the value of certain feedstuffs, but as in crop-growing the practical farmer is pretty close to us; while we have given him some valuable suggestions, and some of not much worth, when he questions us very closely we look wise and talk about compounding rations, nutritive values, and nutritive ratios, etc., something beyond his comprehension; and it is an open question if it is not somewhat hazy with us.

Books could be written on what we don't know of the influence of light, heat, and moisture, atmospheric influences on plant and animal growth; but enough in this line, except to say that this lack of knowledge of the principles that underlie our work seems to me the one great obstacle to the adoption of official methods.

I believe we all recognize the need, the absolute necessity in fact, for thorough and exhaustive study of those mysterious but active forces in soil, plant, and animal, not simply to enable us to work in the same way, but that we may work at all intelligently.

Where shall this work be done and who shall do it?

At one of the meetings of this Association, a large majority of the delegates present were utterly opposed to the establishment of a central station at Washington to be equipped for investigations of a higher order than could be provided for in the State stations, and I dare say the sentiment is as strongly against such a project now as it was then. The work must be done, and several of the stations of the country are taking it up as far as their means will permit.

In looking over the Office of Experiment Stations Bulletin No. 12, I find the orang-ization lists show there are fifty-three stations in forty-six States and Territories, six States having more than one station. Three hundred and twelve expert investigators are named in the list of station workers. This number includes but nine directors, while fully half of the station directors give part of their time to investigation; and it does not embrace assistants. The list is classified as follows:

11 Chemists,	49 Horticulturists,	46 Agriculturists,
38 Botanists,	35 Entomologists,	24 Veterinarians,
14 Meteorologists,	4 Biologists,	4 Dairymen,
4 Physicists,	3 Mycologists,	3 Irrigation Engineers,
2 Geologists,	1 Microscopist,	1 Viticulturist.

Twenty-seven men work in two lines, mostly doubling up on botany, horticulture, and entomology.

Of the regular stations, all but Ohio find it necessary to employ a chemist, while on the other hand the State stations of Massachusetts and Connecticut, with the exception of a mycologist in each, show only chemists on their lists.

The general plan of organization and work in one-half or three-fourths of the stations is very much the same, and with some slight difference in details, practically the same line of experiments have been taken up.

The question I would submit is this: Can 111 chemists, 49 horticulturists, 46 agriculturists, 38 botanists, 35 entomologists, etc., working in 46 different States and requiring as many different laboratories and sets of apparatus, working largely on the same lines, accomplish as much of value as could one-third of the number in each specialty, supplied with three times the facilities in the way of apparatus and assistants that they now have?

Official methods must be based on a better knowledge of principles than we now possess, but the study of principles requires expert skill and materials for working with, that are beyond the means of a station equipped for several lines of work.

We have progressed so far that further investigation in most lines requires for expert skill and apparatus an outlay of from $4,000 to $10,000 per annum for one line of work; and I can conceive of no establishment of official methods until many of our stations devote almost their entire energies to one line of investigation.

If the experiment station is to be considered a training school for college students or model farm for the people of the community, it should have the regulation outfit of agriculturist, horticulturist, chemist, botanist, entomologist, dairyman, etc., and a farm, garden, laboratories for each line of work—in fact, the whole field of agriculture should be represented. The head of each department should have his proportion of the funds to secure harmony, and such an institution would undoubtedly be of value in most States, but shall we expect much original research when the working force is spread over so much ground?

It would seem that the boards of control of some stations and some college presidents have not made sufficient distinction between the object of the agricultural college and the object of the agricultural experiment station, nor do they always appreciate the importance of costly ability and expensive machinery in the work of investigation.

While we have an immense area of country and great diversity of climate, there is not such wide variation in adjoining States that it is necessary to make the same investigations in each.

Disclaiming any intention of questioning the good judgment of State officials, I am of the opinion that we may add greatly to the value of our results by division of labor and expenditure of the greater part of the man power and funds of one station in one line of work. Having made this change in our policy, it will be possible, I believe, to gradually establish official methods of experimentation.

I do not feel competent to present a plan for such division of labor, but I may be pardoned for submitting a few suggestions.

I would suggest a conference of station directors of groups of States lying near together and having somewhat similar conditions and interests; such as the New England States, the Central Mississippi Valley States, the northern, and southern halves of the arid belt, the Gulf States, etc.

In each one of these several groups of States there may be found as many important subjects for investigation as there are States, and these single lines of investigation, to a considerable extent at least, could be apportioned by mutual agreement, and the assignment made should constitute the special work of the station, to which should be given one-half, three-fourths, or better still, the entire energies of the station.

We have an example of what may be accomplished in equipping a station for a single line of work in the sugar station in this city.

Except in verification field tests, there is no necessity for attempting to duplicate the work of this station by expending $1,000 or $2,000 a year in any other Southern State.

Suppose some other station should take up the cotton plant as this station has sugar cane, is it not probable that we should get more positive data in regard to this plant from the one station than we now get from the nine or ten stations that have dabbled in cotton more or less?

Suppose some one station should confine its work to animal nutrition, or that two or three stations should divide the work between them, would it not be possible to disperse the fog that confuses our work in feeding?

The question of soil physics is of great importance in every State, but in the arid belt it is most important of all questions and most needs investigation. If, however, it is to be made one of ten lines of investigation carried on at the same time at one station with no additional help, it might better be omitted entirely.

But enough has been said on this line. I believe all will agree that a much higher class of work could be attempted and more knowledge gained by the division of labor suggested than is accomplished at present.

With the work of the experiment stations of the United States classified and apportioned as outlined, I believe it would be possible for this Association to appoint standing committees composed of men qualified to examine and make official reports upon the work of the stations adopting a specialty. The investigation of the methods of work could be made exhaustive, and from this careful scrutiny it would in time be feasible to build up a system of official methods.

What is the Live Weight of an Animal?

By H. J. Patterson, *of Maryland*.

It is very evident to all who have had anything to do with the weighing of animals, or who have even given the matter thought in looking over the work of others, that there should be something more specific as to what should be considered the starting and ending weight of animals under experiment; how these weights should be obtained, and the manner, time, and condition in which animals should be weighed. The question of the great fluctuation in weight from day to day is worthy of considerable attention, and, if possible, steps should be taken to eliminate this source of error, or at least to greatly reduce it. In looking over the records of weights of animals under experiments and comparing the methods by which these weights have been obtained, we find that it is indeed a very confounding mass of figures, a set of figures which has mainly the effect of producing doubt and distrust. We find recorded in our station literature almost every conceivable method of obtaining the weights of animals, having on the one extreme the holding of pigs at arm's length by their hind legs and guessing at the loss or gain, and at the other the weighing on delicate balances down to 1 gram. We also find that scarcely two persons will follow the same methods and details. It is often the case that the same person will not follow the same methods and details in two different experiments. Still worse, we sometimes find that there was no uniform method used as to manner, time, or condition of weighing the same animals throughout the same experiment.

It is only when we consider the fact of these great discrepancies and lack of uniformity, together with the fact that the conclusions of experiments are often based wholly upon the live weight, that the full importance of this subject becomes apparent.

The natural and normal state of animals is to have food and water always at hand and to partake of these whenever there is the slightest craving or inclination. In such surroundings, and other things being equal and normal, we should expect that the fluctuations in weight due to the change in the amount of material contained in the stomach should be reduced to a minimum. Unfortunately up to this time I have been unable to find any consecutive weighings of animals subjected to these normal conditions to test this point.

In the practice of feeding animals with the modern principles and advanced domestication many unnatural conditions have come into vogue, which makes it very important to us in our experiments to have some definite manner and condition for weighing, and to obviate, if possible, the extremes of fluctuation in weights due to the greater or less retention of food and water in the body.

The first question before us in this connection is: *Shall we weigh before or after feeding and watering?*

Reasoning on the basis that an animal's normal condition is to have all its wants satisfied, we should most naturally say that they should be weighed after feeding and watering. We also find that it is the common practice in stockyards to buy and sell cattle after they have had free access to hay and water. This custom has most probably grown out of the desire to eliminate sources of uncertainty and probable fraud.

To determine if the data at hand would throw any light upon this question I have collected and discussed the results of nearly 5,000 (4,988) weighings before and after watering. These figures have been procured from experiments with 34 different animals, varying from 15 to 175 consecutive weighings each. These represent all the figures I have had access to, which were at all comparable. Although many more like records exist it is believed that these are sufficient to answer our purpose.

The summary and averages of these weighings are given in the following table:

TABLE I.—*Average of weighings.*

Source of weights.	Date of beginning of experiment.	Animal.	Average weights.		Average amount of water drunk.	Number of weeks in experiment.	Fluctuation greatest before watering.	Fluctuation greatest after watering.	Average fluctuation.		Range of fluctuation.	
			Before watering.	After watering.					Before watering.	After watering.	Before watering.	After watering.
			Lbs.	*Lbs.*	*Lbs.*		*Wks.*	*Wks.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Md	Jan., '89	Cow Ramette.....	1,047	1,120	73	9	5	4	49	46	12—81	24—72
Md	Jan., '89	Cow Rose	767	814	47	9	3	6	31	34	18—70	13—78
Md	Jan., '91	Steer A	942	971	29	3	2	1	31	24	18—46	10—46
Md	Jan., '91	Steer B..........	956	985	29	4	3	1	28	30	18—38	16—42
Md	Jan., '91	Steer C..........	568	583	15	3	2	1	18	13	13—27	9—19
Md	Jan., '91	Steer D..........	571	590	19	4	1	3	21	20	17—25	12—25
Md	Feb., '92	Steer 1	730	744	14	3	0	3	22	35	14—28	31—41
Md	Feb., '92	Steer 2	741	768	27	3	1	2	23	35	21—24	23—57
N. Y ...	Jan., '84	Cow Jem	700	739	39	9	3	6	26	31	6—37	15—45

TABLE I.—*Average of weighings*—Continued.

Source of weights.	Date of beginning of experiment.	Animal.	Average weights. Before watering.	Average weights. After watering.	Average amount of water drunk.	Number of weeks in experiment.	Fluctuation greatest before watering.	Fluctuation greatest after watering.	Average fluctuation. Before watering.	Average fluctuation. After watering.	Range of fluctuation. Before watering.	Range of fluctuation. After watering.
			Lbs.	*Lbs.*	*Lbs.*		*Wks.*	*Wks.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
N. Y...	Jan., '84	Cow Meg.........	761	794	33	9	4	5	34	31	15—59	17—46
N. Y...	Dec., '84	Cow Ceres........	740	806	66	23	4	19	32	45	10—65	13—86
N. Y...	Dec., '84	Cow Juno........	903	954	51	23	8	15	40	47	7—79	10—83
N. Y...	Dec., '87	Cow Jem........	902	965	63	8	2	6	34	39	15—75	18—69
N. Y...	Dec., '87	Cow Meg.........	882	950	68	8	1	7	18	30	7—26	15—53
Pa.....	Dec., '85	Steer 1...........	1,083	1,115	32	14	4	10	26	32	10—50	10—67
Pa.....	Dec., '85	Steer 2...........	1,051	1,079	28	14	3	11	21	24	8—40	10—52
Pa.....	Dec., '85	Steer 3...........	1,151	1,192	41	14	3	11	26	29	12—40	10—50
Pa.....	Dec., '85	Steer 4...........	1,125	1,176	51	14	6	8	19	18	5—40	5—50
Pa.....	Dec., '85	Steer 5...........	808	846	38	17	6	11	31	35	15—65	10—55
Pa.....	Dec., '85	Steer 6...........	699	728	29	15	7	8	25	26	5—40	13—40
Pa.....	Dec., '85	Steer 7...........	705	748	43	16	6	10	27	29	10—50	10—60
Pa.....	Dec., '85	Steer 8...........	643	677	34	17	7	10	29	29	15—60	15—50
Pa*....	Nov., '86	Steer X...........	1,083	1,103	20	2	1	1	11	11	0—27	0—38
Pa*....	Nov., '86	Steer 1...........	1,162	1,201	39	15	.....	.....	9.8	9.6	0—40	0—40
Pa*....	Nov., '86	Steer 2...........	1,156	1,205	49	15	.....	.....	7	7	0—30	0—35
Pa*....	Nov., '86	Steer 3...........	1,216	1,261	45	15	.....	.....	12	13	0—50	0—57
Pa*....	Nov., '86	Steer 4...........	1,174	1,211	37	13	.....	.....	7.7	9.2	0—37	0—50
Pa.....	Nov., '87	Steer 1...........	899	930	31	5	3	2	15	13	5—25	6—21
Pa.....	Nov., '87	Steer 2...........	976	1,011	35	5	2	3	21	26	12—35	13—45
Pa.....	May, '88	Cow Topsy.......	751	835	84	6	4	2	38	36	7—60	4—50
Pa.....	Feb., '89	Steer 1...........	944	966	22	6	3	3	31	33	18—50	25—43
Pa.....	Feb., '89	Steer 2...........	933	948	15	6	3	3	38	39	20—50	15—65
Pa.....	Apr., '90	Cow Polly........	658	714	56	13	7	6	39	37	5—90	15—72
Pa.....	Apr., '90	Cow Flossie......	605	662	57	23	11	12	35	37	7—85	5—190

NOTE.—The averages are made by taking the average of the weekly average, except in the cases marked (*), which are for the daily weighings.

From this table it appears: (1) That with 70 per cent of the animals the average fluctuation was greatest in the weights obtained after watering; (2) that with weekly weighings the range of fluctuation was greatest in the weights obtained after watering, with 60 per cent of the animals; (3) that the range of fluctuation in one week's weighings was from 0 to 190 pounds after watering and only from 0 to 90 pounds before watering; (4) that with the greatest care and following the methods least liable to error and having the minimum of fluctuation, we may have an error amounting to 10 or 15 per cent of the total weight of the animal used in experiments.

Let us next look at another phase of the question and see how the gains in weight, as obtained by weighing before and after watering, compare. For this purpose I have used the figures obtained with fourteen different animals under fattening experiments. The results are set forth in Table II.

TABLE II.—*Gains in fattening experiments as indicated by taking weights before and after watering, and using the averages of seven consecutive weighings at the beginning and ending of the experiments.*

Animals.	Number of weeks in experiment.	Gain before watering.	Gain after watering.	Difference.
		Pounds.	*Pounds.*	*Pounds.*
Ramette	9	95	97	2
Rose	9	117	118	1
Steer 1 (1885)	14	126	134	8
Steer 2 (1885)	14	156	162	6
Steer 3 (1885)	14	120	140	20
Steer 4 (1885)	14	116	104	—12
Steer 5 (1885)	17	165	200	35
Steer 6 (1885)	15	130	150	20
Steer 7 (1885)	16	143	161	18
Steer 8 (1885)	17	155	170	15
Steer 1 (1886)	15	128	143	15
Steer 2 (1886)	15	153	153	0
Steer 3 (1886)	15	145	155	10
Steer 4 (1886)	13	138	131	—7

From this table it will be seen that in all but three cases the gains indicated by the weights taken after watering are greater than those obtained before watering and that in the extreme cases 17 per cent of the gain would appear to have been due to food and water. This gives particular stress to the importance of always weighing in the same conditions; and gains to be compared with each other should be obtained in the same manner.

What shall be considered the beginning and ending weight and how shall it be obtained?—It is already pretty well agreed that we should use the average of several consecutive weights for the beginning and ending weights of an experiment; yet we often note that there has been but a single weight taken at the beginning and ending of an experiment, and that they are used to represent the loss or gain due to the particular treatment. A glance at the great fluctuations as recorded in Table I is sufficient to tell that this is unreliable, and that we must use more than one weighing to obviate and reduce this source of error. There is a danger in the other extreme and there must be a limit; consequently how many weighings shall we make and use in our averages?

In Table III are recorded the average weights obtained by using three, five, and seven consecutive weighings with steers on maintenance and fattening rations; also the gains as indicated by following these different methods. From these results we find, as we would naturally expect, that with the maintenance ration it makes but little difference in the different averages whether we use three, five, or seven consecutive weighings, and that probably the more we use the more nearly we approximate the truth. With the fattening rations we find less difference in the different averages than we should expect—in fact, in most cases the agreement is surprising. On this basis alone we would not be warranted in advocating more than three consecutive weighings each at the beginning and ending of an experiment. Cattle on fattening rations and doing well should gain 2 or 3 pounds per day, from which we see that if we use the average of seven weights instead of three that we may introduce an error of from 10 to 20 pounds, and consequently record a gain which was really that much less than was truly the case. The results in a few instances as recorded in Table III indicate that this source of error has been introduced. From the fact as presented by Table III, and reasoning on the above basis, I doubt if we would be warranted in using more than three consecutive weighings for our averages to represent weights in fattening experiments.

Table III.

STEER 1.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Maintenance ration:								
Beginning	870	880	884	886	905	918	919	920
End of two weeks	897	892	898	901	930	930	929	933
Indicated gain	27	12	14	15	25	12	10	13
End of experiment	900	902	903	902	920	929	930	931
Total gain	30	22	19	16	15	11	11	11
Fattening ration:								
Beginning	1, 130	1, 116	1, 112	1, 116	1, 145	1, 136	1, 141	1, 148
First month	1, 150	1, 152	1, 143	1, 144	1, 170	1, 171	1, 170	1, 173
Gain	20	36	31	28	25	35	29	25
Second month	1, 185	1, 179	1, 177	1, 181	1, 227	1, 223	1, 212	1, 213
Gain	55	63	65	65	82	87	71	65
Third month	1, 210	1, 210	1, 207	1, 204	1, 270	1, 262	1, 257	1, 255
Gain	80	94	95	88	125	126	116	107
Fourth month	1, 245	1, 239	1, 245	1, 244	1, 295	1, 287	1, 290	1, 291
Gain	115	123	133	128	150	151	149	143

STEER 2.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Maintenance ration:								
Beginning	953	959	965	969	971	993	998	1, 002
End of two weeks	980	978	980	984	1, 005	1, 011	1, 012	1, 014
Indicated gain	27	19	15	15	34	18	14	12
End of experiment	958	963	967	969	986	995	997	1, 000
Total gain	5	4	2	0	15	2	—1	—3
Fattening ration:								
Beginning	1, 087	1, 102	1, 103	1, 105	1, 145	1, 141	1, 145	1, 148
First month	1, 120	1, 119	1, 120	1, 113	1, 150	1, 147	1, 148	1, 142
Gain	33	17	17	8	5	6	3	—6
Second month	1, 187	1, 170	1, 171	1, 170	1, 225	1, 215	1, 208	1, 207
Gain	100	68	68	65	80	74	63	59
Third month	1, 245	1, 238	1, 235	1, 231	1, 290	1, 290	1, 280	1, 278
Gain	158	136	132	126	145	149	135	130
Fourth month	1, 255	1, 253	1, 256	1, 258	1, 300	1, 297	1, 298	1, 301
Gain	168	151	153	153	155	156	153	153

TABLE III—Continued.

STEER 3.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Fattening ration:								
Beginning	1,160	1,167	1,166	1,169	1,220	1,209	1,212	1,214
First month	1,205	1,202	1,194	1,191	1,225	1,232	1,225	1,228
Gain	45	35	28	22	5	23	13	14
Second month	1,234	1,213	1,222	1,219	1,285	1,272	1,262	1,258
Gain	74	46	56	50	65	63	50	44
Third month	1,300	1,292	1,291	1,291	1,300	1,328	1,334	1,336
Gain	140	125	125	122	80	119	122	122
Fourth month	1,315	1,312	1,314	1,314	1,372	1,365	1,367	1,369
Gain	155	145	148	145	152	156	155	155

STEER 4.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Fattening ration:								
Beginning	1,105	1,107	1,110	1,115	1,140	1,143	1,148	1,155
First month	1,132	1,139	1,142	1,134	1,167	1,167	1,170	1,169
Gain	27	32	32	19	27	24	22	14
Second month	1,195	1,192	1,192	1,186	1,235	1,227	1,228	1,225
Gain	90	85	82	71	95	84	80	70
Third month	1,250	1,248	1,246	1,240	1,300	1,296	1,293	1,289
Gain	145	141	136	125	160	153	145	134
Fourth month	1,240	1,240	1,247	1,253	1,260	1,271	1,276	1,286
Gain	135	133	137	138	120	128	128	131

The question may come up in this connection as to whether there is any relation between the amounts of material consumed, matter voided, and the loss or gain in weight. In order to answer this question, Table IV has been added. But a glance at it is sufficient to show that there is no *direct* relation, for where the difference between food consumed and matter voided would indicate a gain of 34 pounds, we find one of only 4 pounds; and again where we have an indicated gain of 14 pounds, we find a loss in weight of 11 pounds, and so on throughout the list.

TABLE IV.—*Relation between food and water, excreta, and gain or loss in weight.*

Steer 1.						Steer 2.					
Fodder eaten.	Water drunk.	Total eaten.	Total voided.	Difference.	Loss or gain in weight.	Fodder eaten.	Water drunk.	Total eaten.	Total voided.	Difference.	Loss or gain in weight.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
11.7	32	43.7	33.4	+10.3	−7	12.3	41	53.3	33.5	+19.8	−7
11.0	10	21.0	23.1	−2.1	−16	10.5	23	33.5	30.5	+3.0	−5
11.3	36	47.3	28.0	+19.3	+6	9.7	35	44.7	31.7	+13.0	+3
11.7	44	55.7	21.4	+34.3	+4	10.0	38	48.0	28.6	+19.4	+2
11.0	33	44.0	29.4	+14.6	+3	13.5	25	38.5	24.7	+13.8	−10
11.5	30	41.5	29.5	+12.0	0	11.3	43	54.3	29.0	+25.3	+13
10.9	32	42.9	26.3	+16.6	+3	10.4	32	42.4	32.9	+9.5	+2
11.5	33	44.5	28.5	+16.0	0	11.0	20	31.0	25.7	+5.3	−20
11.5	33	44.5	32.9	+11.6	0	11.6	48	59.6	32.8	+26.8	+23
11.3	28	39.3	30.2	+9.1	−5	11.7	28	39.7	25.6	+14.1	−11
12.1	33	45.1	29.3	+15.8	+2	11.3	18	29.3	27.7	+1.6	−7
11.3	33	44.3	26.1	+18.2	+2	11.0	45	56.0	27.0	+29.0	+7
11.9	33	44.9	28.0	+16.9	0	11.3	28	39.3	24.9	+14.4	−2
12.0	28	40.0	33.4	+6.6	−2	11.2	30	41.2	31.4	+9.8	0
11.6	35	46.6	30.8	+15.8	0	10.9	35	45.9	26.1	+19.8	0
12.2	35	47.2	21.4	+15.8	0	10.8	40	50.8	29.2	+21.6	+2
11.6	30	41.6	31.1	+10.5	+5	10.6	29	39.6	25.6	+14.0	−2
12.1	30	42.1	25.1	+7.0	0	10.7	25	35.7	27.6	+8.1	−5
10.3	25	35.3	25.6	+9.7	−3	11.0	30	41.0	30.1	+10.9	−5
11.4	33	44.4	29.4	+15.0	+3	10.5	35	45.5	28.9	+16.6	0

SUMMARY.

From the figures and results which have already been presented the following conclusions may be warranted:

(1.) That it would seem best to follow the rule of weighing before watering rather than after.

(2.) That the average of three weighings at the beginning and the same at ending an experiment should be used as the starting and ending weights.

(3.) We should always weigh in the same manner and condition.

(4.) That it is evident we should endeavor to find methods by which to obviate the great fluctuations in weight which usually occur from day to day.

PHYSICAL TESTS OF SOILS.

By R. H. LOUGHRIDGE, *of California.*

The subject of soil investigation or inquiry into its chemical and physical nature has recently begun to assume some prominence among those scientists who give their time to the study of those conditions that promote or hinder the growth and development of plants and animals.

A few of these have, however, for many years believed the subject to be of prime importance and worthy of serious attention, as preliminary to investigations in which the relation of fertilizers to crops is concerned.

Among these, Dr. Robert Peter, of Kentucky, and Prof. E. W. Hilgard, formerly of Mississippi but now of California, are pioneers in this country; for they began the analyses and interpretation of results as long ago as the fifties.

As more than one thousand analyses of soils from some fifteen States have been made by them or under their supervision, and under conditions and methods so uniform as to make the results entirely comparable, I wish briefly to present these methods both chemical and physical, in order that by their adoption by the experiment stations, the comparability may be extended to all soils over the United States. That such a result is desirable in the extreme no one can deny; and its practical value has recently been very forcibly demonstrated in the comparison made by Prof. Hilgard of soils of the moist and arid regions of the Atlantic and Pacific slopes of the United States in his report to the Weather Bureau, entitled "Relations of soils to climate."

The method of actual analysis is perhaps in itself of no very special importance provided accurate results are obtained; for the results from a given solution should be the same by any method.

It is the method by which the soil solution is obtained that we wish to lay particular stress upon; the condition in which the analytical portion is taken; the solvent used and the time of digestion; for it is these that make the method presented by Prof. Kedzie the object of criticism.

Uniform methods in the preliminary treatment of the soil is then the main point to be insisted upon by those having at heart the comparability of results and the utilization and preservation of the immense amount of work already done.

In this preliminary work there are two points which mainly produce the great differences between the results by the one method and that by Kedzie.

The first is in the size of the meshes through which the soil is passed; or the limit in size of the particles which make up the so-called fine earth. The method of the Kedzie chemists places the maximum at 1 millimeter, while that of our method is one-half millimeter.

This admission of grains of from one-half to 1 millimeter into the calculation would produce in some soils a great difference in percentage results. In many of our sandy soils several per cent of such coarse materials would be added to the basis of calculation, and to that extent dilute the fine soil with inert matter. This question as to what should be rejected from the analyses was considered very early in the history of soil investigation, and both Drs. Peter and Hilgard concluded that all above one-half millimeter should be relegated to the rejected grit and gravel series, as comprising matters entirely devoid of plant food.

The percentages are determined, of course, but it is useless to clog the filter with this increased amount of insoluble residue and dilute the already small amount of plant food.

To include gravel and such coarse material in a chemical analysis is of course preposterous and a limit must be made to the size of the particles admitted to the fine earth So long, then, as this limit is to be an arbitrary one, is it not by far the wisest course to adopt that of the one-half millimeter by which so much work has already been done than to take the one millimeter and throw out of comparison that work as well as the interpretation of results so carefully made by Prof. Hilgard on that basis. The hygroscopic moisture absorbed by a soil is a very important index to its power of resisting drouth, and hence is always determined under conditions representing the two extremes of extra dryness and of air saturated with moisture at a regular temperature.

We thus have data for comparison under uniform conditions; while on the other hand the Kedzie method takes an air-dried soil for its hygroscopic moisture determination, and the condition of atmosphere is not noted.

I have thus briefly sketched the points in the Kedzie method of analyses that are fatal to any attempt at comparison of results with the vast amount of work already done; and they are points embraced almost exclusively in the preliminary treatment of the soil. I will now present the method as used by us, and which has been prepared by Prof. Hilgard, and I sincerely hope that it will be adopted by those chemists who may take up the subject of soil analysis.

MECHANICAL ANALYSIS.

It is hardly necessary to review for you the troubles and trials that Prof. Hilgard was subjected to in his first investigation of the mechanical constituents of soil, and which led up finally to his designing the present apparatus, which he terms a soil elutriator.

I will only say that the cause of all his trouble in the use of the Nobel apparatus and with beakers was the strong tendency of the fine particles to coalescence, a tendency that belongs to all from clay up to particles of 2 millimeters diameter or 16 millimeters hydraulic value. Prof. Hilgard therefore put into exercise his ingenuity and designed the present form of apparatus, though only recently has it been perfected as presented to you. A prime requisite is a uniformity in the velocity of each current of water.

To secure a uniform velocity it was of course necessary that the pressure of the column of water above the elutriator should be constant at whatever the height of water in the reservoir.

The Mariottes bottle fulfills these conditions, and is placed on a shelf some 15 or 20 inches above the top of the cylinder of the elutriator.

With this instrument very accurate results are obtained; and, what is more, sediment of any desired hydraulic value can be isolated by regulating the flow of the current.

The apparatus has the advantage over other methods, also, in permitting the operator to do other work, having only to keep an eye occasionally on it and an ear open to catch any irregular movement in churn or bubbles of air in the Mariottes bottle.

Method of Soil Analysis.

[Adopted by Drs. Robert Peter and E. W. Hilgard in the analysis of over 1,000 soils of the Southern and Pacific States, for the Tenth United States Census, and for the various State reports by the same authors.]

The soil is thoroughly broken up dry with a rubber pestle, or, in case of clayey soils, digested with distilled water until thoroughly disintegrated. It is then sifted or washed (as the case may be) through a sieve of 5 millimeters clear aperture; if washed, the muddy water must be evaporated to dryness with the soil slush and the whole thoroughly mixed. The samples so obtained constitute the "fine earth" to be used in chemical analysis; the coarse portions are to be further segregated by sieves and their mineralogical constituents identified with the microscope, reagents, or Thoulets solution, as the case may require. The fine earth is exposed to an atmosphere saturated with moisture for about twelve hours at the ordinary temperature (60°F.) of the cellar in which the box should be kept. For this it is sifted in a layer of about 1 millimeter thickness upon glazed paper, on a wooden table in a small covered box (12 by 9 by 8 inches) in which there is about an inch of water; the interior sides and cover of the box should be lined with blotting paper, which is kept saturated with water, to insure the saturation of the air.

After eight to twelve hours the earth is transferred as quickly as possible, in the cellar, to a weighed drying tube, and weighed; it is then placed in a paraffin bath; the temperature gradually raised to 200° (C.) and kept there twenty to thirty minutes (rapidity of raising temperature depending upon the amount of moisture in the soil), a current of dry air passing continually through the tube. It is then weighed again and the loss in weight gives the hygroscopic moisture in saturated air.

From the drying tube two quantities are weighed out; 2 to 2.5 grams for general analysis, and 3 to 3.5 grams for phosphoric acid determination. Of very sandy soils, as much as 4 grams may be taken for general analysis.

I.—General Analysis.

(1) The weighed quantity, usually of 2 to 2.5 grams, is brought into a small porcelain beaker covered with a watch glass, treated with 8 to 10 times its bulk of hydrochloric acid of 1.115 specific gravity and two or three drops of nitric acid, and digested for five days over the laboratory steam bath. At the end of this time it is evaporated to dryness, first on the water bath and then on the sand bath. By this treatment all the silica is rendered insoluble.

It is now moistened with strong hydrochloric acid and two or three drops of nitric acid, warmed, and, after allowing it to stand a few hours on the water bath, treated with distilled water; then it is filtered from the insoluble residue which is strongly ignited and weighed.

Note 1.—If the filtrate should be turbid the insoluble residue which has gone through the filter can be recovered in the iron-and-alumina determination.

The insoluble residue is next boiled for fifteen or twenty minutes in a concentrated solution of carbonate of soda, to which a few drops of caustic lye should then be added to prevent reprecipitation of the dissolved silica. The solution is then filtered hot.

The difference between the weight of the total residue and that of undissolved sand and mineral powder is recorded as "soluble silica," being the aggregate of that set free by the acid treatment, and that previously existing in the soil. The latter, however, rarely exceeds 5 per cent.

(2) The acid filtrate from the total insoluble residue is evaporated to a convenient bulk. In case the filtrate should indicate by its color, etc., the presence of any considerable amount of organic matter, it should be oxidized by aqua regia, otherwise there will be difficulty in separating alumina.

(3) The filtrate thus prepared is now brought to boiling and treated with ammonia, whereby the iron and alumina are precipitated; it is kept boiling until the excess of ammonia is driven off, and then filtered hot. (Filtrate A.)

Note 2.—If the boiling is continued too long, filtration becomes very difficult and a part of the precipitate may redissolve in washing. Filtration may be begun so soon as the nose fails to note the presence of free ammonia; test paper is too delicate. Failure to boil long enough involves the contamination of the iron-alumina precipitate with lime and manganese.

(4) The precipitation of iron and alumina is well washed with boiling water, then removed from the filter to a platinum dish. The small quantity which unavoidably remains on the filter is dissolved with hydrochloric acid (boiling); the filter is then added to the alumina or may serve for filtering the alumina subsequently.

The iron and alumina precipitate (with filter) of No. 3 is dissolved in a mixture of about 5 cubic centimeters hydrochloric acid and 20 cubic centimeters water. Then filter (see note 1) and make up to 150 cubic centimeters. Take 50 cubic centimeters for the determination of iron and alumina together (by precipitation with ammonia) and 50 cubic centimeters for iron alone; keep 50 cubic centimeters in reserve. Determine the iron by means of a standard solution of permanganate of potash, after reduction; this latter is done by evaporating the 50 cubic centimeters almost to dryness with strong sulphuric acid, adding water and transferring the solution to a flask, and then reducing by means of pure metallic zinc in the usual way. The alumina is then determined by difference.

(5) The filtrate A from iron and alumina is acidified slightly with HCl. and if too bulky, is evaporated down to about 25 cubic centimeters (unless the soil is a calcareous one) and the lime is precipitated from it by neutralizing with ammonia and adding ammonic oxalate.

The precipitation of the lime should be done while boiling, as the precipitate settles much more easily. It is allowed to stand for twelve hours, then filtered off, washed with cold water and dried. (Filtrate C.)

By ignition the precipitate is partially converted into the oxide. This is then heated with twice its bulk of powdered ammonium carbonate, moistened with hot water and exposed to a gentle heat (50 to 80° C.) until all the ammonia is expelled. It is then dried below red heat and weighed as lime carbonate. When the amount of lime is at all considerable, the treatment with ammonic carbonate must be repeated till a constant weight is obtained.

(6) The filtrate C from the lime is brought into a hard Bohemian flask, evaporated down over the sand bath and the ammoniacal salts destroyed with aqua regia (Lawrence Smith's method.) From the flask it is removed to a small beaker and evaporated to dryness. This process usually occupies four to five hours. The residue

should be crystalline-granular; if white-opaque, ammonic nitrate remains and must be destroyed by HCl.

The dry residue is now moistened with nitric acid and the silica present is separated by filtration from the filtrate which should not amount to more than 10 or 15 cubic centimeters. Sulphuric acid is then precipitated by treatment with a few drops of baric nitrate; both the solution and the reagent being heated to boiling. If the quantity of sulphuric acid is large, it may be filtered off after the lapse of four or five hours. (Filtrate D.) If very small let it stand twelve hours. The precipitate is washed out with boiling water, dried, ignited and weighed. (Filtrate D.)

Note 3.—Care should be taken in adding the barium nitrate to use only the least possible excess, because in such a small concentrated acid solution the excess of barium nitrate may crystallize, and will not readily dissolve in hot water. Care must also be taken not to leave in the beaker the large heavy crystals of baric sulphate, of which a few sometimes constitute the entire precipitate, rarely exceeding a few milligrams. Should the ignited precipitate show an alkaline reaction on moistening with water, it must be treated with a drop of HCl refiltered and reweighed.

(7) Filtrate D is now evaporated to dryness in a platinum dish; the residue is treated with twice its bulk of crystallized oxalic acid, moistened with water and exposed to gentle heat. It is then strongly ignited to change the oxalates to carbonates; this treatment with oxalic acid must be made in a vessel which can be kept well covered, otherwise there is danger of loss through spattering. As little water as possible should be used, as otherwise loss is difficult to avoid from evolution of carbonic gas. Spatters on the cover should not be washed back into the basin until after the excess of oxalic acid has been volatilized. The ignited mass should have a slightly blackish tinge, to prove the conversion of the nitrates into carbonates. White portions may be locally re-treated with oxalic acid. The ignited mass is treated with a small amount of water which dissolves the alkaline carbonates and leaves the carbonates of magnesia, proto-sesquioxide of manganese, and the excess of barium carbonate behind. The alkalies are separated by filtration into a small platinum dish (Filtrate E), and the residue well but economically washed with water on a small filter. When the filtrate exceeds 10 cubic centimeters, it will on evaporation show so much turpidity from dissolved earthy carbonates as to render refiltration on a minute filter necessary, since otherwise the soda percentage will be found too large, magnesia too small.

Note 4.—If on dissolving the ignited mass the solution should appear greenish, from the formation of alkaline manganates, add a few drops of alcohol to reduce the manganese to insoluble dioxide.

The residue of barium, magnesium, and manganese compounds is now treated on the filter with hydrochloric acid, and the platinum dish is washed with warm nitric acid (not hydrochloric, for the platinum dish may be attacked by chlorine from the manganese dioxide), dissolving any small traces of precipitate that may have been left behind.

(3) The solution containing the chlorides of magnesium and manganese is now freed from the barium salts by hot precipitation with sulphuric acid, and the barium sulphate, after settling a few hours is filtered off. The filtrate is neutralized with ammonia, any resulting small precipitate (of iron) is filtered off, and the manganese precipitated with ammonic sulphide. Let stand twelve hours, and filter (filtrate F); wash with cold water, dry, ignite, and weigh as manganic proto-sesquioxide Mn_3O_4.

(9) The filtrate F from the manganese is now freed from sulphur by acidulating with hydrochloric acid, evaporating down if necessary, and filtering. From the filtrate the magnesia is precipitated by adding an equal amount of ammonia and treating with sodic phosphate. After standing at least twenty-four hours, the magnesia salts may be filtered off, washed out with ammoniacal water, dried, ignited, and weighed as magnesium pyro-phosphate.

(10) The filtrate E, which should not be more than 10 or 15 cubic centimeters, containing the carbonates of the alkalies, is evaporated to dryness and gently fused so as to render insoluble any magnesium carbonate that may have gone through; then redissolved and filtered into a small weighed platinum dish containing a few drops of hydrochloric acid, to change the carbonates into chlorides; evaporated to dryness, exposed to a gradually rising temperature (below red heat), by which the chlorides are thoroughly dried and freed from moisture so as to prevent the decrepitation that would otherwise occur on ignition. Then, holding the platinum basin firmly by forceps grasping the clear edge, pass it carefully over a very low Bunsen flame, so as to cause, successively, every portion of the scaly or powdery residue to collapse without fully fusing. There is thus no loss from volatilization, and no difficulty in obtaining an accurate, constant weight.

The weighed chlorides are now brought by means of a little water into a small beaker or porcelain dish, treated with a sufficient quantity of platinic chloride, and evaporated to dryness over the water bath. The dried residue is treated with a mixture of three parts alcohol and one part ether, leaving the potassio-platinic-chloride undissolved. This is put on a filter and washed with ether-alcohol. When dried the precipitate and filter are put into a small platinum crucible and exposed to a heat sufficiently intense to reduce the platinum chloride to metallic platinum and to volatilize the greater part of the potassium chloride. This is easily accomplished in a crucible which is roughened by being constantly used for the same purpose (and no other), the spongy metal causing a ready evolution of the gases.

The reduced platinum is now first washed with hot acidulated water, then with pure water, then all moisture is driven off and it is weighed. From the weight of the platinum is calculated the *potassic chloride* and the oxide corresponding; the difference between the weights of the total alkaline chlorides, and the potassic chloride gives the sodic chloride from which may be calculated the sodic oxide.

II.—Phosphoric acid determination.

(11) The weighed quantity of 3 to 5 grams is ignited in a platinum crucible, care being taken to avoid all loss by dusting. The loss of weight after full ignition gives the amount of chemically combined water and volatile and combustible matter.

(12) The ignited soil is now removed to a porcelain or glass beaker, treated with four to five times its bulk of strong nitric acid, digested for two days, evaporated to dryness first over the water bath and then over the sand bath; moistened with nitric acid, heated and treated with water. After standing a few hours on the water bath it is filtered off from the insoluble residue and the filtrate is evaporated to a very small bulk (10 cubic centimeters) and treated with about twice its bulk of ammonium molybdate, thus precipitating the phosphoric acid. After standing at least twelve hours, at first on the steam bath, it is filtered off and washed with a solution of ammonium nitrate acidified with nitric acid. The washed precipitate is dissolved on the filter with dilute ammonia. After washing the filter carefully the ammoniacal solution is treated with magnesia mixture, by which the phosphoric acid is precipitated. After allowing it to stand twenty-four hours it is filtered off, washed in the usual way, dried, ignited and, weighed as magnesium pyrophosphate, from which the phosphoric acid is calculated. The per cent of phosphoric acid found is to be subtracted from that of the alumina.

Note.—When a gelatinous residue remains on the filter after dissolving the molybdo-phosphate with ammonia, it may consist either of silica not rendered fully insoluble in the first evaporation, or, more rarely, of alumina containing phosphate. It should be treated with strong nitric acid, and the filtrate with ammonic molybdate. Any precipitate formed is of course added to the main quantity before precipitating with magnesia solution.

HUMUS DETERMINATION IN SOILS.

About 10 grams of soil are weighed off into a prepared filter. The soil should be covered with a piece of paper (filter), so as to prevent it from packing when solvents are poured on it.

It is now treated with hydrochloric acid from 0.5 to 1 per cent strong (25½ cubic centimeters of strong acid and 30 cubic centimeters of water), to dissolve out the lime and magnesia, which prevent the humus from dissolving in ammonia. Treat with the acid until there is no reaction for lime; then wash out the acid with water to neutral reaction. Dissolve the humus with weak ammonia water, prepared by diluting common saturated ammonia water (173 cubic centimeters ammonia to .22 water). Evaporate the humus solution to dryness in a weighed platinum dish at 100, C.; weigh, then ignite. The loss of weight gives the weight of humus.

The residue from ignition is carbonated with carbonic gas, heated, and weighed, thus giving the ash. It is then moistened with nitric acid and evaporated to dryness. The residue is treated with nitric acid and water, allowed to stand a few hours, and the solution filtered from the insoluble residue, which is ignited and weighed, giving the silica.

The "soluble" phosphoric acid is determined from the solution by the usual method, as magnesic pyrophosphate. It usually amounts to a fraction varying from one-half to as little as one-tenth of the total in the soil.

While the P_2O_5 so determined is manifestly more soluble and more available to vegetation than the rest of that found by extraction with stronger acid, it is clearly not as available as that which, when introduced in the form of superphosphates, exerts such striking effects, even though forming a much smaller percentage of the whole soil. Nevertheless, very striking agreement with actual practice is often found in making this determination.

The estimation of "humus" by combustion in any form of the total organic matter in the soil gives results varying according to the season, and having no direct relation to the active humus of the soil.

It is strenuously suggested that in the presentation of the results of a soil analysis the order of the electrolytic series be observed, as in the schedule annexed, so as to facilitate comparisons. The "insoluble residue" is best placed at the head of the column, as it indicates at a glance, approximately, the general character of the soil, as sandy or clayey.

For suggestions concerning the interpretation of analyses made according to the above method see "Report on the Experiment Stations of the University of California," 1890, pp. 151–172.

SUGGESTED EXPERIMENTS IN BREEDING.

By WILLIAM H. BREWER, *of Connecticut.*

Practical breeding has become a greatly specialized art, and the natural laws involved are a very fit subject for experimental study at the stations. Although the general rules seem to be fairly well understood, nevertheless some of the fundamental laws of breeding are not yet established, and will not be until proved by experiments made for this special end by trained biologists working according to scientific methods.

For example: It is almost universally believed by practical breeders that "acquired characters" are sometimes, or at least to some degree, transmitted by heredity, and they practice accordingly. This belief has been so widely shared by scientists that until lately it has been a sort of scientific dogma.

Within a few years, however, this dogma has been questioned by a large number of very eminent biologists, many of whom deny it in toto and claim that from the very nature and basis of heredity such transmission can not take place under any circumstances nor to any degree whatever.

Between the two extremes there is a considerable following which allows the possibility of the heredity of "acquired characters," but denies that it has any practical value in the evolution of species in nature, and consequently plays no part in the improvement of breeds by art.

This uncertainty is so far-reaching in its applications and so important in its economic results that I suggest a few series of experiments to be made at agricultural experiment stations. The costly character of the best stock used in practical breeding and the cost of the means and appliances for breeding in its most advanced practice place this out of reach of the stations. The experiments I suggest may be carried out with some small and inexpensive species of domestic animals. The experiments had better be made with mammals than with poultry, and the laws involved can be as well established by experiments on rabbits, guinea pigs, or even rats and mice, as with the most expensive trotters or short-horns.

The eminent Prof. August Weismann and his followers claim that none of the changes produced on an animal after its birth are ever transmitted by heredity to its offspring, even in the slightest degree; that the changes in the parent due to nutrition, those which follow from increased or diminished function, the effects of mutilation, injury, and disease—in short, of "any of the external influences which act upon the body"—never are, and never can be, by any possibility, transmitted; that the fundamental causes of heredity absolutely forbid it.

I have yet to find the successful breeder who accepts this as an established law of nature, nor is it accepted by all biologists. I think, therefore, that experiment stations, established for the investigation of natural laws of economic importance, should undertake experiments to find out what is the law involved in such cases. I would suggest that the experiments be carried along in at least two parallel lines, one to determine the effect of nutrition, the other of function. These would be the easier and of more obvious application to the average practical breeder.

If rabbits, for example, are chosen for experiment, I would recommend that the beginning be made with a sufficiently large number of animals so that the breeding need not be very close, and that the original stock consist of several breeds, half a dozen or more, their blood to be variously mixed by crossing as the experiments go on in order that the mongrel produce may have a greater tendency to vary under the conditions imposed than if but one original breed was used whose characters were well fixed and more liable to breed true to the parent type.

Let two sets from the same stock be bred separately and the experiments carried on along two parallel lines; the one well fed during growth, that the mature animals may be of good and full size; the other be stunted during growth by under feeding. Consider this for a considerable number of successive generations, ten or fifteen at least, the one series continually well fed, the other continually under fed, and carefully record the results during the progress. Also keep a record of the number of each produced, that one phase of the mooted question of the causes of sex may be investigated at the same time.

Inasmuch as the whole increase of the flock could not be kept in the reducing of the numbers from time to time great care should be used that selection as to size be not practiced; they should be selected by averages, by weighing, or in some other satisfactory way.

The outcome of such a series of experiments would be of vast importance ultimately in determining the natural laws which underlie the best treatment for growing animals intended for breeding.

For determining the influence of the exercise or disuse of function another series is requisite. Function may be impaired by disuse, by injury, or by mutilation, by disease, or by other causes.

The most convenient and, for various reasons, the best way would be to impair function by mutilation. Suppose we use rabbits (as in the previously suggested experiments), beginning with a considerable number of breeds, and crossing until one had a mongrel stock of the different breeds variously intermingled. Let us, from the beginning, amputate some one limb, soon after birth, of all the animals, always amputating the corresponding limb (say the left foreleg or the right hindleg, not the left of one animal and the right of another, but always the corresponding limb). Pursue this for at least ten or fifteen successive generations, and record the results. Some other injury might be more convenient, as the extirpation of an eye, inasmuch as there are several recorded cases of alleged transmissions of injury to the eye.

If mutilation be objected to, then resort to the more troublesome process of preventing use. Tie up or in some other way prevent the use of one limb or the use of one eye, from birth on, and note the effect, if any, on successive generations.

While such interference with function is not precisely the reverse of exercise and training (as shown in the development of speed in trotters and milk in cows), yet the laws involved are the same and would be of great scientific interest as well as of practical importance.

It seems to me that experiments on the removal of some organ of little use to the animal in domestication, such as cutting off the tail or an ear, would not fulfill the best condition for experiment. There is too little function involved.

A number of other lines of experiment readily suggest themselves; but I have long had this matter in mind, and on the whole, the directions I have indicated seem to me the most practicable, fair, and the most promising of results, and there can be no complete science of breeding until the fundamental laws are established.

While on this subject, I wish to suggest a line of observations to be recorded at those stations where cows are bred and where milk is tested. There is much assertion, but I know of no extensive recorded observations, as to the effect produced by the milking of the dam on the milking capacity of the offspring. Let a record be kept of the successive calves of each cow, to see if, on the average, the earlier calves are as good milkers as the later ones; if there is any difference, wherein does it lie? Observations on the offspring of any one cow are of little value; recorded observations on many would be of much value in establishing a rule.

Ramie culture in the South.

By C. R. Dodge, *of Washington, D. C.*

Will it pay Southern farmers to cultivate ramie? is a question easier to ask than to answer. At the very outset, we may reply emphatically "No," until a satisfactory machine decorticator or process has been presented that will produce the fiber at a cost allowing competition with the imported China ramie of commerce. But it is not my purpose to speak of the machine question at this time. For the sake of argument we will suppose that question settled, though it is not settled by any means.

Now, with a satisfactory machine or process, will ramie culture pay in those States bordering on the Gulf, where the plant is claimed to grow successfully? As far as my investigations have shown, and in spite of the experimental culture of ramie for many years in the South, it is simply impossible to answer the question, because these experiments have either been conducted in too superficial a manner with failure inevitable from the industrial standpoint, or they have been upon too small a scale to furnish a basis for reliable estimates. In making such a statement I am aware that figures have been published from time to time purporting to show the actual cost of growing an acre of ramie, but they have not borne the test of careful analysis.

Many claim that ramie culture will not pay. But the claim is also made in the South by others that a field of ramie will take care of itself after once planting, the soil requiring no special cultivation or manuring. Here is what a Southern writer says concerning the crop: "Ramie is preëminently a poor man's crop. It is the easiest and least expensive in point of labor of all crops to produce." This is absurd. An experimenter said to me not long ago, "We have given up ramie; there is no money in it." But he did not tell me what I afterwards learned, that the roots had been set out in the poorest soil with no manuring, and had been practically allowed to take care of themselves. The owner of one of the largest tracts of ramie in Louisiana, speaking of his operations the present season, admitted to me after harvesting the crop that all his preconceived ideas upon the subject had been upset, and he was beginning to see where mistakes had been made.

The grain of wheat in all this peck of chaff is that before making any positive statements concerning the cost of ramie cultivation in the United States experiments must be conducted on a large scale for several seasons under most careful supervision, and the conditions of successful growth intelligently studied as they have never been studied in this country.

By successful growth I do not mean the ability of the plant to shoot up stalks of requisite height and to clothe these stalks with a healthy growth of leaves, but to ascertain if such stalks contain proper spinnable fiber after having been grown, and in sufficient quantity per acre to yield an adequate return for the expenses of cultivation and the subsequent expenses of extracting the fiber and degumming it for the spinner. A stalk of ramie either grows rapidly and rankly when there is an excess of moisture, or it is stunted and of slow growth when opposite conditions prevail.

Where one of these conditions follows the other in the same growing crop, the fiber is adversely affected, for, in the after processes to fit it for spinning, treatment necessary to reduce the hard or stunted growth to the condition of spinnable fiber may wholly disintegrate the structure of the fiber in the softer or free-grown portion of the stalk, and great wastage and loss ensue. Or, the stalks in one part of the field may produce one grade of fiber and those on another portion a different grade, or the crops from two cuttings may differ in the same way. An acre of ground should produce 10 to 15 tons of stalks with leaves; say 12½ tons average, of 25 tons for two annual cuttings. French experiments have shown that every ton of stalks and leaves when properly treated will give about 25 pounds of the chemically degummed fiber fit for spinning. Records of these experiments show that this 25 pounds of fiber has cost for culture, cleaning, and degumming not over $3. Multiply this by 25, the product of 25 tons of stalks with leaves, and we have a total of 625 pounds of spinnable fiber that have cost for cultivation and treatment, including chemical degumming, $75. Yet only a few days ago I saw a published statement that the income to a Southern farmer for cultivation alone would amount to $150 per acre.

Before the farmers of the South may be induced to go into ramie culture, several points should be settled that can not be settled by indifferently conducted experiments, or by cultivation on garden plot areas:

(1) How many tons of stalks per acre can be regularly produced?

(2) What quantity of spinnable fiber will an acre produce?

(3) What methods of cultivation, drainage, irrigation with soil selection, or selection of location, will be necessary to produce an even quality of spinnable fiber one crop with another or in the same crop; and lastly, these questions having been satisfactorily answered, what profit will the balance sheet show between cost of cultivation and harvesting, and price that the spinner will pay for the degummed fiber? This, in short, means a connected study of the whole field of operations, culture, the machine problem or the cleaning of the fiber, and degumming, because the price of the commercial China grass, imported without duty, fixes the price of all fiber. The question may be asked, Why include the degumming, and why not stop with the machine-cleaned fiber, as the degumming is a part of the manufacturing process? I will reply that in the hand preparation of commercial ramie by the Chinese the product is partially degummed, and that the machine-prepared fiber in all prob-

ability will never bring the same price per pound as the Chinese for this reason. When the economically successful machine has been placed on the market, and careful field tests have shown the quality and quantity of the output we will know something more than is known now concerning the money value of machine-cleaned fiber, and it will not then be a difficult matter to say what the farmer's share of the ton value of the fiber will be.

Such connected study has been given to the industry in France, followed by valuable practical results, that have made it a recognized industry. The French figures of cultivation are available for our study and guidance, but they do not settle the various problems as regards cultivation in America where such different conditions prevail. We must therefore work out these problems for ourselves.

While these facts are in a sense discouraging, there are some most encouraging features. In the first place my recent investigations have shown that American experimenters degum the China ramie at almost half the cost at which it is degummed in France with a loss by waste of only 5 per cent against 30 to 40, as shown by the French records. If this saving can be made with China grass it can be made with the home grown product, which would mean more spinnable fiber to the ton of stalks, and at a less cost. One of the great expenses of harvesting the crop, the stripping of the leaves, will eventually be accomplished by the machine which strips the fiber, and France already has a machine that has shown promising results and which takes the stalks, leaves and all. And, finally, should a careful system of experiment demonstrate that we can produce good fiber at a paying cost, there is no doubt at all concerning the market. The absence of a regular supply of fiber, in the past, has been one of the chief obstacles that has hindered the manufacturing side of the industry, though there is now a better supply. Ramie goods are purchasable to-day in New York city, manufactured in France by a concern which runs over 5,000 spindles, and I know that capital on this side of the water is already interested in establishing manufacturing plants on a large scale. Their supply of the raw material must be derived from China, but Southern ramie will have equal chance when it has been demonstrated that we can produce good fiber at a cost that will enable its use economically.

The Government share in this work is to secure all available information, from every source, and disseminate this information through its publications, and by correspondence in answer to personal inquiry.

THE SECTION ON HORTICULTURE.

A meeting of the Section on Horticulture was called, but it appeared that only four members were present. An invitation having been received from the Section on Botany for the members of the Section on Horticulture to meet in joint section with them, it was thought best to accept it, and accordingly the two sections held their meetings in conjunction throughout the convention.

By a revision of the constitution the Sections on Horticulture and Botany were consolidated, hence the two sections will in the future meet together, forming a single section.

THE SECTION ON BOTANY.

The Section on Botany organized at 7:30 p. m. November 15.

In the absence of the chairman Prof. P. H. Mell, of Alabama, was elected chairman *pro tem.*

The horticulturists were invited to meet with the Botanical Section. The following persons were present at the different sectional meetings: Halsted of New Jersey, Earle, Tracy, and McKay of Mississippi, Mell and Duggar of Alabama, True of Washington, D. C., Goff of Wisconsin, Woods of Connecticut, Speth of Georgia, Munson of Maine, Scribner of Tennessee, McCluer of Illinois, Neal of Oklahoma, Gulley of Arizona, Osborn and Pammel of Iowa, Warder of Ohio, and F. H. Burnette of Louisiana.

A committee of three, consisting of Messrs. Scribner, Goff, and Pammel, was appointed to consider the papers in hand. The following papers were referred for reading at the general session:

Notes on the treatment of apple scab, by E. S. Goff; Results of spraying potatoes for prevention of blight, by L. R. Jones; Fruit rots, a study, by B. D. Halsted; Notes on the breeding of fruits, by N. E. Hansen; Crossing of cucurbits, by L. H. Pammel.

On November 16, at 10:30 a. m., the section was favored with a talk on the laboratory exhibit of botany and horticulture at the Columbian Exposition by Mr. True, and on the work for the botanical alcove by Mr. Tracy.

On November 17, at 7 p. m., Mr. Halsted acted as chairman and the following papers were presented before the section:

Bean anthracnose and its treatment, by S. A. Beach.—Various fungicides like Bordeaux mixture and cupric borate were experimented with. It was also shown that plants from healthy seed were better than those of diseased seed. At the time of first picking they were ahead by thirty-eight points on yield by pods, forty points on yield by weight, and seventy-five points on condition of foliage; but for the entire season the difference was but nine points, seventeen points, and eight points respectively.

Some experiments in the prevention of Cercospora ribis and Cylindrosporium padi, by L. H. Pammel.—Attention was called to the successful application of Bordeaux mixture, half strength during the season of 1892.

Ammoniacal carbonate of copper half strength and sulphosteatite, as a powder, failed to be as valuable as Bordeaux mixture for the treatment of currants. Those treated with the latter mixture retained their foliage well in October. *Cylindrosporium padi* on cherries can easily be prevented by the use of Bordeaux mixture. Mr. Goff also found Bordeaux mixture valuable for currants.

Quince disease, by B. D. Halsted.—The following fungous troubles of the quince fruit were treated, namely: the quince rust (*Rœstelia aurantiaca* Pk.); fruit spot (*Entomosporium maculatum* Lev.); black rot of the quince (*Sphæropsis malorum* Pk.); quince pale rot (*Phoma cydoniæ* Sacc.?); ripe rot of the quince (*Glœosporium fructigenum* Berk.), and the quince blotch, due to an unrecorded fungus, the life history of which is still obscure. The black rot is the same as that of the apple, and the fact that a large apple tree had the ground beneath it covered with rotting apples, doubtless had much to do with the prevalence of the rot in the quinces. The pale rot may not be *Phoma cydoniæ* Sacc., the description being so meager as to leave a doubt. The ripe rot is the same as that of the apple, as proved by inoculation.

Antagonistic relations of certain potato rots, by L. R. Jones.—He called attention to the great abundance of *Phytophthora infestans* in 1890, 1891, and 1892. There are three common blights in Vermont. *Phytophthora infestans* does its greatest damage on medium and late potatoes. The "new disease" destroyed the potato vines by the first week in August before the conditions of weather were such as to favor the development of *Phytophthora*.

Preliminary notes on rutabaga and turnip rot, by L. H. Pammel.—A disease doing considerable damage, in some cases destroying half the crop, occurred on the Iowa Agricultural College Farm. Dry weather in September almost checked the progress of the disease. The disease is due to a bacterium. Several germs were isolated and one apparently produced the disease in the field. But this is not conclusive evidence that it is the specific germ, as the experiments carried out do not conform to all of the Koch canons.

A new "damping off" fungus, by George F. Atkinson.—A sterile mycelium of a fungus which causes "damping off" of cotton, *Dolichos sinensis*, cauliflower, alfalfa, etc., was isolated. The fungus was grown in nutrient media and young plants inoculated producing the characteristic "damping off." From these plants the fungus was again obtained. The fungus is probably a member of the *Hymenomycetes* or *Discomycetes*.

Relation of frost to certain plants, by L. H. Pammel.—In this paper the exact temperatures at which various plants were affected by frost were noted. In some cases parts of a plant close to the ground were affected while the upper were not injured as in castor-oil bean (*Ricinus communis*). On October 18 the minimum temperature close to the ground was 18° F. Five feet from the ground it was 36° F.

New Jersey mildews (*Peronosporeæ*), by B. D. Halsted.—The chief point in the record for the year is, that while the latter portion of the growing season has been unusually dry, there has been more than the ordinary amount of those members of the group belonging to the genus *Cystopus*. In a further study of the methods these disastrous mildews have for passing the winter, it was found that some species grow upon the fruits and that doubtless the filaments of the fungus penetrate the seeds and when the latter germinate the parasite develops with the host. Large numbers of small young seedlings were taken that were badly infested.

The importance of making field notes upon the prevalence of parasitic fungi extending over many seasons was urged.

Weed seeds, by B. D. Halsted.—Samples of a collection of weed seeds were shown. The set consists of one hundred species of our worst weeds, and the seeds are put up in dram, metal screw-top, vials arranged in a tray, about the size of a herbarium sheet. Each bottle has a printed label, bearing a number and the botanical name of the seeds contained. To the inside of the tray cover is pasted a corresponding list with common names added, and whether the species is native or foreign, and whether annual, biennial, or perennial. The set is designed to assist experiment station workers in determining the nature of foul stuff in commercial seeds. It will also serve the same purpose for the wholesale dealers in seeds.

Method of obtaining pure cultures of Pammel's fungus of Texas root-rot of cotton, by Geo. F. Atkinson.—It is difficult to grow many fungi in nutrient media, and this is one of them. Several attempts were made to induce this fungus to part with its host. When grown in sand in moist chambers the strands grew several inches long, but they failed to grow in nutrient media when transferred. Baits were provided and after some difficulty the fungus was obtained in a pure state.

The section nominated Mr. F. Lamson-Scribner, of Knoxville, Tenn., for chairman, and Mr. E. S. Goff, of Madison, Wis., secretary.

The section then adjourned.

GEO. F. ATKINSON,
Chairman, Ithaca, N. Y.
L. H. PAMMEL,
Secretary, Ames, Iowa.

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NAME LIST.

SUBJECT LIST.

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PUBLICATIONS OF THE OFFICE OF EXPERIMENT STATIONS.

The Office of Experiment Stations issues two classes of publications for general distribution:

(1) Experiment Station Record, Experiment Station Bulletins, and Miscellaneous Bulletins, which are more or less technical. It is the practice to send to persons applying for them one or more numbers, from which they may judge of their usefulness, but not to place any names upon the mailing list until after receipt of applications on special blanks furnished by the Office.

(2) Farmers' Bulletins, which are brief and popular in character, and are sent on application. These bulletins are issued as part of the general series of Farmers' Bulletins of the Department of Agriculture.

The following publications have been issued:

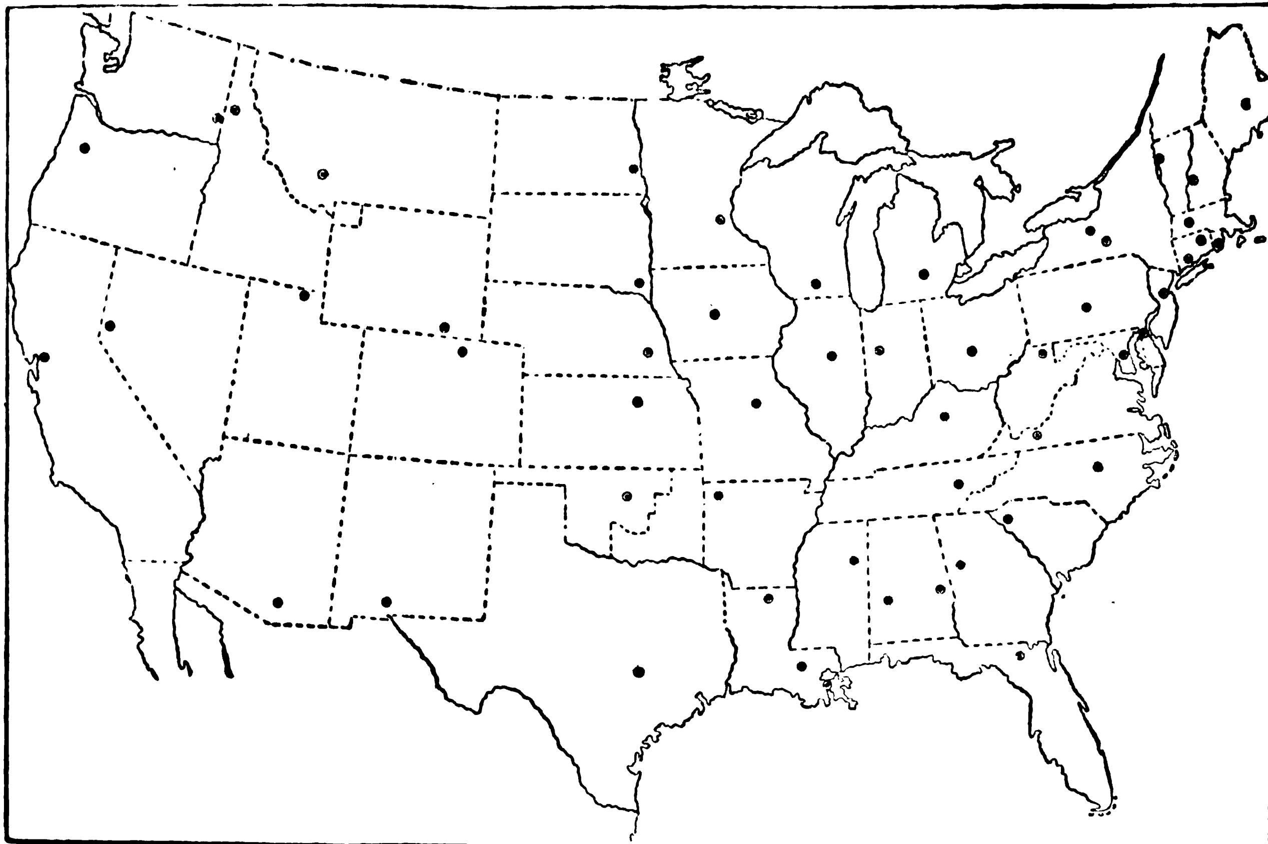
Experiment Station Record, vol. I, 6 numbers; vol. II, 12 numbers; vol. III, 12 numbers and index; vol. IV, Nos. 1-10. Copies of the station and Department publications abstracted in the Record can, in many instances, be obtained on application.

Experiment Station Bulletins.—No. 1, Organization and History of the Stations; No. 2, Digest of Annual Reports of the Stations for 1888, in two parts; No. 3, Report of Meeting of Horticulturists at Columbus, Ohio, June, 1889; No. 4, List of Station Horticulturists and Outline of their Work; No. 5, Organization Lists of Stations and Colleges, March, 1890; No. 6, List of Station Botanists and Outline of their Work; No. 7, Proceedings of the Fifth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, Washington, D. C., August, 1891; No. 8, Lectures on Investigations at Rothamsted Experimental Station; No. 9, The Fermentations of Milk; No. 10, Meteorological Work for Agricultural Institutions; No. 11, A Compilation of Analyses of American Feeding Stuffs; No. 12, Organization Lists of the Agricultural Experiment Stations and Agricultural Schools and Colleges in the United States, June, 1892; No. 13, Organization Lists of the Agricultural Experiment Stations and Agricultural Schools and Colleges in the United States, April, 1893; No. 14, Proceedings of a Convention of the National League for Good Roads.

Miscellaneous Bulletins.—No. 1, Proceedings of Knoxville Convention of Association of Agricultural Colleges and Stations, January, 1889; No. 2, Proceedings of Washington Convention of the Association, November, 1889; No. 3, Proceedings of Champaign Convention of the Association, November, 1890.

Farmers' Bulletins.—No. 1, The What and Why of Agricultural Experiment Stations; No. 2, Illustrations of the Work of the Stations; No. 9, Milk Fermentations and their Relation to Dairying; No. 11, The Rape Plant.

Communications intended for this Office should be addressed to the SECRETARY OF AGRICULTURE, for the *Office of Experiment Stations, Department of Agriculture, Washington, D. C.*



The Agricultural Experiment Stations in the United States.

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

BULLETIN No. 20

PROCEEDINGS

OF THE

SEVENTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

CHICAGO, ILLINOIS

OCTOBER 17-19, 1893

EDITED BY

A. C. TRUE, for the Office of Experiment Stations
AND
H. E. ALVORD, for the Executive Committee of the Association

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

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† President of board of direction.

‡ Assistant director in charge.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., June 5, 1894.

SIR: I have the honor to transmit herewith for publication Bulletin No. 20 of this Office, containing the proceedings of the seventh annual convention of the Association of American Agricultural Colleges and Experiment Stations, held at Chicago, Ill., October 17–19, 1893. The stenographic report of this meeting was made by Mr. S. E. Black, of this Office.

Respectfully,

A. C. TRUE,
Director.

HON. J. STERLING MORTON,
Secretary of Agriculture.

CONTENTS.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called the Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association, and to secure to that end mutual coöperation.

MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department, shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture or mechanic arts who shall attend any convention of this Association may be admitted to similar privileges.

SECTIONS.

(1) The Association shall be organized into sections upon (1) college work; (2) agriculture and chemistry; (2) horticulture and botany; (4) entomology; (5) mechanic arts. The executive committee shall, upon the request of any ten institutions represented in the Association, provide for the organization of provisional sections at any convention.

(2) Each section shall conduct its own proceedings and shall keep record of the same, and present a synopsis thereof to the Association at the close of every convention; and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the Association in general session.

MEETINGS.

(1) This Association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the Association. Special meetings may be held at other times, upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the program. The section meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them.

OFFICERS.

(1) The general officers of this Association shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer. The president, junior ex-president, the secretary, and four persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

(2) Each section shall, by ballot, nominate to the Association in general session, for its action, a chairman and a secretary for such section.

(3) Officers shall be chosen by ballot at the annual convention of the Association, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the Association, or an officer of an institution which is a member of the Association in full standing at the time of election, shall be eligible to office.

DUTIES OF OFFICERS.

(1) The officers of the Association shall perform the duties which usually devolve upon their respective offices.

(2) The president shall deliver an address at the annual convention before the Association in general session.

(3) The chairman of each section shall make, at the annual convention, a report to the Association in general session of the progress during the preceding year of the subject or subjects appertaining to his section, and such reports shall not occupy more than twenty minutes each.

(4) The executive committee shall determine the time and place of the annual conventions and other meetings of the Association, and shall, between such conventions and meetings, act for the Association in all matters of business. It shall issue its call for the annual conventions of the Association not less than sixty days before the date on which they are to be held, and for special meetings not less than ten days before such dates. It shall be charged with the general arrangement and conduct of all meetings called by it. It shall designate the two sections to present in general session a portion of the subjects coming before them, and shall give notice thereof to the chairmen of such sections at least ninety days prior to the annual convention. It shall provide a well-prepared order of business and a program of exercises, and shall make a seasonable issue of said program. Said committee may fill any vacancy in an office or committee of the Association occurring after the adjournment of the annual convention, such appointee to serve until the next annual election.

FINANCES.

At every annual convention, the Association, in general session, shall provide for obtaining the funds necessary for its legitimate expenses, and may, by appropriate action, call for contributions upon the several institutions eligible to membership; and no institution shall be entitled to representation or participation in the benefits of the Association unless such institution shall have made the designated contribution for the year previous to that in and for which such question of privilege shall arise, or shall have had said payment remitted by the unanimous vote of the executive committee.

AMENDMENTS.

This constitution may be amended at any regular convention of the Association by a two-thirds vote of the delegates present, if the number constitute a quorum: *Provided*, That notice of any proposed amendment, together with the full text thereof and the name of the mover, shall have been given in the call for the convention. Every such proposition of amendment shall be subject to modification or amendment in the same manner as other propositions, and the final vote on the adoption or rejection shall be taken by yeas and nays of the institutions then and there represented.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the program.

(3) Speakers invited to open discussions shall be entitled to twenty minutes each.

(4) In general discussions the ten-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general program shall be closely observed, unless changed by a two-thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

President:

S. D. LEE, of Mississippi.

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G. E. MORROW, of Illinois;
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S. W. JOHNSON, of Connecticut.

Executive Committee:

The PRESIDENT; the JUNIOR EX-PRESIDENT (W. A. Henry, of Wisconsin); the SECRETARY;
H. E. ALVORD, the District of Columbia;
H. C. WHITE, of Georgia;
A. W. HARRIS, of Maine;
H. H. GOODELL, of Massachusetts.

Chairmen of Sections:

Agriculture and Chemistry, W. A. HENRY, of Wisconsin;
Botany and Horticulture, E. S. GOFF, of Wisconsin;
College Work, GEO. T. FAIRCHILD, of Kansas;
Entomology, H. OSBORN, of Iowa;
Mechanic Arts, J. H. WASHBURN, of Rhode Island.

Secretaries of Sections:

Agriculture and Chemistry, E. B. VOORHEES, of New Jersey;
Botany and Horticulture, L. H. PAMMEL, of Iowa;
College Work, H. E. STOCKBRIDGE, of North Dakota;
Entomology, C. M. WEED, of New Hampshire;
Mechanic Arts, F. P. ANDERSON, of Kentucky.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Alabama:
College: A. J. Bondurant, professor of agriculture.
Arizona:
Station: F. A. Gulley, director.
Arkansas:
Station: R. L. Bennett, director.
Colorado:
College: A. L. Kellogg, trustee.
Station: C. P. Gillette, entomologist.
Connecticut:
College: *Storrs*—B. F. Koons, president; E. H. Hyde, trustee.
Station: *State*—W. C. Sturgis, mycologist.
Georgia:
College: J. B. Hunnicutt, professor of agriculture.
Station: H. N. Starnes, horticulturist.
Idaho:
Station: J. M. Jones, superintendent substation.
Illinois:
College: G. E. Morrow, dean of agriculture; I. S. Raymond, trustee.
Station: E. H. Farrington, chemist.
Indiana:
College: H. A. Huston, professor of agricultural chemistry.
Station: C. S. Plumb, director.
Iowa:
College: L. H. Pammel, professor of botany.
Station: James Wilson, director; C. F. Curtiss, assistant director.
Kansas:
College: G. T. Fairchild, president; Joshua Wheeler, regent; W. D. Street, regent; N. S. Mayo, professor of veterinary science and physiology.
Kentucky:
College: J. K. Patterson, president; F. P. Anderson, professor of mechanical engineering; W. A. Patterson, tutor.
Station: M. A. Scovell, director.
Louisiana:
College (Southern University, New Orleans): Hugh Jamieson, jr., professor of agriculture.
Maine:
College: A. W. Harris, president.
Station: Walter Balentine, agriculturist.
Maryland:
College: R. W. Silvester, president; W. T. L. Taliaferro, professor of agriculture.
Station: R. H. Miller, director.

Massachusetts:

College: W. H. Bowker, trustee.

Station: *State*—C. A. Goessmann, director.

Michigan:

College: C. D. Smith, professor of agriculture; A. C. Glidden, trustee.

Minnesota:

College: M. H. Reynolds, professor of veterinary science.

Station: W. M. Hays, agriculturist.

Mississippi:

College: W. C. Welborn, professor of agriculture; C. L. Steele, professor of military science and tactics.

Station: W. L. McGee, assistant director.

Missouri:

College: E. D. Porter, dean.

Montana:

Station: S. M. Emery, director.

New Jersey:

College: Austin Scott, president.

New Hampshire:

College: C. S. Murkland, president.

New Mexico:

College: Hiram Hadley, president.

Station: J. D. W. Veeder, member board of control.

New York:

College: J. H. Comstock, professor of entomology.

Station: *Cornell*—I. P. Roberts, director.

North Carolina:

Station: H. B. Battle, director.

North Dakota:

College: H. E. Stockbridge, president.

Station: T. D. Hinebauch, veterinarian.

Ohio:

College: W. R. Lazenby, professor of horticulture; Thos. F. Hunt, professor of agriculture; N. S. Townshend, *emeritus* professor of agriculture; H. A. Weber, professor of agricultural chemistry; H. J. Detmers, professor of veterinary surgery.

Station: C. E. Thorne, director; J. F. Hickman, agriculturist; S. H. Ellis, R. H. Warder, J. H. Brigham, members board of control.

Oklahoma:

College: A. C. Magruder, professor of agriculture.

Pennsylvania:

College: G. W. Atherton, president; W. H. Caldwell, assistant professor of agriculture.

Station: H. P. Armsby, director; W. Frear, vice-director and chemist.

Rhode Island:

College: J. H. Washburn, president.

Station: C. O. Flagg, director.

South Carolina:

College: E. B. Craighead, president.

South Dakota:

College: L. McLouth, president.

Tennessee:

College: C. W. Dabney, jr., president.

Station: C. F. Vanderford, secretary.

Texas:

College: A. J. Rose, W. R. Cavitt, trustees.

Vermont:

Station: J. L. Hills, director.

West Virginia:

College: J. A. Robinson, J. S. Withers, trustees.

Station: J. A. Myers, director.

Wisconsin:

College: W. A. Henry, dean.

Station: F. W. Woll, assistant chemist.

Wyoming:

College: G. R. Hebard, secretary board of trustees.

Station: B. C. Buffum, horticulturist and meteorologist.

U. S. Department of Agriculture:

H. E. Alvord, special agent.

Office of Experiment Stations:

A. C. True, director; S. E. Black, private secretary.

Bureau of Education:

J. W. Holcombe, chief clerk.

Canada:

Ontario Agricultural College: C. A. Zavitz.

Provincial School of Agriculture: H. W. Smith, principal.

CALL FOR THE CONVENTION.

By authority of the executive committee a delegate convention of this Association is hereby called to meet in the city of Chicago, Ill., on Tuesday, October 17, 1893, at 10 o'clock a. m.

Attention is called to Article III of the revised constitution of the Association, entitled "Membership," and which is as follows:

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture who shall attend any convention of this Association may be admitted to similar privileges.

In accordance with Article VII, the Section on Agriculture and Chemistry and the Section on Mechanic Arts are designated "to present in general session a portion of the subjects coming before them."

The program for the session and other particulars will be announced later.

The several agricultural congresses of the World's Congress Auxiliary of the Columbian Exposition will be held in Chicago, October 16–28, and it is intended that the sessions of this Association shall be arranged in harmony therewith.

For the executive committee:

HENRY E. ALVORD,
Chairman.
M. A. SCOVELL,
Secretary.

WASHINGTON, D. C., *July 15, 1893.*

PROGRAM.

TUESDAY, OCTOBER 17, 1893.

10 a. m.—General session. Organization, committee reports, etc.
2 p. m.—Meetings of the sections for business and further arrangements.
8 p. m.—General session. In union with the World's Agricultural Congress.

1. Annual address by the President of the Association.
2. Introduction of Sir Henry Gilbert, special delegate from the Lawes Agricultural Trust, Rothamsted, England.

WEDNESDAY, OCTOBER 18, 1893.

10 a. m.—General session for business, election of officers, etc.
Subject for discussion and action: The Association and the Exposition.
2 p. m.—Meetings of all the sections.
7 p. m.—General session.

1. Subjects presented by Section on Agriculture and Chemistry.
2. Subjects presented by the Section on Mechanic Arts.
3. Final adjournment of general session, unless otherwise ordered.

THURSDAY, OCTOBER 19, 1893.

10 a. m., 2 p. m., and 7 p. m.—Meetings of the sections.

The World's Agricultural Congresses hold sessions on the afternoons and evenings of the same week.

729—No. 20——2

PROCEEDINGS.

MORNING SESSION, TUESDAY, OCTOBER 17, 1893.

The convention was called to order at 10:20 a. m., in room No. 4, Art Institute, on the Lake front, head of Adams street, Chicago, by President Henry.

The PRESIDENT. Gentlemen: In accordance with the call of the executive committee, issued July 15, we have met for this, the seventh, annual convention of the Association of American Agricultural Colleges and Experiment Stations. Allow me to call your attention to the report of the proceedings of our last convention, held at New Orleans last November, copies of which most of you probably received before leaving home. It has been suggested that the section of the constitution relating to membership be read, and I will call on the secretary to read it.

The secretary read the section of the constitution relating to membership.

The report of the executive committee was submitted by Henry E. Alvord, chairman:

REPORT OF THE EXECUTIVE COMMITTEE.

Immediately after the adjournment of the convention of 1892 this committee met at New Orleans and organized, selecting Henry E. Alvord as chairman and M. A. Scovell as secretary.

The committee has performed the duties with which it was charged by the last convention, as far as practicable, and, in accordance with the revised constitution of the Association, has called the present meeting and made the necessary arrangements therefor. A very general expression of preference for Chicago made it an easy matter to decide upon this city as the place of meeting. There was some difference of opinion as to the time, but it was decided in order to accord with the previous assignment of the World's Agricultural Congress to the period from October 16 to 20, inclusive. In consideration of the attractions of the World's Columbian Exposition and of the Congress mentioned, it has been deemed expedient to reduce the program for the convention to the minimum consistent with the constitution, so far as general sessions are concerned, and to leave the several sections to decide for themselves the character and duration of their sessions. These considerations have made it impracticable to conform closely this year to the suggestions contained in two resolutions regarding the length and character of the annual convention, which were referred at New Orleans to this committee.

Since the last convention there has been little for this committee to do except to execute the instructions of that convention. The main work has been in connection with the interests of the Association and the institutions represented by it at the Columbian Exposition.

The standing committees in charge of the collective exhibits of the colleges and stations were greatly aided and supported in their work by the advisory board elected by the New Orleans convention. It may be remarked in passing that this experience shows the advantage of having members of the governing boards appointed as delegates from our different institutions, and of bringing them into the active work of the Association.

The executive committee in charge of the collective college exhibit found that, notwithstanding the active coöperation of many of the colleges and such assistance as the Department of Agriculture was able to give, it would be necessary to have special funds to make this exhibit a success. Senator Morrill and the advisory board were very helpful in this matter, and an appropriation of $8,000 was obtained from Congress, to be disbursed under the supervision of the Department of Agriculture. That Department appointed as its special agent for this business the chairman of the Association committee, and the work of collecting and placing this college exhibit, although late, was carried to completion in a manner which, it is hoped, may meet with the approbation of those interested. Every college prepared and packed its own contributions, defraying all incidental expenses to time of shipment. At that point the General Government took charge, and all further expenses have been met from the special appropriation for the purpose. Thus the demand upon the treasury of the Association in connection with the exhibit has been very light, being almost wholly confined to the expenses of the committees appointed by the Association to care for its interests. Without further comment, reference is made to the exhibit itself as the best report of its work which the committee can now render. But it is believed that there should be some permanent descriptive record of this exhibit, and authority is requested on behalf of the present committee to file a general report on the exhibit with the new executive committee.

The committee on the college exhibit has worked, as directed, in conjunction with the committee on the station exhibit and although really two divisions the result may be regarded as one joint and collective exhibit of the colleges and stations. Since the installation was completed the management has been on the basis of a single exhibit, and this has included the display of the Office of Experiment Stations of the Department of Agriculture. That office has carried, very acceptably, the greater part of the administration of the exhibit, arranging with the different institutions for the detail of college and station men who have served in turn, from month to month, as attendants, guardians, and demonstrators for the exhibit.

The attention of the Association is invited to the comprehensive and attractive exhibit made by the Government of France of the means and methods of the various branches of agricultural education in that country. This exhibit is in the Agricultural Building of the Exposition, immediately adjoining the similar American exhibits, and, as the former has not been entered for competition, it is suggested that this convention might well ask of the Exposition authorities some special examination and official recognition of this excellent French exhibit.

The Association has been represented on the committee supervising the tests of breeds of dairy cattle at the Exposition, in accordance with the action of the convention at New Orleans, and a report may be expected from the testing committee. The executive committee was charged with the duty of providing for payment of the necessary expenses of the four Association members of the testing committee, upon consultation with these gentlemen, and authority was given to call for an extra contribution to the treasury of the Association for this purpose. It has not seemed expedient to make such a special call for funds the present year, when the various institutions have been taxed in several ways on account of the Exposition. Other methods have been tried in the hope of relieving the treasury of the Association from this particular and rather large item of expense. These have failed, however, and the committee now refers the whole question back to the Association for settlement. The subject of the relations of the Association and the Exposition has accordingly been assigned for consideration and action at the general session of this convention on

Wednesday morning. It should be stated, however, that the ordinary income of the Association has enabled the payment of the expenses of the testing committee up to July 1, as well as all other obligations of the Association to date, and it is therefore recommended that arrangement be made for carrying over to the next year the remaining cost of this special committee, amounting to about $1,000, and providing for such increased revenues then as will cancel this debt from the general treasury.

A committee was appointed, as ordered, to coöperate, on behalf of this Association, with the general committee of the World's Congress Auxiliary upon Agricultural Congresses. A statement of the duties performed may be expected from Prof. Morrow.

The chief of the department of agriculture of the Exposition was duly notified of the willingness of the Association, through its executive committee, to coöperate in arranging for a series of popular lectures on agriculture at the Exposition, but after a few trials in June, Chief Buchanan wisely concluded to abandon this project.

Your committee reports that upon investigation, as directed, it has been ascertained that Preston Powers, sculptor (son of the famous Hiram Powers), has, at his studio in Florence, Italy, an original model, or mold, of a bust of Hon. Justin S. Morrill, taken about the time of the passage of the first land-grant college, or Morrill, Act (1862). A plaster cast from this model is now to be seen at the central space of the collective college exhibit. Mr. Powers offers to make a new marble bust from this mold, and from this to have twenty-five plaster casts made, everyone to receive his personal attention and final approval, if guaranteed the sum of $800. If a larger number were ordered, the price of each bust could be materially reduced. Forty could be obtained at about $25 each. In any case the marble would become the property of the subscribers for the casts, and it is suggested that this might be deposited, in the name of the Association, at some suitable place in Washington and that other casts might be made from it subsequently. It should be understood that the casts proposed to be made by Mr. Powers represent an article much superior in quality and finish to the ordinary plaster casts for museum purposes.

In accordance with the instructions of the New Orleans convention, a subcommittee of the executive committee met the President-elect of the United States by appointment in New York in the month of February last. The condition and work of the colleges and stations in the several States were presented, and their relations to the General Government were discussed. The scientific work of the Department of Agriculture was also considered. Subsequently the same committee had a similar interview at Washington with the newly-appointed Secretary of Agriculture. The President and Secretary both expressed themselves as fully appreciating the work of the colleges and stations and as desirous of coöperating in the promotion of the welfare of these institutions and of the interests by them represented.

It was found impracticable to secure the attention of the new Secretary of the Interior to the matter of the several reports required from college officers before the close of the last fiscal year. Since that time the period of college vacations and the opening of the new academic year have combined, with other things, to prevent the desired conference on this subject. Your committee reports this as the one duty committed to it by the last convention which has not yet received attention, but suggests that time still remains for this work to be done before the next annual reports become due.

The Association at its last convention appointed a special committee to consider and report upon a system for uniform station publications. This committee duly reported through its chairman, A. W. Harris, and the report is submitted herewith. It was at first intended to publish and distribute this report soon after its completion, but it was finally decided to postpone such action until after the distractions of the Exposition year. It is now recommended that this report be referred to the new executive committee for publication and distribution, and that it be also incorporated in the proceedings of this convention.

Another special committee was appointed at New Orleans upon college statistics, with instructions to report to the convention of 1893, and President Atherton, as chairman of the committee, is prepared to comply.

Since the last annual meeting the executive committee has issued twelve circulars of information, most of them in connection with Exposition matters. These have been distributed to all institutions eligible to membership under the constitution of the Association, as revised. Now that this constitution has been printed, it is recommended that every institution eligible to membership be furnished a copy, with attention called to conditions of membership, and be served with notice that hereafter no institution will be recognized as entitled to share in the work and benefits of the Association unless it be a member thereof in full standing.

The annual contribution of $10, agreed upon at the last convention, has been very generally paid and has proved sufficient, together with last year's balance, for the needs of the Association to date, excepting, as already noted, the expenses of the dairy test committee since the 1st of July. The treasurer's report will show a balance from last year of $416.54, with collections of $860, making the total receipts $1,276.54; disbursements in all amounted to $1,266.91, leaving a balance of $9.63 on hand at the present time. The obligations of the Association on account of its representation on the dairy test committee of the Exposition will amount to about $1,000 at the close of the present month. It is believed that the simplest and most equitable manner of meeting this unusual expenditure is by a sufficient increase in the annual contribution asked for next year. The committee therefore recommends that the dues for the coming year be fixed at $15 for every eligible institution, believing that this will enable the Association to free itself from debt. The executive committee should also be authorized to make special call for additional funds in case of need, although this does not appear likely. It is further suggested that some special means be taken to impress upon all interested that no matter how close the actual relation of college and station in any State, or as part of one institution, this Association regards every college and every station as a distinct and separate institution for purposes of taxation and representation.

Under existing circumstances, it has been thought unnecessary to issue any program for the present convention other than the schedule for meetings contained in the supplementary convention circular. It is now recommended that that be adopted, subject to the further pleasure of the convention, and also that the precedents of recent conventions be followed as to credentials and rules of order.

Respectfully submitted for the executive committee.

HENRY E. ALVORD,
Chairman.

CHICAGO, ILL., *October 17, 1893.*

Mr. HADLEY. I move that the report be accepted and that it be considered in its various recommendations seriatim at the proper time.

Seconded by Mr. Scott.

The motion was carried.

The report of the treasurer was then presented by Mr. Scovell.

REPORT OF THE TREASURER OF THE ASSOCIATION.

M. A. Scovell, treasurer, in account with Association of American Agricultural Colleges and Experiment Stations.

Balance on hand at last meeting	$416.54
Moneys received since last meeting—dues 1892–'93	860.00
Total	1,276.54
Expenditures	1,266.91
Balance on hand	9.63

REPORT OF THE TREASURER OF THE ASSOCIATION—Continued.

EXPENDITURES.

Stationery and printing	$70.90
Subcommittee to see President, etc. (expenses)	248.11
Dairy test committee	818.16
College and station exhibit committee (expenses)	44.70
Stenography	49.29
Sundries	35.75
Total, as above	1,266.91

ITEMIZED STATEMENT.

Receipts.

1893.		
April 1.	Ohio Experiment Station	$10.00
3.	North Carolina Experiment Station	10.00
3.	Georgia Experiment Station	10.00
3.	Experiment Station, University of Tennessee	10.00
3.	Delaware College	10.00
6.	Maine State College	10.00
6.	Agricultural Experiment Station of West Virginia	10.00
6.	University of Minnesota Experiment Station	10.00
6.	Kentucky Agricultural Experiment Station	10.00
6.	Michigan Agricultural College	10.00
6.	Michigan Experiment Station	10.00
7.	Louisiana Experiment Station	10.00
7.	Maryland Agricultural College	10.00
7.	Maryland Experiment Station	10.00
8.	Mississippi Agricultural College	10.00
8.	Mississippi Experiment Station	10.00
8.	Massachusetts Agricultural College	10.00
8.	Hatch Experiment Station	10.00
8.	Kentucky Agricultural and Mechanical College	10.00
10.	Ohio State University	10.00
10.	New Hampshire College of Agriculture and Mechanic Arts	10.00
11.	Vermont State Agricultural College	10.00
12.	Cornell University	10.00
12.	Cornell Experiment Station	10.00
12.	Purdue University	10.00
12.	Alabama Experiment Station	10.00
12.	Alabama Agricultural and Mechanical College	10.00
12.	Arizona Experiment Station	10.00
12.	Arizona Agricultural College	10.00
12.	University of Wisconsin	10.00
15.	Virginia Agricultural and Mechanical College	10.00
15.	Virginia Agricultural Experiment Station	10.00
15.	Rhode Island State Experiment Station	10.00
15.	Arkansas Agricultural Experiment Station	10.00
17.	Vermont Agricultural Experiment Station	10.00
17.	Indiana Experiment Station	10.00
17.	Delaware Agricultural Experiment Station	10.00
17.	Iowa Experiment Station	10.00
20.	North Carolina College of Agriculture and Mechanic Arts	10.00
24.	Sheffield Scientific School of Yale University	10.00

REPORT OF THE TREASURER OF THE ASSOCIATION—Continued.

Receipts—Continued.

1893.			
May	1.	Connecticut Agricultural Experiment Station	$10.00
	5.	Massachusetts State Experiment Station	10.00
	6.	Colorado Agricultural College	10.00
	6.	Storrs Agricultural Experiment Station	10.00
	6.	Nevada Experiment Station	10.00
	6.	Nevada Agricultural College	10.00
	8.	Experiment Station of University of Wisconsin	10.00
	8.	Agricultural College of University of Idaho	10.00
	8.	University of Minnesota	10.00
	8.	Rhode Island College of Agriculture and Mechanic Arts	10.00
	12.	California Experiment Station	10.00
	12.	New Jersey State Experiment Station	10.00
	13.	Maine Experiment Station	10.00
	15.	New Hampshire Experiment Station	10.00
	17.	New Mexico Experiment Station	10.00
	17.	New Mexico Agricultural and Mechanical College	10.00
	20.	Iowa Agricultural College	10.00
	24.	Kansas Experiment Station	10.00
	24.	Kansas State Agricultural College	10.00
	26.	Illinois Experiment Station	10.00
June	6.	Colorado Experiment Station	10.00
	16.	Utah Agricultural College	10.00
	16.	Utah Experiment Station	10.00
	16.	South Dakota Experiment Station	10.00
July	10.	Wyoming Agricultural College	10.00
	10.	Wyoming Experiment Station	10.00
	10.	Nebraska Experiment Station	10.00
	13.	Rutgers College	10.00
	14.	Pennsylvania Experiment Station	10.00
Aug.	14.	Texas Agricultural College	10.00
	17.	Oregon Experiment Station	10.00
	18.	Florida Agricultural College	10.00
	28.	Louisiana State University	10.00
	28.	University of Georgia	10.00
	29.	Texas Experiment Station	10.00
	31.	University of Tennessee	10.00
Sept.	1.	Nebraska State University	10.00
	6.	Missouri Experiment Station	10.00
	6.	Missouri Agricultural and Mechanical College	10.00
	18.	Alcorn Agricultural and Mechanical College, Mississippi	10.00
	23.	South Carolina Experiment Station	10.00
	27.	University of Illinois	10.00
	29.	West Virginia University	10.00
Oct.	4.	Pennsylvania State College	10.00
	11.	Hampton Normal and Agricultural Institute	10.00
	16.	Oklahoma Experiment Station	10.00

On motion of Mr. Harris the report of the treasurer was referred to an auditing committee of three, appointed by the chair, consisting of Messrs. Harris, Emery, and Vanderford.

The PRESIDENT. The secretary asks me to announce that anyone who desires to see the items of expenditures may do so by calling upon him. It has been suggested that the several sections be called upon for their reports at this time. As chairman of the Section of Agriculture and Chemistry I make their report in these words. It has been considered best to drop the work on account of the Columbian Exposition.

We will next have the report of the chairman of the Section on Botany and Horticulture.

The chairman of the section, Mr. Scribner, of Tennessee, was not present, and no report of the section was presented.

Mr. Dabney, of Tennessee, chairman of the Section on College Work, submitted his report.

REPORT OF THE SECTION ON COLLEGE WORK.

As chairman of the Section on College Work it is my duty to make a report at this session, to occupy not exceeding twenty minutes in the reading. As it would be impossible to treat any large part of our college work in this brief time, we have sought some special phase of our work which seemed to need notice and might be profitably discussed within the limit fixed. In previous reports of our presidents and of the chairmen of the different sections we have had able discussions of almost every other department of our colleges, and we have, therefore, selected the military instruction and drill as a subject which may well receive our attention at this time.

As national colleges endowed with the proceeds of the sale of a portion of the national domain, we are especially charged with the general duty of educating our pupils in patriotism and the special duty of instructing the young men of the country in military science and tactics, so as to form a basis of a national guard in the hour of need. The Land-Grant Act was passed in 1862. The National Government was at that time greatly impressed with the importance of a class of young men educated in military science and having some experience in drill, who might be called upon to organize and command the volunteer armies when the nation needed their services. May the Nation never see just that need again! We never shall, but the experience of that time must be used in preparing for the future.

Later experience has shown that our States must be prepared at all times to put down mobs and riots. As our population becomes more dense and more mixed it is evident that we will have more and more use for strong State militia. Recent events in some of our States teach us that the way to keep the peace is to be well armed. It is well, therefore, that these national colleges were charged with the duty of training young men who might form a class of reserved military officers.

The act of July 2, 1862, requires, thus, that military tactics shall be included among the studies at these colleges. This is not left optional with the States or the management of the institutions, but this instruction is mandatory. The legislatures of the States may prescribe the manner in which all of the instruction at these colleges is to be given, but the "branches of learning related to agriculture and the mechanic arts" and "military tactics" must he taught. Other scientific and classic studies may be included, but there is no option about these subjects. Although we do not believe that military drill has been as well provided for as it might be, the Government has done a great deal for us by detailing officers from the Army, who will serve as instructors, and by the loan of a limited equipment.

Let us at this time inquire briefly into the instruction and practice given in military science and tactics in our colleges for the purpose of seeing what its needs are and what improvements may be made.

According to the latest organization list of agricultural colleges published by the Department of Agriculture there are 61 colleges receiving the benefits of the Land Grant, counting 2 for Massachusetts, 2 for Rhode Island, 2 for Connecticut, and 10 separate colleges or departments for colored students. As the latter are practically departments only we may include them with their State institutions. We have, thus, 51 separate State institutions under this Association. Thirty-seven of these have officers detailed from the U. S. Army to serve as professors of military science and tactics. Eleven out of these 51 Land-Grant colleges, chiefly new institutions not yet fully organized, have not as yet provided any regular military instruction. Two of them give some instruction in military science and drill, although they have no Army officers. It is probable that all of these institutions could have Army officers if they applied for them. The present law allows 85 to be detailed from the regular Army, and an unlimited number of retired officers, who must, of course, be paid salaries. An institution, however, which employs a retired officer can get the military equipment from the War Department.

We learn from the reports of these colleges and of the Inspector General of the Army that efficient work is being done in a majority of the colleges. Some show a want of appreciation of military science and drill as both educating and disciplinary subjects and a very few show a disposition to neglect or slight this department. We believe such colleges make an error. On the one hand for training men in habits of order, system, neatness, promptitude, obedience to constituted authority, and working together with their fellows the military drill is unsurpassed.

There can be no question as to our duty to the nation and our States. In a majority of the States these are the only military colleges. We beg such institutions to consider this instruction and practice more seriously.

According to the report of the Commissioner of Education there were, in 1889-'90, 9,433 students in attendance upon these colleges. Of this number 3,000 were in preparatory departments and 700 were women. As a rule all the preparatory students are required to take military drill, but many advanced and graduate students are excused from it. We estimate that there were still at least 8,000 young men in the military departments in these various colleges in 1889-'90. Ten thousand would be a moderate estimate for the number in 1892-'93—a small army in itself.

The gentlemen here present are all familiar with the details of instruction and practice in the military departments of these institutions. I will not, therefore, go into this subject at any length. It is interesting, however, to note the extremes, especially in regard to the time allowed and the number of classes required to take the work.

We have among our agricultural colleges illustrations of almost all forms of military government, organization, and instruction. Many of these institutions started out with military departments modeled as closely as possible after that at West Point. The older colleges, having a single course of study, with few electives, and located in the country where all of their students lived in dormitories, found that organization entirely practicable. It was especially useful so long as their student body contained many preparatory students and boys. Our country boy made an admirable cadet and profited much by this discipline and instruction. Other institutions located in towns, without or with only limited dormitories, and having, therefore, to put their students in private families, attempted the same plan, but they have, we believe, without exception, abandoned it. In these cases the Army officer was commandant of cadets and in charge of the discipline, as well as professor of military science and tactics. He was the autocrat of the college and controlled everything, including, in some cases, the other professors and their departments.

The other extreme is the large university having many older and more advanced students and many different courses and classes. In such institutions military instruction is usually confined to one or two classes and to its own hours, as the other instruction is. Military government has been wholly abandoned in such cases, and the military professor has no more authority than any other. As our colleges developed and multiplied courses, and especially as the demand grew for work in laboratories, shops, and on farms, the organization of the military departments has been steadily modified in the direction of the latter system.

Older students find continued military drill very irksome. They consider it a hardship to have to give so large a portion of their time to it, when they have no intention of becoming professional soldiers. The juniors and seniors in our college courses taking either literary, scientific, engineering, or agricultural work are in these days completely overloaded with library, seminary, laboratory, and other practical work, and have little time for practical military work. The best of them may be induced to volunteer for this work, as is the custom in many of our colleges, by making military work an elective in science, and giving full credit for it; but it is still a problem in such institutions how to get the very best men for officers.

As all of our colleges must come to this standard sooner or later, the question for us to consider is: How shall we do our duty to the nation in respect to the training of young men in military science and tactics without interfering too seriously with the other work that we are required to do? In other words, how shall we train the citizen soldiery that the country needs and still give all of our students the "liberal and practical education" which is the chief object of these colleges?

The rules prescribed by the President for the government of officers of the Army detailed as professors of military science and tactics are contained in General Orders No. 26, 1891. They require that "the course of instruction shall be both practical and theoretical, and shall be so arranged as to occupy at least one hour per week for theoretical instruction, and at least two hours per week for practical instruction." From an examination of the reports of the various institutions I gather that the average time given to military instruction and practice is greater than this. It is probably nearer four hours per week than three.

It is left to each institution to decide what classes of students are subject to this theoretical and practical instruction. This is the main point of variation between our colleges and the most important one to be guarded. On the one hand, if the students are not required to drill in sufficient numbers and for a sufficient length of time, the institution will not have a respectable battalion, and no proficiency will be attained in the art of war. On the other hand, if it is continued too long, it becomes irksome to the student and detracts from his success in other studies. The majority of our larger institutions have, we believe, reached a proper compromise by requiring all male members of their colleges below the junior class, or third year (counting from the beginning), to take military drill, and by requiring the second-year men and all commissioned officers to receive theoretical instruction. The members of the junior and senior classes and of other departments of the university may volunteer for not less than one term of service at a time, and are encouraged to do this, whenever they have military experience, by giving them commissions as officers and credits for this work on the college course. The course of military instruction and drill should, in all cases, be a part of the regular college course and be duly credited to the student as other recitation or practical work is.

Under this plan the student is subject to drill at the period when he needs it most and can best spare the time. It is also found to be the period when he can learn it most rapidly. The boy who has had military drill for two years and acquired no special interest in it is only an obstruction in his company afterward if he is compelled to drill. If not fit for an officer after two years of drill, he had better be dropped from military instruction, as he will never make an enthusiastic soldier. This plan gives the military department the best material for privates and also the best material for officers, while at the same time it gives the college the full time of all advanced men, not specially interested in military matters, for literary or scientific work.

The original act (section 1225 of the Revised Statutes) provides that the Secretary of War may issue "at his discretion and under proper regulations to be prescribed by him, out of ordnance and ordnance stores belonging to the Government and which can be spared for that purpose, such a number of the same as may appear to be required for military instruction and practice by the students of any college or university, under the provisions of this section; and the Secretary shall require a bond in each case in double the value of the property," etc.

It is right that the property of the Government should be properly cared and accounted for, but in this whole matter of securing and accounting for military equipment and supplies these institutions and their officers are treated as if they were aliens to the Government, instead of a part of it. They are required to pay the freight on all equipment and supplies, to insure the Government property at the valuation placed upon it by the War Department (which is considerably more than its actual value), to pay the cost of all repairs, to pay for gun racks and other necessary armory furniture, to pay for all damaged and missing stores, and after they are worn out to return the débris to a national arsenal "without expense to the United States."

If we are a part of the nation and doing the nation's work, we fail to see the fairness of all this. Why should not these departments be recognized as army posts and be supplied with equipment under the same conditions as other army posts? The Government has its own officer in charge and can hold him responsible for these things under its rules. It would seem to us much fairer and certainly much simpler if the officer in charge of the instruction at each institution could make his requisition for what he wanted, have it supplied, and account for it, or return it at the Government's expense. Why should these institutions be required to pay the freight upon and repair Government property when they are using it for Government purposes? By a strange misunderstanding, this legislation, which treats us as national institutions in most matters, changes its spirit entirely as soon as it comes to this matter of military property. Is there any reason for this? We have been able to find none and must attribute it either to misunderstanding or to "red tape." If the War Department could only treat these institutions as army posts in charge of their own officers, the method of supplying equipment, etc., could, we believe, easily be modified as we suggest and in full accordance with their rules.

The Government does not supply nearly all the military equipment required. Some provision should be made for supplying uniforms, gun racks and armory furniture, side arms, band instruments, flags, tentage, and especially for the care and repair of the Government's property.

In this connection I wish to call especial attention to the recommendation contained in the report of the Inspector General of the Army for the year 1892. The Inspector General recognizes the national character of these institutions and the importance of the work they are doing in training officers for any great emergency, and favors, if we understand correctly, a more intimate relation between these colleges and the War Department. He recommends, therefore, that the Government supply all of the equipment for them, including uniforms. He says (p. 13):

"The objects of the law, therefore, are manifestly national in their character, and while the student and the college derive some benefit from the instruction received, it should not be forgotten that the time devoted to such instruction is necessarily taken away from the time which would be ordinarily given to other college pursuits, and therefore must be regarded by the student as more or less a sacrifice. Indeed, there are those who consider it a great hardship, which they seek by every conceivable excuse to avoid. It would seem, therefore, no more than right to relieve them from the special expense of preparation for military service under the U. S. Government. It should be made easy and desirable for the youth of the country to train themselves for the national defense.

"In many of the institutions where military instruction is now given, the difficulty of procuring the necessary uniforms and camp and garrison equipage is so great as to almost preclude it, and in all cases, owing to lack of experience, such articles can only be obtained at higher prices comparatively than those paid by the U. S. Government, which buys in large quantities under an efficient system of supply."

The Inspector General then refers to a joint resolution which was introduced in the last Congress authorizing the Secretary of War to supply these colleges with additional equipment, and concludes:

"I therefore earnestly recommend such legislation as will enable the Secretary of War to sell to military colleges such articles as it is legal and practicable to furnish with the means now at our disposal, and that hereafter, or as soon as the amount can be determined, an annual appropriation be made for the purpose embraced in the joint resolution, to be expended by the Secretary of War on such conditions and regulations as Congress may prescribe."

This recommendation certainly seems just. The majority of the students in these institutions are poor. They are, we will venture to say, as a class, the most earnest and promising, while they are the least wealthy class of students in our country. The cost of this uniform is a considerable thing to them, amounting frequently to one tenth of their whole year's expenses. This expense keeps, to our certain knowledge, some boys away from these institutions who would otherwise attend them. They buy the uniform simply to conform to the requirements and not for their own benefit. Under the system here proposed these students have very little, if any, use for their uniforms, as they do not wear them except on drill. Why should they be compelled to buy them any more than they are to buy their guns?

The Government appropriates $1,000,000 a year to the different States for the equipment of their militia. Why would it not be right, then, for it to appropriate a much smaller amount for the complete equipment of these cadet battalions? Is not the educated young man who takes a two years' course of training and makes an officer of this militia in time of war entitled to as much aid as the private in this same militia who, perhaps, only serves a few months? Experience everywhere goes to show that these Land-Grant and other civilian colleges are training the men who will defend the nation in the time of need. The Inspector General cites an instance in his report above referred to of one of the oldest colleges whose military department is said to have furnished from its alumni 12 general officers, 25 colonels, 40 field officers, and 198 company officers, a total of 275 commissioned officers for the civil war. During the recent "miners'" war in Tennessee we noted that nearly all of the commissioned officers in the State militia, many of whose companies were organized for the occasion, were the graduates of our Tennessee University. We have no doubt that every State institution can submit similar facts in support of this view.

Our great, rich country should not consider the expense of this business, if it is right to do it; but if we suppose that the additional equipment of each cadet can be made and delivered at the institution by the Government at a cost of $20 (which is more than the average cost of our uniforms, we presume), it will only cost the Government $240,000 to equip this entire army of 12,000 boys. One fourth of the amount apportioned among the States on account of the equipment of the militia would equip all of our present battalions handsomely.

On motion of Mr. Fairchild, the report of the chairman was referred to the Section on College Work for consideration.

The chairman of the Section on Entomology, Mr. Bruner, of Nebraska, was absent, and no report was made by that Section.

No report by the Section on Mechanic Arts.

The PRESIDENT. At the New Orleans convention a committee was appointed on the uniformity of numbering station publications. The purposes for which this committee was appointed were very forcibly brought out at the New Orleans convention. It was there stated, what we all know, that the station publications were very un-uniform and that there was a marked lack of symmetry in their make-up. This committee was appointed to see wherein these publications might be improved. Mr. Harris was appointed chairman of the committee and is here ready to report. I hope that this report will be carefully listened to by members of the Association.

Mr. Harris presented the following report:

REPORT ON UNIFORMITY OF STATION PUBLICATIONS.

The convention of the Association of American Agricultural Colleges and Experiment Stations, held at New Orleans, November, 1892, after a discussion of the inconvenience arising from the different methods of naming and designating bulletins in use by the experiment stations, appointed the undersigned as a committee to devise some uniform plan to be recommended to the stations. After due deliberation and consultation, we have the honor to present the following recommendations:

The publications of the experiment stations should consist of annual reports, bulletins, and circulars.

Annual reports should be numbered in regular order, and be designated by the year which they cover, as "First Annual Report, 1888," "Second Annual Report, 1889." The annual reports should be printed as separate publications, and should not be called bulletins or numbered as such.

All bulletins, with the possible exception of meteorological bulletins, should be included in one series, and should bear the natural numbers in regular order, preferably without volume or year numbers, but in connection with these, if necessary. They should always bear the date of publication on the title-page. This recommendation involves the abandonment of the use of letters or other peculiar means to designate "special" bulletins, or those which are not to be distributed to the whole list. In case bulletins are issued for limited circulation, a note should be included in the next bulletin for general distribution, stating the character of the omitted bulletin, and explaining why it was not sent to the whole mailing list. The words "new series," "second series," etc., should be omitted from the title-page of bulletins. They are not necessary, since the number of a bulletin with the date of issue will always be sufficient for identification.

Reports of meteorological data, issued very frequently, may constitute a separate series of bulletins, if desired, but the existence of this series should be explained in other bulletins by a note.

It will add to the convenience of those who use the reports and bulletins if the stations will use page headings, printing on the left pages the name of the station ("Illinois Experiment Station"), or the designation and year of the publication ("Second Annual Report, 1890"; Bulletin 27, 1891), or both ("Connecticut Experiment Station, Second Annual Report, 1890"); and on the right pages the subject treated ("Spraying of Fruit Trees"; "Fermentation of Tobacco").

Circulars should be used for inquiries or the publication of matter not requiring permanent record, and should never be made the sole repositories of matter of scientific or permanent value.

Newspaper bulletins should never be made the sole repositories of any information of permanent value.

The committee would call especial attention to remarks of Prof. S. W. Johnson on the preparation of bulletins and reports, which will appear in the proceedings of the New Orleans convention, and to the following resolution adopted at the Knoxville convention:

"(*a*) The bulletins to be uniform in size, 5¾ by 9 inches, and not to deviate from this measurement more than one quarter of an inch when trimmed. (*b*) The title-page to bear conspicuously the number of the bulletin, its date, the name and post-office address of the station, the subject presented, and very little besides. (*c*) The reverse of the title-page (or page 2) to carry upon it all other information desired to be conveyed by the bulletin, except its principal subject matter. (*d*) The annual report to be of the same size as the bulletins, if practicable."

Respectfully submitted.

A. W. Harris,
W. A. Henry,
A. A. Johnson,
S. W. Johnson,
R. J. Redding,
Committee.

Mr. Alvord. By direction of the executive committee I now move that this report be accepted, adopted, and referred to the new executive committee for publication and distribution, and that it also be incorporated in the proceedings of this convention.

Motion carried.

The President. Before the close of the session this morning it is suggested that we hear from Dr. True, of the Office of Experiment Stations, in regard to some matters of general interest to the stations concerning their relations to the Department of Agriculture at Washington. I have the pleasure of introducing Dr. True.

Mr. True. In view of the new relations which I have been called upon to sustain towards the Office of Experiment Stations I have desired to come in this way before the Association that I might look into the faces of the delegates and that I might say a few words regarding the work of the Office. While I have been connected with the Office from its organization my duties, as very many of you know, have been of such a character that I have had few opportunities of getting acquainted with those actually engaged in the work at the different colleges and stations. I, therefore, greatly prize this opportunity of standing before you and it will be an inspiration to me in my work.

The Office of Experiment Stations has now been in operation about five years, and its lines of work have developed as circumstances seemed to require. The chief aim has been to do that which would be of most service to the stations and most helpful to the cause in general. At the outset comparatively little was known regarding the needs of such work, and it has only been as we have come to understand what the needs of the stations really are that we have been able to put our

Note.—Stations in the following named States are still using peculiar and undesirable means of naming and numbering publications: Alabama, Georgia, Louisiana, Maine, Maryland, North Carolina, Ohio, South Carolina, Tennessee, Virginia, and West Virginia.

work into definite form. It may be of interest to some of our visitors to know that the Office of Experiment Stations bears a twofold relation to the work of the experiment stations of this country. It is in the first place a branch of the Department of Agriculture, and a considerable portion of its work grows out of the peculiar relations which it sustains to that Department. For example, as a branch of the Department the Office of Experiment Stations must take its share of the daily mail that comes to the Department from all parts of the world, and, as it is one of our duties to collect information from the fifty or more experiment stations of this country which are making investigations on a great variety of problems, the general correspondence of the Office is very large and covers a wide range of subjects. We have other duties growing out of our relations to other divisions of the Department, and our work in general must be carried on under the conditions which exist in the Government service. This is true, for example, in regard to our publications, which must be issued through the Government Printing Office in regular order. We can not simply get up a publication and take the manuscript under our arm and walk into a printing office and make a bargain with the printer to get it out in twenty-four hours or a week, but the publication must go through the regular routine of the Department service.

The other side of our work, and the one to which I wish to call especial attention at this time, grows out of our relations to the colleges and stations. We take the reports of the investigations of the different stations and work them up in a condensed form for the use of other station workers; or we put certain portions of these reports into popular form for general distribution, so that people throughout the country may get information as to what is being done in the different States. Thus far the Office has expended its energies very largely in publishing documents which are primarily of interest to station workers and others engaged in investigations in agricultural science. Our principal publication, as most of you know, is the Experiment Station Record, which is issued monthly, and contains abstracts of station publications and of publications issued by similar institutions in foreign countries.

In another way we have tried to sum up the work of the stations and put it into the brief form of a card index. This enterprise is in some respects of a kind that has never before been undertaken, and we have met with unexpected difficulties, especially in the way of the publication of this work. The classification of the subjects with which agricultural science deals has never been undertaken before in the thorough way in which the Office has undertaken it. We think from what experience we have already had that we have made a reasonably good classification, and we hope that this index, which in manuscript form now covers all the past work of American stations, will be issued more rapidly, and that soon at least one copy will be found in every college and station library throughout the country, so that those who are interested in such studies may readily find the information they desire.

As some of you may know, Congress at its last session gave us authority to sell copies of this index at a cost to cover the additional expense involved in the preparation of the copies sold. The cards will be furnished at the rate of $2 per 1,000, and in addition to this there will be a charge of $1.25 for a set of division cards and blocks. We have issued now about 3,000 cards, so that the cost of a set of the index up to date will be $7.25.

In this informal talk concerning the Office I will mention one other feature of our work in a direction in which we hope hereafter to make greater development. We have been at work for some time in getting up a collection of station publications from the earliest ones down, and we believe that we now have as complete a set as there is in the country. This, as far as possible, we desire to make available to those who have no such collection, and beyond that we want to do a great deal more in the direction of library and bibliographical work. To that end we have secured recently the appointment of a man who will give his attention very largely to that work. The aim will be as far as possible to get acquainted with the literature of agricultural science, and especially with the earlier publications; to know where they are, whether in the library of the Department of Agriculture, the libraries of the different institutions, the Library of Congress at Washington, or elsewhere in the country; to know how they were published, where they may be obtained if still for sale, or how they may be loaned to those who desire to use them, so that the workers in our stations and colleges who desire to study up the literature on any one subject may go beyond the resources of their own libraries and have as far as possible at their command the resources of the libraries of this country which contain works on that subject. Of course this work will require a great deal of labor and can only be gradually performed.

In conclusion, I am glad to say that the prospect is that we will be able, without hindrance, to carry on and develop our work so as to make it more useful to the stations and colleges, and I trust that the same spirit which has pervaded the work of the Office in the past—I speak freely of this because I have had no responsibility for it—will be continued. We shall look with confidence for your coöperation and aid in the formulating and carrying out of plans by which we can make the Office of Experiment Stations more truly helpful to the great cause in which we are all so much interested.

I thank you for your kind attention to these informal remarks, for I had no thought of speaking just at this time, and had prepared no notes.

Mr. Alvord. I think it desirable that as much business as possible be accomplished to-day, and as I understand from the chairman of the coöperative station exhibit that he is willing to present his report to-day, I suggest that he be requested to do so at this time.

Mr. ARMSBY. The committee on the coöperative station exhibit desires to submit to the executive committee a more full and complete report than it has been possible as yet to prepare. We therefore ask leave to present at this time a mere preliminary report and be permitted to file a more complete report with the new executive committee.

The PRESIDENT. I am sure that permission is granted. Proceed.

REPORT ON THE COLLECTIVE STATION EXHIBIT.

Your committee having made two previous reports of progress in which the nature and purpose of the collective station exhibit were described in detail, begs to submit, as the most essential part of its final report, the exhibit itself, located at column D, sec. L-3, in the Agricultural building.

While aware of its defects and conscious that we have by no means reached our ideal, we recognize that the exhibit is the ultimate measure of our success or failure, and we therefore submit it to the indulgent judgment of the Association without apology on the one hand or laudation on the other.

We desire to gratefully acknowledge: First, the very cordial support and coöperation of the several stations. Out of the 54 stations of the United States, 47 are represented in the exhibit, many of them by contributions which have cost much time, labor, and money. Nearly all those stations which did not contribute expressed an interest in the exhibit and regretted the circumstances which seemed to render it inexpedient or impossible for them to take part.

Second, we desire to acknowledge and to call the attention of the Association to the faithful services of those gentlemen who, at no little personal inconvenience and for no reward except the promotion of the general welfare, superintended the collection and installation of the several subdivisions of the exhibit.

Third, we feel that very special and grateful recognition is due the U. S. Department of Agriculture and its representatives, the Hon. Edwin Willits, Assistant Secretary, and Mr. A.W. Harris, Director of the Office of Experiment Stations, both for the very generous financial support, without which the undertaking would have been impossible, and for their personal interest and labors in its behalf. The installation of the exhibit, as well as its care, has been, in accordance with the original understanding, entirely under the charge of the Department and specifically of the Office of Experiment Stations. Your committee endeavored to render such aid as lay in its power, but the whole burden of responsibility and annoyance, inseparable from the installation of so large and complex an exhibit under the conditions prevailing during the early days of the Exposition, rested upon Mr. Harris and his assistants.

Fourth, we wish to record our appreciation of the hearty interest taken in the exhibit by the Hon. W. I. Buchanan, Chief of the Department of Agriculture of the Exposition, as shown in the generous assignment of space in the Agricultural Building and the many courtesies extended to the committee.

Respectfully submitted.

H. P. ARMSBY,
Chairman of Committee.

The PRESIDENT. Unless objection is made the committee will be continued.

Mr. ALVORD. Mr. President, I would remind the Association that the general exhibit of colleges and stations has been made in coöperation with the Department of Agriculture, and it seems to me well to have this connection maintained. I think, therefore, it would be well to hear from the Director of the Office of Experiment Stations as to whether reports on the laboratories can be made and filed with other reports, and published with them in the proceedings of the Association.

Mr. TRUE. I think that without doubt it will be feasible for the Office of Experiment Stations to prepare such a report and have it form a part of the proceedings of the Association.

[It has not been practicable to include the detailed report of the exhibit of colleges and stations in the present bulletin, but arrangements will be made for its publication later.—EDITORS.]

The PRESIDENT. The Bureau of Education of the Department of the Interior is represented here by Mr. J. W. Holcombe. We should be glad to hear from Mr. Holcombe regarding the relations of the Department of the Interior to the agricultural colleges.

Mr. HOLCOMBE. Mr. President and members of the Association: A year ago at this time I had the pleasure of being present at a convention of this Association at New Orleans as a visitor, representing informally the Secretary of the Interior and the Commissioner of Education. At that time it seemed good to the Association to provide that the Interior Department, through the Bureau of Education, should be regularly represented by a delegate, and it is my great pleasure to be present here to-day as a delegate for the first time from the Department of the Interior, and to express to the Association the appreciation of the Commissioner of Education and the Secretary of the Interior of your action at that time.

The relations of the Department of the Interior with this body came about through the act of Congress generally known as the Second Morrill Act, providing additional endowment for the agricultural colleges. The Secretary of the Interior was made by the law the administrator of that act, and by a departmental order this duty is assigned to the Bureau of Education. It may be interesting to the Association to know that all the States and Territories of this Union are now recipients of the benefits arising under this Second Morrill Act, except the Territory of Alaska, the Indian Territory, and the District of Columbia, and it is assumed that these political divisions are not entitled to its benefits without further legislation; at any rate, they have no institutions entitling them to any of this fund. The State of Montana has organized a college of agriculture and mechanic arts and received one installment last year, the year ending June 30, 1893, and that State, together with all the others, received the appropriation, at the beginning of the present fiscal year. I had the honor at the New Orleans convention to speak more formally about the reports of treasurers and presidents of colleges made through the Bureau of Education to the Secretaries of the Interior and Agriculture. You will remember that the act requires that reports of treasurers shall be submitted on or before September 1. This requirement has in most cases been complied with, a very few reports coming in after September 1. I refer now to the present year, September just passed, because previous to this time, owing to the inevitable delay in putting the law into effect and the difficulty, I suppose, of the different colleges preparing themselves to receive the fund, this requirement was not looked into very closely. But the language of the law seems to be mandatory that the treasurer's report should be submitted before September 1, and I take the liberty of calling attention to this, though it has not seemed necessary to the Commissioner of Education to notice that point up to this time; yet there is no telling how a requirement of that kind will be interpreted hereafter.

No date is mentioned in the law for the rendering of reports of presidents, and consequently the Commissioner has recommended the States and Territories to receive installments of the appropriation without regard to these reports, basing his action on the report of the treasurer. But I beg leave to say on the part of the Bureau of Education that it would greatly facilitate the work of the Bureau in tabulating general as well as financial statistics of the different institutions, to make a full and satisfactory comparative showing, if the presidents' reports could also be had before September 1 or very soon thereafter. Each bureau of the Department of the Interior makes an annual report of its work to the Secretary on September 1. The receipt of these reports at that date would afford the Commissioner of Education an opportunity to present at a very early date the work of these colleges for the year just closed. We could at that time make a complete tabular statement of the financial and general educational statistics of the institutions which could be distributed to all these institutions and to some extent among the educational officials of the country.

I thank you for your kind attention, and am very glad to be present in the Association again.

The PRESIDENT. Is there further business?

Mr. ALVORD. I would suggest that as to-morrow's meeting will probably be the last in general session, any resolutions which are to be offered should be submitted now in order to be acted upon by the executive committee.

Mr. TRUE. In the report of the executive committee attention is called to the exhibit of French agricultural schools and experiment stations. I think that there should be some expression of appreciation of this exhibit on the part of the Association, and therefore move that a special committee be appointed by the chair to consider what ought to be done in this and all similar cases, and report to the Association later.

The motion was carried.

Mr. KELLOGG. In conformity with the suggestion made in regard to the meeting to-morrow, I would like to present a resolution in regard to the method pursued by the Government in the distribution of seed.

Resolved, That it is the sense of this convention that the distribution of plants and seeds should be put into the hands of the agricultural colleges of the States and Territories.

This resolution was, under the rules, referred to the executive committee.

Mr. FAIRCHILD. I would like to offer a suggestion as to station notes given in the Experiment Station Record. It seems to me that the stations doing the least make the most reports, for the reason, I suppose, that they have plenty of time for it. Is it not possible to make the form of request for information more explicit, to so formulate it that every station will have to report certain data each month, showing what is going on at the station? As it is now it is a matter of judgment whether anything is worth reporting when compared with the many things undertaken. It seems to me that the Experiment Station Record would be worth more if there was a report of progress from each station.

Mr. TRUE. The Office of Experiment Stations desires to publish in the Record any item of news which is of interest to college and station workers, and would be glad to receive news from any and all college and station officers.

Mr. WELBORN. I submit the following resolution:

Resolved, That it is the sense of this Association that Congress should provide uniforms and other military equipment for the cadets at the Agricultural colleges.

Mr. DABNEY. I suggest that this resolution be referred to the Section on College Work, which has this subject under consideration.

The PRESIDENT. Unless there is objection the resolution will be so referred.

Mr. MORROW. I wish to call attention to the fact that the evening session will probably be held in the hall adjacent. It is to be, formally, a joint session of this Association and the Section on Agricultural Education and Experiment. President Henry will deliver his annual address and we confidently expect that Sir Henry Gilbert, of the Rothamsted Experiment Station, will arrive during the afternoon and will be here to deliver his address. President Fairchild, of Kansas, will deliver an address on intellectual development in agricultural education.

On page 33 of the general program of the Agricultural Congress you will find the one of interest to this Association. I wish to call especial attention to the program for Friday afternoon, which will be devoted to agricultural features of the Exposition, more especially the dairy test. Papers will be presented by Profs. Armsby, Roberts, and Scovell. Dr. Babcock will give the history of the methods of work and some of the results, and Prof. Farrington the laboratory features, of the test.

Chief Buchanan will present a paper on the agricultural features of the Exposition in general.

I may state that after consulting with the authorities, I am able to announce unofficially that the Section on Education and Experiment of the World's Agricultural Congress will meet to-morrow afternoon at 2 o'clock, instead of at 10, as stated in the program, and thus avoid conflict with the program of this Association.

The meeting adjourned at 12:30 p. m.

AFTERNOON SESSION, TUESDAY, OCTOBER 17.

The joint session of the Association with the Section on Agricultural Education and Experiment of the World's Agricultural Congress was called to order by Chairman Morrow at 2:10 p. m.

The following papers were presented:

Agricultural Education in France, Leon Vassilliere, agricultural commissioner from France.

Agricultural Education in Russia, Peter R. Slieskin, professor in Agricultural Academy, Moscow, Russia.

The Agricultural Societies and other Agricultural Forces of Belgium, Paul DeVuyst, agricultural inspector, Belgium.

The Relations of the General Government to Agricultural Experiment Stations, A. W. Harris, president Maine State College, late director Office of Experiment Stations, U. S. Department of Agriculture.

Agricultural Education in Germany, Dr. A. Backhaus, Berlin.

Agricultural Education in Japan, T. Menami, professor of agriculture, Imperial College of Agriculture, Japan.

EVENING SESSION, TUESDAY, OCTOBER 17, 1893.

The meeting was called to order by Chairman Morrow of the Section on Agricultural Education and Experiment of the Agricultural Congress.

President W. A. Henry was introduced and delivered his annual address.

PRESIDENT'S ADDRESS.

In previous gatherings of this Association your presiding officer, always having been chosen from the college side of the organization, has naturally dwelt largely on the educational features of our work. Representing the station side more particularly, it seems eminently proper that on this occasion I should direct your attention to matters which relate to experiment stations, their organization and work.

The gift of the General Government to each of the several States of the Union of $15,000 annually for agricultural investigation stands without a parallel in any other country in its liberality toward agriculture, and is surpassed in this only by that other gift to agriculture whereby in one act there was ceded to the several States some 11,000,000 acres of land for founding agricultural and mechanical colleges. When the history of our American experiment stations is written, it will be found that the relations of our stations and agricultural colleges are so intimately interwoven that an account of the one will be incomplete without the history of the other.

When the grant of 1862 was made, there was little besides theory in regard to agricultural education in this country, and from the president of the board of trustees down to the lowest instructor there seemed to have been only the crudest ideas in relation to the proper method of procedure. As in every case where there is no clear conception of the work in hand in advance of its inception, many mistakes were made in the organization of these institutions, some serious, yet in a majority of cases all will work out well. As I review the situation it seems to me that our experiment stations have made fewer mistakes, and as a consequence have attained far greater success in the short period of their history than did our agricultural colleges in a like length of time. And the explanation of this is easily within our finding. Our colleges, originating in the act of 1862, had but a single example of an agricultural college in this country, and but little was known of those in the old world. With our experiment stations the case was quite different. Some of the German stations had been in existence for a generation, and had accomplished much for the development of agricultural science. Then there was Rothamsted, that ideal station, the work of which is more or less known and appreciated by every intelligent American farmer, and whose reports are regarded by all investigators and teachers in science as agricultural classics. This station had been working for forty years, and its light had shone clear round the world. In our own country the Department of Agriculture at Washington, in some of its divisions, had been conducting most fruitful investigations, not only greatly aiding American agriculture, but, what was equally important, had been training men to this very line of work. Several of our States had already established experiment stations, and some of them were making excellent reputations. The very growth and struggles of our agricultural colleges had accomplished much toward breaking the way for our stations.

In some fair measure, then, times were ripe for the coming of the stations; still, as I look back, it seems to me the act was too general, and too sudden for the greatest good to be derived from the expenditure. The report of the Secretary of Agriculture for 1892 shows that there are now nearly 500 workers in our various stations. In calling to this work in a single year hundreds of men it was impossible that all should be properly trained for the work, and many of those selected were not fitted for it either by training or by natural adaptation, and as a consequence there has been much shifting and replacing, the end of which I fear is even yet not reached. I believe it would have been far better for the reputation of both our agricultural colleges and our experiment stations had the acts establishing them contemplated a progressive gradual movement. This might have been accomplished by coupling conditions with the grant making it obligatory, for example, that each State, in order to receive Government aid, must show its earnest by placing a liberal sum with that given by the Government. This would not only have insured a larger income to the institutions when established, but would have caused each State to regard the matter seriously before taking the initial step. In consequence, probably but a portion would have availed themselves of the act at first, and, this true, these pioneer colleges and stations would have proved the training ground for teachers and investigators for those institutions organized at later periods.

It is now about six years since the passage of the Hatch Act, yet in that brief space of time more than forty stations have been organized and, with all the mistakes, many now have on record investigations creditable to scientific effort and the cause they represent and a few have made a marked success. If you ask me to point out some of the successful efforts of our stations, let me refer you to the great work done in regulating the manufacture and sale of commercial fertilizers in the Atlantic and Gulf States. Without the closest regulations and the protection of law, there is no material in trade where fraud is so easily perpetrated, and where deception is so difficult of detection, as with commercial fertilizers. Our experiment stations have not only done much in developing methods of analysis by which the qualities of fertilizers are made known, but they have secured the placing of laws on the statute books to regulate the guaranty and sale of fertilizers, until now more than $30,000,000 worth of this material is annually bought by farmers in a business-like way, no purchaser being ignorant of what he is securing unless he is blind to the facts laid before him by the stations. Then, too, the study of the effect of these fertilizers upon the growth of crops has been very helpful.

The subject of economic entomology serves another excellent illustration. The Department of Agriculture at Washington early recognized the importance of this branch and the large opportunity it presented for helping agriculture, and here and in a few of our leading colleges and stations there has grown up probably the best corps of agricultural scientific workers we can point out in this country, excepting only the agricultural chemists.

A number of our stations are spending much effort in a study of the Indian corn plant, and already great good has been wrought in the knowledge of how the nutrients are elaborated by the growing plant constantly increasing in amount until the very closing days of its life. Then, too, the work in showing the large amount of nutrients in the cornstalk, aside from the ear, has been worth untold good to our farmers, and is working a small revolution in agriculture in the corn belt.

At the South the sugar-cane investigations and the introduction of new forage plants have been of great help to the planters, who have in a most marked way shown their appreciation of what has been accomplished for them. The waste of cotton seed by the Southern planter for generations and until very recent times is perhaps the most marked example we can point out of the enormous cost of ignorance. Southern stations have shown that in the cotton seed, cotton-seed meal, and cotton-seed hulls there is nutritive material in the highest concentration sufficient to feed hundreds of thousands of cattle where there was only waste before.

The dairy industry, one of the greatest in agriculture, is now undergoing remarkable revolution, which was started by scientific men on the other side of the water, and has been caught up by our own investigators in America, and untold good has been accomplished. No line of agriculture is so rapidly being placed on a scientific basis as is dairying. In all this progress our stations hold an honored position.

Lack of time prevents my calling attention to other work accomplished, but there is one instance that I can not forego calling to your mind. So general has become the interest in agricultural investigation that our World's Fair directors, in planning this colossal exposition, could not escape the impulse, and so here, right in Jackson Park, during all the coming and going, hurrying and sight-seeing, there has been conducted the most remarkable dairy investigation ever undertaken. All honor to Chief Buchanan and the directors who stood by him in his worthy work of rounding out the great agricultural branch of the Exposition with a genuine scientific agricultural investigation! When, as members of this Association, you have come to comprehend the scope and value of the dairy test now closing, and measure its help to that great industry, you will begin to appreciate what a vote of confidence was awarded us by the directors of the Exposition when last November, at New Orleans, they asked this Association to appoint from its members experts, who, in conducting this test, should not only hold the balance of power, but be the main source of direction and control in this great experiment.

If you ask for still further evidence of appreciation, I can point you to the data in the last report of the Secretary of Agriculture, which gives the revenue of the stations for 1892. You will there note that for the support of experiment stations the General Government gave aid to the amount of $689,000 in round numbers. The individual States supplemented this sum by the very large amount of $152,000, while local communities added $85,000, and individuals over $1,000. In other words, States, local communities, and individuals gave over one third as much as the General Government in financial aid to our stations, and the proportion given by the States is rapidly increasing. Surely there must be some appreciation of the work we are doing to have called forth such generous aid from those who, best of all, are in position to measure what we are accomplishing.

One reason that every earnest, faithful, working experiment station has a strong hold on the agricultural people is because its workers have met the farmers at the institutes and farmers' club meetings for frequent conference, and have given instruction through the agricultural papers, acting in no small degree as teachers and counselors. It is true that when a station worker is on the institute platform or addressing a farmers' club, he is not investigating, and when he is writing for the agricultural press he is not doing laboratory work, but the call for help from our farmers has been so great, and so marked their appreciation, that it has been impossible to escape it. With earnestness on both sides and a desire to give and receive help, the most cordial and close relations now exist in a number of our States between the experiment stations and the intelligent farming people. To be frank with you, I believe that our station workers have in many cases accomplished more good for the cause of advanced agriculture through their efforts at instruction than through all they may have discovered.

Nor is this anything but natural when we study the subject carefully. The investigators of Europe had discovered and accumulated a large amount of material of great value to agriculture. Little of what they had done had been explained and made known to the great mass of farming people in the days before the establishment of our stations. Finding this rich material available to our people for the presentation, it is not the least surprising that our station workers have made good use of it in many ways. It is as though we had found gold mined by workers in the Old World which we could have for the asking; we have taken this gold to our American farmers, and in giving it we have not only received thanks from them, but, what is more important, we have gained their confidence in our assertion that there is much that can be discovered in agriculture that will be helpful to them.

The more I study the work of our experiment stations, the more I am pleased with what we have accomplished, and the larger grows my faith in the high position they are destined to occupy in American agriculture.

Trusting that I have left in your mind no uncertainty of my position on this point, let me turn your thoughts now to some of the errors I believe we have made in the management and direction of our stations in the pioneer days of their history, now closing. I admit our stations, one and all, have made some serious mistakes, but I believe they have been of the judgment and not of the heart.

If we study the reports and bulletins as they come to our tables, I think we must all confess that many of the so-called experiments and tests reported show marked faults. Very frequently there is apparently little careful planning and that preparation so essential to good scientific work. With the preliminary work slighted, it is not surprising that other evils follow. Often the figures given in the report are inaccurate on the very face of them, showing errors in simple addition and multiplication; sometimes the proof-reading is careless and the explanation of the work ambiguous and faulty. All of this leads to the suspicion that back of the report were slovenly methods and lack of care in keeping records.

Another error into which many of us have fallen is the lack of continuity. An interesting investigation appears in some bulletin or annual report; the author has taken up his subject in good shape and his investigations are interesting and show a profitable line of experimentation. When later reports come to us, we open them hoping to find additional work on the subject before discussed, but often it is lacking, and the investigation seems to have been dropped for some new line. I here venture the assertion that there has not been a single investigation undertaken by any one of our stations and carried on faithfully for a series of years that has not brought forth good returns for all the capital, mind, and money that has been put in it.

One reason for the lack of continuity is the numerous changes in the personnel of most of our stations. Unfortunately our workers have been shifting about, many dropping out to be replaced by new ones, while others go from one station to another, and in almost every case where a change is made, the work in progress is dropped for something new. Again, changes are frequently made by direction of those in authority. Boards of trustees are constantly changing their membership, and each incoming member is apt to be fired with a burning zeal to distinguish his entry into office by some striking innovation. Here is an excellent opportunity for tact on the part of the director; let him begin the work of educating his board at once, and impress upon them the necessity that each one first understand the situation before advice and counsel looking to changes are given. In illustration of this let me point to a case which occurred at the Wisconsin Station. A certain new member of the board, one who is an ardent admirer of the trotting horse and horseflesh in general, was placed on the station committee. Now, for reasons which seem proper to me, we have never undertaken work with horses at our station, and I assure you that my fears were great when I was told by friends that our enthusiastic trustee would soon have a race course on our station grounds as well as a stable of fine trotters. I have no doubt but his first inspection of our live stock filled him with disgust, and he mentally resolved on some marked changes. But he was a sensible man, fearing radical changes, and willing to study the situation. The result is that for two years I have had the most cordial support from this trustee, lover of horseflesh though he still is, and to-day at our station we have not a horse that can trot a mile in less than five minutes.

But there are often more earnest and importunate advisers to the director than his trustees. There is hardly a man in this country, be he lawyer, doctor, or of any other calling, who has not a weakness for some special line in agriculture or horticulture. And so all classes of people are interested in our station work. Sometime since a lawyer in our State wrote to the president of our board stating that the influence of the moon on vegetation had never been properly studied; that it was a fact that some of those who believed in the moon theory were among the best farmers in the country, and he hoped that our board would at once direct the establishment of a line of investigation which should study this important and burning question. Only a couple of weeks since a letter came to the station from an intelligent citizen saying that he had as yet found nothing in our reports regarding mushroom culture, a subject in which he was deeply interested, and that he hoped to see the Wisconsin Station soon a leader in this work. Not only have we many counselors and advisers from outside our stations, but there is no lack of this form of assistance from within. Many of our workers are young men, with fertile brains and an eagerness to drop the old and take up the new, rather than plod on year after year in some treadmill line. If we are to do better work in the future we must not only work more carefully and more thoroughly, but we must more completely carry out each line that is undertaken before beginning anything new.

If the suggestions just made are to be carried out generally, we must cut down the lines of work we are endeavoring to carry, for many of us are attempting to cover too large a field with the force and means at our command. There must be a greater division of labor among our several stations, and each must be content to leave to others certain lines of investigation, much as we should like to carry them on ourselves. To show that I am trying to follow in some fair measure what I am advocating, let me call your attention to what some of you have noted, perhaps with surprise, as you have looked over the list of our station workers. At the Wisconsin Station we have neither botanist, entomologist, nor veterinarian at this time. When laying out the work it seemed to me that economic entomology was already quite well cared for by the excellent corps of workers in the Department of Agriculture at Washington and the men of marked ability in several of our stations. In order to put our work in entomology equally creditable with the best of other stations, there must be an outlay of several thousand dollars a year, and I believed that we had better use this money in some other line and let the farmers and horticulturists of Wisconsin get their information regarding insects and insecticides from these other sources. By thus saving and concentrating we now have at our station four employés who give almost the whole of their time to the single line of dairy investigation. I believe we are a stronger station by having four men in the single line of dairying than had we four working in four different fields. State lines count for but little in this country. The Babcock milk test worked out in Wisconsin is as helpful to an Iowa dairyman as to one living in Wisconsin. Prof. Roberts's work at Cornell on the great waste of barnyard manure through leaching in the open barnyard is as instructive to an Ohio farmer as though it were performed by his own station.

In endeavoring to strengthen our work we must allow a large sum for maintenance and equipment after providing for salaries. In looking over the reports of some of our stations I am surprised at the small amount of funds left after the salaries are paid. I do not see how the workers in such stations can be content, for surely they can not always have the proper apparatus to wörk with.

Another fault has been the lack of coöperation. We have talked about it in our annual gatherings, but have made little progress. I still feel that, though we have accomplished little, we should continue to look toward a more general and hearty coöperation among those stations pursuing kindred lines of investigation. Why can not those stations which are conducting experiments in dairying confer together in regard to the work in hand, and agree that some parts of it at least should run along the same lines? Why can not stations which are endeavoring to determine the effect of distance of planting on the yield of corn have some things in common in their work? And so on with many other lines. There should be no coercion, and I would have our workers drawn together in their coöperative efforts by natural affinities rather than by positive direction from this or any other body. Whether or not we work together, I have no fears of the useless duplication of work. That was talked of in the first meeting of this Association, but of late we hear nothing regarding it. If we had more duplication we might be more assured of the correctness of some of the results announced.

One more point where it seems to me our stations must improve, and I am done. Should there not be a clearer demarcation between the duties of teacher and investigator in our colleges and stations, and has not our work suffered in the past because of the poor definition which now exists? Our agricultural colleges are the older institutions, and in a generation they have developed a goodly number of able teachers; the stations coming last, and having been added to, the colleges, it has followed quite naturally that in manning them the workers were drawn largely from the teaching force. In a number of cases we find that the president of the college is director of the station, and that each of the divisions of investigation is assigned to a college professor. First of all, how can the president properly do double duty as executive officer of the college and director of the station? The successful president of a modern college represents a combination of more attainments than is required in any of the learned professions, and nowhere is there a harder-worked man. He is a diplomat in his dealings with the State officials on the one hand and no less so while daily attending to petty matters of discipline among the hundreds of pupils under his charge. He is a financier of marked ability in ever watching to increase the income of his institution from every possible source, while yet closely supervising and guarding every expenditure, no matter how small. Besides the accomplishments of diplomat, financier, and guardian of hundreds of young lives he must withal be scholarly, and with voice and pen wait the beck and call of numerous organizations throughout the State. With all this and still other duties, let me ask you, how can a man give proper attention and direction to scientific investigation? As well might some railroad magnate let his ambition carry him to the belief that he could serve as president, general manager, head counselor, and division superintendent of a great railway system.

Nor is the situation markedly better in the case of a hard-worked professor. Our colleges expect not less than three lectures or recitations daily, and often much additional instruction is placed upon them. When the station comes in for consideration these authorities seem to hold that after the teacher has spent three or more hours in the stuffy class room he may just as well devote the remaining hours of daylight to refreshing himself by good, vigorous work as an investigator, since, the two lines being so different, one must prove a recreation from the duties of the other. In a spirit of generosity the authorities sometimes drop an hour a day from the work of a professor that he may have an abundance of time for his investigations, and even agree that he shall have assistants to carry out the details of the work, leaving only the planning and general supervision.

Now, it generally turns out that these assistants are recent graduates, who gladly accept the positions as stepping-stones to something better; often they are undergraduates eager to earn a few dollars to help pay their way. I believe such a combination as this is most unfortunate for the college, because it is harmful to the station which is associated with it. No man, however able, is properly prepared to do any considerable amount of class-room work and then conduct investigations of the grade that our experiment stations must call for in the future. But it is said that these men are not asked to actually do much of the work, but only supervise it. I ask you, how can high-grade investigative work be carried on through subordinates of the class usually given to teachers as helpers in such cases as this? As I understand it, investigation requires in some measure the same play of faculties as does invention; what inventor would be willing to devote his best energies each day to some other line of work, and in lieu of his own powers thus diverted, substitute the work and observation of novices? If we are to secure the highest result from our station work, our investigators must be put just as close to their subjects matter as is possible and they must stay there from first to last. The investigator who is experimenting with steers or swine must keep close to his animals every day of the trial, not a mere looker-on, but a most careful observer and recorder of every action and every development. He who has growing plants under his charge must stay close with them from the time the seed is put into the ground until the harvest is over and the analyses completed. The teacher who spends his time in the class room or at his desk and turns over the care of his animals or his growing crops to subordinates is sure to lose that living connection which must hold between worker and the objects investigated if there is to be any real scientific advancement. You might equally well have come to this great Columbian Exposition by proxy. You could readily have secured a young man for a dollar or two a day and expenses who would come here and tramp through these buildings faithfully week after week and send to you a carefully written record of his observations. But you would not have seen the Fair, nor can any man who wishes to get down to the marrow of an experiment do so by any other means than by giving himself up to that experiment, soul and body, from start to finish. But it will be said in extenuation of the system that our teachers are brainy men and have lots of work in them. So they have, but they are generally worked down pretty well in the class room. There was once a blacksmith in this country who, while pounding iron, by great industry and persistency, and aided by a wonderful memory, became the master of fifty languages. He was called the learned blacksmith. There has been but one learned blacksmith in America, while each day at evening thousands of blacksmiths who have pounded iron all day go home to their families with tired muscles, in no fit condition for a tussle with roots and conjugation. Here and there there may be a professor who can pound iron in the class room all day and write learned books or conduct deep investigations during his spare hours, but they are about as rare as learned blacksmiths.

Nor need our colleges suffer seriously by putting the strongest men at the head as investigators. All studies that have much drill work in them—and three fourths of college work is steady drill—are taught in our leading institutions by instructors and assistants. If we can not have men of first grade in both station and college, let us have them in the station and let us turn over our general instruction to the assistants. These assistants can do excellent work in all the ordinary routine of teaching, such as chemistry, physics, botany, horticulture, veterinary science, and all the other branches common to agricultural colleges. Of course I would have strong men in both places were it possible, but I refer to cases where we are unable to reach this high result. Thus you see my idea is to put the station ahead of the agricultural college in the grade of men employed provided both can not be of first rank.

But I would use our investigators for teachers, bringing the students to them for the final polish—for rounding out the subjects under consideration—after each has had thorough drill under the best assistants the means would provide. The investigators being the strongest men in the institution, were we to bring a class to them one hour a day for one term in the year, they would impart instruction of the highest possible grade. And the student, brought in contact with such men in the closing days of his college life, would receive an impulse and gain a grasp of agriculture in its scientific phases that is impossible to impart to him in any other way. Drilling a student day after day in the elements he must master in order to attain the higher lines of the study requires one kind of teaching; to inspire him to a broad comprehension and a worthy grasp of the subject calls for another kind of teacher, and that feacher above all others is he who comes to the class room fresh from his field of investigation with mind loaded down with the information he has been acquiring and full of enthusiasm for his chosen subject. Under this system we can secure the highest sort of investigation in our stations, while the young men as they leave the college will carry an inspiration and an ideal with them that can be gained in no other way.

I believe the combination system which I have been deprecating is only another of those incidents of pioneer effort. It has been practically out of the question in many cases to find suitable persons for manning the station, and very wisely the college authorities have kept the direction of the station in the hands of the president and used the teachers as best they could for investigators. Under this system some excellent work has been done; indeed, some of the very best that has been sent out has come where this combination is practiced, but in such cases the good work has come from our very strongest institutions, those that from their very nature should prove leaders. I believe the time is not far distant when such institutions will adopt the division of labor somewhat after the method I have mapped out.

In all that has been said I have tried to convey the impression that our work as station investigators is even yet in its pioneer stage, and as a consequence there is much that is necessarily crude and irregular. Conceding that we have all made mistakes, I maintain, as was stated in the beginning, that they are errors of the judgment and not of the heart. I believe that almost without exception our station workers are honest in their efforts and earnest in their desire for the upbuilding of agricultural science. But as I look over the field I am deeply impressed with the fact that our work does not yet compare favorably in many cases with that of the older stations of Europe. These shortcomings and mistakes are incident to pioneer effort, and for the most part could not have been avoided. Let us study more carefully than ever before the work of those great institutions of Europe, using them as models whenever we can to help us on. Let us draw our work closer together, undertaking less, laboring more faithfully and more persistently. Let us grow out of amateur efforts into the true scientific spirit. Already we have gained a strong hold on our people and most cordially are they upholding us in our efforts. May each year see the cause strengthened until our stations shall become an integral portion of our agricultural system, and recognized leaders in all agricultural thought.

President Henry then took the chair and in a few well-chosen words introduced Sir Henry Gilbert, of England, to deliver an introduction to six lectures to be given by him in this country on the work of the Rothamsted Experiment Station covering a period of fifty years.

Mr. GILBERT. Mr. President and gentlemen: I thank you for the kind observations which you have made and the kind way in which they have been received. I have to acknowledge this kindness, not only on my own part, but in behalf of Sir John Lawes. You know—I think he has given you evidence enough of it—that he takes the greatest possible interest in the progress of agriculture, both practical and scientific, on this great continent; and as for myself, those of you whom I met on my two visits to this country know that I spent my time in making myself acquainted with the agriculture of the country and in making the acquaintance of my fellow workers on this side. I will not say that my interest is second to that of Sir John in what is going on among you, and I must say that I have been extremely interested in the remarks of your president, and that I entirely and heartily agree with him in his observations as to the impossibility of uniting active teaching with work of investigation except in a general way. Sir John Lawes and myself have so strongly felt this from the beginning that when asked to allow students to come to Rothamsted it has always been refused; and Sir John has made especial provision that the work of investigation shall be continued and that no part of the fund donated shall be devoted to educational purposes.

You will ask, perhaps, why is it, then, that I went to Oxford as professor for six years. It was simply because in no other way would it have been possible to have presented a great amount of results of investigation at Rothamsted; so I undertook to give lectures at Oxford to bring into form results that would otherwise have been left until now. So that is perfectly consistent with our views of not mixing the work of investigation and education. While I say that we always refused to take pupils at Rothamsted, we said you are perfectly welcome to come and read with others. We will give you no systematic instruction, but if you can learn anything we shall be very glad indeed to let you have the records; and so it is that we have had no systematic teaching, and we believe that if we should have had our investigations would not be where they are now.

Gentlemen, as you know, I have come to this country to deliver somewhere a course of six lectures, giving a résumé of the work covered at Rothamsted for the last fifty years. If you will allow me now I will read an introduction to those lectures.

Agricultural Investigations at Rothamsted, England.

[Introduction to six lectures on the agricultural investigations conducted for a period of fifty years at Rothamsted, England; delivered under the provisions of the Lawes Agricultural Trust, by Sir Joseph Henry Gilbert, M. A., PH. D., LL. D., F. R. S., V. P. C. S., etc.]

As you are doubtless all aware, it is under the auspices of the Lawes Agricultural Trust, which provides for the periodical delivery in the United States of a course of lectures on the Rothamsted investigations, that I appear before you to-day. Had the occasion been an ordinary one it would not be expected that at the age of 76 I should undertake the risks of so long a journey and the responsibility of delivering a course of lectures before this Association of Agricultural Colleges and Experiment Stations. But the occasion is not an ordinary one. Thus, the more systematic experiments at Rothamsted were commenced in 1843, so that the present year, 1893, is the fiftieth of their continuance; and it was considered desirable that under these circumstances something in the way of a general review of the half century's work and results should be brought before you. Obviously, the execution of such a task could only be appropriately undertaken either by Sir John Lawes or by myself, who alone have worked together from the commencement to the conclusion of the fifty years. Sir John Lawes is, however, even more heavily handicapped by age than I am myself, and at the earnest desire both of Sir John and of the trust committee I have accepted the responsibility.

I need not go into much detail as to the origin, scope, and plan of the Rothamsted investigations. These points were pretty fully considered by Mr. Warington in his first lecture in 1891, and a good deal of information on the subject will be found in the early pages of the now annually issued "Memoranda of the Origin, Plan, and Results of the Field and other Experiments, conducted on the Farm and in the Laboratory at Rothamsted." Indeed, I am sure you will readily understand that it is no easy task to compress within the limits of half a dozen lectures anything like an adequate account of the labors of a gradually increasing staff of workers over a period of fifty years. This must be fully recognized when it is borne in mind that the reports and other papers on the results at present number about 120, and that they occupy nearly 4,000 octavo and more than 800 quarto pages. These publications, moreover, brought together as they have been into bound volumes for the purpose of distribution in a collective form, make up 6 octavos and 3 quartos, while papers since published are accumulating toward another volume. A few years ago 50 sets of the 9 volumes were prepared, requiring the reprinting of nearly 500 octavo pages and the purchase of a good deal of the quarto matter. As many of you are aware, a number of these complete sets of 9 volumes each—I believe 26 sets in all—were presented by Sir John Lawes to as many educational and experimental institutions in the United States, and I am authorized by Sir John to say that he hopes to be able to send perhaps about an equal number more before or about the middle of next year (1894). In all 125 sets, involving the reprinting of about 1,100 pages octavo, and about 370 pages quarto, are now in course of preparation. Of these our own board of agriculture takes 50 to distribute to various institutions in the United Kingdom. There will then be left only 75 sets for distribution by Sir John Lawes himself to our colonies and to foreign countries, including those still to be sent to the United States. It may be added that to provide any more sets than those now in preparation would necessitate further reprinting almost in proportion to the number required; and when it is considered how much time must be expended in the revision of the reprints and how great the cost, little surprise can be felt at the delay in the completion of the work and the necessary limitation of the number to be provided.

Unfortunately, however, besides all the published matter, there still remain large arrears of as yet unpublished results. It is from this mass of material, published and unpublished, that I have to make my selection in endeavoring to give such a view of the objects and results of the Rothamsted investigations as may be of value, both as illustrating the advance in knowledge already attained and as indicating points for future inquiry.

Obviously the scheme proposed precludes the idea of going into much detail on any one subject, and supposes rather a comprehensive, but at the same time only outline, view of the whole. The next question is, whether the illustrations relied upon should have reference primarily to results obtained in the field and in the feeding shed, or chiefly to those of laboratory investigations. Now, as a prominent characteristic of the Rothamsted work has certainly been the devotion of great attention to both field and feeding experiments; and as by far the greater part of the laboratory investigations, whether chemical or botanical, have had for their object the solution of problems suggested by the field and feeding results, it has been thought that the most appropriate, and at the same time the most useful plan, will be to give a comprehensive view of the plan and results of the field and feeding experiments themselves, and to enforce the lessons which they teach, by such reference to laboratory results as the questions raised require for their elucidation, and as space and time will permit. In other words, the analytical and other laboratory work must be treated as essential means to an important end, and can not, within the limits of such a review, be made the subject of critical consideration as such. And here it should be observed that nothing is done at Rothamsted, in the way of manure or feeding-stuff analysis or seed control, for any purposes external to those of the investigation.

True it is, that although, as has been said, a large amount of field, feeding, and analytical results remains as yet unpublished, yet fortunately a much larger amount has already been put on record. Hence, it may be that some of those before me who are well acquainted with what has been written will be disposed to say as I proceed that we knew much of this before. On the other hand, probably a larger number of those present are not so well acquainted with what has been written, and a still larger proportion of those who may read these lectures afterwards may feel that the outline only which I can give will serve the useful purpose of assisting them the more effectively to study the fuller published records. Indeed, the object I have had in view throughout has been to afford guidance for further study rather than to attempt the impossible task of giving anything like an adequate account of the results that have been obtained or of specifically indicating lines of inquiry for the future.

It will be appropriate here to explain that, meeting Prof. Atwater two years ago in Germany, he urged the desirability of our sending to the World's Columbian Exposition pretty full illustrations of the Rothamsted work and results, to be exhibited side by side with those to be sent by the agricultural colleges and experiment stations of the United States; and that, on his way home some months afterwards, he paid a visit to Rothamsted, further to urge the plan on Sir John Lawes. A general assent to the proposition having been given, the question arose as to what sort of illustrations should be sent. Finally it was considered desirable to send such a series of exhibits as would serve to some extent as a substitute in case I were not able to visit Chicago on the present occasion; and which, in case I were able to give the proposed course of lectures, would be of service both to myself and to my hearers, in illustration of the facts and arguments I should have to adduce. Accordingly, it will be found that a large proportion of the 44 exhibits that have been sent have for their object the presentation to view of the results of the field experiments, of the nitrogen statistics of some of the crops, of the results of experiments on the question of the fixation of free nitrogen, and of results relating to the amount and to the composition of rain, and of land drainage. There are also plans of the experimental fields, showing their areas and the arrangement of the plots. Unfortunately, there is only one illustration relating to experiments on the feeding of animals. It was, however, intended that a pretty complete series relating to that most important subject should be prepared; but the enormous amount of time occupied and the great hindrance to other work involved in the preparation of the exhibits that have been sent rendered it impossible to complete the original design. Some of the omissions in the execution of the intended list of exhibits will, however, be made good by illustrations embodied in my lectures.

With regard to the amount of the exhibits which have actually been sent, it may be observed that the quantity of wall space originally asked for was from 3,000 to 4,000 square feet; but the area actually covered is 4,786 square feet. To put the thing in another way, 4,000 square feet corresponds to a quarter of a mile in length, a yard high; and the actual space covered (4,786 square feet) corresponds to rather more than three tenths of a mile a yard high; and yet, as above stated, the original design has not been fully carried out.

As a preliminary to any detailed explanation of the scheme of the lectures I propose to bring before you, it will be convenient to call attention to the general arrangement of the field experiments, and also to their extent and duration, as shown in the following table (I), which is No. 29 in the list of exhibits:

TABLE I.—*List of the Rothamsted field experiments.*

	Commencing.	Number of years.	Area, acres.	Number of plats.
Wheat (various manures)	1843–'44	50	11	34 (or 37)
Wheat (alternated with fallow)	1851	43	1	2
Wheat (varieties)	1867–'68	15	4–8	about 20
Barley (various manures)	1852	42	4½	29
Oats (various manures)	1869	[1] 10	0¼	6
Beans (various manures)	1847	[2] 32	1½	10
Beans (various manures)	1852	[3] 27	1	5
Beans (alternated with wheat)	1851	[4] 28	1	10
Clover (various manures)	1848–'49	[5] 29	3	18
Various leguminous plants	1878	16	3	18
Turnips (various manures)	1843	[6] 28	8	40
Sugar beets (various manures)	1870	5	8	41
Mangel-wurzels (various manures)	1876	18	8	41
Total	....	....	56¼	277
Potatoes (various manures)	1876	18	2	10
Rotation (various manures)	1848	46	8	12
Permanent grass (various manures)	1856	38	7	22

[1] Including one year fallow.
[2] Including one year wheat and five years fallow.
[3] Including four years fallow.
[4] Including two years fallow.
[5] Clover, twelve times sown (first in 1848); only 8 crops, 4 very small; one year wheat, five years barley, twelve years fallow.
[6] Including barley without manure three years, 1853–'55.

The general scope and plan of the field experiments has been to grow some of the most important crops of rotation, each separately, year after year, for many years in succession on the same land, without manure, with farmyard manure, and with a great variety of chemical manures; the same description of manure being, as a rule, applied year after year on the same plat. Besides the experiments on the growth of individual crops year after year on the same land, without and with different manures, so to speak complementary experiments, on the growth of crops in an actual course of rotation, without and with different manures, have been made; as also have others on the mixed herbage of permanent grass land, both without and with various manures. And here it is to be observed that the arrangement of the manures is made entirely regardless of the comparative cost as between plat and plat; the question at issue being entirely one of constituents against constituents, and not of shillings against shillings, or dollars against dollars.

It is obvious that the results of field experiments with the individual crops of rotation conducted as above described, must of themselves throw much light on the characteristic requirements of the particular crop under investigation; whilst those on the growth of crops in an actual course of rotation will serve to confirm and control those obtained with the individual crops, and will, in their turn, receive elucidation from the results with the individual crops. Then again, the results of the experiments on the application of different manures to the mixed herbage of permanent grass land, which includes members of the botanical families that contribute some of the most important of our rotation crops may, independently of their special value in reference to the main objects for which they were undertaken, be expected to afford interesting collateral evidence in regard to the requirements of individual plants thus grown in association, instead of alone, year after year, or in rotation, as in the other series of experiments. Obviously, too, the chemical, and in some cases the botanical, statistics of the various crops so variously grown, and the chemical statistics of the soils of the plats upon which they have been grown, must afford very important data for further study and elucidation.

An examination of the table will show that the individual crops grown separately year after year on the same land, include wheat, barley, and oats, as members of the gramineous family; beans, clover, and other plants, of the family *Leguminosæ;* turnips of the *Cruciferæ;* sugar beet and mangel-wurzel of the *Chenopodiaceæ;* and potatoes of the *Solaneæ.* Then the experiments on rotation include those with members of three different botanical families, turnips, of the *Cruciferæ;* barley and wheat, of the *Gramineæ;* and clover and beans, of the *Leguminosæ.* Lastly, there are the experiments on the mixed herbage of permanent grass land, which includes, besides gramineous and leguminous plants, numerous species of other families.

The first experiments were those with root crops, which were commenced in June, 1843, so that the present year, 1893, is the fifty-first of their continuance. The second were those on wheat, commenced in the autumn of 1843, so that the crop just harvested is the fiftieth grown in succession on the same land. The experiments with beans were commenced in 1847, but for reasons that will be fully explained, they have not been continued up to the present time. Those with clover were commenced in 1848, and have been succeeded by others with various leguminous plants, which are still continued. Then, of the other more important series, those on barley were commenced in 1852, and are still in progress, the crop of the present year being, therefore, the forty-second in succession. Lastly, the experiments on an actual course of rotation were commenced in 1848 and are still continued, so that the present is their forty-sixth year; and those on the mixed herbage of permanent grass land were commenced in 1856, so that this year completes the thirty-eighth of their continuance.

It should be observed that many of the experiments were commenced without any idea of long continuance, and it was only as the results obtained indicated the importance of such continuance that the plan eventually adopted was gradually developed. It is, however, to long continuance that we owe some of the most interesting and the most valuable of our results, as will be fully illustrated as we proceed.

The table further shows the area and the number of plats under experiment in each case, and it may be stated that the total area under exact and continuous experiment has been for some years, and is at the present time, from 39 to 40 acres.

The point I have next to consider is: What is the most appropriate order in which to bring the field and other results relating to these various series of experiments before you? As you will readily understand must have been the case, our selection of crops for investigation was influenced by the actual practice in our own country, the separately grown, individual crops being the chief of those entering into our rotations; whilst the course of rotation selected for study was that which is well known as the four course, namely: Roots, barley, leguminous crop (or fallow), and wheat. Obviously, therefore, the most natural order of illustration would be that indicated by the ideas and conditions in accordance with which the experiments have been arranged and conducted; and, notwithstanding the very widely differing conditions of the agriculture of our country and of yours, I think that the order so indicated will be found to be, upon the whole, not only the most convenient, but the most instructive.

Even in our own country we have a great variety of soil and of climate, and, accordingly, great variety in crops and in the order of their rotation; whilst in your more than fifty States and Territories, extending over such vast ranges of country, the mutual adaptations of soil and climate, and consequently the variety of crops, and the order of their alternation with one another when so grown at all are almost infinite. On the other hand, it is to be borne in mind that one of your most important crops at the present time is wheat, a member of the great and widely distributed gramineous family, and not only was it one of the most important of our crops until it came to be so largely grown by you, but it has been the subject of very special investigations in various aspects, at Rothamsted. Then, maize and the sugar cane are extremely prominent American products, and they, like wheat, also belong to the great gramineous family. True, the conditions under which even wheat is grown are, as a rule, widely different in the two countries, but in some important respects their characteristic requirements are very similar, whether grown in the one or in the other. Maize and the sugar cane, again, in spite of their characteristic differences of requirement, nevertheless show very characteristic similarity of requirement to that of wheat and its allies of the same family. Much the same may be said in regard to leguminous crops, and also to potatoes, as grown in the two countries.

Indeed, I think it will be recognized that, *mutatis mutandis*, the results which have been obtained under given conditions at Rothamsted, are not without their significance and bearing under the different conditions of the American Continent, whilst the modes of experimenting adopted may afford suggestions for the conduct of more or less parallel investigations, varied of course, according to the varied conditions.

In accordance with what has been said, the following list shows in outline the order in which it is proposed to treat of the crops experimentally grown at Rothamsted, and of the laboratory investigations connected with them. It may be explained that Nos. 1 to 6 refer to the crops separately grown.

1. Root crops—turnips, beets, and mangel-wurzels.
2. Barley.
3. Leguminous crops—beans, clover, and various other *Leguminosæ;* also the question of the fixation of free nitrogen.
4. Wheat.
5. Oats.
6. Potatoes.
7. Rotation—root crops, barley, leguminous crop or fallow, and wheat.
8. The mixed herbage of permanent grass land—produce and composition, botanical and chemical.
9. Rainfall and drainage—quantity and composition.
10. Results of experiments on the feeding of animals.

Those of you who have seen the Rothamsted exhibits in the great exposition will recognize that they have been arranged to illustrate the results of the experiments enumerated in the list I have just given, and that the order of subjects is, in the main, the same in the two cases. Indeed, as has been already said, a prominent object in the selection and arrangement of the exhibits was that they should give a comprehensive view of the plan and results of the fifty years' experiments, and that they should also serve the purpose of illustrations to my lectures.

At the conclusion of Sir Henry Gilbert's lecture President Fairchild, of Kansas, delivered an address on "Intellectual development in agricultural education."

WEDNESDAY, OCTOBER 18, 1893, MORNING SESSION.

The Association was called to order at 10:20 o'clock.

Mr. ALVORD. As to the program for to-day the executive committee has issued a program which was intended only as a starter, leaving the convention to determine, after getting to Chicago and seeing the various attractions, how it would conduct itself as to time and duration of sessions. The committee presents as a program for this morning a general business session of the convention. It is believed that if the convention thinks best the business of the Association (or nearly all of it) can be completed at the present session in time to adjourn by half past 12 o'clock. The afternoon session will be in coöperation with the Congress on Agricultural Education and Experimentation, papers being read from the Sections on Agriculture and Chemistry and Mechanic Arts.

The Association is invited to visit the joint college and station exhibit at the Exposition to-morrow morning at 10 o'clock. I will announce for the sections that they may obtain a hall for meetings at any time on application to the gentleman in charge of the building.

The program was approved.

The PRESIDENT. The Section on Botany and Horticulture will meet in this hall at 4 o'clock this afternoon.

Mr. ATHERTON. I move that a committee be appointed by the chair to nominate officers for the ensuing year.

Motion carried.

The PRESIDENT. The topic for discussion this morning is the relation of the Association to the dairy test at the Exposition.

There has been in progress since May 1 what is thought to be one of the finest pieces of scientific work ever conducted anywhere in the world. It has a number of peculiar features. In the first place it is a public test; in the next place it is a general test. It is of the highest credit to this organization that we are the controlling influences; that the test has been left to be practically managed by delegates of this body appointed last fall at New Orleans. This has been a gigantic undertaking. As I understand, it has taken four trained bookkeepers to simply record the figures.

Prof. Scovell, of Kentucky, chairman of the test committee, will present you with the different features of the test. I will, however, not allow him to read all the figures.

Mr. Scovell presented the following paper:

REPORT OF THE COMMITTEE ON DAIRY TESTS.

The rules governing the dairy test at the World's Columbian Exposition, among other things, provided for the appointment of the committee on tests, said committee to be composed of four representatives of the Association of American Agricultural Colleges and Experiment Stations and such additional members as may be furnished by associations or breeders representing breeds competing, one member being allowed each competing breed. This committee was to have general charge of the tests.

At the New Orleans meeting of this Association, by request of Hon. W. I. Buchanan, chief of the department of agriculture, World's Columbian Exposition, this Association nominated to him four members of this committee, namely, M. A. Scovell, S. M. Babcock, I. P. Roberts, and H. P. Armsby, to represent the Association. Subsequently Mr. Buchanan appointed these members, together with other members, as provided for in the rules, and called the committee together in Chicago on the 6th of last February.

The committee there organized by electing M. A. Scovell chairman and H. H. Hinds, representing the Shorthorns, vice-chairman. Mr. Valancy E. Fuller represented the Jerseys, and W. H. Caldwell the Guernseys. At a subsequent meeting the committee elected H. P. Armsby secretary. At this and a subsequent meeting the members of the committee suggested many minor changes in the rules, mainly for the purpose of making the individual cow tests and the breed test uniform as to results.

Following are the essential features of the rules as finally adopted:

First. The selection of the cows for the test to be made by the various cattle associations, respectively, each association to be responsible for the feed and care of its cows. Some criticism has been made as to this feature of the rules, especially as to the matter of feeding. It has been maintained by a few experimenters and others that the committee on tests should have had authority to regulate the amounts and kinds of food to be given the cows, in order to have uniformity in this respect among the different cows and breeds. The advocates of such a proposition do not seem to understand the real purpose of the test. The proposition which they lay down is: Given a certain quantity of food, which breed or cow can make the most butter or cheese from it? Whereas the real problem contemplated by the rules is: Given a cow or a breed, how can she or it be best handled and fed in order to produce the greatest profit to the owner? This problem is what brought the breeds here to battle for supremacy, and it is well that the responsibility of the selection, care, and feeding devolved upon the cattle associations, for it undoubtedly brought the best cows available for the purpose of the different breeds competing into the test, and it will also prevent the different associations competing from claiming that had the cows been handled differently or fed by those who knew them best the results would have been otherwise.

Second. The rules provide for four tests, the net profit produced by any cow, cows, or breed during any test to be the basis of awards. In all the tests the food eaten by any cow to be charged to her at a fixed price for the different articles, the price being fixed by the chief of the department of agriculture, based upon the average market prices of the various articles at the time the rules were drawn.

TEST No. 1. *The cheese test.*—Time assigned, fifteen days, May 10–25. The breeds competing were the Jerseys, Guernseys, and Shorthorns. Number of cows in each breed, 25; total number, 75. The awards in this test to be based upon the value of the cheese and whey made and the increase or decrease in live weight, less cost of food. The milk from each breed to be kept separately and made into cheese by uniform methods, the cheese to be cured, and then rated by expert judges. A fixed scale of prices was laid down for cheese, depending upon the rating, prices varying between 8 and 16 cents. The price of whey was fixed at 8 cents per 100 pounds. Each cow to be weighed the first five days of the test, the average of these five days to be taken as her weight at beginning of test; also to be weighed in like manner at end of test. If the last average weight showed an increase over the first weight, such increase to be credited to the cow at 4½ cents per pound. If she decreases in weight such decrease to be charged against her at 4½ cents per pound. Each cow to be credited each day with that proportion of the cheese made by the herd to which she belongs, which the total solids found in her milk bears to the total solids of the breed, and with that proportion of the whey which her milk bears to the total milk of the herd.

TEST No. 2. *The ninety-day butter test.*—Time, from June 1 to August 29. The cows in cheese test alone eligible to this test, with the exception that two alternates from each breed might enter this test. Number of cows in test, 75.

Awards in this test based upon value of butter, skim milk, and buttermilk produced, and gain or loss in live weight, less cost of food consumed. The milk from each breed to be kept separately and creamed separately by a uniform approved mechanical process; cream to be handled and churned by uniform method for each breed.

Butter color, if used, to be charged against breed using it at usual prices, butter to be sampled and the amount of butter fat to be determined in the butter of each breed daily. Credit to be given for the number of pounds of butter containing 80 per cent of fat, which such amount of fat would make.

Uniform packages of butter to be preserved for rating, and scored weekly. Butter to be credited according to a sliding scale of prices based upon the score. The prices were agreed upon before the tests began and were supposed to represent the average retail price of the finest butter at the time. The skim milk and buttermilk to be weighed and solids determined. Solids-not-fat in the skim milk and buttermilk to be credited at 2 cents per pound. Increase in live weight to be credited and loss to be debited, as in test No. 1.

The amount of butter made by any breed daily and the amount of solids-not-fat in the skim milk and buttermilk to be prorated among the cows of that breed. Each cow to be credited with that proportion of the butter made by the herd to which she belongs, that the amount of fat found in her milk by analysis bears to the total amount of the fat found in the milk of the herd, and with a similarly ascertained proportion of the solids in the skim milk and buttermilk found in the herd.

TEST NO. 3. *The thirty-day butter test.*—Any cow, Jersey, Guernsey, or Shorthorn, to be eligible to this test. Number of cows from each breed, 15. Total number of cows, 45. In this test the Jerseys substituted 3 fresh cows, the Guernseys 5, and the Shorthorns 4, the other cows in the test being carried over from tests Nos. 1 and 2. Credit to be given for butter alone in this test. Awards to be based upon value of butter, less cost of food.

In this test the superintendent of a herd had the right to designate how the milk of the herd should be handled at the dairy and how the cream should be separated and butter made. The choice was also given him to have the milk of individual cows churned separately. Otherwise the methods were the same as in test No. 2.

TEST NO. 4. The rules provided for a young herd test, animals to be of same breed as competed in other tests and not to be over 3 years old on September 1, 1893. The awards to be based upon the same condition as test No. 2, the ninety-day test. Subsequently, however, on recommendation of the committee, the rules governing this test were changed as follows:

"Saturday, September 30 to October 20, inclusive, 21 days. Breed test No. 4.—This test will be of young herds entered in accordance with Section 7 of the rules, and will be conducted under the same conditions and requirements, and the awards will be upon the same basis as provided for in Test No. 2, except that the amount of 80 per cent butter produced be calculated from the fat in the milk from day to day as found by analysis, and that the butter so found be rated at the uniform price of 40 cents per pound, and that credit be given for all of the solids-not-fat in the milk at the rate of 2 cents per pound."

Two breeds competed—the Jerseys with 7 heifers and Shorthorns with 6.

The rules provide against substituting one cow for another, against giving stimulants, and against giving medicine except by official veterinarian, and excepting certain nonstimulating drugs specifically named which could be given if the operation were witnessed by a number of the committee, not the superintendent in charge. They also provide that the cow shall be milked at stated times and only in the presence of a member of the committee or its representative. That the milk shall be weighed and an aliquot sample taken for analysis, and that in case of sickness of the cow she shall be dropped from the test, until reinstated by the veterinarian. If sick longer than seven days or if she dies, she shall be credited thereafter with the average quality and quantity of the milk given on the first three of the ten days prior to her sickness, increased or decreased by the per cent of increase or decrease of the products of the herd to which she belongs. Such estimates to be specially noted in the records. (This was necessary to provide for constant comparison of an equal number of cows in the several breeds.)

In case the weight of milk from any cow or breed is lost, the average of the corresponding weights for the two days preceding and two following shall be credited to such cow or breed. In case any sample is lost its composition shall be assumed to be the average of that of the corresponding samples for the two previous days, and the cow or breed shall be credited accordingly. If the weight of butter be lost, its amount shall be calculated from the amount and composition of the milk on the basis of the average results in skimming and churning, or cheese-making, obtained for the same breed during the two days previous and the two following.

It was evident to the committee that the plans for everything necessary in carrying out the tests under these rules should be thoroughly considered and well matured before the tests began, in order to secure successful accomplishment. One of the most important things to be considered was how to keep a constant watch over the 75 cows which entered the tests, in order that results might be trustworthy. To accomplish this purpose, guards were stationed in each of the dairy barns both night and day, with positive instructions to allow no food to be brought into the barns or to be given to the cows except when the properly authorized person was present to attend to the weighing of food, to report any irregularities as to feeding, milking, or giving medicine to cows, to watch the milkers and see that no extra milk or cream was put into the milk buckets while milking.

To assist the committee in their work, three assistants were appointed, one for each of the three breeds. These assistants represented the committee in the barns and were authorized to weigh and record the feed of the cows, to weigh and sample the milk, seal the feed bins and the milk cans and the sample-carrying cans. They were present at every milking and feeding. These men were appointed by the chief of the department of agriculture, on recommendation of the committee on tests, and were generally young men from the stations and colleges. These representatives, as well as the guards, were frequently changed from barn to barn and were under instructions to watch the milkers and feeders in such manner that they could be confident that no irregularities took place.

In order to systematize and facilitate the work the cows were numbered from 1 to 25 in tests Nos. 1 and 2 and from 1 to 15 in test No. 3, and these numbers (and not the names of the cows) were used in all the records.

The scales used were decimal, weighing to one tenth of a pound, and were tested from time to time. The milk pails were uniform in weight and size; the carrying cans were of uniform size and varied but little in weight.

The milk as drawn in each barn was brought to the representative of the committee, who weighed it and recorded the weight. He then poured it into a special sample pail and took a uniform aliquot sample with a sampling tube made especially for this purpose, pouring the sample of milk into a sample jar corresponding in number to the cow. The rest of the milk was poured into the carrying can. Whenever the carrying can was full the milk was mixed and a sample taken by means of a sampling tube, and the sample was put into a sample jar marked X.

There were provided for taking samples a number of sets of 26 one-half pint Mason sample jars. Each set was placed in a galvanized iron box of just the right dimensions, and containing handles and a cover, which could be easily sealed. The sample jars were numbered 1, 2, 3, to 25, and X. The different sets were of nearly uniform weight.

After the milking and sampling were finished a member of the committee or one of its representatives sealed the carrying can and the box of samples. The former was sent to the dairy building and the latter to the laboratory. Subsequent milkings of the same day were treated in the same manner, the sealed box containing the samples being brought from the laboratory and opened in the presence of the superintendent of the breed or his representative and of a representative of the committee, and the samples from the same cow being united. After the last milking of each day the sealed boxes of samples were collected and taken to the laboratory for analysis. The sample box was weighed empty before it left the laboratory and again when it returned from the barn after the last milking. This, together with the weight of the milk taken at the dairy, gave a check on the weights of milk as reported by the committee's representative taken at the barns.

The work in the laboratory was under the direct charge of Dr. E. H. Farrington, chemist of the University of Illinois Experiment Station. Associated with him were five and sometimes six assistant chemists, selected from the various stations, and who were especially fitted for the work in hand. Dr. Farrington organized the assistant chemists in two divisions. Each division working independently on the same samples, thereby insuring strictly independent duplicate work. The fat in the milk was determined by the Babcock test and the solids-not-fat by the Quevenne lactometer. The butter was analyzed by the official method.

Dr. Farrington deserves much credit for the manner and skill in which the laboratory work was carried on. He had many difficulties to contend against, but the results show conclusively that he was the right man in the right place. Dr. Farrington made his report daily to the committee, handing in the original results as well as the average of duplicates for the inspection of the committee.

When received at the dairy the seals upon the cans containing the milk were examined to see that none were broken, after which the cans were opened by a member of the committee or by its representative. The milk from each breed was then thoroughly aërated and cooled. The can containing the milk was then placed in a refrigerator room and kept there under lock and seal until the separating, which was done each morning between 9 and 11 o'clock.

The milk from each herd was weighed just before separation, the difference between this weight and the weight of milk in the barn, less the weight of samples, giving the mechanical loss. This loss usually amounts to from 5 to 7 pounds, and any wide discrepancy from these figures showed error in some part of the work, which was immediately investigated. When such discrepancy could not be satisfactorily accounted for the yield of butter for the day was estimated according to rule 20. Necessity for such action occurred only once or twice during the whole test. The total milk for each day from each herd was mixed together in a receiving vat and warmed to a proper temperature for separation. After separating with the centrifugal the skim milk and cream were both weighed as a check upon the first weight taken. Samples of skim milk were taken for analysis with a Scovell tube in the same manner as from the mixed milk. The cream was immediately cooled to a proper temperature for ripening and placed under seal until churned; when ready to churn the cream was again weighed and the weight compared with the weight when first separated, in order to detect any loss in handling. When churned, a sample of the buttermilk was taken for analysis in the same manner as that of the skim milk. When salted and worked, while spread upon the worker, a sample of butter was taken for analysis by taking small portions from different parts of the worker. It is believed that fairly representative samples were obtained in this way. The butter was then removed from the worker and weighed, together with the sample taken for analysis. A 5-pound package of the worked butter was packed for the judges and placed under seal in a refrigerator until judged. The butter was judged every week by three judges, who made their scores independently of each other, the butter from each breed being designated by number, no one being present except the judges and the attendant who brought the butter to them. When completed each judge placed his individual score in an envelope addressed to Chief Buchanan, who, after removing the signatures, sent the scores to the committee.

Throughout the whole test each step of the dairy work has been carefully watched by some member of the station committee or its representative, and every precaution against fraud or error has been taken.

During the cheese test similar precautions were taken to guard and care for the milk previous to manufacture. Separate vats were provided for the milk from each herd into which the milk was weighed and made into cheese on the Cheddar plan by expert cheese-makers. When taken from the press the cheese was weighed and a lead seal similar to those used upon the milk cans was affixed to each to designate the kind of milk from which it was made. The cheese from all of the breeds was kept in the same room, which was locked and sealed, no one being allowed to enter it except in the presence of a member of the committee. When properly refined the cheese was judged by three judges appointed by Chief Buchanan, the same precaution being taken as with the butter, the judges being in every case ignorant of the kind of milk from which the cheese was made. In both the cheese test and the ninety-day butter test, the milks from the three herds were handled as nearly as practicable in the same manner as provided for in the rules governing these tests.

The question of blanks for keeping the records occupied the attention of your members of the committee as early as February. After many consultations and considerable work, a set of blanks was adopted which have worked very satisfactorily. A series of small blanks of original entry were provided as follows:

A blank for feed records, a blank for milk records, a blank for laboratory milk record, a blank for dairy records, a blank each for buttermilk, skim milk, and butter analysis records, and last, a ledger record on which the figures from the original entry blanks were copied each day and the necessary computations made.

The original records were made in duplicate by means of carbon paper, the original being delivered at once to the secretary of the committee and the duplicate copy given to the superintendent of the breed which it represented.

At the daily meeting of the committee the original entries were submitted to the superintendents of the respective breeds for approval.

The test has been unique in many particulars. It has furnished opportunity for the study of dairy problems such as could only have been secured under the auspices of such an organization as the World's Columbian Exposition and such as may never occur again.

The cows entered were picked representatives of their respective breeds, selected by experts in the most careful manner and in number sufficent to afford as fair representation of the breeds as we can ever hope to attain. These cows were fed and handled throughout the test by persons fully conversant with the breed and individual peculiarities of the animals, and who had had large practical experience in the care and management of dairy stock.

The test was of sufficient length to fully test the staying capacity of the cows, some individuals having been under continuous observation for four and one half months. The records of the test, as provided for in the rules, are of the most complete character, and every precaution that ingenuity could suggest was provided to secure absolute accuracy and trustworthiness.

In brief, the test represents an unusual combination of the best practical skill and the best available scientific methods, under conditions such that the results are put beyond reasonable doubt as to accuracy.

This has not been attained without extraordinary expenditures. While no complete statement of the cost of the test can now be made, the following may serve to suggest its magnitude:

COST OF THE TEST.

A. To the Cattle Association:	
1. Selection and transporting cows	
2. Salaries and wages	$48,000
3. Cows killed	
B. To the Exposition:	
1. Stables and dairy buildings	
2. Feed	
3. Salaries	
a. Dairy force	67,000
b. Chemist	
c. Clerks	
d. Superintendent of feed	
e. Labor	
C. To the stations:	
1. Expense of committee	6,000
2. Time of committee	
	121,000

There has been, as yet, neither time nor opportunity for careful study and discussion of the vast amount of data accumulated in these tests, but it is already apparent, even in the most cursory scrutiny, that results of the greatest interest and value may be expected from systematic, thorough, and impartial study of the facts now on the records in the books of the committee.

It is our confident belief that these results will be well worth all the expenditure necessary to secure and disseminate them.

The report of your representatives upon the committee would be incomplete without mention of the very pleasant and gratifying relations which have existed throughout the test with the chief of the department of agriculture and with the representatives of the several breeders' associations.

By his unfailing courtesy and unreserved support, his prompt compliance with every reasonable request, and his unstinted recognition of the efforts of your representatives to faithfully perform the duties assigned them, Chief Buchanan has placed us under obligations to him which it is a pleasure as well as a duty to recognize.

Our associates in the committee, too, have met us in the most friendly manner, and the whole committee has worked harmoniously together throughout to secure what all had at heart, an absolutely fair, accurate, and unprejudiced test.

Mr. ATHERTON. While Prof. Scovell was reading it occurred to me that this was a fitting time to express to this committee our appreciation of their work, and I have hastily prepared a resolution which I will read and ask that it be referred to the proper committee:

Resolved, That the thanks of this Association be, and hereby are, conveyed to the committee on dairy tests at the Columbian Exposition for the thoroughness, fidelity, and skill with which they have discharged the very important but burdensome duty intrusted to them, a public service which reflects the highest credit upon the individual members of the committee and upon the Association of American Agricultural Colleges and Experiment Stations, which they have so ably represented.

Mr. ALVORD. I take pleasure in announcing that the executive committee pass at once upon this resolution and unanimously report it favorably for action.

The resolution was adopted.

Mr. ALVORD. I have a few additional resolutions to submit from the executive committee bearing upon the same subject. The committee submits the following, with the recommendation that they be now adopted:

Resolved, That the standing committees of the Association on the collective college exhibit, the collective station exhibit, and the dairy test at the Exposition be continued, with authority to file final reports with the executive committee as a part of the proceedings of the Association for this year.

Resolved, That the Office of Experiment Stations of the Department of Agriculture be requested to make a report of its exhibit to accompany the corresponding reports of the Association committees.

On motion the resolutions were adopted.

Mr. DABNEY. I rise to call attention to some points and to ask for information. Is it possible to publish the ledger sheets of the dairy test record—is that contemplated? Then again I wish to ask what rights or interest have we in these records?

Mr. MYERS. Is it not the expectation that this report will be published as a part of these proceedings? It was certainly done by station workers and reported here. Why not print it as a part of the proceedings?

The PRESIDENT. I think that if you will leave this matter in the hands of the committee they will not allow the records to be lost nor allow the stations' interest to be lost sight of. The matter is somewhat complicated. Though the stations have put in a few thousands, the Exposition authorities have put in ten to our one.

I will now announce, as a committee to nominate officers for the ensuing year, Messrs. Atherton, Dabney, Koons, Thorne, Gulley, Cavitt, and Hays.

Mr. ATHERTON. May I ask if the committee have leave to retire?

The PRESIDENT. Yes, sir.

Mr. TRUE. As chairman of the committee appointed to draft suitable expression of our appreciation of the foreign educational exhibits, I submit the following resolutions:

Resolved, That this Association greatly appreciates the value of the exhibit of the Rothamsted Experiment Station made by the Lawes Agricultural Trust at the World's Columbian Exposition, and it seems fitting that some official expression of appreciation of this exhibit should be made by the authorities in charge of the Exposition.

Resolved, That copies of these resolutions be sent to the proper authorities of the Exposition and to the commissioner in charge of the exhibit of the Rothamsted Experiment Station.

A. C. TRUE,
J. H. WASHBURN,
J. A. MYERS,
Committee.

Resolved, That this Association greatly appreciates the value of the exhibit of agricultural schools and experiment stations made by the Government of France at the World's Columbian Exposition, and it seems fitting that some official expression of appreciation of this exhibit should be made by the authorities in charge of the Exposition.

Resolved, That copies of these resolutions be sent to the proper authorities of the Exposition and to the commissioner in charge of the French exhibit.

A. C. TRUE,
J. H. WASHBURN,
J. A. MYERS,
Committee.

The resolutions were adopted.

Mr. SCOTT. If in order to submit a report from the Section on College Work I should like to bring the following resolution before the Association.

The Section on College Work recommend the adoption of the report of its chairman on "The Instruction in Military Science and its Needs," and submits the following resolutions for the consideration of the Association:

Resolved, That this Association heartily approves of the recommendation of the Inspector General of the Army in his report for 1892, that such legislation be had as will enable the Secretary of War to supply the military departments of the land-grant colleges with the necessary uniforms and camp and garrison equipage; and

Resolved, That the executive committee is instructed to confer with the proper authorities on this subject and take such other action as may be found necessary to secure the favorable consideration of this recommendation.

On motion of Mr. Bondurant the resolutions were adopted.

Recess was then taken for twenty-five minutes.

Mr. Alvord, on the convention being called to order, presented the following resolutions from the executive committee, with recommendations for their adoption:

Resolved, That the new executive committee be instructed to inform by circular all the colleges interested, of the terms upon which the bust of Hon. Justin S. Morrill can be obtained.

On motion the resolution was adopted.

Resolved, That the dues of institutions eligible to membership in the Association for the ensuing year be fixed at $15.

Adopted.

Resolved, That the executive committee be charged with editing and publishing the proceedings of this convention, in coöperation with the U. S. Department of Agriculture.

Adopted.

Resolved, That the unfinished business of the Association be referred to the executive committee for action at its discretion.

Adopted.

Concerning the resolution of Mr. Kellogg, regarding the distribution of seeds and plants, the committee reports that the proposed action is inexpedient at the present time and recommends that it be laid on the table. Action approved.

Concerning the resolution, introduced by Mr. Cavitt, regarding action to be taken by the Association on the proposed legislation repealing all permanent appropriations (which will include the Morrill Act of 1890), the committee regards the matter as of the highest importance, but it is believed inexpedient to take definite action at present, and therefore recommends that this preamble and resolution be referred to the new executive committee.

Mr. Cavitt. Does that mean that it will be postponed until next year's meeting?

The President. It is in their hands for action at any time. The executive committee represents the Association *ad interim*.

Reports from sections on nominations of officers are now in order. First, the report of the Section on Agriculture and Chemistry.

Mr. Frear. We report the following nominations: Messrs. Henry, chairman; Brooks, vice-chairman; and Voorhees, secretary.

Nominations confirmed.

Mr. Stockbridge. The Section on College Work reports the following nominations: Messrs. Fairchild, chairman; Harris, vice-chairman; and Stockbridge, secretary.

Nominations confirmed.

Mr. LAZENBY. In absence of the secretary I report for the Section on Botany and Horticulture nominations of the following as officers for the ensuing year: Messrs. Goff, president; Taft, vice-president; and Pammel, secretary.

Nominations confirmed.

Mr. COMSTOCK. For the Section on Entomology I report the following: Messrs. Osborn, president, and C. M. Weed, secretary.

Nominations confirmed.

Mr. HALL. For the Section on Mechanic Arts, I report for chairman, Mr. Washburn, and for secretary, Mr. Anderson.

Nominations confirmed.

Mr. HARRIS. As chairman of the auditing committee, I respectfully report that the committee have examined the accounts of the treasurer and have found them correct, with proper vouchers for every item of expenditure.

Report accepted.

Mr. LAZENBY. I wish to say that I am authorized by the trustees and faculty of the Ohio State University to invite this Association to meet at Columbus, Ohio, at its next session.

Referred to the executive committee.

On motion of Mr. Myers, it was decided to attend the Exposition the day following and to meet at the exhibit of the Office of Experiment Stations in the Agricultural Building.

On behalf of the officers of Cornell University, Mr. Roberts extended an invitation to the Association to hold its next meeting at Ithaca, N. Y.

Mr. THORNE. I have asked permission of the executive committee to occupy a little of your time. I have a short paper which I wish to present.

HOW CAN WE INCREASE THE ATTENDANCE OF STATION OFFICERS AT OUR ANNUAL CONVENTIONS?

The Association of American Agricultural Colleges and Experiment Stations was called into being by the necessity which those charged with the organization of agricultural investigation in America, under the so-called Hatch Act, felt for conference with each other, in order that this new work might be established with the fewest possible mistakes; and in the first year of our work there was no topic which more urgently demanded our time and thought than those relating to general administration. But it is now nearly six years since the Hatch Act went into effect, and this is the seventh general convention of our Association. Most of our stations have passed through the experimental stage in their organization, and have found and settled into such lines of work as seem best suited to their various conditions and environment. There will, of course, always be some questions of general policy calling for discussion, but I apprehend that in the future such questions will be few as compared with those which relate more closely to the details of scientific investigation. In other words, and to come squarely to the point, I think the time has come when the attendance of those members of the stations' staffs who are most directly concerned in the work of investigation should be looked upon as even more desirable than that of the directors themselves; and I would say the same with reference to those who are charged with the work of instruction in the colleges. The college presidents have done a most useful work, and one which no one else could have done in the organization of this Association, but the time has now come when the very life of the Association demands that they should earnestly plan for participation in its work by such members of their faculties as are engaged in the various departments of research and instruction which come within the scope of our Association's work.

I think I need not stop to argue this point. The Association itself, by practically unanimous action, has decided to enlarge its work, from the mere adjustment of relations between college and station and the coöperative action of all in matters of general policy, into a field which covers the entire work of the American college of agriculture and the mechanic arts and the agricultural experiment station, a field as broad as the universe.

Having set this high ideal before us—and wisely, I believe—how shall we proceed in order to attain the largest possible measure of success? One or two of our shortcomings I shall try to indicate, and in doing so, I wish it to be distinctly understood that I am making no personal criticisms. I believe that every man who has been charged with responsibility in the conduct of this Association has had its interests at heart, and that any falling short of the best possible attainment should be charged to the overload of other duties which too many of us are forced to carry, and not to any intentional neglect. The fact is, that thus far our annual conventions have steadily increased in interest and value, and it is only because I see in some quarters indications of a lack of appreciation on the part of some of those who should be most benefited by the opportunities which these meetings offer that I venture to make any suggestions. For instance, it is not encouraging to look over the report of our meeting at New Orleans and observe that horticulture had but four representatives at that convention, and entomology but two, yet these are two of the most important departments of station work.

One of the chief causes of this lack of appreciation has been the lack of preparation for the convention. When the various sections were first organized it was expected that sectional programs would be prepared and distributed in advance of the convention, but the instances in which this expectation has been realized have been too few to enumerate. Now, it is utterly useless to expect that a man whose work is confined to a single specialty will spend from $30 to $50 a year out of the too meager salaries which most of our station workers receive for the purpose of attending a meeting where no provision has been made for consideration of the problems in which he is most interested. Our sections in agriculture and chemistry have always had a fair attendance, and the reason is obvious. Most station directors are either agriculturists or chemists; but it is evident that there must be a decided change if our conventions are to become a general rendezvous for all workers in scientific investigation in agriculture.

Another cause of apathy on the part of those who are neither station directors nor college presidents is to be found in the practice of sending delegates to our conventions at the expense of the colleges and stations. While we were passing through the organizing stage of our work it was perfectly legitimate that the various institutions represented should pay the expenses of their delegates, but we are past that period now. The American agricultural experiment station is on its feet and is a power in the land, and the question whether it shall retain this position lies with the men who are doing its work; but the man who has not ambition enough to impel him to spend a few dollars yearly for such opportunities of improvement as the conventions of this Association should offer is not worthy of a place in the work and will not long be permitted to retain such a place.

But station workers are like the rest of humanity, and those who are not so fortunate as to have their expenses paid to our conventions naturally feel that it is an injustice that this favor should be shown exclusively to those who are already receiving larger salaries than they, and as a consequence they stay at home or organize themselves into independent societies or join some section of the already overloaded American Association for the Advancement of Science.

I observe, for instance, that at the recent Madison convention of this general association there were well-attended sections in botany and entomology; yet the work in these sections was chiefly done by experiment station men, that in entomology being almost altogether economic and that in botany chiefly so. But this is work that should first appear in the proceedings of our Association, and will do so if we use the proper measure to bring it to us. The idea should be inculcated that the upbuilding of this Association is something more than a privilege on the part of station workers, and if it comes a little awkward on the part of us directors and presidents to insist that our associates shall put their hands in their pockets to develop the scientific work of the Association, while we are having a good time together without expense to ourselves, I think we should at least be willing to divide with them. Thus far our work has had very smooth sailing at Washington, but when Congress comes face to face with a deficit in the National revenues instead of an unmanageable surplus we may expect a close scrutiny of experiment station work. When the work was being organized we could only offer promises, and our promises were accepted, but when the next crisis comes promises will be of no avail. Results will be demanded then, and we shall need to be ready to put forward these results in the most concrete form.

Now, if I were sure that we were ready for them, I would ask this convention to adopt three resolutions, the first of which would be a suggestion as to the expediency of making a more general distribution, or none at all, in the payment of the expenses of station and college officers as delegates to our conventions; but as I realize that this might seem like a hardship in the case of the stations most remote from the place of meeting I merely drop the suggestion and pass to the next, for which I ask the usual reference and final consideration of the convention:

Resolved, That the chairman and secretary of each section of the Association are constituted a committee on program for that section, and that it is made their duty to prepare and submit to the chairman of the executive committee, within twenty days after publication of the call for the next annual convention of the Association, a program for the work of their section in that convention, said programs to include not less than six papers each.

Resolved, That it is the sense of this convention that all scientific workers who are supported wholly or chiefly from funds appropriated by the National Congress for the encouragement of scientific instruction and investigation in agriculture, under the acts known as the Morrill and Hatch acts, should look upon it as a duty to so use the results of their investigations that due credit may unmistakably accrue to the American agricultural experiment stations, separately or collectively.

In other words, I mean by this last resolution that we should say, and I think we should say it emphatically, that in the proceedings of this Association is the proper place for the first publication in full of such papers as appropriately appear in the proceedings of scientific societies, when such papers are the results of work paid for out of these National funds.

Let me illustrate a little: I employ a man to work my farm and pay him a stated salary by the year. He plants and cultivates and harvests my crops, but has he any right to sell or even give away any portion of these crops? or has he any right to go across the road and work a day occasionally for my neighbor without accounting to me for the time? I am employed to edit a newspaper, with the understanding that I am to give my entire ability to that work; have I any right, while so employed, to use the information and experience which I acquire in that work in conducting a newspaper across the street? Yet I have known station workers to do what would be the exact equivalent of what I have described. It will not do to say that this work is all for the public anyhow and it does not matter how it gets to them. It does matter, for the continuance of the work depends upon the people understanding definitely what they are getting for the money they are putting into it.

Mr. ATHERTON. I suggest that we adopt the two resolutions presented. I would like to ask for a report from the executive committee.

Mr. ALVORD. The committee reports the resolutions back without recommendation.

Mr. FREAR. Does the last clause of the resolution mean that no results of scientific work of station men shall appear before appearing in a station publication?

Mr. THORNE. No; but that credit shall unmistakably be given to the station.

After some discussion the resolutions were adopted.

Mr. Harris offered a resolution inviting such inspection of the work of the stations as might be deemed proper, which, after some discussion, was adopted in the following form and as an instruction to the new executive committee:

Resolved, As the sense of this convention that this Association would welcome, on the part of the United States authorities, such inspection of expenditures by the several stations established under the act of 1887 as may be deemed proper by the General Government.

Mr. ATHERTON. If in order, I would like to submit the report of the nominating committee. I am directed by the committee to present the following nominations for officers of the Association for the ensuing year:

President, S. D. Lee, of Mississippi.

Vice-presidents, G. E. Morrow, of Illinois; J. S. Newman, of South Carolina; H. Hadley, of New Mexico; J. H. Canfield, of Nebraska; and William Frear, of Pennsylvania.

Secretary and treasurer, M. A. Scovell, of Kentucky.

Bibliographer, S. W. Johnson, of Connecticut.

Executive committee, H. E. Alvord, of the District of Columbia; H. C. White, of Georgia; A. W. Harris, of Maine; H. H. Goodell, of Massachusetts.

The nominations were accepted and the persons named were duly elected and declared the officers of the Association for the ensuing year.

The following resolution in regard to annual meetings was presented by Mr. Rose, of Texas:

Resolved, That the executive committee be instructed to consider the advisability of holding our annual meetings during the month of June, July, or August.

Mr. Cavitt offered the following resolution in regard to the name of the Association:

Resolved, That the name of this Association shall be so changed as to hereafter read as follows: "American Association of Agricultural and Mechanical Colleges and Experiment Stations."

The resolutions were referred to the new executive committee.

Mr. Atherton extended an invitation to the Association to hold its next meeting at the Pennsylvania State College.

The PRESIDENT. There will be a session of the convention this afternoon at 2 o'clock, to be held in conjunction with that of the Congress on Agricultural Education and Experiment. At the session this evening at 7 o'clock papers will be presented by the Section on Mechanic Arts.

On motion of Mr. Bondurant, the convention adjourned at 1:20 p. m.

WEDNESDAY, OCTOBER 18, 1894, EVENING SESSION.

The following papers were presented by the Section on Mechanic Arts:

SHOPWORK INSTRUCTION AT THE IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, AMES, IOWA.

By G. W. BISSELL, *of Iowa.*

The following is presented, not as embodying new ideas, but as descriptive of old ideas put into practice, and with the hope of provoking discussion by others who have to do with shopwork instruction in the land-grant colleges.

The shopwork instruction is composed of sixteen weeks of carpentry and wood-turning, sixteen weeks of blacksmithing, sixteen weeks of pattern-making, covering the first year and one half of the second year of the course, and sixty-four weeks of machine-shop practice, with which is incorporated some work in the foundry. A week's work in every case consists of eight hours, usually in two shifts of four hours each.

For the instruction of the various classes a machinist, a blacksmith, and a carpenter are employed. These men are skilled mechanics.

The time of the instructors required for the work of instruction to scheduled classes is about three and one half days per week. The shops are open and the machinery running eight hours per day for the six week days. The instructors, when not employed as above indicated, devote their time to the maintenance and making of tools and to the commercial work of the shops. The latter is sufficient of itself to keep them employed and for a good share of the time additional mechanics are employed to do commercial work.

Students are assigned to work at stated hours in sections or classes of convenient size and are expected to be punctual in attendance as per schedule. Each student is given credit daily on the class book for time spent at work and is required to put in the specified number of hours in each shop. Time lost by absence for good cause can be made up as the student may arrange with the instructor.

The student pays for the material used in shop instruction which does not revert to the shop. For this purpose he deposits the sum of $5 per term with the college treasurer, and an account is kept of charges made against the deposit. These charges include individual material, breakage, fuel for the shop engine, waste, oil, etc., and small tools lost or otherwise unaccounted for. The amount named has been found to more than cover all expenses justly chargeable to students. The balance is refunded.

We have no difficulty in maintaining order in the shops. The incentive to the unwilling student is the time book, the instructor having the right to dock those guilty of disorder, "soldiering," or leaving their tools or benches without cleaning the same.

The work done by the students in the shops is of two classes—exercises and job work. If the student were required to do all the exercises included in the scheme of the course they would serve to keep him employed for more than two years of his shop course. The plan is, however, to shorten this time by omitting many of the exercises and to assign others taken from the commercial work which is in hand at the time. In general, the beginners spend one term upon exercises. In the succeeding terms the exercises become less and less the rule, and are entirely abandoned in the junior and senior years. The job work forms the most interesting and valuable feature of the shopwork for the advanced students. It consists of selected work from the commercial work done in the shops, and comprises the construction of experimental apparatus for the several departments of the college, the repair and construction of tools, apparatus for the shops of our own department, and work done for parties having no connection with the college. A large proportion of the last class comes from a suburban steam railway connecting the college with the town of Ames. This work is a source of revenue to the department. In assigning job work to the students the judgment of the instructor is an important factor. To show the scope of this feature of our work the following examples are given:

A 4 and 2¼ by 6 duplex steam pump has been constructed from drawings and with castings furnished by an Eastern maker. A 6-horse-power vertical engine is now under way. A 10 and 5 by 12 steam pump, belonging to the college pumping station, is being overhauled; this includes reboring the water cylinder and the valve seat. For the former, owing to the limited swing of the largest lathe, the boring will be done with a star feed boring bar, which one of the students has just completed for the job. Two small steam engines have been overhauled, involving such operations as reboring the cylinders, scraping the valves and seats, putting in new crank pins, forging and finishing a connecting rod, rebabbitting the boxes, etc. Two special indicator motions for the engines in the mechanical laboratory. A large amount of apparatus for the department of physics, including galvanometers, a hygrometer, ammeters, linear expansion apparatus, 500 binding posts, the students making the special tools for the same to fit an Almond turret head used on one of the lathes.

A more extended list might be presented, but the above will serve the present purpose. It will be seen that the number of accessory exercises involved in the above, such as the making of special reamers, jigs, etc., is sufficient to fill up many hours of the required time. Useless labor and superfluous finish are not encouraged. The student is taught to economize his time. The reasons for every step are explained whenever such explanation is needed.

The results obtained by the above-described features of our work, as measured by the general interest manifested in the work by the students whom we seek thus to benefit, are all-sufficient. As to the permanent benefit to the student thus placed in an atmosphere of business and competition, the writer thinks that there can be no question.

The words of Dr. R. H. Thurston (p. 761 *et seq.*, vol. VII, Transactions of the American Society of Mechanical Engineers) bear directly on this point and are here quoted:

"The question as to whether the shop shall be a business establishment as well as a school, or simply the latter, is a very interesting one. * * * For my own part, I have watched the progress of the two systems very carefully, and can see the advantages claimed for each very clearly; but I see no reason why the advantages of both plans should not be combined. * * * There can be no question that to teach the use of tools first is the first and indisputable duty of the instructor, and that, the use of the tool being once taught, its application in the arts is no less his second and no less imperative duty. I should therefore first attempt systematically and thoroughly to teach the entering pupil the use of the tools of his art. This can undoubtedly best be done by a series of graded exercises. * * * The progress which can be made by the skillful application of this system of exercises is astonishing to one who has not seen it in operation. * * * As a means of attaining skill in the use of tools simply, it is beyond question the only commendable system. A good knowledge of the nature, special characteristics, and uses of the tools of any art being thus taught, the next step, it would seem evident, must be the acquirement of some useful knowledge of the proper and best methods of application of this skill. This can be obtained by an extension of the same general system to a very considerable and useful extent, and, so far as this is possible, there can hardly be any question that this is the best course to take. But this division of the work of instruction demands vastly more than the familiarizing of the student with certain standard and stereotyped methods of forming parts and assembling machines. It demands such variety of work as will give the young man some idea of the thousand difficulties and problems arising in actual practice and in the course of a regular business. Such practice and instruction can not well be given, ordinarily, by deliberately planned exercises, beyond a certain and somewhat limited extent, and the experiences of a manufacturing establishment do, I think, more generally confer upon the novice that kind of knowledge and readiness in adapting himself to circumstances. In fact, it is the habit of promptly meeting emergencies and of inventing and of perceiving on the instant just what is needed to meet unexpected and exceptional demands upon the skill and intelligence of the learner, that actual shop life and practice gives which constitutes its special value in the development of the young mechanic. I also think that the life of the young man in the shop, in the atmosphere of real life which he finds there, must in all cases prove a very valuable incentive to industry, and a good spirit of work and thought. Nothing so greatly stimulates a boy as to be able to feel that he is taking part in a man's work, and doing something which will have a real and immediate practical outcome. It has always seemed to me that if these two methods can be combined, either by synchronous or by successive practice, the result must have a maximum value. * * * I can see a possibility of the two being made to work together. * * * But if the attempt is made to effect this combination, the primary object must be instruction and not the making of money. * * * I should in every case, however, insist upon the preliminary training by systematic performance of carefully planned exercises to such an extent that the student should have acquired a good knowledge of the use of tools of all the familiar kinds in regular use in the principal trades which underlie the work of the engineer."

The equipment of the carpenter shop consists of 14 wood lathes, 16 benches, sets of small tools for 20 students, a combination buzz saw, jig saw, pony planer, molding machine, and mortiser; 2,400 square feet of floor space.

The equipment of the blacksmith shop consists of 8 forges, anvils, tongs, fullers, flatters, swages, swage block, and cone block; 400 square feet of floor space.

The equipment of the foundry consists of a small brass furnace, 4 molders' benches, and small tools and flasks for brass molding and casting; 1,300 square feet of floor space.

The equipment of the machine shop consists of 6 engine lathes from 10 to 20 inches swing and from 4 to 12 feet length of bed, 2 speed lathes, 2 emery grinders, 25-inch back-geared drill press, 18-inch plain drill press, Brainerd universal milling machine, Browne & Sharpe No. 1 universal grinding machine, 24 by 24 inch by 6 feet planer, pipe tools and machines up to 4 inches, a good assortment of small tools in the tool room, and vises and benches for 20 students; 2,800 square feet of floor space.

There are at present about 80 students of all classes taking shopwork.

TECHNICAL EDUCATION.

By C. W. HALL, *of Minnesota.*

GENTLEMEN OF THE SECTION OF MECHANIC ARTS: As we look over the field of technical education and note the progress that has been made, we can see strong reasons for the creation of the Section of Mechanic Arts in this Association. We certainly see the vast amount of work before us as individual educators and as an organization; and we see it even more clearly than we see the work already accomplished in the line of preparation for professional pursuits. Before us is a long stretch of possible progress, while behind lies the kaleidoscope of many minds working along different lines to reach the vantage ground of present things. We can not now discuss the three time phases of the subject; the past is a heterogeneous mass of mingled efforts and accomplishments and the future is as yet scarcely outlined in its trend. Let us therefore take a look at the present, weigh some things within our reach of an educational kind, and estimate, so far as we are able, their bearings on the future of this Association.

The institution of this section—Mechanic Arts—was a significant thing for the Association to do. It is doubly significant for having been instituted in a Southern city and through the persuasive efforts of a Southern college president.* "Tools and the man," as Carlyle put it, is to be henceforth the epic of the South; we all want it to be so, and from every quarter we will take up the cry.

Technical education, as we use the word, means agricultural education as well as education for mechanical pursuits, such as railroad building, mining, or chemical manufactures. Plainly, the development of education along this line sprang from the competition of men. Large numbers occupied in any line prompt many to attain excellence. Unity of effort along a definite plan of work is secured only after long and too often discouraging trial. Such has been the history of agricultural education in America, and such was its history in Germany, France, and England.

The two steps that competition invariably prompts are: (1) Development of a broader market ground and (2) diminution of the cost of production. The former has been secured in every age through caravans crossing deserts, ships plowing unknown seas, and military conquests. The latter is attained by starving workmen and artisans and perfecting methods and processes. In the former lie those incentives to heroism and daring which make manhood noble and mark with sharp definition the patience, fortitude, and endurance of the highest types of human plans and achievements. In the latter step there is a constant calling into play of high ability and inventive genius through a constant consolidation of energy. Here, too, lies the mainspring of unrest and industrial disease. The conditions of this unrest lie deep. The train of evils and calamities befalling society is sure to be a long one before the end—a perfect adjustment of wants to possibilities—is attained. We are not to be discouraged; the development of the moral sense in mankind keeps full pace with the advancement of the knowledge of his material environment.

We can not here enter into the history of those educational institutions where agriculture and the mechanic arts have been taught. While a beginning had been made in both classes of schools long before the passage of the Morrill bill, the extension of aid under that bill to the several States was a wonderful impulse to educational activity. Indeed, let me right here emphasize the fact that interest in such education had already taken root on this side of the sea, and this interest was the impulse which led Senator Morrill and others to work all the years from Buchanan's administration until 1862 to secure the passage of this beneficent law. This, like all other successful legislation, was built upon the sound sense and capacity of the people, and thus we see a reason for the high success of these so-called land-grant schools and all others of related character. Their work appeals to the strong good sense of the people and the people patronize them; legislatures appropriate State aid for their maintenance and the wealthy contribute generously their private fortunes to endow them. The schools in turn are adopting the advice of the pedagogue of two hundred years ago; they are accommodating their studies to the present state of our manners and are studying those things which are of use in the world rather than wasting their energies in the vain endeavor to conform the world to the order of their studies. President Johnston, of Tulane University, told us a year ago that the object of a university is to open the door of the mind; to throw the win-

* President James K. Patterson, of the State College of Kentucky, was the earnest mover in the action.

dows of the soul wide open to receive all the inspiring thoughts of the time. Looking into nature in the spirit of research is the highest object of a liberal training. To reach nature we must use the methods and the tools of our every-day work, our, snses sharpened that nothing in the shape of a fact or a phenomenon escape use and our hands so skillful that they will obey the desires and thoughts of our minds even before the command of the will be given them to follow.

Having, then, that scientific spirit which is now permeating the intellectual processes of civilized mankind; having founded schools which are characteristic of the times; and resting in the fact that the character of the English-speaking race is prone to consecutive action, that sudden revolutions are contrary to its spirit—we then have all the necessary conditions for a vigorous and long-lived system of education which, in all lines, shall be and become of the highest practical value and usefulness. It shall make engineers, and not merely workmen; generals in the great army of the employed, and not merely officers of the line and the rank and file. A technical education means much more to-day than in 1862. Think what the science of agriculture was at that time; societies for the promotion of agriculture had been established in this country as early as 1784, in which year the Agricultural Society of South Carolina was organized, and Washington had urged improvements in agriculture upon the people, as was shown by his letters to Sir John Sinclair; yet it was not until the eloquence of that genius in chemistry, Justus Liebig, applied his science to the development of better farm crops and more perfect domestic animals and Johnston put into practice as well as into print the results of many experiments in practical farming, that any widespread interest was aroused. So late as 1860 the lectures and experiments of these men constituted the best there was to the science of agriculture. To be sure, the Rothamsted experiments had been begun more than twenty years before Morrill's labors were undertaken; in Germany Albrecht had done noble work and some local results had been secured in America. He who asks why it is that man is so late as the nineteenth century in acquiring his present civilization has food for reflection in the fact that the rise of civilization and the development of agricultural technical education are coincident.

Again, the scientific agriculture of the '60's, viewed in the light of the science of agriculture of to-day, was extremely crude. Even Liebig's knowledge of the chemistry of plant and animal tissues was incomplete. What did he know of sugar manufacture as we saw it one year ago at New Orleans, or of butter and cheese making as we see it to-day in Jackson Park, Chicago, or of methods of planting and harvesting crops as practiced on Minnesota and Dakota farms, or of the preparation of preserved foods of all kinds? To anyone interested in an answer to the foregoing questions, I would point out the difference between Liebig's works on agricultural chemistry and the files of the Experiment Station Record for the past four or five years; and I might mention many other admirable works of authority and reference familiar to every member of this convention. The comparison between the '60's and to-day is still stronger when we turn to the mechanic arts. I have no hesitation in saying that the conception of mechanic arts in Senator Morrill's mind was that understood by us in the term manual training as this work is exemplified in the work of our best high schools. It is simply that training of the hand and eye to enable the workman to use them in unison and secure dexterity in the prosecution of the ordinary arts of every-day life. At that time there were but few schools of high grade for the training of engineers. Those were of a nature to convince the Senator that the people of the United States needed the expenditure of the funds which his bill proposed to set apart for educational purposes. And what was the people of the United States but the great mass of wage-earners like the Senator's constituency in Vermont, and, for that matter, every other Congressional constituency in New England?

Therefore, thirty years ago the term mechanic arts meant what manual training does with us to-day. Agriculture meant a scientific culture of the farm, a careful and systematic management, far in advance, it may be, of what farmers of that time understood and put into practice; yet it did not comprehend the manufacture of sugar as that business is carried on to-day, nor the multiplication of the chemical establishments we call creameries and cheese factories, nor the perfected method of harvesting our cereal crops.

We have convened for the purpose of conferring together about the ways and means of mechanic arts in the agricultural colleges of America. The first thing that impresses me is the condensed character of the work typified by this Section of Mechanic Arts as compared with that by any other section in the Association. Let me illustrate my meaning:

Two capitalists, A and B, have each a half million dollars to invest in a business. After mature deliberation A decides to become a farmer. He examines localities as to soil, water supply, markets, and climatic conditions, and determines upon "diversified agriculture" as giving the most chances for success and the least ratio of failure. He employs a general manager to lay out his fields, locate his barn and sheds, build the houses for his workmen, and takes general charge of the business. Leaving $150,000 in the bank for paying the wages of the first season and meeting any contingencies that may arise in the way of crop failures, storms, fires, or disease, he finds himself the possessor of 7,000 acres of good land with plain strong buildings and a fair amount of machinery. He hires a chemist to analyze his soils, determine upon his fertilizers, examine his water supply, and become an expert assistant in all his investigations. Then an agriculturist is found. As he purposes to keep stock, an expert in breeds and methods of stock-raising is secured; a superintendent of his creameries and cheese factories is next called into his employ; then a horticulturist is brought from the best school of horticulture; and finally a gardener is brought who is recommended for his experience in the Government grounds and greenhouses in Washington. All the rest of his employés are common men of sturdy, honest American, Scotch, Scandinavian, and German stock. He has, then, secured seven well educated, scientifically trained agricultural college men; in short, one for each 1,000 acres of his farm. He proceeds with his enterprise and discovers that he has made so wise a choice of an occupation and of men to aid him in it that three out of his five lines of production are highly successful, and on the whole his fortune grows; he soon has a farm of several thousand more acres than at first and a corresponding number of experts to develop his opening lines of agricultural business.

Now let us follow B, who, seeing the manifold uses of iron in railroad building, mining, manufacturing, and building of every sort, decides upon the establishment of a factory for the working of iron. He selects a location and buys 10 acres, ample ground, well situated for his plans, erects his shops, employs his workmen, builds their tenements, secures an additional acre and establishes his home. Instead of extending his operations over 11 square miles, he occupies 11 acres. He finds competition so sharp that he is driven to employ the very best trained talent, and his roll of experts, engineers, superintendents, agents, designers, draftsman, etc., is a score. The development of his business soon demands more capital, and he protects himself against increasing competition by buying an iron mine, erecting a foundry, building a railroad, taking partners into the business, and calling in another score and more of trained men to look after the various details of his flourishing business.

The foregoing illustration serves fairly, as it seems to me, to represent the difference, in the present decade, between the average application of professional knowledge to agriculture and professional technical occupations. We see in sharp contrast the lines of the agricultural and engineering professional schools. Concentrated masses of men involve the sharp competition of the highest grades of professional business.

Permit me to say a word regarding the great mass of workmen under these two capitalists, A and B, who are not specialists, who expend their muscle instead of their brains in wage-earning. The farmer, probably, I suspect, from the very nature of his occupation, is not skillful in manipulation; sometimes he is a bungler. This is natural enough: the work he does, from its very nature, does not require much skill or care or exactness. The putting of seed into the ground, the killing of weeds, the harvesting, all demand only ordinary treatment. So through generations engaged in such work he has inherited methods and habits. He relies on the mechanics for his tools and all repairs. He can not make a harvester, nor can he even make a pitchfork or a hoe. Indeed, it is not every farmer who can select a hoe constructed according to the best mechanical principles.

But a different condition of things is soon to prevail. The successful farmer of 1900 must be differently equipped from his grandfather of 1850. It has been found that a business to be successful under the sharp competition of to-day must be conducted on a large scale; that is, a vast product turned out with a small proportion of high-priced labor. So, too, with farming. The successful farmer must possess the knowledge of an agriculturist and must add to that the best mechanical capacity, for machines—plowing, cultivating, thrashing, mowing—are essentials in the equipment of the modern farm. Large crops must be carefully cared for. Thus we see that not only must technical schools be built up and developed for the thorough training of men to become engineers, superintendents, and foremen, but manual training and mechanic arts must be developed in our distinctively agricultural colleges. Farmers must be mechanics. The more mechanical farmers will be the more successful ones other attainments being equal.

Too often farmers' boys go to colleges instead of technical schools. They are taught that educated men are lawyers, doctors, clergymen; that engineers grow up beside the level, the lathe, and the engine. They are urged that book farming is poor farming; that the proper training for a farmer is that practical sort gained only on the farm. Yet no wage-earner in the whole wide range of industries is so intelligent as the farmer, who is so slightly under control by his environment, who has higher ambitions for his family of sons and daughters, or who is more patriotic and loyal to his institutions and Government.

Turn now to the community of B. The boy is an artisan, and embryo engineer. This is quite as true in A's community as in B's. In America he inherits a certain natural aptitude for tools; his ancestors conquered nature and her forces quite as much by mechanical ingenuity as by physical strength. Thus the farmer boy, whenever he can, leaves the cultivation of the soil for the more fascinating work of making a cultivator; he leaves the raising of wheat to build a railroad over which to take it to market, or to erect a mill in which to grind it.

The employé of a shop or a mine is a specialist; he develops himself for a certain use in human society in a somewhat more restricted sense than the farmer. Whenever he seeks employment he finds himself examined for strength and endurance, as is the draft horse and the ox. His occupation is the result of a sort of natural selection; he becomes what he is physically fitted for; he draws his pay and takes his place in the community accordingly.

It should be the duty of these schools, founded on the grant which Senator Morrill's wisdom and patient persistence secured, to aid these men. Their families must be placed in improved environment. To be sure, experimental farms and shops and drafting rooms can not be made compulsory; there is not money enough, under that grant even to make them common. But there should be wisdom enough, and far-sightedness and benevolence enough, on the part of college trustees and faculties to encourage to the utmost the development of the mechanic arts in our high schools. Place in every such curriculum in the United States the opportunities to train the eye and hand together, and the average of average artisans and farmers will be vastly heightened. This is not an impossible thing to attain; we must attain it in order to meet the competition which is to environ America in the fast-coming decades.

Let me parenthetically say: Many speak of luxuriance and extravagance as attendants on American life. Let me express the opinion that everything is perfectly natural; we are no more extravagant, nor wasteful, nor lavish than is nature around us. We have grown up in a perfectly natural way into conditions which have environed the American people since 1607. We could not have been otherwise if we would. Wastefulness is a relative term; what is wasteful when labor is twenty-five cents per day perhaps can well be afforded when labor commands $2. There every straw of grain must be picked up by women and children; here we could not afford to do such a small thing. Since habits are of slow and persistent growth, so they are given up after a long struggle. The habits of living which we have grown into through generations will not be surrendered in a day, nor within the period of one or several administrations. We must gradually conform to a new environment if we conform at all.

Let me here suggest a duty to officers and instructors in our technical schools, whether they be schools for agriculture or engineering pursuits. It is founded on the experience of the past thirty years. Those institutions are most successful that are closest in touch with the sentiment of their generation. Experience showed centuries ago that a farmer could not raise figs on thistle bushes, and the builder who "stablished not upon a rock" had an uncertain foundation beneath his structure. It is a hard and discouraging task to build an institution of learning in the face of the plain trend of the times. An education is material; it fits young men for contact with material things; it trains them for this world instead of the next; it develops their tastes and aspirations; it impels to a higher plane of living and thus develops a broader and more enjoyable life. That materialism which makes higher and more perfect the home life of the citizen has its advantages, whatever of censure it may receive. We can not expect every State to develop precisely along the same line of educational activity as our own commonwealth is making successful progress. As each community has its own lines of material success so it has its parallel lines of intellectual bias and progress. A community of sugar producers does not desire a farmers' institute devoted to dairying; neither does a community devoted to the manufacture of boots and cloths care for a school to teach assaying and mine engineering; nor an engineering school want its curriculum filled to the close with Latin and Greek. Let us aim, then, to direct our several States along the plain and unmistakable lines of their destiny. Some of us have tastes, or predilections, or prejudices, perhaps, which run counter to such a course; then let us bury such feelings and work for the great cause of the commonwealth and not emphasize the small matter of our own preferences.

I know a State—I have lived in it more than twenty years—where there has been a constant contention against the evident condition of things. I am within bounds in saying that tens of thousands of dollars have been expended in the effort—and I may say it was a vain effort—to keep a course of study and an organization that nobody wanted sufficiently to patronize. It was not because the people of Minnesota were not intelligent enough for such work, but because they could get all the professional training they wanted in a cheaper and more practical way. While this effort was carried on scores of her sons were obliged to go to other States for the education we would not give because the other useless work must be offered. I venture the assertion if we had done the things we ought to have done and not done the thing we ought not to have done, the foundations of higher education and professional training in our State would be far better and more broadly laid than they are to-day. They would have been laid along the trend of our development as a commonwealth. Professional skill and high scientific attainments would be far better grounded in the thoughts and aspirations of our whole people than we see them now. Yes; keep in touch with the times. Encourage the faculties of your colleges always to act as a unit in the advancement of those lines of study and research which are of the highest character and are the best adapted for the advancement of the enterprises peculiar to your State. Then, when your institutions are old, as we speak of old institutions to-day, citizens will look back and laud the prophetic wisdom of the founders.

To bring our reflections to a close: Paraphrasing Prof. Huxley, our schools—schools of agriculture, technology, general science, and classics—exist. Common sense surely suggests that they be made efficient or abolished. We can not accept the alternative of abolition, as that would knock the keystone out of the edifice we have, since 1862, been rearing. Efficiency means a liberal support in means and in energy of administration. Economy does not lie in sparing money but in spending it wisely. So it is desirable that resources, both public and private, be made available and distributed among our schools. The trend of events now compels us, as never before, to look the future squarely in the face. We see the outlines of an industrial struggle far more stupendous and far-reaching than we have hitherto conceived. It will reach every activity of life. No one can escape it except he die. Technical education is that kind of training which will make future Americans excel future foreigners in this industrial struggle just in proportion as present Americans possess superior aptitude and energy to take advantage of surrounding conditions and bend every circumstance to their good.

The scientific spirit is abroad in the land. It is pervading the masses of humanity. It aims at practical, tangible results. The day is far distant when pure science will be the highest aim of our educators and investigators. The more perfect the attainments of the practical men and teachers of this day and generation, the sooner will come the day of highest attainments in the arts and in all the conveniences and accessories of life.

The Manual Training and the Apprentice System.

By C. Russ Richards, *of Nebraska.*

One thing that I hope to see taken up by our legislators, and our educators as well, is the problem of the trade school. I believe that our system of education for the mechanical engineer is a most excellent one. The engineering student receives a sufficient amount of shop training to make him familiar with the use of tools and with a good many of the more important shop operations. Our so-called "manual training" schools—whose methods are the same practically as the mechanic-arts schools, but whose ideas are different—are doing an excellent work for the youth of this country. But it is the American trade school which has been sadly neglected.

We can train engineers, or we can teach a boy that he has two eyes and a pair of hands in addition to his brain, but how about the hundreds of thousands of young men who must earn a living and make a place in the world by hard work. Many of these young men have not the ability to become engineers, and, besides, we can not have all engineers and no laborers. The manual training school, pure and simple, does not attempt to teach a trade, and could give them little but the rudiments of any line of work. What, then, will be done with them?

Shall they grow up as unskilled laborers, eking out a miserable existence, doing that which requires no skill or knowledge, and which breaks down any ambition they may ever have had? These are questions of the utmost importance not only to us as educators, but to the General Government as well, for by the number of its skilled artisans can a country's worth be gauged.

As I have before said, the present system of mechanic-arts training and manual training are well nigh perfect for the particular purpose for which they were devised. The mechanical engineer must know the "how and why" of the use of tools, but he may not necessarily be an adept in their use himself, although, if he is, he is much better off.

The manual training schools, while they were not devised for the technical training, are of immense benefit for any person who expects to make a future use of technical training, but for a person who expects to become a tradesman they do not go far enough. The fundamental principles of tool work are thoroughly taught, but it requires an apprenticeship of some sort before anyone could become a journeyman laborer in whatever branch of work he might select. That is, the mechanic arts or the manual training schools are not and never can be complete enough to educate a tradesman, for any trade or professional school to be complete must combine within itself all the points that will be necessary to the successful following of that trade or profession.

We may say, then, that at present the only way of learning a trade in this country is by an apprenticeship of from three to five years, providing, always, that the boy can secure a place as an apprentice.

Being curious to know the present attitude of prominent machinery builders and manufacturers to the apprentice system and the system of mechanic arts and trade schools, I sent a number of questions to some of our representative firms in this country, bearing directly on this subject. I confess that I was very much surprised at some of the replies. I desire to give as much prominence to the opinions of these men as is possible, although I may not agree with what they say.

My first question was: "Will you take an apprentice in your shop?" To this question I received nearly all replies in the affirmative from the 16 or 17 firms who were kind enough to answer my queries.

Bement, Miles & Co. say: "Yes; we take 3 or 4 apprentices into our shop every month."

The Yale & Towne Manufacturing Company answer that "We formerly took apprentices, but have not for a number of years. Our present practice is to take young men under instruction, paying them moderate wages, increasing yearly, but without obligation to them to remain for any specified time."

Mr. Bole, superintendent of the Westinghouse Machine Company, says: "Not knowing anything, practically, of the old apprentice system, we can not well draw any comparison between that and our present practice. We have no very well-defined system, but we do take apprentices, giving them three years' term of service, paying them $4, $5, and $6 per week during the three years, respectively. If the boy be unusually bright and capable, we encourage him by paying larger wages. We do not attempt to rigidly treat everybody alike in the sense of giving a stupid boy the same consideration or the same wages as the bright boy. Engaged as we are in manufacturing a specialty, it is to our interest to keep a boy on one class of work as long as possible, so that when he becomes proficient we continue to derive the advantage from his proficiency. Of course, the average apprentice is taught to run a lathe, planer, milling machine, and to do such work as drilling and boring. We have not employed apprentices for fitting work or bench work of any sort, but use older mechanics for such purposes.

Mr. Grimes, superintendent of Williams, White & Co., replies as follows: "Yes, if he agrees to stay five years and work all around the shop."

Mr. F. A. Pratt, of the Pratt & Whitney Company, says: "We do take apprentices, and have now 105, with a large number of applications ahead. We take boys from 16 to 20 for four years, and bind them. We have our selection from a large number of names always on our books. We choose those who have parents who are responsible, and select them by their mental and physical qualifications, and have very little trouble in keeping such boys their full term. The bound apprentice gets a discipline that can not otherwise be obtained."

Chandler & Taylor say: "We take apprentices in our shops, that is, they are called such, but in reality they do not learn the full machinist's trade. They simply go with the trade far enough to become expert as lathe, planer, or machine-tool hands."

J. W. Anderson, superintendent of the Moline Wagon Works, answers: "Yes, I would take an apprentice if I was conducting a machine shop as a business, employing 4 or more men, as in a shop of this kind there is work enough to employ a novice and give him a chance to gradually acquire the handicraft part of the trade.

But as I am at present situated, managing a large factory, using machinery, but not building it for sale, keeping 3 to 4 machinists to keep the factory machinery in repair and make special tools, an apprentice would not be available. This, I think, is the position of most manufacturers whose business is not building machinery.

Prof. Sweet says: "We do have and always have had about half as many apprentices in our machine shop as workmen."

Question 2 was: "Do you believe that the average young man can, as an apprentice, secure the best general knowledge of practical mechanics (I refer to the present time)?"

The J. A. Fay & Egan Company reply that "The average young man can, as an apprentice, secure a good, thorough knowledge of practical mechanics, but only in one branch at a time?"

William Sellers & Co. say that "An apprentice must go to his trade at about 16 years of age, and hence can not have much of a technical education. Apart from that fact, he has an opportunity to gain an excellent knowledge of practical mechanics."

Prof. Sweet answers: "No; even in our shop, which is above the average, I do not think it is a good place to learn the machinist's trade. He gets very little knowledge of anything but steam engines, and that of but one kind."

Mr. Grimes replies: "As a mechanical engineer, no."

Chandlor & Taylor say: "As trade is now running everything is drifting into specialties, and therefore an apprentice is an apprentice for a specialist."

The Hendey Machine Company say: "With our system, yes. We teach them all parts of the work."

J. W. Anderson answers: "No, I do not; for, while an apprentice in a machine shop may acquire the manual dexterity that will enable him to do good work, he lacks the knowledge of the underlying principles which govern machine construction. A man with that kind of training does well as long as he has a guiding hand to direct him, but when thrown upon his own resources he usually makes a signal failure. Of course, there are exceptionally bright and ambitious men who will rise in spite of their lack of proper training."

Mr. Pratt replies that "The machinist is not, as a rule, the drudge he formerly was. The milling machine, planer, grinding machine, etc., take the place of hard drudging, and the boy learns to construct and run these machines in place of chipping and filing, as formerly. In our work he has a few months (if he desires and has a fair education and natural talent for it) in the drafting room."

The Westinghouse Machine Company say: "It is difficult to answer this question in a few words. While there is no royal road to learning in the machine business, yet some boys find the road much easier than others. It is doubtless true in a manufacturing establishment such as our own (when special machinery is used, and where nearly all the planning of machine operations is done by the foreman, and the men simply operatives), that there is not the same opportunity for a wide experience as in jobbing shops, when the men do a little of everything, and oftentimes do it as they please. On the other hand, the standard of workmanship in a manufacturing establishment is generally higher; and if graduates of such an institution can not do as many things as graduates of the 'old line' shops, they can generally do what they can do both quicker and better."

The Yale & Towne Manufacturing Company say: "Under existing conditions, in most lines of industry, it is not easy for young men to become apprentices. On the other hand, it is not difficult for them usually to obtain opportunity to become practical mechanics, providing they have fair aptitude and diligence."

Bement, Miles & Co. say: "Most of our best mechanics are those who have served their apprenticeship with us, and the others have all served apprenticeships in some similar establishment. We believe it is the best way to get a knowledge of practical mechanics."

Brown & Sharp Manufacturing Company reply: "We do not believe that the average young man can, as an apprentice, secure the best knowledge of practical mechanics at the present time."

In my third question I ask directly, "Do you believe that the so-called manual training or trade schools give a good foundation for a person expecting to become a machinist?"

Mr. J. H. Springer, superintendent of Frazier & Chalmers, replies emphatically, "*I do not.*"

Mr. Robert C. McKinney, of the Niles Tool Works, answers this question as follows: "The average apprentice starts in with very little education, and many of them with little ambition, and therefore do not become very skilled or expert. An education at a manual training or trade school, gives a young man a good foundation to start on, and applying the knowledge there obtained, he can, in a shop where he is brought in contact with the practical business, make a success of it, and succeed better and be advanced more rapidly than one commencing his trade without these advantages."

Prof. Sweet says: "I have had no opportunity to form an opinion of what is really being done. Do not believe there is any use in stopping short and simply give the boy a foundation, but go on and make him a machinist. That is, a better general machinist that can be made in any shop during an apprenticeship; of course, assuming that funds are supplied for fitting up the plant."

Bement, Miles & Co. reply: "Yes, if the person goes to the training school before entering into a mechanical establishment, it would certainly give him an advantage over one who had not studied the subject at all. We think it would be a better system if boys could learn the practical side at an early age and the theoretical side afterwards. If both could be learned together it would be still better, and this, we understand, the training school attempts to accomplish. They have not been established long enough as yet for their success to be demonstrated by the result."

The Westinghouse Company answer: "We do not know by any personal experience as to the benefit derived from manual training schools, but believe that they ought to have a beneficial effect; and, while it will not take the place of a practical apprenticeship, it is certainly an assistance to any boy who wishes to become a machinist afterwards. In a manufacturing establishment the chief end of the employment of labor is the making of money; therefore, more attention is paid to getting out a product than to the education of the operative for his own advantage."

William Sellers & Co. say that "If the manual training schools have no automatic machinery, and merely teach the boys how to use their eyes and hands, then there is no better foundation for an apprentice, and we seek boys who have had this training."

Mr. Grimes replies: "Yes, so long as the student realizes that it *is* only a foundation."

The J. A. Fay & Egan Company answer: "We believe that the so-called manual training or technical schools are very advantageous to a person expecting to become a machinist. We have had some of that class in our employ and they always take a leading part and become much more proficient in mechanics than the average boy we take in to learn a trade. In other words, this class of boys is just a little better educated than the other, and the practical training they receive in a technical school gives them a great advantage, and they advance in a shop like ours much more rapidly than others."

In answer to this question J. W. Anderson says: "Yes; they not only teach correct and approved methods of doing work, but the theoretical knowledge gained is invaluable. A thorough knowledge of drafting is also of great importance, but seldom learned by an apprentice."

Brown & Sharp answer: "We consider the manual training or trade schools to be a help and good as far as they go."

Chandler & Taylor think that "Manual training or trade schools most certainly give a foundation to a young man expecting to learn a trade, whether it be a machinist, founder, or pattern-maker, but in our opinion a manual training is only a foundation."

Other replies to this question were practically the same as those given above. The next question I asked was: "Is not the vast amount of special machinery now built detrimental to the apprentice system?"

From Mr. Pratt I got this answer: "The vast amount of special machinery now built takes the place of drudgery, and places the machinist on a higher plane. If the apprentice is in a machine-tool works, certainly his practice in designing and building these special machines is so much above that which the writer received fifty years ago that there is no room for argument. Yet the apprentice in any shop will get sufficient practice with cold chisel and file to be of service to him when these special tools are not available."

The Putnam Machine Company say: "Yes."

The Yale & Towne Company answer: "Undoubtedly the continually increasing use of special machinery militates against the old apprentice system, which latter is likely to practically disappear in this country. On the other hand the use of such machinery and the ease with which an unskilled person can become skilled in the use of some one machine enables vast numbers of persons to find better employment than they otherwise could."

Chandler & Taylor reply that "The specialization of work in the various lines would of course destroy in a great measure the old apprentice system."

Mr. Anderson answers: "Yes; for the reason that an apprentice is usually kept on one part of the work, and has no opportunity to become a general machinist. He may be a skilled lathe man, but if so, that is as far as his knowledge goes. This condition is similar with other parts of the work."

The Niles Tool Works answer: "To a certain extent, yes."

Prof. Sweet says: "Yes, as a general thing."

Bement, Miles & Co. reply as follows: "No, not in the least. There are plenty of establishments where apprentices can obtain a complete mechanical education. Mechanical engineering is becoming divided into branches, and no one can be expected to know them all. The apprentice must select the branch he desires to follow, whether it be marine, locomotive, land engine, electrics, machine tools, etc."

The Westinghouse Company think that "As to the special machinery it has its own lessons. It does not throw any obstacles in the way of a bright boy making a good man of himself. It rather teaches him that the chief aim of a mechanic is not to put in time and draw wages by the hour, but to produce some desired result with the least expenditure of time, labor, and money."

William Sellers & Co. believe that "The increased accuracy and expedition in methods of manufacture required by modern practice offset the disadvantages suggested."

Mr. Grimes says: "No; for the apprentice must fit himself to design, build, and repair such machines."

Brown & Sharp answer: "We do not consider the special machinery now in use detrimental to the apprentice system. It gives a different kind of knowledge than that obtained under the old system, but a kind that we think is more suitable for modern requirements."

Question 5 is practically the same as question 4, only in a little different form: "Does not the sharp competition in the manufacturing business cause the boy as an apprentice to be practically shut out from a general knowledge of the machinist's trade?"

Mr. Anderson says: "Yes; especially in what are known as manufacturing machine shops, for the reason given in question 4. The smaller jobbing shops are approximately the only places where an apprentice can get a general training in the machinist's trade, and then usually only the manual part of it."

Chandler & Taylor reply that "The sharp competition in manufacturing has expanded the machinist's trade to such an extent that the average boy does not desire to make himself familiar with the entire trade."

The Putnam Machine Company, answer that "Yes. In a large number of shops manufacturers desire to get all the profit possible out of a boy by having him do one particular kind of work all the time."

Mr. Pratt believes that "the sharp competition compels the invention of new and special machines and processes in which an intelligent boy becomes interested and will try his hand in such improvements."

The Niles Tool Works say: "To a certain extent, yes. An apprentice is more apt to be taught only one part of a trade instead of a general knowledge itself."

Prof. Sweet replies: "If not, then it is the fault of the instructors, growing out of the almost irresistible disposition to teach the theory and principles and then try and put it in practice, instead of keeping the hand work ahead all the time. It is the machinist's business to *learn to do*; it is the engineer's and foreman's business to learn to know and to explain *why*."

The Westinghouse Company believe that "sharp competition in the manufacturing business should conduce to the best methods in manufacturing, and a sharp boy should not be slow to distinguish as between the shop which can do work cheaply and well and the shop which can not do it cheaply and well. There is an object lesson in this for the boy almost as important as learning his trade."

Wm. Sellers & Co. reply that "many establishments have ceased to take apprentices partly from the cause suggested, but the shops which continue to take them still turn out excellent workmen."

Mr. Grimes answers: "Yes, if the apprentice becomes simply a cheap attendant upon a special tool. This should be arranged in the agreement to serve as an apprentice."

Brown & Sharpe's answer is: "We do not consider that sharp competition in the manufacturing business causes a boy to be shut out from a general knowledge of the machinist's trade. On the contrary, it gives him an opportunity to observe methods and economies which never would be thought of or practiced were it not for sharp competition."

The J. A. Fay & Egan Company answer: "The sharp competition in the manufacturing business causes most factories to use a boy or an apprentice on one class of work. In other words, we put a boy on a lathe and he generally stays there, or we put him on a planer and he stays there, or we put him on a vise and he stays there, and so on; but we have a great many boys who learn all three branches in the same time that one boy learns one of them, and whenever a boy displays any ability of that class we generally move him around and give him a much better opportunity of perfecting himself."

In my last question, I ask directly: "In your opinion is the present system of manual training and trade schools a practical success?"

Mr. Springer underscores his "*No.*"

The J. A. Fay & Egan Company say: "We really believe that the system of manual training and trade schools is a practical success. We have seen quite a number of good mechanics turned out of them, and all they wanted was just a little practical work in a good first-class shop to make them first-class mechanics. We believe that technical schools are doing a great work, especially in the South and West, where shops of our kind are not so plentiful, and it gives the American boy a chance to learn a trade that he could not obtain in any machine shop."

Brown & Sharp reply that "The manual training schools should not be considered as taking the place of the apprentice system, but should be supplemented by an apprenticeship."

Chandler & Taylor say: "In our opinion the present system of manual training in the trade schools is a practical success so far as it goes, but not with the view of the student learning any practical trade, but rather in the line of developing his judgment and the skill of his hands."

From the Putnam Machine Company: "Yes."

Bement, Miles & Co. answer: "It is too early as yet to decide. Every subject should be better understood when special attention is devoted to it, and, therefore, we suppose the manual training schools will have a good effect by causing their subjects to be more intelligently studied. We think it is still open to question whether, if a boy were kept at a good school until 17, and then apprenticed in a good establishment, he would make a better engineer than if he went through a training school. Our Mr. Miles is of the opinion that the only way to make a good engineer is to cultivate his imagination, as the creative or inventive faculty."

Mr. Pratt replies to this question: "The manual training school is a success, more or less, depending upon its management, but it will not take the place of a regular apprenticeship, when productions must be sold at a profit in competition with others. You might as well say that railroads spoiled the old stage coach business and the sale of horses, that the bicycle saved shoe leather and hurt the shoemakers and the leather trade, as to say that labor-saving machinery is making the machinist's trade less desirable. Do all we can in the direction of education and improvement, and there will still be enough hand work and plenty of mechanics who are fit for nothing else but such drudgery."

Such is a synopsis of the replies I have received from some of the most successful firms in the United States. I believe that in a majority of the replies you can secure arguments in favor of the school system of training a tradesman, as against the apprentice system, although in a number of cases the evident intention of the writer was to condemn the school training, or if not to condemn it, to withhold all praise of the system.

We can not but agree that the apprentice system is a good one in some shops and bad in others; in some shops the apprentice is given every possible chance, in others he is given none, practically. But no matter how conscientious a firm may be as regards their apprentices the system can not give good results without a great effort on the part of the apprentice. Although in many of the replies to my questions it is claimed that competition in business does not affect the apprentice, I really can not see how it could help placing difficulties in the way of obtaining a trade, because the cost of production must be reduced to the lowest possible point, and every employé must exert himself to the utmost for the benefit of his employer. How, then, can it be possible to spare valuable time for the instruction of the novice? How will it be possible to allow a beginner to spoil material (and every beginner will spoil a certain amount of stock) when every possible economy must be practiced if the business is made most successful.

It is the necessity of cheapening production that has called forth all the skill of inventors to produce special machines to do the work. These machines cheapen and facilitate production in every way, and we would not go back to the old drudgery, as Mr. Pratt calls it, even if we could, although I am sure that these machines make it more difficult for an apprentice to secure a trade.

A number of manufacturers in answering my questions admit that a majority of boys will be put on a certain line of work, at a certain machine, and in all probability they stay there, becoming in time a mere machine themselves, a part of the one they operate. Of course there is some benefit to the bright boy in seeing new machinery built, but not much unless he understands the details of the machine, and helps in assembling the parts to produce the finished whole. If the apprentice's connection with a new machine consists merely in turning up a piece to a given size and shape, or in planing down a piece as directed by the foreman, he would receive no more benefit from it than he would from turning or planing only comparatively simple work.

Of course, there are firms who endeavor to the best of their ability to give the apprentice a proper training, and with such firms the apprentice can secure a thorough knowledge of his trade. I understand that there are things that an apprentice will learn that could probably never be fully incorporated into a school training. The apprentice must feel a certain sense of responsibility that is ordinarily lacking in the school boy. On the other hand, when thrown upon his own resources the school-trained boy, having been taught to analyze things and to understand the "why" as well as the "how," will be the better able to assume any responsibility, for, if I may say it, the responsibility of the apprentice is more one of fear than anything else.

School methods are such as to impart more knowledge in a given time than any other, for each operation is carefully explained by the instructor, and the reason for each step given, so that the novice can see why a certain thing is done in a certain way, instead of being merely shown how to do the work, and then left to discover reasons as best he can. If a mistake is made it will be corrected by the instructor without making the boy feel that he has committed some crime.

In the school there is also given a thorough knowledge of drafting, which, as Prof. Unwin aptly remarks, is a kind of "written language" for the designer and the machinist. There are some establishments that give their apprentices a chance to learn something about drafting, but they are rare indeed. The foreman usually lays out the work to be done, so there is but little chance even to pick up a knowledge of this very important work.

Aside from the technical work, the boy will be better educated in the school and will make a broader man in consequence. Having a better education than the apprentice-made man, he must advance more rapidly in whatever line of work he may choose.

Believing as I do that the school system of technical training is a success, and that it could be made equally successful in giving instruction to the artisan, I would like to see trade schools organized by the different States. To be eminently successful they must necessarily be kept separate from any other school of collegiate rank, and at all times retain their primary aim of turning out artisans. It would be an absolute impossibility to successfully conduct such a school in connection with a college or a university; for, as Francis A. Walker says, in replying to an article on "Relations of academic and technical instruction," "Young men do not greatly care to go to schools where they are not respected equally with the best; where all the praise and all the prizes go to others; where the stained fingers and rough clothes of the laboratory mark them as belonging to a class less distinguished than students of classics and philosophy."

The school should include instruction in the following trades: The machinist's, the pattern-maker's, the blacksmith's, the cabinetmaker's, the tinner's, the molder's, the plumber's, and the steamfitter's. In certain sections of the country other trades of special importance in those localities should also be added. The practical instruction should begin with a course in the shop similar to that now given in our best technical schools, so that the student would obtain a general knowledge of tools and their use, and thus get a better knowledge of the relations between his own and other trades. After this general tool work, let the student select the trade in which he is most interested, and make a specialty of that particular work. Every detail of the trade should be carefully taught, so that the student will be, in truth, a master of his craft when he completes his course.

Particular stress should be laid upon the scientific principles underlying each trade, and every possible means taken to make the student thoroughly interested in everything he does.

In a school of this sort, after teaching the elementary principles of the work, the most successful policy would be to manufacture articles of a commercial value, wherever possible, and use the proceeds from the sale of such articles for the purchase of new materials. If the proceeds should exceed the expenditures, the balance might be used for the support of indigent students.

The other work of the school should include a thorough course in mechanical drawing, mathematics through trigonometry, a good knowledge of English, some work in history, and physics. In other words, give a good liberal education in addition to the practical work, the whole course extending through three or possibly four years.

As teachers of the trades, well-educated men who have been foremen would be best fitted for the work. If the instructors in all the branches could be men of technical education the school would be the better for it, for the one central idea could then be best carried out.

In suggesting this system of trade schools, I can realize that it would be most successful in the Southern and Western States, where there are but few shops and factories as yet, and where, consequently, it is difficult to learn a trade. Even in the Eastern and Central States, where there are better chances to learn a trade as an apprentice, a school of this sort would undoubtedly be successful, for ordinarily the applicants for apprenticeships are more numerous than are the places for them.

A school of this sort would be a success; it would educate and make skilled workmen of a class that would otherwise receive but little education; it would interest a man in his work for his work's sake, and he would consequently strive to improve himself and make himself better fitted to do his work. New means of enjoyment and recreation would be opened to him, and, even though he always remained an artisan, his life would rise above the mechanical existence of the ignorant laborer.

Mechanical Drawing in Technical Schools.

J. J. Flather, *of Indiana.*

The comparatively recent rise of engineering as a profession and its rapid growth have called into existence numerous technical schools for the education of the future engineer, which have been organized and oftentimes controlled by those who have derived their ideas of proper methods of professional training from inherited or acquired experience in teaching the old or "learned professions"—theology, medicine, and law.

In the learned professions intellectual development is the primary thought, whereas in the education of the engineer the aim is to so train the student that he may have a thorough conception of the principles upon which the profession is based, and such practice in applying these principles as will best enable him to succeed in whatever branch of engineering he may enter after leaving college.

Whatever intellectual development the student may acquire is a result of the process, not the direct aim.

Considering the newness of engineering education, it is not surprising that features exist and are carried out in the curricula of some of our technical schools which only in a measure attain the desired end.

Owing to the comparatively short time they have been in use these features have not been generally recognized, or, if recognized, the adherents of the old school have opposed any change.

Another reason for their existence is the fact that each new school is equipped with instructors and professors who usually adopt the methods they were taught; hence we see in certain lines a general similarity of instruction which, although it may promote the knowledge of the student and enlarge his mental capacity, does not best subserve his ultimate advancement.

While we recognize that the subject of engineering education is not sufficiently old to be crystallized into a definite form, and while we further recognize the advisability of having different kinds of engineering schools—some having departments for shop practice and others providing courses where manual training is omitted—yet there are many subjects which are commonly included in all courses for engineering students, prominent among which is mechanical drawing.

This subject, as frequently taught, does not give the student that training, of which we have already spoken, which will enable him to make the greatest advancement after graduation.

The actual system of projection as taught by many professors is opposed to shop practice, and the student so taught, when he enters upon the duties of his profession, has not only to learn the shop methods, but he must forget much of what he has previously learned.

As drawing is the language of the engineer, it is of the greatest importance that the student be properly taught to express himself, and that his methods conform to those in vogue among practical men. You are doubtless familiar with Chordal's boy Joe, who wrote 22 pages of legal cap to explain a detail drawing. A drawing which requires explanation does not fulfill its mission. A draftsman can not always be at hand to interpret his drawing, nor should he be. Drawings for use in the shop, right at the draftsman's hand, should be so complete and self-explanatory that a properly skilled workman a thousand miles away could execute the work without a word of descriptive matter.

The machine-shop drawing is simply a memorandum, showing what is to be produced. It is necessarily an illustrated memorandum, and to be perfect it should answer all questions which a workman can reasonably ask in regard to the work.

It is not necessary to have a finely-finished drawing; in fact, shop drawings should not be finely finished. A clear representation of the piece with good heavy lines and distinct dimensions, even if drawn freehand, is to be preferred for shop use to a highly finished fine-line drawing which the college graduate is so prone to turn out when he first enters a drafting room.

As freehand sketches enter largely into the work of the engineer the importance of teaching freehand drawing can not be overestimated; and although it may not be generally considered as mechanical drawing, yet its common use in the drawing room and shop entitles it to be properly classed under this general head. Moreover, in this connection it is most frequently used to give form to an object in a manner similar to that employed in mechanical drawing. In this respect it differs from artistic sketching, which gives a general representation of the prominent features of an object or scene.

Freehand drawing is a wonderful aid in the cultivation of the observing powers, and practically the first step in drawing is to learn to see accurately. One of the foremost American engineers of the present day, whose name you would recognize were it mentioned, has so cultivated this power of observation that he has in several instances comprehended the details and dimensions of a machine so completely by inspection that he has been able to make working drawings and duplicate the machine without making a single measurement or sketch.

The beginner will soon recognize that the untrained eyesight is untrustworthy, and when this is realized the importance of keen observation becomes apparent. Erroneous conceptions which the untrained eye will cause the hand to execute may be corrected by intelligent practice, and for this purpose the student should early be given a course in object drawing.

His first work should consist of exercises in drawing straight parallel equidistant lines, both horizontal and vertical; then should follow exercises with curved lines and circles in the flat, after which the student should be given a few examples in shading with the pencil from copy. At this time he may be given simple objects and machines to sketch, and the relation of the several views of a mechanical drawing to the object represented and to each other should be early impressed upon his mind. For this purpose actual machine pieces and combinations will be found of greater value than geometrical forms or wooden models, for a machine piece not only presents a greater range in offering several views which may differ in some respect, but it is the general experience that a boy takes to such drawing more readily and with greater interest.

As the work progresses the student should take measurements from the objects to be represented and the sketch should be dimensioned according to the conventional shop methods.

Another advantage in employing actual machine parts is thus obtained, for where a measurement is a little above or below a standard size the student must exercise his judgment in deciding upon the suitable dimension to adopt—a point which the draftsman must learn sooner or later.

A valuable exercise in freehand drawing is given by introducing, from time to time, memory sketches in which the student has to draw a given piece after an examination of the part. Time sketches are also an aid in teaching this work and should be alternated with the memory sketches.

An aid to the proper disposition of the views in a mechanical drawing is the conception (proposed by Mr. Sellers) that the object is surrounded by a glass case hinged on all sides and so constructed that it can be opened out flat as shown in the sketch on blackboard. By assuming this case to be placed over the object to be drawn, the top view will be seen by looking on top of the object; the front view will be seen from the front; and the right and left views to the right and left of the front view respectively. By tracing the outlines of these several views upon the glass and opening out the case the several views will be placed as follows: The top view will be shown on top, the front view will appear immediately under the top view, and the end views will be drawn to the right and left of the front view and in line with the latter, so that the position of the drawing indicates the view taken. This disposition of the views has so many practical advantages that it is employed almost universally in the shops.

Exercises in lettering should begin with the first work in freehand drawing and should be continued throughout the entire course. There is nothing which discounts a drawing so much as poor lettering, and there is scarcely one graduate in twenty who, upon leaving college, can print his own name rapidly so it will look well. A part of this fault lies with the teacher, who must bear constantly in mind that the old proverb, *poeta nascitur non fit*, does not apply to lettering. The man who would letter rapidly and neatly must acquire the ability by continued practice; he is seldom born with a pen in his hand. The student should be given one or two simple forms of letter which can be made rapidly, and all his subsequent work should be confined to these simple forms. It is folly to attempt fancy lettering, and time spent on such work is thrown away, for no office draftsman could spend the time necessary to make such letters. A plain block letter for titles and a runnng law Italic, a plain Roman, or a style of round writing, are the only forms which the student should try to master.

The writer has adopted a plan which is productive of good results and one which might be carried still further to advantage. It is that in all exercise work and in weekly tests all subject headings, with name and date, must be neatly printed offhand. This gives continual practice in addition to that obtained in the drawing room, and it is found that the men gradually acquire a fair degree of rapidity and style.

In this groundwork the principles of projection should be thoroughly inculcated in the mind of the student, as much of his after success and advancement depends upon his thorough knowledge of these elements.

The time spent on this freehand work is, in most colleges, too short to accomplish much good. It is the writer's opinion that the average student is in a better condition to enter upon the more advanced work of drawing and machine design by a thorough course in freehand, and that ultimately he accomplishes much more than if such time were devoted to instrumental work. From four to eight hours per week may be advantageously devoted to this work throughout the first term of freshman year.

At this time instrumental work should be taken up, and right here much valuable time is wasted in elementary exercises in line work, consisting of the construction of geometrical diagrams arranged with a view to securing facility and accuracy in the use of instruments.

Why not start the student upon projection drawing at once and let him acquire facility of execution at the same time he is obtaining practice in projection? His experience in freehand sketching has taught him the principles of projection and his subsequent work with the T-square and compass should be in the nature of a development. Let the student then be given machine pieces and simple machines suited to the capacity of the individual from which he must make working drawings. By the use of notes, blackboard, and elbow work, let him know what constitutes a good working drawing and let him use the ordinary conventional shop methods of representation. Have good examples of shop drawings so disposed in the drawing room that he may refer to them for comparison and for such minor details as are necessary to make a proper drawing. Above all let the student assume that his drawing is going into the shop to be worked from, and treated in all respects with no more care than any other working drawing. If there is any error or misunderstanding the draftsman alone is responsible; if the lines and figures become indistinct with shop use, it shows they should have been made heavier; if verbal or written explanations (other than the customary notes which appertain to a working drawing) are necessary, it shows an incomplete drawing; and it is the province of the instructor to see that these objects are attained. In this work the character of the examples may be very properly differentiated for the several departments of engineering.

In the present discussion of the subject we shall confine ourselves to such work as would be suitable for mechanical or electrical engineers.

Tracing and blue printing should be taken up at this time and the work of the term completed by a series of graded exercises in isometric drawing, line shading, and tinting. To carry this work through successfully will require from six to ten hours per week for twenty-four weeks.

At the beginning of sophomore year a short course should be given the student in descriptive geometry, including shades and shadows. The time devoted to this subject may vary from five to eight hours per week for sixteen weeks, two hours of this time being given to recitation-room work. Upon the conclusion of this subject our student should be given over a line of work preparatory to machine design. For lack of a better name we shall call this work the "mechanism of machinery." Its object is to study the nature, proportions, construction, and analysis of existing machines, and may be taught by means of lectures, inspection of the actual machine, and drawing-room exercises. Where possible the machine should be taken apart by the students and its several parts sketched. Visits of inspection to manufacturing works, in which the students may watch and note the more important methods of construction, constitute a part of this work. In the various machines inspected, the methods of oiling and adjustment, provision for taking up wear, extent of wearing surfaces, different metals used and reasons therefor, should not only be carefully pointed out to the student, but he should be taught to observe these features himself. By noting at the same time the widths of belt used and the speeds at which the machines are run, also the character and quantity of work turned out, the student is not only preparing himself for the immediate work of machine design, but he is acquiring habits of observation which will be an advantage to him throughout his entire career. The ability to get at the true inwardness of a machine by observation and analysis from point to point is not usually possessed by the untrained engineer.

Lectures on methods of handling and turning out work in machine shops and other works constitute a valuable feature of this subject, for even with the best of college shops and methods of instruction the student obtains but a limited knowledge of shop practice.

The object of the lecturer on this subject should be to point out ways and means, and to indicate where designs are defective; where they may be improved; where and why other proportions should be used; how parts may be changed so they may be constructed more cheaply; in short, as far as possible, in the limited time at his disposal, his object is to teach the more important principles which guide the successful engineer in his designing, so far as the constructive features are concerned. Mere statements and facts should be subjected to the idea of bringing out the reasons pro and con in any given case. Suitable exercises to be worked out in the drawing room should accompany this work. These may consist of combinations of several pieces shown in section and otherwise, so that the student learns the relation of the drawing to the *thing*, and in assembling these several pieces he learns the relation between the individual thing and the machine. For this work the exercises may be taken in part from sketches made by the student, and in part from the blue prints of details of machine parts which may be obtained from the manufacturer, or they may be taken from senior designs. This work should extend through to the end of sophomore year, or for a period of twenty-four weeks. One lecture, and from five to eight hours per week, inspecting, sketching, and drawing, may be very advantageously devoted to this subject. The student is thus prepared at the beginning of junior year to take up the study of machine design.

Machine design is both a science and an art. It is a science in that it is based upon rational deductions; it is an art in that it requires skill and judgment in applying these deductions to the engineering materials which are available. Calculation from a given formula is not machine design; judgment, or what has been termed "horse sense," enters quite prominently as a factor in the work. If calculation calls for a 60-inch boiler to be 2 inches thick, the designer must know intuitively that something is wrong. He should also be sufficiently informed on shop practice and methods that when he designs a piece of work he must know whether it can be made in the shop.

In the designing of new machines and mechanical constructions, the draftsman must draw from his knowledge of well-known forms and parts and combine them; but to proportion them properly and adapt them to the purposes required, he must take into consideration the stresses to which they are subjected, and the behavior of the available material under varying conditions. The choice of suitable dimensions and forms is the work of the machine designer.

Engineers and practical shop men are enabled to proportion the various machines which are daily manufactured, and to satisfactorily design new machines, without a knowledge of the character of the forces acting in the various parts of the machine; but it is safe to assume that this knowledge has been obtained only as a result of long experience and the process of substitution—that is, when a part failed in a machine a larger or stronger piece was substituted in the next one built—an expensive method of design.

The shop designer is frequently an averager, who obtains his results largely from the catalogues and publications of other manufacturers; and, while this is valuable as affording a means of comparison and corroboration, we believe that all intelligent mechanical design must be based on a knowledge of scientific principles. On the other hand, there is a difficulty in proportioning many machine parts on account of the lack of exact information, and of their variable functions not amenable to exact rules. For such cases empirical formulas and tables made up from the results of experiment and practice will be found of great assistance to the designer.

From these considerations it will be seen that the province of the instructor in machine design is to teach the principles available as guides in machine design, and to furnish such examples to be worked out at the drawing board as will ultimately tend to the development of the student's engineering knowledge. The teacher of machine design should evidently be a man familiar with practical shopwork and modern methods, but he should not attempt to cram the student full of facts and tables. If the underlying principles are made prominent let the instructor feel that his work is well done; for development into the full-fledged engineer can not occur at once. It takes time, and we must remember that there is inertia in mind as well as in matter.

The teacher of machine design must also guard himself against giving the student formulas without showing their derivation and the relation of the several factors involved. It is not teaching principles if we select a dozen or more formulas with constants already determined and say to the student: Draw a piston rod end, for instance, making the diameter of rod equal to one sixth of the diameter of cylinder. If this is the way to teach our boys, why not get out tables for general cases and put them into the hands of our students? The average student is a reasonable and a reasoning person, but even a student is limited in capacity. For this reason we should so much the more teach principles as foundations and let the character of the individual problems be determined by the ability of the man. It is unwise to gauge all men by the same standard, and the old saying, "You can't make a whistle out of a pig's tail," should constantly be borne in mind by the college professor who puts all his men through the same work in machine design and expects all to be equally gifted in designing. If a boy has capacity for engineering he may be given problems and designs to work out that a man of less natural ability could not possibly execute. Although natural aptitude is a great advantage in this work, much can be acquired, and the teacher must judiciously direct the work of each student in order that he may thereby the better prepare the individual for his future vocation.

Before entering upon the real work of the drawing room it is advisable to spend about three weeks in the recitation room (three hours per week) in a general discussion of the engineering materials and the principles and general rules of calculation which are applicable to problems that may arise in the determination of machine parts.

The subject-matter taken up under these heads is not intended to displace nor should it be substituted for the study of metallurgy and applied mechanics. The properties and strength of engineering materials and the principles relating thereto are to be considered as an equipment of suitable tools which will enable a man to intelligently design those simple elements of which a machine is composed. The hasty preliminary view of the field is merely to indicate to the student where these tools may be found.

From six to ten hours per week for twenty-eight weeks should be devoted to the design of machine elements, such as those which come under the head of fastenings, gearing, pulleys, shafts, and bearings. This may be followed by problems in kinematics relating to straight line motions, quick return motions, and various cam motions, after which practice should be given in the application of Zeuner's diagram to valve gears. Eight to ten hours per week for twelve weeks are necessary for this portion of the work. At the beginning of senior year steam-engine design may be taken up and carried on for sixteen weeks, seven to nine hours a week being necessary for the work. Upon its completion the student takes up the design of machine tools, boilers, pumps, clutches, hoisting, punching, and other machinery. The time allotted to this section of the subject should vary from eight to twelve hours per week for twenty-four weeks. It will be found that quite a number of men will even spend as much as twenty hours per week on this work if permitted to do so.

The method of teaching machine design as carried on at Purdue University varies with the character of the work. So far as possible the students are given individual problems so that each may make his own calculations and become familiar with the method and application of the formula involved. Preceding each new series of problems a short lecture is given to the class, in which are pointed out the underlying principles relating to the problems, and the derivation and application of the formula to be used are explained, and reasons noted why other proportions should be adopted under other conditions. In these problems each part is designed to do some definite work for which the data are given or may be determined.

Upon the completion of these elementary problems the student is given a course of exercises in kinematic and valve-gear problems, as previously indicated. With the commencement of senior year he takes up steam-engine design. In this work a given horse power of engine is assumed, suitable limits are chosen, and the indicator cards drawn for minimum, maximum, and normal conditions. These diagrams are modified to conform to practical conditions; and the diameter, length of stroke, and speed of the engine are determined after the tangential pressures upon the crank pin have been ascertained from assumed inertia effects. Instruction is given by means of lectures and drawing-room notes. Each student makes a complete set of theoretical diagrams in pencil on sheets 24 by 36 inches (standard size for senior drawings), after which the details of the engine are worked up by ths class collectively—one man takes the cylinder, another the bed, another the crosshead and connecting rod, and so on. In designing these details the student has access to a good reference library in the drawing room and a very complete collection of trade catalogues and working blue prints from manufacturers, so that he has every means of becoming informed in regard to current practice.

In the design of details and in machine drawings which follow this work, the tracings are made direct from the penciled drawings. When completed, each student obtains a full set of blue prints. Conventional shop practice is used throughout all the work in machine design, and this is especially emphasized during the senior year where greater occasion for its use arises. For calculation and preliminary notes a system has been adopted by which the work and results are kept distinct, and yet both are preserved for future reference or comparison. The advantage of any such system in locating errors is apparent. In the present case notes, formulas, and results are kept on one page, while the calculations are made on the opposite page, so that the work and results are together, yet distinct. No attempt is made to economize paper, the only object aimed at being to save time, and this is best obtained by teaching the student to systematize his work and have the calculations where they may be referred to in case of error or in checking results. During the progress of the work, especially in scale drawings, the draftsman is encouraged to make full-sized sketches of the several parts of his design in order that he may obtain a better degree of proportion. To this end, specially prepared section paper is provided, so that the part may be rapidly sketched in freehand without other reference to size than that furnished by the paper itself.

The concluding work of the senior year consists of special designs, assigned individually, according to ability and circumstances. This work is generally presented in the form of a problem which involves more or less engineering knowledge and the exercise of judgment in the application of principles studied earlier in the course. Time blanks are used for these designs, as it is thought that a record of the work and time spent on it is advantageous to both student and instructor. Instruction is given in this work by means of consultation with the student, advice, and corrections. References are cited when the problem is assigned. As the design progresses many of the details are sketched off and worked up by under-classmen. For this purpose several of the more advanced freshmen and sophomores are detailed as assistants to the seniors, and from an experience of two years the plan can be indorsed as producing excellent results. The senior is given a responsibility which insures greater care and thoroughness on his part, besides which it enables him to accomplish a great deal more of real shopwork than would otherwise be the case. There is also an advantage to the under-classman, as he is brought more intimately in contact with a class of work as nearly as possible similar to that carried on in engineering drawing rooms.

Recapitulating and taking the average time allowance, it will be seen that we advocate a course in mechanical drawing covering four years and occupying a total of 1,168 hours, allotted as follows:

Hours occupied in mechanical drawing.

Class.	How occupied.	Hours per week.	Number of weeks.	Total hours.
Freshman year	Freehand drawing and lettering	6	16	96
	Instrumental drawing: Tracing, blue printing, shading, tinting, isometric.	8	24	192
Sophomore year	Descriptive geometry, shades, and shadows	6	16	96
	Mechanism sketches, assembling, and section drawing.	6	24	144
Junior year	Design of machine elements, cam motions, and valve gears.	8	40	320
Senior year	Steam-engine and machinery design	8	40	320
	Total			1,168

APPENDIX.

MINUTES OF SECTIONS.

SECTION ON AGRICULTURE AND CHEMISTRY.

The Section on Agriculture and Chemistry held but a single meeting, in which the only work done was to elect officers for the coming year.

SECTION ON COLLEGE WORK.

Much of the work usually coming before this Section during the annual conventions of the Association was merged with that of the various agricultural congresses in session at the same time and place. Two sessions only of the Section were held.

The first session was called to order at 11 a. m., October 17, President Dabney in the chair. The secretary of the Section, President Fernald, of Maine, being absent, President Stockbridge, of North Dakota, was elected to serve in his place. The report of the president of the Section, Dr. Dabney, read in the general session of the Association, was brought up for consideration. On motion of President Scott, of New Jersey, it was voted that the report of the president be referred to a committee of three, with instructions to embody the recommendation of the report and those of the Inspector General of the Army on the same subject, namely, military instruction in land-grant colleges, in a resolution to be presented to the War Department as the sense of the Section. Messrs. Scott, Welborn, and Harris were named as such committee. The Section then adjourned.

The second meeting of the Section was called to order at 12 m., October 18, President Dabney in the chair. No business was brought up except the election of officers for the ensuing year, resulting as follows: President, President Fairchild, of Kansas; vice-president, President Harris, of Maine; secretary, President Stockbridge, of North Dakota. The Section then adjourned *sine die*.

H. E. STOCKBRIDGE,
Secretary.

SECTION ON HORTICULTURE AND BOTANY.

The following papers were presented by Prof. B. D. Halsted, of New Jersey:

THE SOLANDI PRINTING.

By B. D. HALSTED, *of New Jersey.*

Your worthy secretary suggests that the papers before the Section be mainly upon methods and plans; therefore the following process of making records of various results is given. It was given at the Madison meeting of the American Association for the Advancement of Science, but as many of the station botanists and horticulturists were absent, and because several have expressed an interest in the process, it is again stated in brief: It is a process of sun printing, and can be employed for any subject not too thick or dark to admit the passage of light. With leaves and objects similar to them it is particularly well adapted. The process consists in exposing an object like a leaf, for example, to the sunlight while closely held upon sensitized paper, the aristotype paper being the kind most experimented with in an ordinary photographer's printing frame.

This sun print thus obtained is toned in the same way as an ordinary photograph print. This print becomes a negative, from which a positive is printed. To do this the negative is placed in kerosene for a minute, wiped clean, and put in a printing frame, faced by aristo paper. This positive is toned in the same way as was the negative, and the work of taking a picture is finished, and, if well done, there is an exact reproduction of very many of the details of the subject.

If green leaves or subjects be taken fresh, they need no previous treatment, the only precaution being to have them dry upon the surface exposed to the aristo paper. When dry subjects are used, they may be placed in the kerosene for a short time, which only makes them more translucent in the lighter parts and facilitates the printing.

There are many subjects that yield better results by the Solandi process than by photography. The former is by transmitted light, and brings out some of the peculiarities that lie beneath the surface and are not, therefore, secured by photography.

The cheapness and ease of the process commend it to everyone who desires exact prints of various objects. There is no camera needed, no sensitized glass plates, or even a dark room. A photographer's printing frame and a few cents' worth of aristo paper are sufficient to secure a dozen pictures. The toning is easily done, costs but a little for a hundred pictures, each one of which is absolutely natural size and the details represented without distortion.

Samples of the work are shown, and they must speak for the process.

FIELD OBSERVATIONS WITH FUNGI.

By B. D. HALSTED, *of New Jersey.*

The study of destructive fungi has been confined very largely to the laboratory. This has been as it should be, for it is only with the compound microscope and various methods of tube and plate cultures that the nature of the pest may be determined. It seems to me that this indoor work with many of the parasitic fungi has gone far enough to be at least supplemented by observations in the field. While it is well to study the fungi minutely and separately, often the best results, particularly from a practical standpoint, are to be derived from careful and continuous field observations.

The following instance may help to enforce the above, and, while it is drawn from my own notebooks, it serves the purpose of calling the minds of other students of similar subjects to the importance of making similar observations:

In 1892 a laboratory study was made of the quince diseases, and particularly one known as the black rot, then very destructive. The miscroscopic study developed strong suspicions that the fungus was the same as that causing a similar decay of apples, namely: *Sphæropsis malorum* Peck. Inoculations were easily made from the quince to the apple and *vice versa*. Having established the identity of the black rot of the quince and apple by laboratory methods, attention was turned to the orchard, when it was soon found that one apple tree standing near the center of the grove of quince trees and loaded with fruit abounded with the *Sphæropsis* while the quinces nearest to this tree were the most affected. It was then found that the same relations existed between a similar rot of pears and the above-mentioned apple tree, and this decay was shown by inspection and cultures in the laboratory to be due to the same fungus. These are instances of important information, aided by field observations, and are introductory to a study that was made in the same field early in the present season.

Feeling assured from other experiments of the value of beginning in time the apple tree was visited in June, and this proved none too soon. One large branch loaded down with fruit was a graft of the Red Astrachan, and at that time many of the fruits were decaying upon this branch, while those upon the other portions of the tree were yet small, green, and sound. This fact of observation taken with those of last season, in this single branch of the Red Astrachan, was the beginning of the serious trouble from black rot in the orchard and particularly with the quinces. In other words, while in 1892 the field observations traced the possible source of the rot to a single apple tree; those of the present season pointed out that the *Sphæropsis* started and gained headway in the early maturing fruit of a single large branch of that tree.

From the remedial standpoint the suggestion comes naturally that either the whole apple tree should be removed—that was the advice given last year—or the branch of the early sort cut away. This latter may prove to be the desired check and should be tried. This is a case of saving the life at the expense of the limb and comes under one of the rules of modern advanced surgery.

If our knowledge of the field habits of fungi were better known examples similar to the one cited might be given without number.

At the present time the writer is attempting to gather information upon the relationship which one cruciferous crop bears to another in the matter of clubbing of the roots, due to the low fungus *Plasmodiophora brassicæ* Wor. It seems to prefer the roots of the cabbage, but within the past month most aggravated cases of it have been found upon turnips. Radishes are least affected, and the point of observations is to see how much risk is run by growing turnips after cabbage and radishes after either, also how long the fungus may remain virulent in the soil. Not the least item in the examination of the roots of wild weedy *Cruciferæ*, as suspicion rests upon them as the "common carriers" of this underground enemy.

A final suggestion in the matter of an appeal for more field study of fungi is that of coöperation. The time element is the only one that stands in the way of botanists from Maine to California working together upon some problems requiring only the use of the eyes while in the field, orchard, and garden, and recording the facts so obtained. In laboratory studies we can not expect to coöperate largely, but in field observations there is no barrier against it. Therefore let us do more field work with fungi at odd hours, mingled with recreation at times it may be, and labor helpfully together upon some of the numerous subjects that can not fail to interest many if not all the station botanists and horticulturists.

SECTION ON MECHANIC ARTS.

According to the plans of the Association, the Section on Mechanic Arts of the Association of American Agricultural Colleges and Experiment Stations held its first annual meeting in Hall IV of Art Palace, on Michigan avenue, Chicago, on Wednesday evening, October 18, 1893.

The meeting was called to order at 7:15 p. m. by Chairman C. W. Hall, of Minnesota. This meeting being the first held by the new Section, no minutes were read.

Prof. C. W. Hall, of Minnesota, presented a paper on "Some Relations of Mechanic Arts to Agriculture." The production showed concisely how intimate the agricultural and mechanic arts were and how they could assist each other in individual development. The paper created considerable discussion and a free exchange of opinions regarding manual training operated in connection with agricultural colleges.

In the absence of Prof. G. W. Bissell, of Iowa, his paper on "Shop-work at the Iowa Agricultural College" was read by the secretary of the Section.

Prof. Bissell outlined the system of shop instruction at the Iowa Agricultural College, and illustrated his methods by a very complete set of blue prints.

Although the article was specific, the presentation of the exercises used in one college was fruitful of interesting discussion.

On motion of Maj. H. E. Alvord, the papers read were ordered incorporated in the general proceedings of the Association.

On motion of F. P. Anderson, the three remaining papers on the program were read by title and referred to the executive committee of the Association for publication.

The other papers prepared for the Section on Mechanic Arts, and which were referred for publication, are:

"Mechanical Drawing in Technical Schools," by Prof. J. J. Flather, of Purdue University.

"Manual Training and the Apprentice System," by Prof. C. Russ Richards, of University of Nebraska.

"What Tools are Necessary in a Manual Training Course," by Prof. H. E. Smith, of University of Minnesota.

In the general discussion following the reading of the papers some interesting questions were examined relative to the amount and character of shopwork that should be given to agricultural students. Expressions of opinions came from Maj. H. E. Alvord, Prof. W. C. Latta, of Indiana; Prof. Lewis McLouth, of South Dakota; Prof. J. H. Washburn, of Rhode Island; Prof. C. W. Hall, of Minnesota; President A. W. Harris, of Maine; and Prof. Hugh Jamieson, of Louisiana.

The qualifications of instructors in shopwork were freely discussed, the universal opinion being that a man having a practical shop experience, together with that training received in a technical school, is the most desirable instructor in manual training.

No further business was transacted, and the first meeting of the Section on Mechanic Arts, considering the diverting influences of the Columbian Exposition, proved very successful.

F. P. ANDERSON,
Secretary.

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NAME LIST.

SUBJECT LIST.

O

No. 24

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

PROCEEDINGS

OF THE

EIGHTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

WASHINGTON, D. C., NOVEMBER 13–15, 1894

EDITED BY

A. C. TRUE, for the Office of Experiment Stations

AND

H. H. GOODELL, for the Executive Committee of the Association

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., April 25, 1895.

SIR: I have the honor to transmit herewith for publication Bulletin No. 24 of this Office, containing the proceedings of the Eighth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, held at Washington, D. C., November 13–15, 1894. The stenographic report of this meeting was made by Mr. R. M. Reese, of the Division of Entomology of this Department.

Respectfully,

A. C. TRUE,
Director.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called the Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association, and to secure to that end mutual cooperation.

MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department, shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture or mechanic arts who shall attend any convention of this Association may be admitted to similar privileges.

SECTIONS.

(1) The Association shall be organized into sections upon (1) college work; (2) agriculture and chemistry; (3) horticulture and botany; (4) entomology; (5) mechanic arts. The executive committee shall, upon the request of any ten institutions represented in the Association, provide for the organization of provisional sections at any convention.

(2) Each section shall conduct its own proceedings and shall keep record of the same, and present a synopsis thereof to the Association at the close of every convention; and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the Association in general session.

MEETINGS.

(1) This Association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the Association. Special meetings may be held at other times, upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the programme. The section meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them.

OFFICERS.

(1) The general officers of this Association shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer. The president, junior ex-president, the secretary, and four persons to be chosen by the Association, shall constitute an executive committee, which shall elect its own chairman.

(2) Each section shall, by ballot, nominate to the Association in general session, for its action, a chairman and a secretary for such section.

(3) Officers shall be chosen by ballot at the annual convention of the Association, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the Association, or an officer of an institution which is a member of the Association in full standing at the time of election, shall be eligible to office.

DUTIES OF OFFICERS.

(1) The officers of the Association shall perform the duties which usually devolve upon their respective offices.

(2) The president shall deliver an address at the annual convention before the Association in general session.

(3) The chairman of each section shall make, at the annual convention, a report to the Association in general session of the progress during the preceding year of the subject or subjects appertaining to his section, and such reports shall not occupy more than twenty minutes each.

(4) The executive committee shall determine the time and place of the annual conventions and other meetings of the Association, and shall, between such conventions and meetings, act for the Association in all matters of business. It shall issue its call for the annual conventions of the Association not less than sixty days before the date on which they are to be held, and for special meetings not less than ten days before such date. It shall be charged with the general arrangement and conduct of all meetings called by it. It shall designate the two sections to present in general session a portion of the subjects coming before them, and shall give notice thereof to the chairmen of such sections at least ninety days prior to the annual convention. It shall provide a well-prepared order of business and a programme of exercises, and shall make a seasonable issue of said programme. Said committee may fill any vacancy in an office or committee of the Association occurring after the adjournment of the annual convention, such appointee to serve until the next annual election.

FINANCES.

At every annual convention the Association, in general session, shall provide for obtaining the funds necessary for its legitimate expenses, and may, by appropriate action, call for contributions upon the several institutions eligible to membership; and no institution shall be entitled to representation or participation in the benefits of the Association unless such institution shall have made the designated contribution for the year previous to that in and for which such question of privilege shall arise, or shall have had said payment remitted by the unanimous vote of the executive committee.

AMENDMENTS.

This constitution may be amended at any regular convention of the Association by a two-thirds vote of the delegates present, if the number constitute a quorum: *Provided*, That notice of any proposed amendment, together with the full text thereof and the name of the mover, shall have been given in the call for the convention. Every such proposition of amendment shall be subject to modification or amendment in the same manner as other propositions, and the final vote on the adoption or rejection shall be taken by yeas and nays of the institutions then and there represented.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the programme.

(3) Speakers invited to open discussion shall be entitled to twenty minutes each.

(4) In general discussions the ten-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general programme shall be closely observed, unless changed by a two-thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

President,

H. E. ALVORD, of Oklahoma.

Vice-Presidents,

A. A. JOHNSON, of Wyoming; T. B. COMSTOCK, of Arizona; A. Q. HOLLADAY, of North Carolina; E. B. CRAIGHEAD, of South Carolina; O. CLUTE, of Florida.

Secretary and Treasurer,

J. H. WASHBURN, of Rhode Island.

Bibliographer,

S. W. JOHNSON, of Connecticut.

Executive Committee,

H. H. GOODELL, of Massachusetts, *Chair.*; M. A. SCOVELL, of Kentucky; H. C. WHITE, of Georgia; H. P. ARMSBY, of Pennsylvania; *Ex officio:* The PRESIDENT; the JUNIOR EX-PRESIDENT (S. D. LEE, of Mississippi); the SECRETARY.

Chairmen of Sections,

Agriculture and Chemistry, E. B. VOORHEES, of New Jersey;
Botany and Horticulture, S. M. TRACY, of Mississippi;
College work, A. W. HARRIS, of Maine;
Entomology, C. P. GILLETTE, of Colorado;
Mechanic Arts, J. K. PATTERSON, of Kentucky.

Secretaries of Sections,

Agriculture and Chemistry, C. C. GEORGESON, of Kansas;
Botany and Horticulture, W. R. LAZENBY, of Ohio;
College work, H. H. WING, of New York;
Entomology, J. M. ALDRICH, of Idaho;
Mechanic Arts, F. P. ANDERSON, of Kentucky.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Alabama:

College: W. L. Broun, president; J. J. Wilmore, professor of mechanical engineering.

Station (Auburn): P. H. Mell, botanist and geologist.

Arizona:

College: T. B. Comstock, president.

Colorado:

College: A. L. Emigh, president of board of control.

Station: W. P. Headden, chemist.

Connecticut:

College (*Storrs*): B. F. Koons, president.

Station (*Storrs*): W. O. Atwater, director; C. D. Woods, vice-director and chemist.

Station (*State*): E. H. Jenkins, vice-director and chemist; W. E. Britton, horticulturist.

Delaware:

College: A. N. Raub, president; W. H. Bishop, professor of agriculture.

Station: M. H. Beckwith, horticulturist and entomologist.

Florida:

College: O. Clute, president.

Georgia:

College: H. C. White, president.

Station: R. J. Redding, director.

Illinois:

College: T. J. Burrill, professor of botany and horticulture; G. E. Morrow.

Indiana:

Station: C. S. Plumb, director.

Iowa:

College: H. Osborn, professor of zoology and entomology.

Kentucky:

College: J. K. Patterson, president; F. P. Anderson, professor of mechanical engineering.

Station: M. A. Scovell, director.

Louisiana:

College (Southern University, New Orleans): V. L. Roy, professor of chemistry and physics.

Maine:

College: A. W. Harris, president.

Maryland:

College: R. W. Silvester, president; W. T. L. Taliaferro, professor of agriculture; M. P. Scott, professor of biology and comparative anatomy; H. B. McDonnell, professor of chemistry; J. S. Robinson, professor of botany and horticulture.

Station: R. H. Miller, director; C. V. Riley, entomologist and physiologist; H. J. Patterson, chemist; E. H. Brinkley, assistant agriculturist; S. Key, assistant soil physicist; J. R. Owens, treasurer.

Massachusetts:

College: H. H. Goodell, president.

College (Institute of Technology): W. W. Tyler, professor of mathematics.

Michigan:

College: L. G. Gorton, president; C. W. Garfield, trustee.

Station: C. D. Smith, agriculturist.

Minnesota:

College: W. M. Hays, professor of agriculture.

Mississippi:

College: W. C. Welborn, professor of agriculture.

Station: S. M. Tracy, director.

Missouri:

College: R. H. Jesse, president.

Nebraska:

College: L. Bruner, instructor in entomology.

New Hampshire:

College: C. S. Murkland, president.

New Jersey:

College: A. Scott, president.

Station (State): E. B. Voorhees, director.

Station (College): B. D. Halsted, botanist and horticulturist.

New Mexico:

College: S. P. McCrea, president.

Station: A. E. Blount, agriculturist and horticulturist.

New York:

Station (Cornell): I. P. Roberts, director; H. H. Wing, deputy director and secretary.

North Carolina:

College: A. Q. Holladay, president; B. Irby, professor of agriculture.

Station: F. E. Emery, agriculturist.

North Dakota:

College: J. B. Power, president.

Station: E. F. Ladd, chemist.

Ohio:

College: W. H. Scott, president; T. J. Godfrey, trustee; T. F. Hunt, professor of agriculture; W. R. Lazenby, professor of horticulture.

Station: W. J. Green, vice-director and horticulturist.

Oklahoma:

College: H. E. Alvord, president.

Pennsylvania:

College: G. W. Atherton, president.

Station: H. P. Armsby, director; W. Frear, vice-director and chemist.

Rhode Island:

College: J. H. Washburn, president; W. E. Drake, professor of mechanical engineering.

Station: C. O. Flagg, director.

South Carolina:

College: E. B. Craighead, president.

Station: W. L. McGee, agriculturist.

Tennessee:

College: T. C. Karns, professor of philosophy and pedagogics.

Station: C. F. Vanderford, secretary.

Vermont:

College: M. H. Buckham, president.

Station: J. L. Hills, director.

Virginia:

College (Hampton): C. L. Goodrich, instructor in agriculture.

West Virginia:

College: F. W. Raue, professor of agriculture.

Station: J. A. Myers, director; R. De Roode, chemist.

Wisconsin:

College: N. D. Fratt, trustee.

Station: W. A. Henry, director.

Wyoming:

College: A. A. Johnson, president.

U. S. Department of Agriculture:

C. W. Dabney, jr., Assistant Secretary.

Office of Experiment Stations: A. C. True, director; E. W. Allen, assistant director; W. H. Beal, W. H. Evans, J. F. Duggar, F. C. Test.

Bureau of Animal Industry: D. E. Salmon, chief.

Division of Chemistry: H. W. Wiley, chief.

Division of Forestry: B. E. Fernow, chief.

Division of Agricultural Soils: M. Whitney, chief; C. C. Moore, jr., J. P. Alexander, jr.

Division of Pomology: W. A. Taylor.

Weather Bureau: A. McAdie.

W. P. Cutter, librarian.

Canada:

Ontario Agricultural College: J. Mills, president.

Visitors:

E. Willits, J. R. Dodge, H. W. Diederich, J. W. Hoyt, G. De Chalmot, J. Hamilton, W. Thompson, jr.

CALL FOR THE CONVENTION.

By authority of the executive committee, a delegate convention of this Association is hereby called to meet in the city of Washington, D. C., on Tuesday, November 13, 1894, at 10 o'clock a. m.

[Here follow extracts from the constitution relating to membership and finances.]

In accordance with the provisions of the constitution, the Section on Agriculture and Chemistry and the Section on Entomology have been designated "to present in general session a portion of the subjects coming before them."

Upon proper application, notice is hereby given of the organization of a Section on Station Work which will be assigned position in the programme for this convention.

Mr. Cavitt, from the State Agricultural and Mechanical College of Texas, offered at the last convention the following as a proposed amendment to the constitution, and the same will therefore be subject to action by the convention now called, viz: Change the article entitled "Name" so that the same shall read:

Name.—This Association shall be called The Association of American Agricultural and Mechanical Colleges and Experiment Stations.

The headquarters of the Association will be at the Ebbitt House.

The general programme, and programmes for the sections will be duly issued, together with a circular of information as to travel, hotel rates, and places of the meetings.

For the executive committee:

HENRY E. ALVORD,
Chairman.

M. A. SCOVELL,
Secretary.

PROGRAMME.

TUESDAY, NOVEMBER 13, 1894.

9 a.m.—Meeting of the executive committee at the Ebbitt House.

10 a.m.—General session. Reports of committees and chairmen of sections.

2 p.m.—General session. Reports from chairmen of sections.

4 p.m.—All sections meet for organization and preliminary business.

7.30 p.m.—General session. New and miscellaneous business.
Annual address by the President of the Association.

9 p.m.—Meetings of Sections on College Work, Horticulture and Botany, and Entomology.

WEDNESDAY, NOVEMBER 14, 1894.

9 a.m.—General session. General business.
Consideration of proposed amendment to constitution (see Proceedings of Convention of 1893, p. 63) and action thereon.
Address by Prof. J. W. Hoffman, Ph. D., Director of Agricultural Department, Tuskegee Institute, Ala., on The Colored Farmers of Alabama.
Address by Hon. William T. Harris, LL. D., Commissioner of Education, Department of the Interior.

2 p.m.—Meetings of the Sections on Agriculture and Chemistry, on Mechanic Arts, on Entomology, and (Provisional Section) on Station Work.

7.30 p.m.—General session. Reports on resolutions, appointment of committees, etc.
Presentation of subjects from the Section on Agriculture and Chemistry.

THURSDAY, NOVEMBER 15, 1894.

9 a.m.—General session. Action on resolutions, committee reports, and business from sections. Election of officers.
Address by Inspector-General Breckinridge, United States Army.
Address by Hon. Charles W. Dabney, jr., LL. D., Assistant Secretary of Agriculture.

2 p.m.—Meetings of the Sections on College Work, on Horticulture and Botany, and on Entomology.

7.30 p.m.—General session. Nominations and other reports from the sections.
Presentation of subjects from the Section on Entomology.
Adjournment of the convention.

9.30 p.m.—Social gathering at the Ebbitt House. Reception tendered by the Association to the Secretary of War, the Secretary of the Interior, and the Secretary of Agriculture.

PROGRAMMES FOR THE SECTIONS.

I. Section on Agriculture and Chemistry.

1. The Scope of the Short Courses in our Agricultural Colleges. Discussion to be opened by H. H. Wing, of New York, and J. L. Hills, of Vermont.
2. Shall the Full Course in Agriculture be Specialized? H. J. Waters, of Pennsylvania, and C. C. Georgeson, of Kansas.
3. The Attitude of the Agricultural Colleges toward University Extension, W. C. Latta, of Indiana, and S. M. Emery, of Montana.
4. The Office of the Station Bulletin, H. H. Goodell, of Massachusetts, and M. A. Scovell, of Kentucky.
5. Cooperation of Experiment Stations in Field Experiments and Dairy Investigations, C. D. Woods, of Connecticut, and W. W. Cooke, of Colorado.
6. Cooperation of Stations with Farmers' Organizations in Experiment Work, E. H. Jenkins, of Connecticut, and F. E. Emery, of North Carolina.

Note.—The gentlemen assigned are not expected to prepare written papers, but merely to give form and character to the discussion of the topics named.

II. Section on Entomology.

1. The Use of Arsenites on Tobacco, H. Garman, of Kentucky.
2. The Entomological Work of Experiment Stations, H. Osborn, of Iowa.
3. The Economic Value of Parasites, F. M. Webster, of Ohio.

III. Section on Horticulture and Botany.

1. Two Fungus Diseases of Oats Prevalent in Maine, F. L. Harvey, of Maine.
2. Fertilization of Grape Flowers, S. A. Beach, of Geneva, N. Y.
3. Proper Position of Hybrids in the Classification of American Grapes, H. N. Starnes, of Georgia.
4. Effect of Change of Soils upon Growth of Wheat, H. L. Bolley, of North Dakota.
5. A Contribution to the Life History of *Glœosporium fructigenum*, Berkeley, and *Sphæropsis malorum*, Peck., William B. Alwood, of Virginia.
6. What Shall Constitute a Variety from the Standpoint of the Horticulturist? G. W. McCluer, of Illinois.
7. Position of Greenhouse Benches for Experiment Work, and Construction of Greenhouse Benches for Subirrigation, W. J. Green, of Ohio.
8. Determination of Sex in *Shepherdia argentia* by Bud Characters, L. C. Corbett, of South Dakota.
9. Field Experiments with Fungicides, B. D. Halsted, of New Jersey.
10. Weed Migration in the State of Iowa, and Rot of Ruta-bagas, L. H. Pammel, of Iowa.
11. Plant Breeding at the Experiment Stations, E. S. Goff, of Wisconsin.

PROCEEDINGS.

MORNING SESSION, TUESDAY, NOVEMBER 13, 1894.

The convention was called to order at 10.30 a. m. in the hall of the Cosmos Club by Vice-President G. E. Morrow. The meeting was opened with prayer by President M. H. Buckham, of the University of Vermont.

The CHAIRMAN. We are deprived to-day of the presence of our president, General Lee. I need not say that we all regret this, or that he regrets it as much as we do. It is no lack of interest in the Association that keeps him away; it is the condition of his invalid wife, which makes it unsafe for him to leave her for even a day at a time. Very recently he decided that he would be unable to come, and he wished me to express his regret that this was the case and his best wishes for the Association, for its work, and for this meeting in particular. It becomes my duty, as best I can, to stand for a time in his place.

We will first listen to the report of the executive committee, H. E. Alvord, chairman.

REPORT OF THE EXECUTIVE COMMITTEE.

The committee chosen at the Chicago convention organized for the year 1893–94 by electing as chairman, Henry E. Alvord, of the District of Columbia, and as secretary, M. A. Scovell, of Kentucky.

The several subjects referred to the committee by the last convention have received due consideration and action. Reports upon some of them have been made by circular. The committee has performed its duty in preparing for the present convention, and submits for approval the programme as printed.

This convention being held in Washington, it has seemed desirable to make engagements for participating in the proceedings with officials representing the three Executive Departments of the Government with which the institutions composing the Association (in the main) have official relations. Invitations have therefore been extended to and accepted by those officers who have most direct connection with the colleges and stations, and are best informed as to their work.

The colleges or branch institutions for the instruction of colored youth in agriculture and the mechanic arts, all eligible to membership in this Association, have been represented at the annual conventions in two or three instances by one or two delegates, but have never participated in the proceedings or presented any of the results of their work. A similar institution in Alabama, not a beneficiary of the Morrill acts, but entitled by courtesy to a seat in this convention, gave notice of its purpose to send a delegate to this meeting and this person has been assigned a place in the programme to describe some of the work done by the institution which he represents.

As so often before, the committee found it necessary to give close attention to the progress of legislation during the last session of Congress, to guard the various interests intrusted to the institutions composing this Association.

The Sayers bill, repealing all permanent appropriations from the Treasury—including, of course, the annuities under the Morrill Act of 1890—and substituting a system of annual appropriations for all purposes, was in a doubtful state for months. It has never been reported from the committee, but may yet appear at the coming session of Congress. The subject received careful attention, and your committee is confident that if the bill is reported, it will include several exceptions, and the college annuity will be among them.

During the early spring a proposition appeared very unexpectedly, incorporated in the Army appropriation bill, cutting off the commutation of quarters for officers on duty at colleges and requiring every college, before receiving such detail, to provide quarters free for the officer. This measure had the almost unanimous support of the Committee on Military Affairs, including some of the strongest men on both sides of the House of Representatives. For a time it seemed probable this provision would pass the House, but active measures secured the interest of members friendly to the colleges, and the objectional features were struck from the bill when in Committee of the Whole House. This was a short but spirited contest, and very satisfactory in showing once more the strength which this Association can command—in the halls of Congress—when necessary to sustain a good cause.

This movement, combined with other circumstances, made it inexpedient to do anything toward bringing forward the plan of having the War Department supply uniform clothing and camp equipage to the land-grant colleges the same as to the Army. This plan is favored by the Inspector-General of the Army, and would not be objected to by other high officers. But the present Quartermaster-General of the Army, whose Bureau would be affected by such a law, is unalterably opposed to the project. The increase in the number of officers on college and school duty, and correspondingly of the young men and boys by them instructed, would make the expense of uniforms very great, if supplied to all, and for that reason the proposition will be opposed by the Secretary of War. Altogether, your committee considers it unwise for the Association to agitate this subject further at present, beyond giving moral support to the officials of the War Department who may declare in its favor.

There are other points of interest in connection with the military departments of land-grant colleges which seem to need attention at the War Department. Army officers naturally favor those institutions which furnish the greatest number of persons for drill and which give special prominence to the military feature, by requiring uniforms to be worn at all times, keeping students under military regulations continually, and placing the entire subject of discipline in charge of the military professor. In the recently published report of the Adjutant-General of the Army, that officer recommends the detail of officers to largely attended city high schools rather than to land-grant colleges offering fewer students for drill, and proposes that the law be changed so that no officer shall be detailed to any institution having less than 150 students actually present and required to perform military duty. Already the Department has refused to detail officers to some of the smaller agricultural and mechanical colleges, on the ground that they had too few students in attendance, notwithstanding the legal obligation to teach military tactics at these colleges. In short, despite the phraseology of the existing law, the Department reserves the right to refuse a detail to any college for reasons sufficient to itself, and as mentioned, there are indications of a tendency to discriminate against land-grant colleges.

Since the last full conference between a representative committee of this Association and the War Department officials (in 1890), the latter have entirely changed in personnel with the exception of the Inspector-General. It seems well, in view of these facts, for this convention to consider whether it would not be wise for the Association to provide for another formal conference on military matters with the Secretary of War and his assistants.

In accordance with the action of the Association, the attention of the Secretary of the Interior has been called to the inadequacy of the provisions in the Bureau of Education for maintaining suitable relations with the land-grant colleges and giving them such assistance as seems proper and practicable on the part of the Department. The Secretary has expressed himself as fully appreciating this subject, and although he has not found it expedient to take decided action as yet, he has declared his intention of doing so at an early date, somewhat on the line of the Office of Experiment Stations in the Department of Agriculture. It seems probable that this matter will receive the necessary attention without further effort on the part of this Association.

Based upon the action of the Association at its last convention, your committee proposed to the Committee on Agriculture of the House of Representatives an addition to the annual appropriation bill, giving to the Secretary of Agriculture supervisory powers in connection with the expenditure of experiment station funds under the Hatch Act. The Department of Agriculture concurred in this proposition and the new legislation was perfected as announced by Association circular. Subsequently the Department invited the cooperation of this committee, as representing the interest of the stations, in preparing the "Form of annual financial statement" to be "prescribed" by the Secretary with accompanying schedules and regulations. The committee consulted station treasurers, accountants, and other officers as far as time and circumstances permitted, and a special and prolonged meeting was held in this city in this connection. Various opinions were developed, as was to be expected, but a compromise conclusion was reached which, in the main, accorded with the views of nearly all, and this was substantially adopted by the Department. The perfected form of the papers and the model report and schedules are to be credited to the Office of Experiment Stations.

This legislation and the resulting form of report has been regarded as a matter of great importance by your committee, and it is hoped that the end attained will meet with general approbation. It could not be expected to satisfy the views of all in matters of detail. It seems to be a question not yet decided whether the Department should confine its supervision to a critical examination of the annual reports, rendered after the year has closed to which they refer, or should adopt other means to "ascertain whether the expenditures under the [Hatch Act] appropriation * * * are in accordance with the provisions of the said act," during the progress of the active operations of the station year. There is certainly grave doubt as to the sufficiency of the financial reports alone giving the Secretary of Agriculture the necessary information to enable him to do justice to the stations and their work in his required report to Congress thereon. It may be well for the representatives of the stations at this convention to give some expression to their views on this part of the subject.

The lectures of Sir Henry Gilbert, LL. D., F. R. S., etc., as special delegate from the Lawes Agricultural Trust for the year 1893, were commenced under the auspices of this Association at its last convention, and were concluded at the Massachusetts Agricultural College. These lectures comprise the only complete and authorized review of the famous investigations of Lawes and Gilbert at Rothamsted during a half century. The manuscript has been revised by Dr. Gilbert, and your committee is gratified to be able to announce that the Department of Agriculture has liberally and wisely decided to publish the lectures entire, as a special bulletin from the Office of Experiment Stations.

A very cordial letter has been received, through the Office of Experiment Stations, from Dr. P. Nobbe, president of the Association of Agricultural Experiment Stations of the German Empire, inviting participation in the annual meeting of that body by any and all representatives of the stations in this country. The seventh general meeting of the German Association was held at Dresden in September last. It would be appropriate for this eighth convention of the American Association to reciprocate this courteous attention, and the suggestion is offered that this convention might inaugurate a system of international conference and cooperation through representative delegates.

During the past year the executive committee has issued five circulars of information in the interests of the Association. The last of these, dated November 1, 1894, relates to procuring busts of Senator Morrill for such colleges as want them. This circular is distributed at this convention with a view to having action taken here which will save the executive committee much correspondence and probably insure more satisfactory results than could be obtained by letters.

At the adjournment of the last convention there was a very small cash balance in the treasury of the Association and a debt of about $1,000 existed, resulting from the work of the Association at the Columbian Exposition. The Chicago convention fixed the annual contribution at $15 for the purpose of meeting this debt. Ninety-four institutions have responded to this call and your committee is pleased to announce that the Association is now free from debt, and the report of the treasurer will show enough cash on hand to meet all the expenses of the present convention and leave a balance larger than a year ago. It is believed that a contribution of $10 from every college and every station eligible will be sufficient for the needs of the Association during the coming year.

Appended is a list of the institutions eligible to membership in this Association, but which, under the provisions of the constitution (title, "Finances"), are not entitled to representation in this convention.

Although the executive committee, after mature deliberation, deemed it unwise to hold the convention of 1894 during the summer months, it is of the opinion that the preference for a summer meeting, frequently expressed by many, should be regarded, and the time fixed accordingly for the convention of 1895. The chief difficulty will be found in combining with such a time the conditions which seem essential as to place. When not meeting at Washington, there is a very general wish to visit some associate institution which is in session, and at the same time ample hotel accommodation and good railroad facilities are prerequisites of a successful convention.

Since the programme for this convention was printed, President Lee has been compelled, by reason of illness in his family, and much to his regret, to deny himself the pleasure of attending this meeting. He sends fraternal greetings, and has joined his associates of the executive committee in requesting Vice-President Morrow to preside in his stead and deliver the annual address.

Respectfully submitted, for the executive committee.

HENRY E. ALVORD, *Chairman*.

WASHINGTON, D. C., *November 13, 1894*.

(Mr. Alvord then read a statement of a personal nature, setting forth his inability to continue as chairman of the executive committee.)

On motion of Mr. Johnson, of Wyoming, the report of the executive committee was adopted and ordered printed in the proceedings of the convention.

On motion of Mr. Armsby the programme of the executive committee and the rules of order were adopted by the convention.

The CHAIRMAN. The next business will be the report of the treasurer.

Mr. Scovell read the report, as follows:

REPORT OF THE TREASURER OF THE ASSOCIATION.

M. A. Scovell, treasurer, in account with Association of American Agricultural Colleges and Experiment Stations.

Balance on hand at last meeting	$9.63
Moneys received since last meeting—dues, 1892–93	40.00
Dues, 1893–94	1,400.00
Total	1,449.63
Expenditures	1,367.33
Balance on hand	82.30

EXPENDITURES.

Stationery and printing	88.40
Dairy test committee	1,031.44
Subcommittee on "Form of report"	111.74
Rental, room in Washington	78.00
Stenography (Washington)	37.00
Sundries	20.75
Total, as above	1,367.33

ITEMIZED STATEMENT.

Receipts.

1893.		
Nov. 21.	Florida Experiment Station	$10.00
1894.		
Jan. 4.	North Dakota Agricultural College	10.00
26.	South Dakota Agricultural College	10.00
Feb. 8.	Washington Experiment Station	10.00
Mar. 31.	Cornell University Experiment Station	15.00
31.	Agricultural and Mechanical College of Alabama	15.00
31.	Alabama Experiment Station	15.00
31.	Delaware College Agricultural Experiment Station	15.00
Apr. 4.	Hampton Normal and Agricultural Institute of Virginia	15.00
4.	North Carolina Experiment Station	15.00
4.	Massachusetts Agricultural Experiment Station	15.00
4.	Massachusetts Hatch Experiment Station	15.00
4.	Massachusetts Agricultural College	15.00
4.	Arkansas Agricultural Experiment Station	15.00
4.	Missouri Agricultural Experiment Station	15.00
4.	Connecticut Agricultural Experiment Station	15.00
4.	Virginia Agricultural and Mechanical College	15.00
4.	Virginia Agricultural Experiment Station	15.00
4.	West Virginia Agricultural Experiment Station	15.00
5.	University of Tennessee	15.00
6.	Mississippi Agricultural and Mechanical College	15.00
6.	Mississippi Experiment Station	15.00
7.	Georgia Experiment Station	15.00
9.	North Carolina College of Agriculture and Mechanic Arts	15.00

Receipts—Continued.

1894.			
Apr.	9.	Louisiana State University and State Agricultural and Mechanical College	$15.00
	9.	Maryland Agricultural College	15.00
	9.	State Agricultural College of Colorado	15.00
	10.	Ohio Experiment Station	15.00
	11.	University of Tennessee Agricultural Experiment	15.00
		Station	15.00
	11.	Storrs Agricultural College Experiment Station	15.00
	11.	Delaware Agricultural College	15.00
	12.	Iowa Agricultural Experiment Station	15.00
	12.	Purdue University	15.00
	12.	Cornell University	15.00
	12.	Ohio State University	15.00
	12.	Agricultural and Mechanical College of Kentucky	15.00
	12.	Pennsylvania State College	15.00
	12.	Louisiana Experiment Station	15.00
	12.	Pennsylvania Agricultural Experiment Station	15.00
	18.	Maine State College	15.00
	18.	University State of Missouri Agricultural College	15.00
	18.	Iowa Agricultural College	15.00
	18.	Oregon State Agricultural College	15.00
	19.	University of Minnesota Experiment Station	15.00
	21.	Montana	15.00
	21.	Maryland Agricultural Experiment Station	15.00
	21.	Rhode Island Agricultural Experiment Station	15.00
	21.	Rhode Island Agricultural College	15.00
	23.	Agricultural Experiment Station University of Arizona	15.00
	23.	University of Arizona	15.00
	23.	New Hampshire College of Agriculture and Mechanic Arts	15.00
	26.	University of Minnesota	15.00
	28.	Vermont Agricultural Experiment Station	15.00
	28.	New Hampshire Agricultural Experiment Station	15.00
	28.	Kansas State Agricultural College	15.00
	28.	Kansas Agricultural Experiment Station	15.00
	30.	Purdue Experiment Station	15.00
	30.	New Jersey State Agricultural Experiment Station	15.00
May	2.	Nevada State University	15.00
	2.	Nevada Agricultural Experiment Station	15.00
	10.	Sheffield Scientific School	15.00
	15.	University of Vermont and State Agricultural College	15.00
	16.	University of Wisconsin	15.00
	16.	University of Wisconsin Agricultural Experiment Station	15.00
	17.	Nebraska Agricultural Experiment Station	15.00
	17.	Michigan Agricultural College	15.00
	17.	Michigan Agricultural Experiment Station	15.00
	17.	Kentucky Agricultural Experiment Station	15.00
	21.	University of Nebraska	15.00
	26.	New Mexico Agricultural and Mechanical College	15.00
	26.	Agricultural Experiment Station of New Mexico	15.00
	28.	University of California	15.00

Receipts—Continued.

1894.		
June 4.	Georgia State College of Agriculture and Mechanic Arts	$15.00
9.	Experiment Station University of Illinois	15.00
9.	Rutgers Scientific School, New Jersey College	15.00
9.	State Agricultural Experiment Station of Colorado	15.00
30.	West Virginia University	15.00
July 2.	University of Illinois	15.00
16.	New Jersey State Agricultural College Experiment Station	15.00
27.	Maine Experiment Station	15.00
Aug. 8.	South Dakota Agricultural College	15.00
8.	South Dakota Agricultural Experiment Station	15.00
16.	Wyoming University	15.00
16.	Wyoming Experiment Station	15.00
30.	Washington Agricultural College Experiment Station, balance	5.00
Sept. 13.	Utah Agricultural College and Experiment Station, in part payment	20.00
14.	North Dakota Agricultural College	15.00
14.	North Dakota Experiment Station	15.00
14.	North Dakota Station, dues 1892-93	10.00
19.	Oklahoma College	15.00
Oct. 5.	Texas Agricultural and Mechanical College	15.00
8.	Clemson Agricultural College	15.00
8.	South Carolina Experiment Station	15.00
20.	Utah Agricultural College and Station, balance due	10.00
22.	Oklahoma Experiment Station	15.00
29.	Massachusetts Institute of Technology	15.00
July 11.	Florida College and Station, on dues 1893-94	20.00
Nov. 12.	Southern University Louisiana	15.00
	Total	1,440.00

Expenditures.

1894.		
Apr. 21.	Sarah S. Johnson, rent of room at 932 New York avenue, Washington, for use of executive committee for three months	$42.00
21.	Dr. H. P. Armsby, expenses dairy committee	142.05
21.	S. M. Babcock, expenses dairy committee	111.31
23.	I. P. Roberts, expenses dairy committee	156.26
28.	Judd & Detweiler, printing and stationery	30.00
28.	S. M. Babcock, expenses dairy test committee to October 1	69.00
28.	M. A. Scovell, expenses dairy test committee	183.40
May 12.	Transportation Printing Company, printing letterheads, bills, etc	10.90
July 9.	H. P. Armsby, balance expenses dairy committee	64.70
9.	S. M. Babcock, balance expenses dairy committee	96.00
21.	I. P. Roberts, balance expenses dairy committee	100.00
21.	M. A. Scovell, balance expenses	108.72
21.	Sarah S. Johnson, rent of room, Washington, for office executive committee from April 30 to June 30	36.00
21.	Ebbit House, board executive committee	28.00

Expenditures—Continued.

1894.			
Sept.	29.	H. H. Goodell, expenses Washington committee on report	$30.00
Oct.	5.	H. P. Armsby, expenses Washington committee on report	21.04
	5.	M. A. Scovell, expenses Washington committee on report	32.70
	5.	Express on programmes and circulars	.75
	18.	M. E. Olcott, stenographic work	37.00
	18.	Judd & Detweiler, printing	28.50
		Postage and stationery	6.75
Nov.	13.	Paid H. E. Alvord, sundry expenses	20.00
	13.	Paid Judd & Detweiler, printing	12.25
		Total	1,367.33

On motion of Mr. Vanderford, the report was referred to an auditing committee of three, appointed by the chair, consisting of Messrs. Vanderford, Buckham, and Godfrey.

The CHAIRMAN. I will call now for the report of the Section on Agriculture and Chemistry, to be presented by Mr. Henry, of Wisconsin.

Mr. HENRY. The Section on Agriculture and Chemistry occupies so large a part of the proceedings of this body that I have no special report to make, believing that the time can be better occupied by the general session. There was no special work before the section.

There were no reports from the sections on College Work, Botany and Horticulture, and Entomology.

The CHAIRMAN. The remaining section is that on Mechanic Arts.

Mr. WASHBURN, of Rhode Island. I have no special report to make for the Section on Mechanic Arts. I do not know why this section was not included on the regular programme. I presume the report was not received in time, for which I am sorry. I did not know but that it was because a section on mechanic arts has no business in an association of American agricultural colleges, and I do not suppose that it has. I think it really ought to be an association of American agricultural and mechanical colleges. I will say, however, that we have a very good programme, and I invite all who are interested in the mechanic arts to attend our session.

The CHAIRMAN. This report will be received without formal motion. The reports have been surprisingly brief.

Mr. ARMSBY, of Pennsylvania. I dislike to appear in the rôle of a critic, but with your permission I wish to read a short section from the constitution on the duties of officers:

(3) The chairman of each section shall make, at the annual convention, a report to the Association in general session of the progress during the preceding year of the subject or subjects appertaining to his section, and such reports shall not occupy more than twenty minutes each.

The words I wish to say, Mr. President, are not dictated by any desire to criticise, but simply for the good of the Association. When this provision was adopted, it was adopted, as I understand it, with the thought that such reports of progress on what had been going on in the different departments during the past year would be of great value to the Association in helping to weld together the sections into which otherwise the Association would almost inevitably split up. It seems to me unfortunate, at least, that this idea, underlying this provision of the constitution, can not in the future be carried out. I repeat that I make this suggestion simply in the interests of the Association, and not from any desire to find fault.

The CHAIRMAN. I desire to add my word to what has been so well said. I heartily believe in the great value and wisdom of the course of the Association in dividing into sections, but I should also consider it a great misfortune if the failure to make these reports should tend to separate us, so that all our work except purely formal work in general session be done in sections.

Mr. ALVORD. I move that those portions of the report of the executive committee referring to military department matters and to the procuring of the Morrill bust be referred bodily to the Section on College Work for consideration.

Ordered.

Mr. ALVORD. I now move that the portions of the report of the executive committee relating to new legislation regarding station funds and to the invitation from the German Association of Experiment Stations be referred to the new provisional section on station work for its consideration.

Adopted.

Mr. ALVORD. For the executive committee, I now ask leave to read two paragraphs of the constitution, relating to membership:

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture or mechanic arts who shall attend any convention of this Association may be admitted to similar privileges.

I am instructed to move that the chiefs of the several divisions and bureaus of the Department of Agriculture be admitted to the floor of this convention with all privileges under this provision of the constitution, and that all visitors who have registered and come under the fourth provision of membership be also admitted to the floor of this convention during its proceedings.

Adopted.

Mr. BUCKHAM. I move that the personal statement made to us by the chairman of the executive committee be referred to a committee of three, to be appointed by the chair, with instructions to report at a future meeting of this general session.

Adopted.

The CHAIRMAN. The chair will nominate the committee in a moment. Is there any further business?

Mr. BURRILL. It seems to me proper that we should send a greeting to our absent president, and, under the circumstances, a telegram of sympathy also. Therefore I move that the secretary be requested to send such a telegram to General Lee.

Ordered.

Mr. HARRIS. I understand that ex-Assistant Secretary of Agriculture Willits is in the city, and as he has been of such great service to this Association, I move that the secretary of this body be instructed to extend him an invitation to attend our meetings.

Ordered.

Mr. BUCKHAM. I am sure the Association will understand why I make this motion, which is, that the Association appoint a committee of three to wait upon Senator Morrill, who, I understand, is in town, and express to him the respect of this Association and invite him to attend our meetings.

Adopted.

The CHAIRMAN. Will the convention kindly designate this committee? There may be personal reasons for selecting certain members.

Mr. KOONS. I would name as chairman of the committee Mr. Buckham.

Mr. Harris named the chairman of the Association.

The CHAIRMAN. I will name Mr. Broun, of Alabama. The chair now announces as the committee on the personal statement made by the chairman of the executive committee, Mr. Buckham, of Vermont, who made the motion; Mr. Harris, of Maine, who is peculiarly fitted because of his intimate association with that work, and, that the other side of the Association may be represented, the chair will nominate Mr. Plumb, of Indiana.

Adjourned at 11.50 a. m.

EVENING SESSION, TUESDAY, NOVEMBER 13, 1894.

The convention was called to order at 7.45 p. m. by Vice-President Frear.

Mr. JOHNSON. I offer the following resolution:

Resolved, That the executive committee of this Association be requested to select Denver, Colo., as the place for the next annual meeting in 1895, if in harmony with the best interests of the Association, and that we suggest August 15 to October 1 as the most suitable season of the year.

If this resolution is seconded, I desire to present some very important matters from the city of Denver. (Mr. Johnson then read communications from the Denver Chamber of Commerce, the mayor of the city, the Mining Exchange, and the Manufacturers' Exchange, indorsing the invitation to meet at Denver in 1895. He vouched for the interest of Senators Teller and Wolcott in the work of the land-grant colleges, and set forth the advantages and attractions of Denver as a convention city.)

Referred to the executive committee.

Mr. HARRIS. There are reasons this year why we should give unusual attention to the selection of officers of the Association, and although this is a very early point in the convention, I think it wise to appoint a committee now to make nominations. I therefore move that the chair appoint a committee of three on nominations.

Mr. Alvord suggested that this committee had usually consisted of seven members.

Mr. Harris accepted the suggestion and the motion as amended was carried.

Mr. HAYS. I would like to say something regarding an invitation from Mr. Northrop for the Association to meet in Minnesota. We are ready and anxious to entertain you at Minneapolis. The invitation is given very heartily and comes from the two cities of St. Paul and Minneapolis. Regarding railroad rates, I am authorized to say by the representatives of the lines centering at Minneapolis that we shall be able to get for you rates of one or possibly one and one-half for the round trip.

Mr. SCOTT. I have no desire to enter Ohio in opposition to Colorado and Minnesota, but the Association has once or twice expressed a willingness to come to Ohio, and circumstances have intervened which made it desirable to meet elsewhere in both cases. We are ready to receive the Association whenever it desires to come, and will give it a cordial welcome.

Hon. Edwin Willits, ex-Assistant Secretary of Agriculture, who entered at this moment, was invited by the chair to address the convention. He responded very briefly, declining to make a speech, but expressing his pleasure at meeting the Association and wishing it continued growth.

The CHAIRMAN. I have a letter from the secretary of the Cosmos Club, stating that the privileges of the club are extended to the members of this Association during the present week.

A resolution was adopted that the Association accept with thanks the courtesy of the Cosmos Club.

Mr. Vanderford, chairman of the auditing committee, reported that the committee had examined the accounts of the treasurer and found them correct, with proper vouchers for each item of expenditure.

Report adopted.

The vice-president, G. E. Morrow, of Illinois, delivered the annual address as acting president of the Association.

PRESIDENT'S ADDRESS.

MR. CHAIRMAN, MEMBERS OF THE ASSOCIATION, LADIES AND GENTLEMEN: When at the meeting of the Association at Chicago last year the election of General Lee as president for the year was announced, it at once occurred to me that the choice was a peculiarly fortunate one, in that the Association would have the help of a wise counselor, and especially that those of us who should be able to attend this convention would have the pleasure of hearing an address from one who has had long and remarkably successful experience in the management of an institution which has peculiar features and in which we all feel a deep interest. Very recently, to my entire surprise, and I need not say regret, I learned that he would not be here, for the sad reason given. Recognizing that the time was very short to do it in, I wrote urging that he would at least prepare an address. He replied that the same cause which prevented his being present would prevent him from preparing an address, and requested me to deliver an address in his stead. I therefore stand, as best I may, in his place, and will read you such words as I have been able to prepare.

"The test of national welfare is the intelligence and prosperity of the farmer." These words by the graceful essayist, thoughtful student, and friend of his country and his kind, George William Curtis, may well stand at the head of an address before this Association, which owes the possibility of its existence to the belief by the people, represented by Congress, that the institutions it represents would be helpful to the national welfare; and this by adding directly to the intelligence of the farmers of the country by giving them the best special education for their work, and thus aiding their prosperity, and by directly advancing their prosperity by communicating to them the results of research and investigation as to methods by which they can most profitably conduct their business.

We may not easily overestimate the extent and importance of the work this Association represents. No longer with boastfulness and exhilaration do thoughtful Americans speak of the vastness of our country and the problems that confront us. As a nation we have passed beyond the buoyancy of spirit and impulsive confidence of youth to the cares, anxieties, and thoughtfulness of maturity. And so, not boastfully nor flippantly—perhaps almost appalled, but rather, let us hope, stimulated to increased effort by the vastness and importance of the field of labor—we recognize the fact that the interest we represent is, by far, the chief material interest of this great nation; the one on which millions of our citizens directly depend for their livelihood, and the one the prosperity or adversity of which most quickly and most directly affects the welfare of all classes. Not more honorable than other needed industries, agriculture is the great basal industry of the world on which others peculiarly depend.

This great industry shares the depression which has affected all the working forces of our land. Aside from this, as we hope, temporary depression, American agriculture is in a transition stage, and none of us may with certainty predict the outcome in all directions. In a degree greater than ever before the American farmer is feeling the effects of direct competition with a vastly increased number of his fellows in his own land and of many millions in many other lands. In the sale of his products he is made aware of the fact that whether or not modern civilization has made all the world more akin in kindly feeling and mutual helpfulness, it has brought all people closer together in the competition of trade. He realizes that modern means of transportation have made the supply of an agricultural product almost anywhere in the world an appreciable factor in supplying the demand for that product almost anywhere else in the world. If he be thoughtful he must recognize the fact that in the future he must work on a narrower margin of possible profit than in the past. He sees that economical methods of production are the foundation essentials to success; and he is asking more earnestly than ever before how he may most wisely dispose of and distribute the products of his farm. He is beginning to ask not only for new or better methods of production, but whether there be not new crops he may wisely produce, or whether there be not new uses for old crops, and thus the stress of competition in supplying the old wants be lightened.

As we look over the field we see the commencement or the full progress of agricultural changes, the outcome of which we await with interest if not with anxiety.

We find the available public lands practically exhausted. Nowhere, in all the country, is there any considerable body of Government land now available for ordinary agricultural operations. Consequent upon the almost unparalleled drought of the year we are seeing a backward ebb of the tide of farmers that has steadily flowed westward, and the conviction on the part of many that there are large areas which have been settled by farmers but which must be abandoned by them unless irrigation can be made practicable. We have heard overmuch perhaps of the abandoned farms in the oldest settled portions of the country, but it is clearly true that over large areas prices for farm lands have been greatly lowered; that much land once regularly cultivated is now waste. Alongside this we see other large areas, with great natural fertility or exceptional artificial advantages, in which prices for farm lands have advanced until they seem to have reached a maximum under present conditions.

The extent and rapidity of the changes in our farming population may well give us concern. There are three great drainage systems carrying vast numbers of our people from farms. Two of these are inevitable, and if we are wise we will not fight the inevitable. We will not only submit, but adapt ourselves to it. The first of these drains is that from the country to the city. This will continue. The percentage of our farmers, as compared with those engaged in other callings, will become smaller. There is no lack of agricultural products. We produce much more than we consume. We feed our rapidly increasing population and have an increasing surplus for export. Often three-fourths of all the exports from our country in a year are those of agricultural products. The second of these drains is that from the farms of the older to those of the more newly settled portions of the country. This means no loss of productive power; only change of the place where it is exercised. This movement is inevitable and clearly wise in many cases. When the real or supposed advantages of different sections of the country are more nearly equalized, it will cease in large degree. The third of these drains is in full progress in my own State, and I witness it with regret, and protest that it is not, at least it ought not to be, inevitable. This is the removal of farmers when they have acquired a competence or have passed the prime of life from the farms to the country towns and villages. The results are often unfortunate for these farmers and their families; not always desirable to the communities to which they go, and very often deplorable to the communities they leave. In many cases there is not only the loss of wise, energetic, experienced men, but the advent of a tenantry distinctly inferior as citizens and farmers. In a multitude of farming communities there has been a marked retrogression during the last twenty years in the intellectual and moral tone, as well as in the appearance of and methods pursued on the farms.

An increase not only in the number but in the percentage of tenants on American farms seems inevitable, unless there is a recasting of our system of land tenure. Whether such increase of the tenantry is to be a great misfortune will depend on the character of the tenantry and the terms on which they hold the land. If the system be one of equitable partnerships between landowners and those who furnish not only labor but skill, there need be nothing of degradation or injustice to either party. If the system be one in which wealth and intelligence dictates terms to ignorance and poverty, which can furnish only labor without skill, the results will be bad for the tenants, bad for our agriculture, and bad for national welfare. Emerson has said: "That that is bad for the bee can not be good for the swarm."

There are great changes in our land ownership. In some parts of the country the process of subdivision of farms seems to be going on. It will be a great misfortune if this be carried to the extent that shall bring us a peasant proprietorship. In other sections there is a manifestation of "land hunger" by the rich. An instance comes to mind of a multimillionaire of the metropolis of the central west, largely interested in banks, in railways, in mines, in manufacturing enterprises; the coiner of the phrase "speculation is civilization," and steadily striving to prove his own advanced civilization by the extent of his speculative operations—this man is the owner of tens of thousands of acres of farm lands, and is quietly adding other thousands to them year by year. This is but one of many cases of like character. What they may mean may well give us pause.

Much as the labor question has been in evidence one phase of it has received little attention. When a manufacturing establishment closes its doors and hundreds or thousands of workmen are thrown out of employment we properly regard it as a great misfortune. Many have not seriously considered the fact that, largely because of the nature of the work, but partly because of the peculiarities of our farming system, each year, on the approach of winter, not hundreds, not thousands, not scores of thousands, not hundreds of thousands, but literally millions of men and boys employed on the farms of the United States during summer are thrown into comparative or absolute idleness, so far as work on the farms is concerned. The unequal demand for labor at different seasons of the year is one of the weak places in our farming system. A thoughtful observer from France has recently called attention to this, and emphasized, as one cause of it, the absence of minor agricultural industries. We are lacking in farm manufacturing. This same observer was much impressed by and highly complimented the perfection of our farm machinery, as have multitudes of other intelligent students of our agriculture. This large use of machinery makes necessary both intelligent direction and intelligent workmen on our farms.

In many ways the ingenuity of the inventor and the skill of the mechanic are adding to the productive power of our farms. Not always have we been able to equally rapidly find markets for these products.

These are some of the conditions seen by thoughtful students of American agriculture, and each suggests great problems not fully solved.

If we look at special conditions of the year, we are confronted by the effects of the most disastrous drought ever known in our country, measured by the diminution of farm products. How far can irrigation be made practicable; what are the best methods of introducing the system where it is practicable; how can we best conserve the rainfall where this is deficient, and how best reduce evaporation during drought, are questions which ask themselves.

We see the end, we may hope, of the reduction in price of one of our great cereals, a reduction which has caused wheat to cease to be used almost exclusively as food for man and led to perhaps one-seventh of the crop for the year being fed to farm animals. It would seem that efforts to induce Europeans to use maize as food for man might be suspended for a time while we urge them to more largely use wheat.

To the agricultural colleges and experiment stations is given the duty and privilege of carefully considering and trying to solve the problems suggested by this hasty sketch—and others like them.

I closely associate the two classes of institutions here, as I always do in my thought. It is well they are linked together in the name of this Association, as they are by law. In exceptional cases it has been thought best to separate them, but I wish to emphasize my earnest conviction that, as a rule, an intimate union is best for both; that the teacher should investigate and the investigator teach. That there are difficulties in the proper adjustment of the work is freely admitted. Usually the attempt to make an equal division of time and thought between the two classes of work will be unwise. But for teacher, investigator, student, and the farming public, I believe there should be good opportunity and good use of the opportunity for each worker to observe, and for many of them to do work both as teacher and investigator.

We all admit something of disappointment in the results as yet reached by the agricultural colleges in giving direct education along agricultural lines. They have done good work and are doing more and better than ever before; but at the best they reach directly only a very small percentage of the farming population. In the discussions at former meetings of this Association many reasons have been given for this condition. Perhaps a chief reason for our disappointment is that many of us had too high hopes. It was hardly reasonable to expect that any large percentage of the working farmers or mechanics of the country should have a full collegiate education.

The indirect influence of these institutions has been most important and beneficial. They have had large effect in modifying and improving methods in higher education. They have exalted the study of nature and have given stimulus and honor to the study of useful applications of science. If the time ever was when the scientist whose work was in the direction of seeking to make discovered truth directly useful to mankind felt that he was on a lower plane than was his fellow engaged in the study of "pure science" that time has gone forever, and men in this Association, in this room, have helped banish it.

While this Association has principally concerned itself with the agricultural side of the colleges, I am heartily glad a section has been established devoted to the mechanic arts side. Not grudgingly, but most gladly, we whose work has to do chiefly or wholly with the agricultural side recognize the remarkable development and success of the departments of mechanic arts in many of the land-grant colleges and universities, We may not forget if we would, and we ought not if we could, that by the very terms of the law providing for the establishment of these institutions, as well as by any fair estimate of what will be best for the national welfare, mechanic arts are placed alongside and on a level with agriculture. Local conditions and present emergencies modify the plans of institutions; some wisely give more attention to the one, others to the other side, but neither has exclusive right to the provision designed to aid in the education, not of any one branch of the workers of the nation, but of "the industrial classes."

And may I, whose work has been so exclusively along severely practical lines, express the earnest hope that never shall members of this Association give either sneer or ridicule to the plea that the colleges it represents shall do what they may in giving that education which tends to develop what we call culture. Alongside the word "practical" as descriptive of the education to be given by these institutions the law places the word "liberal." In even the most extended college courses we can do little more than give starting points along a few lines. There must be wise selection, and our charter laws clearly indicate what must be the leading lines of study. But we make a grave mistake if we needlessly strike out of the curriculum anything that directly tends to liberal culture.

It is interesting to note the fact that only one specific requirement is made by law as to what shall be taught. There is express direction that these institutions shall teach military tactics. It is pitiful if student or officer ever allow himself to feel that this was an unreasonable requirement to accompany a munificent endowment by the nation. Does it not rather suggest that it is the high privilege of these institutions, not only to teach young men so they may be better fitted to pursue useful callings, and better fitted to defend their country by force of arms if ever the sad need be, but also to fit them for the best possible discharge of all the duties of the citizen?

The keynote of all I am trying to say is that the advancement of the national welfare is the one chief and sufficient reason for the establishment of these colleges and stations. And this is to be done not alone by helping young men and women to be better farmers, machinists, housekeepers, scientists, but also by helping them to be better citizens, better men and women.

The work of the experiment stations has been highly successful; in view of all the circumstances phenomenally so. They were necessarily hastily organized. The mass of the workers were inexperienced; some proved to be incompetent. There have been too many changes. Boards of management and workers alike have often not sufficiently appreciated the loss that comes from frequent changes of workers or lines of work. There have been mistakes made in choosing lines of investigation and more serious ones in changing the lines when once chosen. Important interests have been partly neglected. There has been some needless duplication of work. The ideal cooperation between stations has not been reached. There have been cases of hasty generalization from insufficient data. In other words, station directors and workers have been human beings working along comparatively unfamiliar lines.

Granting all this and much more, the good already accomplished is very great. There has been accumulation of a great mass of useful facts, and the clear formulation of many important principles. These have been widely distributed. They have affected our agricultural literature. The subjects discussed and, still more, the method of discussing these subjects in agricultural papers has been modified. A few days since I examined a recent work on a practical agricultural subject by a practical farmer. Every chapter, almost every page, contains references to or quotations from the bulletins of experiment stations as worthy of highest respect. Already agricultural practice is being affected, and for good.

The successes of the past stimulate us for the future. The mistakes and failures of the past must never be an excuse or a reason for lessened effort. They may warn us to change our methods, but can not be a reason for lessened effort to accomplish a work laid upon us. Some day, somehow, somewhere, the problem of fully popularizing agricultural education is to be solved, and solved for America.

I plead, then, for persistent, hopeful work in both college and station, and along two lines of work in each. In the colleges let us strengthen the agricultural courses. Let there be shorter, more elementary courses also, but in each agricultural college, whether there be few or many who seek it, let there be facilities for education and training in agriculture the full equal of the facilities for an education along any other line. Let there be more, not less, of science; more, not less, of culture, if time permit; but in an agricultural college let us magnify the teaching of agriculture.

There are great difficulties. In these colleges we are seeking to give two educations in four years—sometimes starting with only the education gained in the public schools—a general and a professional one. A supposed or superficial familiarity with agricultural subjects tends to lessen interest in their study. There has been a lack of definition of what the teacher of agriculture may properly teach. On the one hand he has often felt obliged to teach a wider range of subjects than anyone could thoroughly master. On the other hand he has sometimes felt warned off from a full discussion of almost any part of agriculture, on the ground that he is trenching fields belonging to the "scientist." He has sometimes been expected to impart only details of practice.

And, as one who has given years to this work, I may be permitted to name as one chief difficulty in the way of successful, popular teaching of agriculture, the lack of knowledge of how best to teach it. I can think of no greater help to the cause of distinctive agricultural education than may be expected to come from systematic, perhaps long-continued, study, by some of the best men in the work, of methods of teaching agriculture—in the broad meaning of the word—and the devising of apparatus for use in such teaching. Some of us have paid far too little attention to the study of methods of teaching in general. Most of us know almost nothing of methods of teaching agriculture, except what we learned from the practice of our own teachers or from our own experience.

Aside from the value of a study of agriculture as a help to more successfully practicing it, I believe it can be so taught as to be not only as interesting but have as much disciplinary value as almost any other study, but this can only be done by those who know how.

An appreciation of the importance of better systematized methods of teaching agriculture is not new with me. Years before this Association was organized I had the honor of suggesting and aiding in the organization of a modest society of teachers of agriculture and horticulture, the chief object of which, in my own mind, was to help its members to better teach their specialties. The society met annually for several years. We enjoyed much; we learned much; but little directly along this special line.

I am sure that all engaged in the work feel the need of which I have spoken. A letter recently received from Professor Hunt, of the Ohio State University, whose unusual success as a teacher of technical agriculture might lead us to suppose he would feel this need less than many others, so well expresses my thought that I quote a part:

"One line of thought has been forcibly presented to my attention. It is better methods of instruction in technical agriculture and the difficulty in successfully teaching the knowledge we possess because our information is not systematized along any pedagogic lines. Subjects like mathematics, English, and some other sciences are now so thoroughly systematized and graded that a student not only comprehends the subject much more speedily, but gets a much better training at the same time. Methods that are appropriate in language or mathematics would not be appropriate in teaching technical agriculture. New methods must be worked out and these methods must be systematized and printed for common use before any great success in teaching can be obtained. I am thoroughly convinced that a small proportion, but fairly large aggregate of students will study agriculture when they can learn as much in a given time and get as much thorough scholastic training in the study as they now do when they study Greek, Latin, and mathematics.

"We must confess our deficiencies in this matter and try and overcome them. To overcome them some men must devote a considerable part of their time to the development of proper methods, and when these methods are developed there ought to be some method of publication and coordination of the methods so that each worker in the line can profit by the work of the different individuals. We have at the present time a most admirable experiment station system by which every station worker profits by the work of every other station worker. The matter is published and widely distributed free of charge and then is summarized and systematized in the Office of Experiment Stations at Washington. In this matter of instruction, however, we have no system whatever. Every instructor is a law unto himself, which is no law whatever, and there is absolutely no method by which others may profit by any good ideas which he develops. I know this to be a matter about which you have thought a great deal for many years and you appreciate the situation, I am sure, quite as fully as I do.

"Could there not be some system by which the United States Department of Agriculture could help to systematize and coordinate the work of technical instruction in agriculture?"

Whether or not the means suggested by which this work can be best done prove practicable or most desirable, I earnestly commend the subject to the Association and especially to those directly charged with the duty of giving instruction in agriculture.

There need be no shame in making this full acknowledgment of the need of a well-defined system of teaching agriculture. Have not the methods of teaching almost all sciences, even of teaching language and mathematics, been greatly modified within recent years? Have there not been revolutions not only in methods of teaching but also in the whole mass of illustrative material used in teaching some sciences? Does not the valuable report of "the committee of ten" seem to show that we have little idea of proper order and proportion in our teaching in the public schools?

Alongside this thorough, higher, full-course teaching of agriculture which I have been advocating, I would have shorter, simpler, purely "practical" courses—the longer the better. I would have these courses extend through two years where this is practicable; one year, if this be all that seems possible; three months, where no more can be done. I would teach in these courses the beginnings of science and the primer of its agricultural applications if need be, as well as have courses designed to give training in specific branches of farm work.

Such short courses can not give a well-rounded education, and there will always be need for care lest those attending them fall into error on this point. But they may do much good. I would have such courses absolutely free if need be. I would grant special scholarships for them if this is necessary.

I hope there may be a much more extended trial than we have yet had of a modification of the university extension lecture system as a means by which instruction may be given in agriculture to those who can not come to the colleges. It is more difficult for residents of farming communities to come together regularly than for those who live in towns and villages. It is probable it may be best, in many cases, to have the lectures for agricultural communities given in close succession rather than at intervals. The instruction given at farmers' institutes is valuable, but generally is fragmentary in character. Gratifying results have come from trials of the plan of having professors from the colleges give one or more courses of lectures in connection with the institutes, or at meetings arranged for the purpose.

A fair measure of success has come from some efforts to make use of the Chautauqua system of reading circles in teaching agriculture. With due regard to their chief work, I would have college professors and station workers avail themselves of every opportunity to give instruction in the way of lectures, articles in the agricultural papers, discussions at farmers' meetings, etc., not only because such work is abundantly worth doing in itself, but also because it is one of the most effective methods of arousing or increasing interest in better and fuller agricultural education.

I may not weary your patience with more than a brief reference to station work. I would have more of research and experiment along purely scientific lines, not restricting such work to that which gives large promise of immediate and direct practical applications, not stopping it even if good men are unable to see its utility. Alongside this I urge the continuance of the plain, "practical" lines of experiment.

Not many striking discoveries will be made, but that which seems unimportant in itself may be of vast importance in aggregate results. If experiments by station workers should enable the farmers of the country to increase the average yield of corn one peck per acre, the value of this increased yield would be far above the cost of all the stations.

I name only two of many important lines of work—the introduction of new crops to secure greater variety of agricultural products, and the finding of new uses for the crops we already produce. There may be great possibilities in this direction. The definition of a weed as a plant the virtues of which we have not yet discovered suggests that there may be most important uses in plants now little regarded. The large range of uses to which cotton seed and its products are now put suggests that we may have been content with very partial utilization of other products of our farms.

As firmly as ever do I believe there should be more of cooperation between stations working along the same lines, and that there should be more of differentiation of work between stations. But more clearly than formerly do I see difficulty in securing these things. It is hard to resist the pressure for trial of experiments admittedly important. The wise rule seems to be that each station should have a very few main lines of work, with possibly a number of minor and incidental ones. But the fact that one station has done most excellent work along one line and received deserved credit for it, is often made an argument why the station in an adjacent State should do the same work. There is difference of opinion even among station officers as to what constitutes a too narrow or a too wide range for work. In discussing the work of one of the stations, the director of another gave it praise but thought the attempt had been made to investigate too many problems. The director of the station in an adjoining State also praised the work, but thought the station at fault in having neglected important fields of experimentation.

Much as has been accomplished in making the results of the work done available to farmers, I believe much more is desirable. The bulletins of the stations reach only a small minority of the farmers. Many of these bulletins are more valuable to station workers and to those with a fair education in science than to farmers generally. Valuable as is the aid given by some agricultural papers in disseminating the results of station experiments, these usually give only partial results.

I would be remiss in a duty and deny myself a pleasure if I did not bear hearty testimony to the admirable work done in this direction by the Office of Experiment

Stations. Its Record is invaluable and its Handbook is the best ready-reference work we have. But these aids are chiefly used by station workers. I believe the time has come when there should be much compilation of results already obtained, and that these compilations, in form and matter, should be adapted to popular use. Making such compilations is not showy work; it will not bring fame to those who do it, but I doubt if there is a more useful work awaiting some of the best trained station investigators. The plan of having two classes of bulletins, one giving processes and results, the other giving conclusions based on these results, has much to commend it. The station worker may care much more for a detailed record of what we saw or did than for what we think these things teach. Many farmers care little for the means by which conclusions are reached, as they assume these were wisely chosen and accurately used, but will read with interest what we think we have proven.

In a peculiar degree the success of both agricultural colleges and experiment stations depends on their being kept in close touch with the people. Endowed by the General and State Governments, dependent for their full success on additional endowments, it is peculiarily fitting and necessary they should, as nearly as possible, be working in line with the popular thought. The relations of all connected with them and the public should be frank and cordial. Especially would I impress the importance of keeping the colleges in close relationship with the public school systems of the States. But the choice of the most desirable lines of work and of methods of doing that work must finally be decided by those directly charged with the conduct of these institutions. Trustees, boards of control, presidents, faculties, directors, and station workers can not escape the responsibilities resting upon them. The general policy must be decided by the boards of control, subject to the plain provisions of law. The carrying out of this policy, the choice of methods, and all details will wisely be left to those who are to do the work.

It is one of the most pleasant and valuable characteristics of this Association that its membership is not confined to any one class of workers in this great field, but includes trustees, college presidents, station directors, members of the college faculties, and station staffs. It is a cause for congratulation that each of these classes is so well represented at this meeting, especially that there are so many members of boards of control, and that almost all sections of the country are represented. It has been wisely provided that much of the work of the Association shall be done in meetings of the several sections, but I urge that we make much of the opportunities for meeting together, of seeing questions from different standpoints, that each may be better prepared for doing his own part. It is a great work, with many divisions. No one can work in all or know very much of all, but each will do his own share best if he have a clear apprehension of the whole.

I close with the repeated thought that the institutions this Association represents were established and are maintained not for us, not primarily for those who attend them or are directly aided by them, but as means for advancing the welfare of the nation, and this by increasing the intelligence and prosperity—in the widest meanings of the words—of the great industrial classes of the nation. We will come, do our little part, and go; but the work will go on with increasing efficiency, increasing appreciation by and value to the nation and the States to the wise liberality of whose statesmen it owes its inception and the possibility of its continuance on so broad a scale.

Morning Session, Wednesday, November 14, 1894.

The Association was called to order at 9.45 a.m. by Chairman Morrow.

Mr. Harris. The Section on College Work has two matters to report to the Association. The executive committee called attention to the plan for the purchase of a bust of Senator Morrill. The Section on College Work passed the following resolution, which it submits for your approval:

Resolved, That the executive committee be authorized to take subscriptions, order casts, and to obtain the marble bust proposed, and keep it in a suitable place in Washington for subsequent use.

Adopted.

Mr. Alvord stated that the executive committee would receive subscriptions for the plaster casts of this bust until the new executive committee was appointed. The cost was $50, which might be reduced by further subscriptions to $45 or $40.

Mr. Harris. The attention of the Section on College Work was called to the fact that the entrance requirements and courses of study in the various colleges, including not only the agricultural but other departments, vary very greatly. Attention was also called to the fact that high school preparatory courses were not only very different in different States, but in different parts of the same State. A committee was appointed to report immediately upon what action might with profit be taken by the Association to remedy this. The committee reported as follows:

That a committee of five be appointed by the Association, which committee shall report at the next annual meeting, and that the executive committee be asked to defray all expenses of the committee.

That the committee be authorized to confer with the New England Association of Colleges, the Committee of Ten, the National Educational Association, and such other bodies or associations as may be, and to embody the results of such conferences in its report to this Association.

I move the adoption of that recommendation.

Seconded.

Mr. Tyler, of Massachusetts. I have been very much interested, personally and officially, in this matter of entrance requirements, and am in full sympathy with the motion proposed. I should be personally glad if, among the societies specifically named in the resolution, were included the Society for the Promotion of Engineering Education. This society was organized at Chicago last year, and had its second meeting last August in Brooklyn. The matter of college entrance requirements was very carefully treated in a paper by Professor Craven, of the University of Kansas, and aroused considerable discussion. At the close of the discussion it was voted that a committee of five be appointed by the Association to consider entrance requirements and report at the next annual meeting of the Association. The field to be covered is of course not identical with that represented in the present Association, but certainly on the mechanical side of this Association the work is very much common to the two. I think the result would be very satisfactory on both sides if there were the best possible cooperation between the two committees.

Mr. Harris. While the field is of course not identical with the field we represent here, it is entirely included within it, and the last clause of this resolution was intended to include associations of this sort. It seems to me, however, that the Association for the Promotion of Engineering Education should be mentioned by name, and I therefore second the amendment of Mr. Tyler.

The amendment was carried. The report of the College Section was then voted upon and adopted.

The CHAIRMAN. This carries with it the appointment of a committee of five. I call attention to the fact that this is a very important committee.

On motion the chair was directed to appoint the committee.

The chair announced the following gentlemen as the committee on nominations: Messrs. A. W. Harris, A. A. Johnson, W. L. Broun, W. A. Henry, C. W. Garfield, C. F. Vanderford, and A. C. True.

Mr. Scovell (secretary) stated that while he had been unwilling to decline to serve as secretary while the Association was in debt, he now felt, as the burden was removed, that he must decline a reelection to the office of secretary.

Mr. SCOVELL. I would state that there are 65 institutions represented here, and 37 States; 105 members and visitors are present.

The CHAIRMAN. If there is no further business of a general character, we will proceed to the consideration of the proposed amendment to the constitution. (See proceedings of the convention for 1893, p. 64.)

Mr. Cavitt offered the following resolution in regard to the name of the Association:

Resolved, That the name of this Association shall be so changed as to hereafter read as follows: "American Association of Agricultural and Mechanical Colleges and Experiment Stations."

May I ask Mr. Alvord if the executive committee has made any report on this proposed change of name?

Mr. Alvord stated that the executive committee had incorporated it in the programme, which brought it before the Association.

The CHAIRMAN. I understand, then, that we have before us a proposal to change the name of this Association so that it shall read "American Association of Agricultural and Mechanical Colleges and Experiment Stations."

Mr. HARRIS. I move to amend by striking out "American Association of Agricultural and Mechanical Colleges and Experiment Stations," and substituting therefor "Association of American State Colleges."

Mr. BROUN. The objection to the present name was that it is too long and not sufficiently comprehensive to include the mechanical branch of the colleges. I move, if we change the name, to call it the "Association of Morrill Land-Grant Colleges." This is brief and comprehensive and commemorates the name of Senator Morrill.

Mr. Holladay seconded Mr. Broun's amendment.

Mr. PLUMB. How does that affect Canadian institutions?

The CHAIRMAN. Do I understand Mr. Broun to desire or not desire to make any reference to experiment stations?

Mr. Broun. It is proposed to include experiment stations.

Mr. Patterson. I think that whatever nomenclature be adopted, it ought to be in conformity with the organic act of 1862, and with the acts of the several States accepting the trust implied in that act. The act of 1862 knows nothing of the suggestion made by Mr. Broun. It is not designated the Morrill Act, but an act for the endowment of agricultural and mechanical colleges in the several States of the Union, and whatever legislation has been had by Congress recognizes the fact that this supplementary legislation is designed to supplement and complete the organization of the colleges under the original act. The same objection applies to the change moved by Mr. Harris. There are State colleges which have neither part nor lot in this endowment. Now, whatever change be adopted, it ought to be in conformity with Federal and State legislation. These ends will be accomplished by the amendment introduced by Mr. Cavitt last year, and all the requirements of those who desire a change in the designation of this Association will be met by the insertion in the present name of the words "and mechanical." I do not believe in any cumbrous nomenclature; the shorter the name the better, so that it expresses adequately what we want to express by the name of the Association. It was argued at New Orleans that the mechanical side of these colleges ought to obtain recognition in this Association. There is a general disposition to recognize that. This disposition is shown on the part of those connected with mechanical training in these colleges to bring their part of the institutions up to the level which has been obtained by the other sections represented here. I think we can not evade the responsibility attaching to the development of the mechanical side of these institutions of learning. It is important that we should educate the agriculturists; it was truly said that they are the backbone of American industry, but there are mechanical industries that will be second in importance only to the agricultural interests of the country. It is important that we educate our mechanics, our laboring classes, and do as much for them as for the agriculturists. You are well aware that there is a constant tendency of the agricultural population to move from the rural districts to the towns. When you bring that fact into connection with another important fact, namely, that practically all the wealth of the country is in the cities, you bring together the two explosive elements that endanger this country. I argue that education for the artisan is as important as for the agriculturist, and Congress in its farsightedness foresaw in 1862 that that would be the case. From these points of view it seems to me we can not neglect this duty to further the development of the mechanical side as largely and liberally as the other side. The other side is well established; the mechanical side is unfortunately not so. In a great many institutions established under the land-grant act, mechanical training is still in its infancy. What I want this Association to encourage by its official act is to give it the recognition it deserves. Let Congress and the several States see that we are in earnest about this matter, and that, while we are not going to neglect the one, we are equally willing to foster the other.

Mr. SCOTT. It gives me great pleasure to second the speech of Mr. Patterson as I did at New Orleans two years ago. It seems to me he has hit the right nail on the head. We must adhere closely to the national purpose as expressed in the organic act of 1862. The act says, "colleges for the benefit of agriculture and the mechanic arts;" the two are there associated and we shall be safe if we keep close to that original and organic act. I have debated in my mind some time for a substitute that should be comprehensive and at the same time descriptive, and I have come to the conclusion that we can know no better name than that proposed in this amendment. I do not like such adjectives, but for the present I think this amendment should prevail, and that the colleges should be known as the agricultural and mechanical colleges. I would that it might be colleges for the benefit of agriculture and the mechanic arts, but that seems cumbrous. Therefore I support the amendment proposing that this Association shall be the "Association of American Agricultural and Mechanical Colleges and Experiment Stations." It seems quite necessary to include the experiment stations, not only because we have college experiment stations which are in the act designated departments of colleges, but because we have State experiment stations associated with us as well. Therefore they should be included in the title of the Association.

Mr. CLUTE. I agree heartily with the speeches that have been made in regard to our name, but I think we ought to avoid a long and cumbrous title and am inclined to believe that we can find a name that shall adequately describe the colleges and stations and that shall be brief. It seems that we all desire to honor Mr. Morrill, from whom we have our first and second grants, and we should all like to honor Mr. Hatch, who introduced the bill. We want to include colleges and stations in all their departments in the name. It seems to me, therefore, that if we call our Association the "Morrill-Hatch Educational Association," we shall have a short, yet comprehensive, name.

Mr. HARRIS. There seem to be two objections to the proposed name. It is too long, and for that reason I favor leaving out the experiment stations. It does not seem to me necessary to mention in the name all the institutions that are entitled to membership. The second objection to calling this an association of agricultural and mechanical colleges and agricultural experiment stations seems to me more important. It tends to confine the Association to those colleges here represented. The time is coming when every college in the land will be willing to be in fact, if not in name, an agricultural and mechanical college. Already there exist many good agricultural colleges in the United States which do not call themselves such. I see here my good friend, Mr. Atwater, and if I counted the men who have received inspiration from him and the men who have received instruction in that old classical college, I think you would agree with me that at Middletown, Conn., there is a first-class agricultural college—a better one than we find in many of our States to-day. There is a representative here from the Institute of Technology, and in the Institute of Technology there exists now an admirable course in agriculture; they do not call it agriculture, but that is what it really is. For that reason I think it important that we should stamp out, if we can, the word "agricultural college." Any college with the word "agriculture" in its name seems to the public something less than other colleges. If there is such a thing as an agricultural college, it is first a college, and afterwards agricultural. Now, what shall the name be? It is proposed that we shall follow the organic acts, but you will find no name there. Does not the Pennsylvania State College conform to the organic act as well as the agricultural and mechanical college of some State or other? Does not the University of Wisconsin conform to the act better than some other institutions? What, then, shall we select? Some one out of many characteristics must receive emphasis. I believe that the most important idea we represent is not agricultural education, nor the wider industrial education, but *State education*—the assertion that the State owes it to every boy and every girl to give, not the meanest education it can get off with, but the very best education, which shall take him from his A B C's until he receives his diploma from the State university. For these reasons I am in favor of my own amendment, and I should call the Association the "Association of American State Colleges," and include all the arts, the old-fashioned liberal arts among them, when you can.

Mr. HENRY. We have been quarreling about what the baby's name shall be ever since it was born. To-day it is said that the mechanical section of this Association is already leading the agricultural. They seem to be doing very well; why not let them alone? I learn that 37 States are represented in this convention; I learn that adjectives do not represent them, and yet we propose to add another adjective. If the mechanical section is doing its work so well, why not let it go on? Our name is good enough, and I move that the proposed amendment lie on the table.

Seconded.

The yeas and nays were called for, with the result that 33 yeas and 16 nays were recorded, as follows:

Yeas—Messrs. A. L. Emigh, C. S. Plumb, A.W. Harris, H. H. Goodell, W. M. Hays, W. C. Welborn, W. P. Headden, C. D. Woods, R. H. Miller, S. M. Tracy, S. P. McCrea, I. P. Roberts, J. B. Power, W. H. Scott, H. E. Alvord, T. C. Karns, M. H. Buckham, C. L. Goodrich, F. W. Rane, N. D. Fratt, A. A. Johnson, A. C. True, A. E. Blount, H. H. Wing, E. F. Ladd, W. J. Green, H. P. Armsby, C. O. Flagg, W. L. McGee, C. F. Vanderford, J. L. Hills, J. A. Myers, W. A. Henry.

Nays—Messrs. W. L. Broun, A. N. Raub, O. Clute, J. K. Patterson, W. W. Tyler, R. H. Jesse, P. H. Mell, M. A. Scovell, C. S. Murkland, A. Scott, A. Q. Holladay, J. H. Washburn, E. B. Craighead, E. B. Voorhees, F. E. Emery, V. L. Roy.

The chairman then introduced Mr. J. W. Hoffman, who delivered an interesting address on "How Tuskegee Assists the Colored Farmers of Alabama."

Mr. Broun spoke in indorsement of the Tuskegee Institute, and commended its exhibit at Montgomery. He spoke of the excellent moral training given, and stated that its students became good citizens. In industrial education, he thought, lay the best hope for the colored race.

The chairman expressed the pleasure the Association had had in listening to Mr. Hoffman's address, and then introduced Director True, of the Office of Experiment Stations, who delivered the following address:

THE WORK OF THE OFFICE OF EXPERIMENT STATIONS.

The agricultural experiment stations have three agencies for promoting their general interests. One is this Association, and I may say that the Department of Agriculture has recently given an official opinion that such an association is an essential feature of a great system of experiment stations like our own, and is therefore entitled to the support of all the stations. A second agency is the journal called "Agricultural Science," so ably conducted by Dr. Frear, of Pennsylvania. This offers an opportunity for a freer and wider discussion of station methods and results than is appropriate in Government publications, and is, or may be, virtually the continuation of the discussions of this Association at monthly intervals throughout the year.

The third agency is the Office of Experiment Stations, which, whatever its functions as a branch of the Department of Agriculture, is primarily established to render the stations such assistance as will best promote the objects for which they were organized. The office desires above everything else to keep in close touch with the stations, to have their hearty support in its undertakings, and to receive their intelligent criticism of its mistakes.

As a delegate of that office to this convention I desire very briefly to speak of some of the ways in which the office has sought to promote the interests of the stations, and I may add of the colleges likewise, during the past year.

There are many evidences that the work of our stations is better appreciated not only in this country but in those lands where the experiment stations have been longest established. One pleasing evidence of this is the cordial invitation received this year from Dr. Nobbe, president of the Association of German Experiment Stations, to representatives of American stations to attend the annual meeting of that association.

While there is now, as probably there always will be, room for improvement in the management and work of the stations, there is no doubt that these institutions are firmly intrenched in the favor and support of the great agricultural public. They have proved their usefulness by their good works, and as a rule they are pursuing the object for which they were established with greater earnestness, intelligence, and success than ever before. The world-wide system of which the American stations are but an important part is extending and growing stronger every year. Within the past few days a message has come from a portion of the Orient, where agriculture has scarcely made any progress since the pyramids were built, asking for the aid of this country in an effort to establish the experiment station there.

Certainly we have every incentive to do our best work, each in his appropriate place and way, to promote the great interests of agricultural science and education, which are so vitally related to the welfare of our fellow-men of every nation.

In the time allotted me I can not, perhaps, do better than to briefly review the work of the Office of Experiment Stations during the past year and point out some of the ways in which the office has sought to promote the general interests of the agricultural colleges and experiment stations. In doing this I shall anticipate some things which will probably appear in the Annual Report of the Department, but it may be that the oral statement of them will be more intelligible than the written, and will open the way for questions and suggestions from members of this convention either at this time or in informal conversations or otherwise hereafter.

During the fiscal year ending June 30, 1894, the office issued 24 documents, aggregating 2,089 pages. These include 12 numbers of the Experiment Station Record with index, 6 bulletins, 2 farmers' bulletins, and 4 circulars. In these publications, with one or two exceptions, the work of the individual experiment stations was compiled for distribution throughout this country and the rest of the civilized world. The fifth volume of the Experiment Station Record comprises 1,196 pages and contains abstracts of 267 bulletins and 43 annual reports of 55 experiment stations in the United States, and 67 publications of the Department of Agriculture. The total number of pages in these publications is 17,161. There are also 227 abstracts of reports of foreign investigations. The total number of titles abstracted is 973, classified as follows: Chemistry, 46; botany, 42; bacteriology, 4; zoology, 6; mineralogy, 1; meteorology, 36; water and soils, 36; fertilizers, 72; field crops, 155; horticulture, 84; forestry, 10; seeds, 16; weeds, 8; diseases of plants, 66; entomology, 74; foods and animal production, 119; veterinary science, 18; dairying, 89; agricultural engineering, 18; technology, 4; and statistics, 69. Classified lists of titles of foreign articles not abstracted are also given in each number. The aggregate number of titles thus reported is 1,514. Special articles contributed by eminent foreign workers in agricultural science were translated in the office and published in the Record.

A notable feature of the fifth volume of the Record is a review of recent work in dairying, prepared by Dr. Allen, assistant director, which serves to show how large and important a feature of experiment station work investigations on dairying are. In the preparation of the Record constant effort has been made to condense the abstracts as far as practicable, and as a result they have become increasingly technical as regards their language and form of statement. In spite of this the demand for the Record from intelligent farmers has steadily increased, and the number of commendations which it has received from persons without scientific knowledge has been surprisingly large. An edition of 8,000 copies is now required to meet the regular demand for this publication. When the cards were recently sent out asking the persons on the mailing list whether they wished to receive the next volume of the Record, almost all of them returned an affirmative answer. Of course no such cards were sent to college and station officers. The Record is now regularly sent to a large number of the foreign experiment stations and other institutions engaged in agricultural investigations. In the sixth volume of the Record all the abstracts have been arranged under one series of topics. This enables us to make a more thorough classification of our material and to get more in the same space. We have at the same time enlarged the scope of the Record by securing the cooperation of the scientific bureaus and divisions of the Department, and the abstract committee of the Association of Official Agricultural Chemists. It is hoped that by this means we shall be able to present a comprehensive summary of the investigations in agricultural science throughout the world.

The Handbook of Experiment Station Work, in which the work of all the stations in this country for about twenty years was summarized, has proved to be a popular document, the demand for it having greatly outrun the ability of the Department to meet it. We still hope that Congress may be induced to issue a large edition for general distribution. This publication has, it is believed, helped to impress Congress and the country that the experiment stations have accomplished much work that is useful to farmers in all parts of the Union and are institutions which should be generously supported by States and nation.

A general view of our system of agricultural education and research has been presented in the bulletin entitled "Organization Lists," and in the annual report of the office. I am aware that the preparation of these bulletins has involved considerable labor on the part of the station and college officers who had to collate the statistics for their respective institutions, but I believe that this labor is amply repaid in the general effect of the publication of complete and accurate statistics regarding these institutions. My experience leads me to believe that there is a wide demand for such information. I appreciate the difficulty of making a satisfactory presentation of an agricultural department as distinguished from other branches of the colleges, but I believe that as far as this can be done, with some definiteness, it helps the cause. We are about to send out our circulars for annual statistics, and I would urge their careful attention and prompt return. I would be glad to receive suggestions regarding particular inquiries which ought to be made. As it is intended to include in the annual report this year some historical statements regarding the colleges and stations, a few inquiries along this line will be made in our statistical circulars.

The card index of station literature has steadily progressed during the year. The office still has on hand a considerable number of sets which may be purchased by individuals or institutions, and members of this convention may render a service by helping to place these sets where they will do the most good.

As many of you know, the office has undertaken an index of articles by station workers, and all station workers who have not so far contributed to this index are earnestly requested to do so, that it may be made as complete as possible. Card indexes of other literature on agricultural science are being prepared in the office. When college or station men are writing up any subject relating to agricultural science, the office will be glad to render them assistance by furnishing them lists of references as far as practicable. Correspondence in this direction will at least help the office by suggesting bibliographies which it should compile.

The office occupies a portion of its time in preparing bulletins for the series of Farmers' Bulletins of the Department of Agriculture. While it does not confine itself to compilations of the work of the American stations, yet it refers to their work so frequently in these bulletins that this constitutes an important means of disseminating the results of station work to the farmers of the country. A good many persons seem to think that the Farmers' Bulletins all emanate from this office, perhaps from the fact that the office begun the series which was afterwards adopted by the Department. This office is responsible only for those bulletins which contain the letter of transmittal of its director.

The lectures on the investigations at Rothamsted, England, for the past fifty years, delivered in this country last year by Sir Henry Gilbert, have been transmitted by him to your Association and transferred through your executive committee to the Department for publication. It will be issued as a bulletin of the Office of Experiment Stations, and after careful examination of the manuscript, I am prepared to say that they will constitute an exceedingly interesting and important contribution to the literature of agricultural science.

The office is also engaged in the preparation of a bulletin on cotton culture. This is being prepared with the aid of experts in the stations and outside. We aim to show the state of our knowledge regarding this plant and what further experiments and investigations are needed to promote the interests of the great cotton industry.

Congress has this year given the Department $10,000 for investigations on the nutritive value of human foods. The supervision of this work has been assigned to this office, and Professor Atwater has been appointed special agent in charge. In expectation of such an appropriation the office has prepared a bulletin containing a résumé of investigations on this subject and suggestions for further work. This will, in a measure, be a handbook for workers in this line. It is proposed this year to carry on work in several directions, to make analyses of food materials as far as this may be necessary, to study dietaries of different classes of people in different parts of the country, to look into the relations of food supply and consumption, to consider how cooking affects the digestibility and economy of food, and especially to make inquiries with a view to improvement in methods of investigation. A portion of this work will be done under Professor Atwater's charge at Middletown, Conn., but a good deal of it will be carried on at different points in the country. It is hoped that some of the agricultural colleges and experiment stations will be able to take up work in this line, and their cooperation will be sought in so far as seems desirable in view of their facilities for this kind of research and the demands of the work in which they are already engaged.

The schedules for the financial reports of the stations for the present fiscal year, as required by Congress, have been prepared and distributed. An effort has been made to make a schedule which would show how the money has been expended and which would at the same time accommodate itself to ordinary methods of book-keeping and not impose unnecessary labor on station accountants. The schedules for this year are in a sense tentative, and it is hoped that the station officers will be free to make suggestions for their improvement. It is expected that the financial reports will be accompanied with clear and detailed statements of the work of the station for the same period. It is believed that a clear presentation of expenditures and work will greatly strengthen the position of the stations before Congress and the country.

The experience and correspondence of the Office of Experiment Stations bring out certain criticisms of station management to which it may be profitable for me to briefly advert, provided it is clearly understood that I am not finding fault, but seeking to help the cause. Perhaps one of the most frequent and serious criticisms of station management which is brought to the attention of the Department is that in the conduct of college and station there is a mingling of college and station funds to the undue advantage of either the college or the station. It is easy to see how this idea may be causelessly entertained, owing to the intimate relations which must necessarily exist between the college and the station. At the same time, the criticism serves to emphasize the desirability of making as broad a distinction as practicable between the work of the college and the station, so that it will be clear to all fair-minded observers that each institution is doing its own work without trenching upon the province of the other.

Another vexed point is the question of inserting in station publications what are practically advertisements of private concerns. This has been most often done by the use of pictures bearing the trade-mark or names of manufacturers. This is usually justified on the ground that the station is thus enabled to give the farmer useful information without which the investigations of the station in certain directions would not be practically effective. This practice has, however, excited serious criticism, and it is very doubtful whether the information thus given is of sufficient importance to compensate for the risk growing out of charges of partiality to private interests.

Another matter which perhaps deserves more consideration than it has received relates to unity in the management of the station considered as a public institution. In the conduct of station business and in the issuing of publications it has sometimes appeared that the person doing the work or the author of the bulletin was for the most part individually responsible for what he did, and that in case of mistake or mismanagement the director, or even the board of control, did not have or feel any particular responsibility in the matter. It is believed that this lack of unity is a weakness in station management. One way in which this is illustrated is in the form and general make-up of station publications; that is, in certain of these publications it would appear that different officers had each contributed their part and that no one felt called upon to do any editing or had considered how the publication as a whole would impress the reader. It is believed that the highest interests of the stations will be promoted by making the public feel that they are permanent and solid public institutions, working steadily and consistently for the benefit of agriculture. The workers may change, but the institution itself should pursue its proper course without interruption or deviation.

Mr. Alvord stated that the question whether it was a legitimate application of the Hatch fund to pay the expenses of a delegate to these conventions and to pay the annual contribution of the stations to the funds of the Association had been exhaustively considered by the Department of Agriculture, and the decision was that these disbursements were perfectly legitimate. The Treasury Department has sustained the decision of the Department of Agriculture.

The CHAIRMAN. Mr. Harris this morning emphasized the truth that the institutions we represent are first of all colleges, and that our work is for education. This being so, we are not only connected with the Department of Agriculture, but with all educational work, particularly as represented by national officers. I count it a great privilege to listen to one who not only by personal qualifications, but by long personal experience, is so well entitled to our most earnest attention. I take great pleasure in introducing Hon. W. T. Harris, Commissioner of Education.

THE TEACHING OF AGRICULTURE.

I thank you, Mr. President, for your kind allusions to me personally. In the few remarks which I have to make I propose to call attention to the twofold relation which the agricultural college bears, namely, on the one hand to the Department of Agriculture, and on the other hand to the Bureau of Education. The Department of Agriculture assists it by making wise and useful experiments in regard to plants and animals, the selection of the best methods of training and cultivating, the modes of adaptation to climate and soil. We in other Departments of the Government here in Washington are proud of what the Department of Agriculture does in these and in other lines. But my Bureau wishes to be kept in mind by the managers of agricultural colleges for its interest in methods of teaching and school management. I shall speak at length of the method of teaching agriculture as a branch of study. The agricultural population in any country is the most conservative class of all its people. They follow the methods of their predecessors; they are patriarchal in their ways; you have dealt with them and do not need assurances from me. You could read us a lesson on this subject. But I was born on a farm, and had the education of a farmer and know something about the prejudices and conceits that he harbors. The farmer believes his vocation to be the one which secures the most personal independence of all employments, because he raises what he eats and often the raw material for clothing; he thinks of an ideal civilization in some far distant future which shall have no cities but only farms. I could make a long story of the development of my own ideas in this regard. I could tell how I changed my former ideas and came to see that farming is the most dependent of the employments, and that instead of farm life, urban life is the life of the future and of the highest civilization. Farming will in that period become market gardening and be as profitable as manufacturing and commerce are. I began by supposing that the farmer produced most of the wealth of the country, but when I investigated the questions of political economy I learned that it is the manufacturer and commercial vocations which add most to the value of our productions. The raw material furnished by the farmer constitutes one-fourth or one-fifth of the wealth of the country, and the three-fourths or four-fifths which includes the other wealth of the country is furnished by the manufacturer and trader and the one who transports the goods. Looking into the problem of the education of the farmer one meets first these curious facts. He finds the farmer the most conservative person and the person who is the most ignorant of the true basis of modern civilization, which rests on productive industry and the application of machinery to the performance of the drudgery of the world. All this points directly to the significance of the agricultural and mechanical college.

It shows its great power and usefulness. The agricultural college takes a boy from this place and another from that place, educates him, teaches him what his gifted fellow-men have been doing in the way of inventing new methods of creating wealth, increasing the production of farms, aiding human labor by machinery; it sends him back to his community charged with information and with a spirit of inquiry. The college may profitably set its students to reporting upon the condition of their local communities; discussing the methods in vogue, and especially making note of the enterprising citizens of their localities. This suggests what we call "university extension," now creating so much interest in this country and England. University extension seems to be the very field of greatest usefulness open to the agricultural college. I defer to your better wisdom in this matter. It seems to me that such extension of higher education and of secondary education promises to enable us to take account of two kinds of youth in the community. One kind of youth we have provided for. He is the boy who wants the old-fashioned education and his parents can afford to pay for it.

We make him pass strict examinations in the elementary work, and promote him step after step when he has completed the course prescribed. Hitherto we have excluded the other kind of boy, the boy who has great talent in some particular direction, but has not a taste for the old-fashioned education and will not pass through a course of study extended through many years. The secondary school and the college lose their hold of this class of youth. But a great many of our successful men come from this class. Perhaps they would have taken a regular course of education in the schools if their parents had furnished the money for it. A great many of our millionaires are not college bred; many of our inventors are not college bred; they have nevertheless become giants in their special provinces. They have been gifted in special powers. It would be interesting could we trace in every case the history of these men back through their infancy, and study their heredity also. We should see how the brain, nerves, and energy of the family worked to develop a man who has a faculty of secreting wealth as the adipose tissue is secreted in the body. It is a matter of congratulation that the agricultural college is about to take hold of this work and look after the sporadic individual who is good in some particular line, but has no activity for general studies, or at least no taste for them. His whole soul goes out in activity on some particular line. It may be entomology, or astronomy, or meteorology, or botany, or archæology, or it may be a much narrower province, such as the cultivation of the potato, the improvement of the beet root for the table or for sugar-making purposes. We shall agree that the schools ought to get hold of such men. I believe it is one of the important functions of the agricultural college to look out for the youth who do not come to school, but who show eminent capacity in particular lines relating to the industries, or especially agriculture. My neighbor, Mr. Bull, in Concord, Mass., invented the Concord grape by a long series of experiments on the native grapes of his region.

I do not mention this function of the agricultural college as seeming to offer advice to you who are present, for I well know that you are the most competent men in the United States to understand the work of the agricultural colleges, and I believe that you have found out or are in the process of finding out the lines in which to best direct their work. This annual conference of agricultural college presidents is itself sufficient evidence that what each discovers in the course of the year is brought to the attention of all his fellows. There is a constant process of reenforcing each agricultural college by the experience of all similar institutions.

While I, as an outsider, am not competent to suggest new lines of work, I claim to know enough about the subject to arouse in me the desire to get brief reports on the progress made by the faculties of your institutions in reducing agriculture and kindred branches of industry to a pedagogical form. The branches of instruction in the old colleges have long since been reduced to such a form. The studies of Latin and Greek, mathematics, history, geography, grammar, have been so arranged that the lesson that lies nearest to the pupil's mind is placed at the beginning. It is followed by a second lesson, which presupposes the first lesson and builds upon it, a third lesson, a fourth lesson, and all the rest follow; each one building on what has gone before it and adding some new matter of consideration that is important and useful. It is essential to the pedagogical form that the first lesson shall be useful and good if no other lesson follows it. It is essential that if you cut off the series of lessons at any point that all shall be useful and valuable up to that point. It is bad pedagogical form to oblige the pupil to learn a series of lessons which are nothing in themselves but the mere scaffolding to an important idea by and by to be developed.

In your branches of mechanical industry you find that much has been done to reduce these to a pedagogical form. In the public schools of many cities, especially in Massachusetts, cooking is taught in a series of progressive lessons. Its pedagogic form has been fully developed. I take it that in the study of agriculture whatever brances are taught as preliminary disicipline should have practical illustrations drawn from soils, plants, and animals at every step. As in all other branches, we must get hold of the interest of a pupil, both hereditary and acquired, and fasten one by one our studies to this interest. I desire to get from each agricultural college brief reports of progress made in reducing the various features of this field of study to a pedagogical form, being confident that when this reduction is complete, instruction in agriculture will not only be well managed in your institutions, but also will find its way into the elementary schools of the farming districts.

I read some time ago in Thorold Rodgers, in his book entitled "Six Hundred Years of Wages," Chapter XVI, the following: "We owe the improvements in English agriculture to Holland. From this country we borrowed, at the beginning of the seventeenth century, the cultivation of winter roots, and at that of the eighteenth century the artificial grasses. The Dutch had practiced agriculture with the patient and minute industry of market gardeners. They had tried successfully to cultivate everything to the uttermost which could be used for human food or could give innocent gratification to a refined taste. They taught agriculture and they taught gardening. They were the first people to surround their homesteads with flower beds, with groves, with trim parterres, with the finest turf, to improve fruit trees, to seek out and perfect edible roots and herbs, at once for man and cattle. We owe to the Dutch that scurvy and leprosy have been banished from England, that continuous crops have taken the place of barren fallows, that the true rotation of crops has been discovered and perfected, that the population of these islands has been increased, and that the cattle and sheep in England are ten times what they were in numbers and three times what they were in size and quality. Even now the ancient agricultural skill of the Hollander is not extinct. The gardeners of Haarlem still purvey roots and bulbs of flowers for the civilized world, and there is much which the English agriculturist of the present day could learn with advantage from the industry, patience, and skill of the Dutch farmer, and perhaps will learn, when England is relieved from the curse of her present land system and her tenant farmers till the land under the same guarantees as the Dutchman does." It would seem from this quotation that England changed her agriculture from the old-fashioned style of raising staple crops to the more lucrative and highly-developed farming known by us as "market gardening." I think that it is one of the most important subjects connected with the study of agriculture, this matter of market gardening. I can see that it is very important to detail intelligent students or committees of students from each class to study the methods of the market gardeners who live in the suburbs of the nearest large cities. The States remote from cities show a much less profitable farming than those States whose farmers reside in the neighborhood of the great cities. Some years ago I found that the farmers of Maine averaged about $300 a family, counting their total productions at market prices, while the farmers of Connecticut averaged only a little less than $600 a year because of their nearness to New York and its densely-populated suburbs. What an interesting seminarium or college conference could be held with a class of agricultural students who discussed in a round-table style the report of a committee of their classmates who had been inquiring into the market gardens and ascertaining what crops are raised and in what order of succession; how many in the year; how the gardeners meet the first demands of the market in the spring; how they use forcing houses; how they handle transportation; how they get to market; how they live—that is to say, how they sleep and eat while on the way to the city and while there. All these little practical items become interesting and suggestive when discussed in this way. The uneducated person lives and acts, but does not think about the method of his living and acting. School education sets the individual at once to considering the method in which things are done. What an interesting thing it would be to compare the methods of market gardeners in New Orleans, Cincinnati, Boston, New York, Chicago, St. Louis, Baltimore, etc. Set to study these processes, the students of the agricultural college become centers of information and directive power for their neighborhoods when they return as graduates to their homes.

It has been found that university extension stands in need of endowment much more than the regular teaching work of the colleges of the country. There should be fellowships founded by wealthy men interested in agriculture so that young men of genius may repair to the college on these fellowships and have their necessary expenses all provided for. This is the one country of the world for endowment of educational institutions by private munificence. I presume that each college president knows of certain persons who would be glad to erect monuments for their families in the shape of scholarships in the State university, if they were sure that the money would increase the practical acumen of students who seek higher education. I believe that in this direction large endowments may be expected in the near future and that a proper account of the practical work done by agricultural students when published in the Annual Report of the Commissioner of Education will be found the best means of attracting from men of wealth numerous endowments for the purpose of founding fellowships in agriculture. Many of the wealthy men of this country look askance at the liberal education furnished in our colleges and universities. Many have devoted large sums to establish nondescript institutes with the hope that they would better fit young men for industry and the practical demands of life. They want something, but they do not know how to obtain what they want. I believe that it is in the future of these land-grant colleges founded for agricultural and mechanical instruction to solve this problem and to hold up for the would-be practical philanthropists a kind of education which makes the most of the talents of the youth and to stimulate him to original investigation and to lead him onward into the abstruse and highly technical studies which are necessary in order to endow him with power to solve the highest problems. I have ventured to make these remarks in order to show more clearly what kind of contributions I should like from the presidents and professors of agricultural colleges who will kindly undertake to record for me these items of progress in the development of the pedagogical form for the new branches of instruction.

EVENING SESSION, WEDNESDAY, NOVEMBER 14, 1894.

The Association was called to order by Chairman Morrow, at 7.30 p. m.

Mr. ALVORD. I call attention to the fact that the constitution, while it names the number of vice-presidents, does not indicate any difference in their relative rank. It has been thought best to dispose of any possible complications by the following resolution, which is recommended by the executive committee:

Resolved, That the nominating committee be instructed to designate the vice-presidents in numerical order when making their report to the convention.

Adopted.

Mr. ARMSBY. The provisional section on station work desires to present the following resolution, relating to the letter received from the German Association of Experiment Stations:

Resolved, That the representatives of the agricultural colleges and experiment stations of the United States have received with great pleasure the communication of Prof. Dr. Nobbe and deeply appreciate the evidence of the regard and fraternal feeling of the Association of Agricultural Experiment Stations of the German Empire.

Resolved, That the secretary of this Association be instructed to convey to Prof. Dr. Nobbe our greeting and grateful acknowledgment of his courtesy and to assure him that we shall always welcome in the meetings of this Association the presence and participation of any gentlemen connected with the German stations.

Adopted.

Mr. ARMSBY. I am instructed also by the same section to present for the action of the Association the following resolution:

Resolved, That this Association heartily approves recent legislation by Congress giving to the Secretary of Agriculture a measure of supervision over the expenditure of the stations.

Resolved further, That this Association indorses the scheme of financial statement adopted by the Secretary of Agriculture, and will approve and welcome the closest scrutiny of the work of the stations by the Department of Agriculture, either by personal visitations of an agent of the Department, or such other method as the Secretary of Agriculture may deem most efficient.

Adopted.

The chair then introduced the Hon. J. Sterling Morton, who made the following address:

GENTLEMEN: I experience much pleasure in learning, through the resolution which you have just passed, that the agricultural experiment stations and agricultural colleges are in perfect accord with the Department of Agriculture as to the manner in which the public funds appropriated for their support shall be accounted for. It was my misfortune, perhaps (or my lack of ability to state a proposition clearly), to suggest in a former report that these $750,000 annually appropriated for the maintenance of these stations and colleges were the only moneys ever appropriated out of the Treasury of the United States for which no accounting had ever been required by an officer or through an office of the United States Government. There was no auditing, and no Auditor or Comptroller ever saw the results of these appropriations itemized and put before him or filed in a department of the Government. It seemed to me that it was in the interest of every real, sincere lover of this work that these accounts should be made plain and put in the archives of the Government, so that those who came after us might see precisely what was accomplished by every dollar expended, so far as possible. It was said that that report antagonized all the agricultural experiment stations and colleges; yet any one reading it could see that it not only did not antagonize the existence of these valuable aids to the science of agriculture, but prescribed further duties for them. You may remember that, in treating of the gratuitous and promiscuous distribution of seeds at Government expense the report said then, what I reiterate now, that if there ever had been good reason for this promiscuous distribution of seeds, that reason had been obliterated when the experiment stations were established, and that, in my judgment, it would be far better for the country in practical results if all seeds were sent directly to the experiment stations, which were in charge of scientific men and could test each variety as to its adaptability to their particular soil and climate and their environment. Now, we have distributed this last year, in round numbers, 9,000,000 packages of seeds throughout the

United States, through the agency of Congressmen, the county reporters for the Division of Statistics, and the Department. To show how sincerely this dissemination is appreciated, remember that each person receiving these seeds is requested to experiment therewith and to report results. The records of the Department show that these 9,000,000 of packages reached more than 1,500,000 addresses, and we have heard, out of that million and a half of citizens, from 1,500 of them, in round numbers. In no case has there been any report by which the value of these seeds, or the things which grew from them, can be ascertained. In nearly every case where a report has been made, it has been like that of Oliver Twist on soup—they have asked for more! I shall recommend that this appropriation, which has amounted to $160,000 annually, be utterly abolished, and that in its stead there shall be an additional appropriation made to each experiment station in each State and Territory of the United States, which shall be for the purchase of seeds by the station director, himself authorized to get those things which may be adapted to his soil, climate, and environment. Then we shall really have experiments with new and improved varieties. This last year, at the suggestion of Dr. Dabney, Assistant Secretary of Agriculture, an appropriation was put in, as a sort of amelioration to Congressmen, who disliked to give up this cheap method of electioneering through packages of seed, so that $30,000 should be used for the publication of plain, practical bulletins for the farmers upon such topics as might be deemed important at the time. And now the question to be determined by this coming Congress is, Which shall do the most good to the agriculture of the United States, the distribution of unfertile turnip seeds or the dissemination of live thoughts among the farmers of the country? A bulletin will convey thoughts with very much more certainty of doing good, it seems to me, than seed packets will convey seed. The results of this seed appropriation in late years have not been at all satisfactory. Besides their cost, they have loaded down the postal service. Last year's seeds weighed, when packed and put into the mails of the United States, more than 305 tons; and you may well imagine that that much dead matter assists materially in increasing the deficiency in the postal service. Now, it seems to me that this distribution of bulletins should meet with your approval; and certainly that a direct appropriation made for each station for the purpose of the purchase of new and improved varieties of seeds will also meet with your approbation.

A word more, and that is to say that, while the seeds are generally annuals, there is another planting that may be taught in experiment stations which will produce things of far grêater duration. I refer now particularly to forestry. In this country the extent of denudation of hillsides in every State of the Union is illustrating every day what vast waste comes to the lands in the valleys. In many portions of Pennsylvania, where the hillsides and mountains have been deforested, the sweeping torrents have poured down with such force as to wash away all the surface soils of the valleys. In the State of Ohio to-day there are 1,000,000 acres of land, which a few years ago were fertile and productive, which are to-day absolutely untillable, because from the erosion of the water pouring down the hillsides the soil has been washed away. In view of this denudation and its results here, as well as in the presence of the vast waste that has occurred in European countries from this same cause, it seems to me that every agricultural experiment station and college should have at least a kindergarten school in forestry. We are using in this country now 30,000 acres of timber every twenty-four hours. To-night, because of its consumption by railroads and manufacturers, there are 30,000 acres less of timber than there was this morning. We have only 460,000,000 of acres in the entire Union of States and Territories, and it is not a difficult problem to solve, nor does it take a very profound mathematician to see that in a few generations this country will be as denuded of timber as the Orient is to-day. And remembering that nothing lives so long as a tree and the truth, I commend this question of forestry to you for your most thorough consideration.

The chair expressed the gratification and interest of the Association in the address they had listened to.

The Section on Agriculture and Chemistry then called up the third of its topics, "The Attitude of the Agricultural Colleges toward University Extension." In the absence of Messrs. Latta, of Indiana, and Emery, of Montana, Mr. Voorhees, of New Jersey, presented the subject:

Mr. VOORHEES. I come before you unprepared to give any special information in reference to the attitude of the agricultural colleges toward university extension, but rather to give you some results of our experience in New Jersey with agricultural extension work. It began with us in 1891 and has continued with increasing usefulness up to the present time, the courses for the present winter not having been yet determined. In a general way the work is regarded as extremely successful, meeting a class of agricultural workers who are anxious for information on certain topics that can not be reached by the college in any other way. The chief difficulty we find in presenting extension work is to get it in such a form as to meet specific requirements on the part of farmers. It was recognized at first that agricultural instruction in extension methods must differ materially from instruction in college. At the same time it was felt that there were certain specific principles in the work which could be presented in such a way as to have important practical results. In teaching agriculture we divided the work into sections, or courses, of lectures covering specific points. We gave first lectures on soils and crops which would give the farmers in any one community sufficient information of the character of soils as to enable them to benefit in dollars and cents from the information. The main idea in every lecture was to bring the farmer or young man to see the relation of that principle to the dollars he expected to get into his pocket. That, of course, was a little different from the method we might use in college, yet the work was presented in just as scientific a manner as we present it to students in college.

The second course was on feeding plants, with specific reference to fertilizing materials and fertilizers, exhibiting the methods of using and buying matters of that kind, and the whole question was covered, so far as we could do it in six lectures, so that the farmer, after hearing the six lectures, would be enabled not only to purchase intelligently but to use intelligently.

The third course included animal nutrition, with especial reference to the preparation of rations, the economical use of farm products, and the handling of dairy products. These lectures covered the whole ground, so far as we could in lectures of that sort, without going into details.

As to the result, of course farmers were given the option of taking any one of the three courses of six lectures each, intimating in any case that they should be taken in the order in which they were prepared, as, first, soil and crop, then fertilizer, then utilization of the crop; and in most cases the lectures were taken in that order, though in many cases they were directly interested in the question of plant food and could see more clearly the principles which governed in that direction than in any other direction.

The lectures were presented all the time with the idea that this work meant money to them. At the same time it was intended that they should be educated. If they began right, the result would be to greatly increase their interest in matters purely of an educative character. The lecture hour was given up entirely to the lecture, but students had an opportunity of asking questions as to what was not entirely clear. The lecturer had his specimens and his illustrative material, and made just as clear as he could the principles he was trying to get before them. The second hour was given up to a quiz, in which the students had an opportunity of asking questions of the lecturer and the lecturer had an opportunity of finding out from the students whether they saw the point and whether they were following in a logical manner the points brought forward. In a large number of cases we saw that our hearers did not understand the reasoning brought forward very well; they were not students in the strict sense of the term. Occasionally, however, we did find a person who took hold of the right idea and saw that one thing hitched on to another, and at the end of the course we saw that there was really some very important work done. I have some figures here which will give some idea of the proportion of those we lectured to who really took it up as a matter of education, in addition to the matter of making it apply to the farming business.

Agricultural courses of lectures have been given in seven different sections of the State. The average attendance at each lecture was 60, ranging from 109 to 26. These were regular attendants. Out of that 60, 22 took the regular work in connection with it—that is, in addition to attending the lecture, they remained during the second hour and were willing to be quizzed upon the work and to carry on the work required during the week, such as essays and the reading of agricultural works. At the end of the six weeks we examined and gave credit for the work of the 22, and that, practically, was the whole work.

I found that those who took the first course—that is, began with the course on soils and crops—were the ones who were most likely to go through and study the work. That is, if we could get them started right, we generally carried them through better. It was noticeable that out of a large number very few, after they had arrived at the age of 25 years, seemed to care for any more than simply to hear the lecture and pick up such information as might be of use in regular work. We could not get them to study between lectures or give an account of themselves so far as study was concerned. But the most useful course was given at Newton. It was inspiring to have these young men as students, every one a young man who had not gotten far enough along to get into a rut, and still believed that there might be something a little better than had been taught him by his father. As to the practical result: A young man of 23, who took hold of it in a bright way, took up the question of fertilizers. He raised early potatoes, and the whole question with him was, How can I get my potatoes into market a day or two earlier than my neighbor? If you can give us a formula that will do that it will be dollars to us. Of course the only thing to do was to give him principles and tell him how to apply these principles in the application of the formula. He says to himself, If this professor is right, I must get a crop if I do thus and so; hence I will buy the best potato manure in the market, and I will put it on, making the formula according to theory, and see where I come out. He did put it on, and told me the other day in great glee that he thought there really was something in it. He took the principles of science and applied them to practice. His neighbors asked him how he knew it. He says he attended the extension lectures.

The only fear we have is that we shall not be able to meet the demands made upon us to carry on the work. However, I believe the indirect effect will be of great value to our institutions in stirring up interest and bringing men to us for the long course. So far as my experience goes, I consider this one of the most useful lines of work we have ever taken up in New Jersey.

The CHAIRMAN. We will proceed at once to the topic "The Cooperation of Stations with Farmers' Organizations in Experiment Work."

Mr. JENKINS. The special resources and equipment of the different institutions and the character of the education given, as well as the special needs of the great farming interests in the different States, make it a very dangerous work for anyone who has spent his whole life in a single State to dogmatize with regard to a question like this, and I shall offer only one or two brief notes.

Of course a plan which may be useful in Connecticut might not be useful in Texas, and a method which will work in New York may not work in Colorado. The conditions under which we work in different States are very dissimilar. This results in decided embarrassment in discussing questions like this.

It is the makeshift work of agricultural stations which takes the soonest, which excites the most interest and is most appreciated at first by the farming population in my country, and I presume the same is true throughout the whole country. The examination of fertilizers, the testing of seeds and soils, the analysis of milk—all that sort of work, which is very useful in its way, but still I call it makeshift work. But it is more difficult to get sympathy and appreciation and interest in more strictly scientific work, which is in the end more practical—the investigation of the great principles which underlie our agriculture. Yet the station is, it seems to me, under an obligation to undertake and carry on, to some extent, and an increasing extent, work of this kind, which does not so readily meet with appreciation from farmers; and if it is to be a successful station, it must educate its constituency up to work of that kind. When an opportunity offers for cooperation with any farmers' club or society or a grange, it should be heartily welcomed by the experiment station, as affording an opportunity to enlist the sympathy and interest of the farmers and extend the sphere of influence of the institution, also to accomplish, if possible, some work which shall be of scientific value and which will stand. But the station should not undertake a line of work at the invitation of any farmers' organization which it is not able to carry through satisfactorily and completely. There is always a tendency to multiply the lines of our work and divide our forces and to weaken ourselves by so dividing. We are apt to be always in a hustle, when a long pull and a strong pull at some one thing would accomplish more in the end. Now, if a line of work suggested is such that a station can not undertake it, it ought frankly to say so. Assuming, however, that a station has the time and resources and the personnel to carry through a work, I should say, by all means undertake it; undertake it at some risk and great inconvenience, if necessary; undertake it for the sake of presenting an object lesson of what a thoroughgoing scientific piece of work should be, and enlist the sympathy and attention of the farming community. There are none of us, I think, who will not acknowledge that we are in need of bringing the station into closer sympathy with the farming constituency. I should be willing to sacrifice work I had planned or even begun if it were necessary in order cordially to accept any offer of cooperation with a farmers' organization in carrying on one of these experiments.

I have one word more to say about a danger I have met with in my experience in undertaking work of this kind. There is always the danger of sacrificing accuracy to the prejudices of those who are associated in the work, and to save those who are working in it from inconvenience and extra trouble. A farmer or an association puts land at the disposition of the station, or offers men, or tools, or money, without full appreciation of the pains and labor involved in carrying through experiments thoroughly, as they ought to be carried through. We all know that an experiment generally calls for a good deal larger outlay of time, money, and pains than we anticipated at first, and there is always this danger of sacrificing something of accuracy to those who are cooperating in the experiment. It is a mistake. It is especially essential in such cases that the work which is carried on with farmers' organizations should be a model of exactness. It should be an object lesson to the farmers of strict accuracy of work and strict accuracy in the interpretation of results obtained. We have had a little experience in our station in work of this sort, and I must say I consider it the most useful work the station has done; and it is not devoid of scientific value, but has a distinct and permanent value. But above all, it has been of use to the farmers, and the value of any station is in the usefulness of its work to the everyday farmer. George Eliot has said that the object and aim of any rightly constituted man is use; it is for use he exists. The same may be said of the experiment station.

Mr. EMERY. This subject has been one of considerable thought with me. In 1889 there was quite an extensive series of experiments performed by citizens of different parts of the State of North Carolina and the matter collected has been published in a bulletin. The experiments were in the nature of soil tests and variety tests of leading crops, cotton and corn being the chief ones. The second series was very much reduced in numbers, seven stations being carried forward in different sections of the State—in the east-central portion, the Piedmont section, and in the mountains. These stations were conducted by men of intelligence, who took great pains with the work. They spent a great deal of time, and for the season of 1891 we paid them $20 for their time and the use of the land, they of course keeping the crop. We recognized the necessity for moving these stations round and not keeping them in the same section if we would carry them forward for any considerable time. Men conducting experiments of this kind get tired after a while and the interest does not continue so much as during the first season. The first season there was quite a considerable interest manifested by the people in the neighborhood, but they rather tired of it. The difficulty of securing in their places trustworthy assistance without the close supervision which it needed caused us to give up the work. It requires a great deal of painstaking care, and with the distances we have and the expense of traveling we did not feel that we got results of sufficient value to warrant us in carrying on the work. As I said to the section this afternoon, we attempted then to meet the farmers' alliances. We got into correspondence with a considerable number of the alliances and an agricultural committee was appointed to receive our circulars and to delegate one of their members or some member of the alliance to conduct experiments. In this way we got a considerable number of experiments on new crops and soil tests started in different parts of the State. Some we carried through were quite successful, though the percentage we received reports from was so small we did not consider the results worth publishing. The interest of the alliances dwindled out apparently as their interest in politics developed. Perhaps if we had been in a position to visit these alliances occasionally during the season we might have held their interest, but that was impossible. Later we have distributed seeds of desirable varieties of plants and have followed these up at the end of the season with a series of questions in circular form, and by that means we have got a considerable number of favorable replies as to the growth of crimson clover. We have no doubt that we shall get a considerable number of farmers to growing crimson clover as a result of that, but so far as substation work is concerned we do not think the results obtained are worth the time that has been expended on them, though as a matter of education it is probable that enough has been done on the whole to warrant the work having been undertaken and carried forward.

Mr. Mills spoke of very successful cooperation with farmers in the Province of Ontario. His experimenters were largely ex-pupils of the Ontario College.

The Section on Agriculture and Chemistry here took the floor with a discussion on tuberculosis.

On motion it was resolved to strictly enforce the five-minute rule, and to recognize no speaker a second time until all who desired had spoken.

Mr. HENRY. In order that we may understand each other upon a subject which is crowding upon some of us and in which all are interested, I would like to get a few statistical data. I would ask all colleges and stations represented here how many stations have directly used the tuberculin test? Seventeen responded.

Now, how many have used it on the station herd and found the herd infected? Twelve.

How many have used it on the station herd and found no infection in the herd? One responded (Storrs College).

How many cattle were tested? (Mr. Koons was not able to say. The herd consisted of 20, and the veterinarian made tests on those suspected.)

Mr. HENRY. We have had an idea that this thing is pretty general already. Are there any other questions we should ask?

Mr. ALVORD. In how many cases have animals been tested a first time and have responded on a second test? Five.

In how many cases was the second test verified by post-mortem? Four.

The CHAIRMAN. Will the five gentlemen who report above state how long a time intervened between the tests?

Mr. HARRIS. Six months.

Mr. HUNT. About two years.

Mr. MYERS. About two months.

Mr. MILLS. About a month and a half.

Mr. HENRY. In how many cases have stations taken charge of, or assisted with, other people's herds? Ten.

Mr. PLUMB. How many persons here have injected cows and received no response, yet the cows were afterwards found to be diseased? Three.

Mr. Hills, in something like 1,200 cases, had found 2 cases where tuberculin did not react.

Mr. ARMSBY. How many who have had experience with tuberculin have observed injurious effects of any sort upon animals not reacting to the test?

Mr. PLUMB. We had a case of abortion, but it was not certainly from this cause. It occurred two or three months afterwards.

Mr. HILLS. Out of 1,200 cases there was 1 case of erysipelas, starting at the point of injection.

Mr. EMERY. In North Carolina we had one animal which responded very slightly, but it was a cow which a month or two afterwards died from abortion, and upon examination we found the lungs very badly affected with foreign matter. We doubted very much whether the animal had tuberculosis, though one or two of the examiners thought it had. I believe there was no tuberculosis in the animal.

Mr. MYERS. I would like to ask whether any animals were allowed to live, when found infected, and were afterwards found to be free?

Mr. HILLS. Our veterinarian had an opportunity to test the herd of the Pratt Institute, at Brooklyn, and through the courtesy of Mr. Pratt three manifestly tuberculous cows were isolated. One has been injected eight or nine times at intervals, and seems to be getting better. The others have been killed, after injection two or three times.

Mr. ARMSBY. I wish to add to what Mr. Hills has said that I am told by a competent veterinarian that he has some reason to believe that tuberculin has some effect in curing cases of tuberculosis.

Mr. HAYS. In Minnesota we have tested eight cattle. Some showed a low, some a high reaction. We are trying doses of different size and at different seasons. Are there any other stations keeping animals under such conditions?

Mr. HENRY. In how many cases have tubercle germs been found in the milk of animals infected? Three.

How many have made tests along this line and failed to find them where the milk was from cows that had the disease? None.

At the Wisconsin station a cow had one-quarter of the udder greatly enlarged, and in the last stages of her sickness from consumption her milk from that quarter became like whey. We had it injected into a rabbit, which died in fifty-five days with its lungs gone entirely. The milk was fed to five calves which were killed five months after using this milk, and we found a few tubercles along the alimentary tract. Of course this is in the direction of the danger to humans in using this milk.

Mr. BECKWITH. We have tested milk at our station and found bacilli frequently.

Mr. MILLER. I was going to substantiate what Mr. Henry has said, by a case I know of in my vicinity. A cow had a bad case of tuberculosis, and the veterinarian having charge of her made a test with a pig which he fed for three weeks or a month on her milk. The pig being then evidently affected, he killed it and found it badly diseased. I had a steer about a year ago which was drooping, but did not have a test made, as it was evident he was affected, and was found to be so when killed. About a month after the steer was killed some hogs which had followed him in the field were badly affected, and eleven were found more or less diseased. I cremated the whole lot, but was interested to find that after keeping hogs away for about two months in midwinter and thoroughly disinfecting about the spot, a subsequent lot were not affected at all. The examinations were made by a veterinary surgeon.

Mr. POWER. Among the animals affected or killed, how many were high bred and how many commoner grades?

Mr. HARRIS. According to our experience tuberculosis is no respecter of persons as to breeds or families of animals.

Mr. PLUMB. I would like to ask how many stations here represented have had their veterinarians make inspection of slaughterhouses in their immediate vicinity? Two.

Mr. HENRY. In how many States are there laws now relative to tuberculosis? Five.

How many States are contemplating legislation in this direction? Thirteen.

Mr. ARMSBY. In how many States having laws on this subject is provision made for compensating owners of animals killed? Four.

Mr. FLAGG. In Rhode Island the State Board of Agriculture has had an appropriation of $15,000 which has been mainly used for work with tuberculosis. Perhaps more than $10,000 has been used for that purpose. We have a cattle inspector in each county, an appraiser at large, and a veterinarian. If the animal is condemned and found tuberculous, one-half the appraisement is paid to the owner; if found sound after being killed the full appraisement is paid. A limit is fixed of $50 for a grade animal and $100 for a pure bred.

Mr. VOORHEES. We have a dairy commission in our State, and the control is in the hands of the State Board of Agriculture. They, however, can not examine any animal except upon request of the owner or the State Dairy Commission. This commission, however, has power to make its own rules, and they are the law, and it can pay for an animal according to its judgment, not to exceed $60 for a registered animal.

Mr. ARMSBY. We practically have in our State a system of examination and payment for animals, although it is not directed at tuberculosis. It relates generally to the health of animals. The maximum price paid is $20. There is in contemplation this winter legislative action upon the subject of tuberculosis, and while it does not emanate from the station, doubtless the station will have a hand in it.

Mr. JOHNSON. Has any conclusion been reached as to locality? Does a low or a high altitude have any effect upon the disease? So far as I am able to say, I do not now know of the disease existing in Wyoming or Colorado.

Mr. HILLS. In the course of preparing our bulletin I corresponded with every veterinarian in the country. Those from the high plateaus of Wyoming and Colorado disclaimed the presence of the disease there.

Mr. DABNEY. I should like to hear something more about this important matter of paying for tuberculous stock. It appears from what gentlemen here have said that the disease is quite prevalent, affects all races of cows in this country, and has reached all parts of it. If this be true I do not think it is right to begin paying for worthless stock. If a man has animals of this sort they are more dangerous to him and his family than to anybody else. I think if legislation is to be so extensively started this winter it ought to be on right lines. I do not think it good policy to pay for this stock.

Mr. MILLS. It appears to me it would be entirely unjust to slaughter a man's stock, if it is proved that the stock is only slightly infected, unless you are prepared to say, in the first place, that the bacilli have been found in the milk of animals only slightly affected. Is there any instance of milk from such an animal furnishing tuberculous bacilli? In the second place, will an animal slightly affected in that way give the disease to another animal? It seems to me these two questions have to be answered before asking for legislation condemning a man's stock and then refusing to pay for it.

Mr. MYERS. There is another side to this question. We are in a fair way to get panicky, and there is no occasion for it. People are not going to die any faster than they have died simply because we have found that there are some tuberculous cattle, and it behooves this Association, in my judgment, to be extremely careful how it takes hold of this matter. There is an association of veterinarians in this country, and politicians and others who would gladly avail themselves of any excitement that might be raised by scientific investigations, so let us be extremely careful what we say and do upon this matter.

Mr. DABNEY. With regard to this whole matter, we are simply to get at the facts, and the question I raised was for information only. It will be our business to furnish the legislatures with facts upon which to legislate. I want to say one more thing about paying for stock. Should we not shape our legislation so as to aid the hygiene of our cows? I think if we go on paying for tuberculous stock it will not promote the hygiene of the stock, to say nothing of the morals of the community. Stock will be kept just as it is now. On the other hand, if a man loses the value of his stock he will be moved to take better care of it. We know that in tuberculosis it is almost wholly a matter of hygiene. If we encourage hygiene among our dairy herds we shall stamp the disease out in time. I might suggest here that people will import tuberculous stock into States where they will be paid for it, or even, as they did with pleuro-pneumonia in certain States, infect them.

Mr. VOORHEES. In reference to the attitude of the stations toward the tuberculosis question, in aiding or directing legislation, I would state that in New Jersey we were forced into it by an unfortunate accident, perhaps, but inasmuch as we are in, we have taken it up with the idea of guiding legislation with reference to the extent of the disease and the reliability of the tuberculin test, whether animals that are diseased in a slight degree are liable to communicate the disease. We have but a small appropriation, and we have laid down the following plan, which is now being carried out: We have employed a biologist and a veterinarian. Every animal is examined by both the veterinarian and the biologist with the tuberculin test. Animals that are manifestly badly diseased are destroyed. Those not badly diseased are isolated and treated further, and those animals which we have killed in herds throughout the State we have not paid for because we have found that wherever farmers have diseased animals, so diseased as to show it, they are glad enough to let the pay go provided we say nothing about it. I think that by working along these lines we shall get as much valuable information as if we make a spread about it. In the work we are doing we have divided the State into three districts. One, where the hygienic conditions are manifestly bad, and we are taking the statistics of animals under these conditions. Then, animals that are high bred but are kept under conditions of food and management not supposed to be the best. The third and last, those which are under as good conditions as possibly could be, in reference to food and management and hygiene, and we test herds in that section and get statistics. In every case when an animal is killed we keep full records of temperature and the veterinarian's diagnosis before and after the animal is killed, and we have samples, not only of portions of the infected animal, but samples of the milk subjected to bacteriological tests, so that when the legislature meets this year we shall be able to present some facts which shall guide the State in making laws for the coming year. Some very curious results have been obtained, especially in reference to the tuberculin test. They may, however, not be verified. It seems to me that the station should take just this attitude at the present time; we should recognize the fact that the disease is one which should be exterminated, if possible; that we do not know everything in reference to the best way to exterminate it, and that we should proceed on lines which are scientific and will be helpful.

Mr. HENRY. The consumer of milk is, after all, the person most interested in this problem. When we issue these startling bulletins we are inflaming the people, and I early recognized that something must be done in the line of giving relief while we were fighting disease. We are working on the line of pasteurization in Wisconsin. We shall give lectures on pasteurization, and have one instructor this winter who teaches it. We are ready to send out young men to factories and places where milk is supplied. I want to say to you who are working in dairy schools, work fast. The pasteurization of milk is simple, but it takes a trained man to do it. We are supplying pasteurized cream to our citizens, and are delivering milk to families whose children need it. At present we only supply milk to families who bring a physician's certificate, charging 10 cents per quart. Our dairy schools ought to take hold of it this winter and give courses in pasteurization. The people want it. Do not let us scare the people and then give them no comfort. Let us tell them that when milk is heated to a certain degree it is perfectly safe and free from this dread disease. It is not scalded milk, but pasteurized milk.

Mr. ROBERTS. Do you consider milk that has been pasteurized safe milk always? Your method is good as far as it goes, but it does not go far enough. Pasteurized milk is no more fit to drink than tuberculous beef that has been cooked. They are both dangerous. It seems to me this recommending half measures is not what this Association wants to do. The only way to get sound milk is from a sound animal.

Mr. HAYS. How long do you propose to continue the sale of pasteurized milk?

Mr. HENRY. Being a station measure, we shall discontinue it at any time we get something better.

Mr. HAYS. Do dealers enter into competition with you in the sale of pasteurized milk?

Mr. HENRY. We are urging them to do so.

Mr. HAYS. What guaranty have you that the process will be properly followed?

Mr. HENRY. We have none.

Mr. ALVORD. I want to say a word from the standpoint of the breeder or dairyman, whom you gentlemen must meet, and in goodly numbers, if you start a crusade in this country against tuberculosis based solely upon the tuberculin test. For seven years there have been very few days when I have not been so unfortunate as to have tuberculous cows under my observation. I have watched them, not from the standpoint of the veterinarian nor of the bacteriologist, and not much from the point of view of scientific observation, except in so far as close observation of any kind, with common-sense deductions therefrom, are entitled to come under that head; but I have watched them as an interested party, as touching my pocket. There are a good many things in this matter of tuberculosis that the breeder and dairyman must yet be convinced of before he will be satisfied to be raided on by the scientific men. I will not go into detail, but take the matter of heredity. I have been reading, observing, and studying and informing myself, as an owner of stock subject to this disease, as to all the facts about it. I am not convinced yet, by the evidence presented, that good, healthy animals, free from the disease, that will stand the tuberculin test, if you please, can not be bred from parents one or both of which have been tuberculous. I believe this is as true in the bovine as in the human race. I have not yet been satisfied that animals treated under the best hygienic conditions will easily communicate the disease when they are not themselves in an advanced stage of it. I have not yet been convinced that the milk the community is using to-day generally is any more dangerous than that which generations before us have used. I do believe that there are places in the country where there are greater percentages of unhealthy milk. I am not yet convinced that milk from tuberculous animals, that give no other evidence of their being infected than the tuberculin test, is dangerous to man or beast, be the animal young or old. In this line I have carefully watched the use of milk, which I was not willing to have come into my house, in the feeding of pigs, calves, and lambs, all of which have been slaughtered and examined as a butcher would examine them, not as a veterinarian or microscopist would. I want to say as a breeder that if there is any such thing as defending one's rights of property in this country, you have got to go further with your evidence than you have yet to take my stock and slaughter it, when the animals are performing all the functions we demand of healthy stock and show to the closest scrutiny of superficial observation that they are not diseased animals. Suppose that I have a cow that is a good feeder, a good breeder, a fine dairy animal, or in any other particular is a profitable animal in my estimation; I say that that cow is healthy if she performs all these functions, notwithstanding the fact that she may respond to the tuberculin test. Animals have been slaughtered as a result of this test which I do not believe can properly be called diseased animals. I believe, with the gentleman from Canada, that the owner of stock must be carefully protected.

Mr. Murkland spoke of a suggestion quoted with favor in a report of the Department of Agriculture to the effect that where the tuberculin test has been used with marked reaction, but where there is no other indication of disease, the animal need not be immediately slaughtered but kept and prepared for beef. He thought this a suggestion worth considering.

On motion the session adjourned at 10.07 p. m.

Morning Session, Thursday, November 15, 1894.

The Association was called to order by Chairman Morrow at 9.30 a. m.

The secretary read a letter from the National Statistical Association, inviting the members of the Association to join with that organization and unite in their national work. On motion of Mr. Armsby the secretary was instructed to convey the thanks of the Association to the National Statistical Association and invite its members to attend the meetings of the Association.

The secretary read the following telegram which, in accordance with the instructions of the Association, he had sent to Gen. S. D. Lee:

President S. D. Lee: The Association of Agricultural Colleges and Experiment Stations in session sends greetings to its absent president and sympathy on account of the cause of his absence.

M. A. Scovell, *Secretary.*

Mr. Alvord presented the following resolution from the executive committee, with recommendation that it be adopted:

Resolved, That the executive committee be authorized to call upon every institution eligible to membership in this Association for a contribution of $10 to defray the necessary expenses for the next year, the same to be payable as soon as practicable after the 1st of January, 1895.

Adopted.

Resolved, That the executive committee be authorized to edit and procure the publication of the proceedings of this convention in cooperation with the United States Department of Agriculture.

Adopted.

Mr. Goodell offered the following:

Whereas this Association has heard with pleasure the address of the Honorable Secretary of Agriculture, and especially his suggestion that Congress be requested to increase the appropriation to each station for the specific purpose of testing new varieties of seeds, bulbs, etc.; and believing that this will conduce to that system of cooperation which has long been desired, and to the realization of one of the chief benefits which the authors of the Hatch Act expected that the connection of the United States Department of Agriculture with the stations would confer: Therefore,

Resolved, That this Association request the Secretary of Agriculture, by correspondence or otherwise, to determine what additional appropriation will be needed to accomplish the purpose he has in view, and to include it in his estimate for the coming session of Congress.

On motion referred to the executive committee.

Mr. Buckham, from the committee appointed to take into consideration the personal statement made by the chairman of the executive committee, reported as follows:

Whereas President Henry E. Alvord has served with signal ability and fidelity as chairman of the executive committee of this Association of American Agricultural Colleges and Experiment Stations since the organization of this body; and

Whereas this Association learns with much regret that President Alvord will no longer consent to serve in this capacity, for which he is so eminently fitted: Therefore, be it

Resolved, That this Association, in general session assembled, hereby desires to express its grateful and hearty appreciation of the valuable services rendered to this Association by President Alvord, and directs that this resolution be spread upon the minutes of the Association and published in its proceedings.

At the suggestion of the chairman this resolution was unanimously adopted by a rising vote.

Mr. Holladay moved the appointment of a committee to draft resolutions of thanks for the various courtesies which the Association had received in Washington, the committee to report at the general session at night, November 15.

Adopted.

The chair subsequently appointed Messrs. Holladay and Emigh such committee.

Mr. Hays addressed the convention on the subject of a card index to agricultural literature relating to field crops and field management, live stock, and dairying. He and some voluntary associates, with the help of students, had made some 5,000 or 6,000 catalogue cards, arranged and catalogued under the system or key furnished by the Office of Experiment Stations, with additions along certain lines. He thought one or two thousand dollars would bring this work up to date, cataloguing such works as the Association would be especially interested in.

The CHAIRMAN. No formal recommendation has been made; you have the matter before you.

Mr. ALVORD. I am instructed by the committee on order of business to give an opportunity at this time for delegates to make motions testing the sense of this meeting as to time and place of the next annual convention.

Mr. JOHNSON. I call up the resolution I have already offered to select Denver, Colo., as the next place of meeting, and suggest August 15 to October 1 as the most suitable time.

Mr. Clute extended a cordial invitation to the convention to meet in Florida, suggesting a winter meeting as the most interesting and agreeable for Florida.

Mr. Johnson desired to divide his motion, the first half to relate to the place of meeting, the second to the time.

Mr. Emigh earnestly seconded Mr. Johnson's invitation to Denver, reminding the convention that it was invited not by the city alone, but by the whole State.

Mr. Roberts extended an invitation to the convention to meet at Ithaca, N. Y., and Mr. Hays repeated his invitation to Minneapolis.

On motion the roll of delegates was called, each delegate stating his preference as his name was called. The vote resulted:

Denver, 36; Florida, 11; Ithaca, 3; Columbus, 0.5; California, 1.

The chair declared that the sentiment of the convention favored Denver, Colo., as the next place of meeting.

The time of holding the next convention was then discussed. Mr. Raub announced that the National Educational Association would probably meet, as usual, the third week in July, at Denver, and on motion of Mr. Scott it was declared, by a vote of 30 to 4, that the sentiment of the Association was to hold its convention the week preceding that of the National Educational Association.

The CHAIRMAN. The executive committee will take note of this expression of opinion in favor of holding the meeting one week before the meeting of the National Educational Association. Are any of the sections now ready to report upon their officers?

Mr. Washburn, for the Section on Mechanic Arts, reported the names of Mr. Patterson, of Kentucky, for president, and Mr. Anderson, of Kentucky, for secretary. On motion these nominations were confirmed.

Mr. Voorhees, for the Section on Agriculture and Chemistry, reported the names of E. B. Voorhees for president, A. E. Blount, vice president, and C. C. Georgeson, of Kansas, secretary. On motion these nominations were confirmed.

Mr. Myers offered the following resolution, which was referred to the executive committee and immediately referred back to the convention for action:

Whereas close relations exist between the agricultural colleges and experiment stations of the United States and those of the Dominion of Canada: Therefore be it

Resolved, That this convention extends a most cordial invitation to all of the agricultural colleges and experiment stations of the Dominion of Canada and its several provinces to send representatives to the meetings of our Association; and we hereby extend to the same the full privileges of the Association permissible under our constitution.

Adopted.

Mr. Mills expressed the thanks of the Dominion experiment stations.

Mr. Plumb reported the following nominations for officers of the Section on College Work: Mr. Harris, of Maine, president; Mr. Connell, of Texas, vice-president; Mr. Wing, of New York, secretary.

On motion these were confirmed.

Mr. Harris, of the committee to nominate officers of the Association, presented the following report:

Your committee appointed to nominate officers of the Association for the ensuing year have the honor to present the following recommendations:

For President—Henry E. Alvord, of Oklahoma.

For Vice-Presidents—(1) A. A. Johnson, of Wyoming; (2) A. Q. Holladay, of North Carolina; (3) T. B. Comstock, of Arizona; (4) E. B. Craighead, of South Carolina; (5) O. Clute, of Florida.

For Secretary and Treasurer—J. H. Washburn, of Rhode Island.

For Executive Committee—H. H. Goodell, of Massachusetts; H. C. White, of Georgia; M. A. Scovell, of Kentucky; H. P. Armsby, of Pennsylvania, and the ex officio members provided for by the constitution, S. D. Lee, of Mississippi, the retiring president; H. E. Alvord, of Oklahoma, the incoming president; and J. H. Washburn, of Rhode Island, the incoming secretary and treasurer.

Respectfully submitted.

A. W. HARRIS,
A. A. JOHNSON,
W. L. BROUN,
W. A. HENRY,
C. W. GARFIELD,
C. F. VANDERFORD,
A. C. TRUE,
Committee.

WASHINGTON, D. C, *November 14, 1894.*

On motion the report was adopted and the officers named declared duly elected.

Mr. Test presented, for the Section on Entomology, the names of C. P. Gillette, of Iowa, for chairman, and J. M. Aldrich, of Idaho, for secretary, which, upon motion, were confirmed.

Mr. Craighead presented the following resolution:

Resolved, That it is the sense of this Association that the executive committee continue its efforts to secure an appropriation for the purpose of furnishing, under proper restrictions, students in land-grant colleges with uniforms and such other equipment as may be necessary for their more complete instruction in military science and tactics.

On motion of Mr. Harris this was referred to the Section on College Work.

Mr. Silvester, followed later by Mr. Miller, extended a cordial invitation to the delegates to visit the Maryland station and college, at College Park, Md., 8 miles from Washington.

Mr. Alvord announced that General Breckinridge, having been ordered away from Washington, would not be able to address the convention.

Mr. Wing moved that a committee of three be appointed to examine into the proposition offered by Mr. Hays in regard to indexing agricultural literature, and to secure, if possible, the cooperation of the Department of Agriculture, Mr. Hays to be chairman of the committee, which was to report at the next meeting.

Adopted.

The chair appointed Messrs. Hays, Wing, and Plumb such committee.

Mr. HARRIS. By an error the committee on nominations overlooked the office of bibliographer. The committee recommends that the present incumbent, Mr. S. W. Johnson, of Connecticut, be reelected.

Adopted.

Mr. Scott offered the following resolution, which was seconded and referred to the executive committee:

Whereas this Association, sensible of the value of the present and possible functions of the Office of Experiment Stations in bringing the various stations into close relations with the Government of the United States, and in serving as general clearing house for investigators and those seeking the results of their investigations: Therefore be it

Resolved, That the executive committee be instructed to communicate to the honorable Secretary of Agriculture the judgment of this Association that a similar channel of communication between the agricultural colleges and the Government is desirable, and to assure him of the readiness of the executive committee to cooperate, should it be desired, in perfecting a plan which may serve this purpose, either through the enlargement of the scope of the work of the Office of Experiment Stations or by such other means as may be judged wise.

Dr. Charles W. Dabney, jr., Assistant Secretary of Agriculture, was introduced and spoke as follows:

The Scientific Work of the Department of Agriculture.

Mr. President and Gentlemen of the Association: I thank you very much for your kind invitation to meet you at this time, although I understand thoroughly that this invitation is more to the Department of Agriculture than to myself. It was my honor to receive from the honorable Secretary of Agriculture, on the first day I entered upon my duties at the Department, a commission to take general direction of some of the more purely scientific divisions of that Department; so I am permitted at this time to speak to you about that part of our work. Since you are the appointed representatives of agricultural science in America, it is very appropriate, I hope, for me to tell you something about the scientific work the Department of Agriculture is doing.

I address this morning the representatives of the agricultural colleges and experiment stations organized under a system of Federal laws for the investigation of science as applied to agriculture, and I feel, therefore, that the best way I can use the few moments allotted me is in telling you about some of the new things now being done for the advancement of the sciences to which you are devoted. You are all, I am happy to believe, already pretty familiar with the ordinary work of the Department of Agriculture. I shall not, therefore, talk about the old lines on which we have published bulletins and reports, but will confine myself to certain new subjects, chiefly for the purpose of exciting your interest and inviting your cooperation in working them out.

In pursuance of the resolution passed by you at the convention in Chicago, recommending that the Secretary of Agriculture be authorized by law to exercise supervision over the expenses of the stations, Congress has incorporated in the agricultural appropriation bill for 1895 the following words:

"And the Secretary of Agriculture shall prescribe the form of the annual financial statement required by section three of the said act of March second, eighteen hundred and eighty-seven; shall ascertain whether the expenditures under the appropriation hereby made are in accordance with the provisions of the said act, and shall make report thereon to Congress."

This is the only change in the laws regulating our relations. Since it was made at your request and with the approval of the Secretary we have reason to hope for perfect harmony in carrying it out.

In order that the stations might have the fullest opportunity to order their expenditures in accordance with the plan of the Department, schedules for these financial reports, to be made first at the end of the present fiscal year, were prepared and sent to you soon after the appropriation bill passed. This law, in connection with previous legislation, gives the Secretary of Agriculture authority to investigate and report upon the expenditures of the stations and to visit them for the purpose of securing detailed information in order to make his report to Congress. This examination and visitation, which you have said you will most "heartily welcome," will be sure to increase the efficiency of both the stations and the office of the stations in the Department. I think, therefore, that we are to be congratulated upon this change, which brings us into still closer union, and that we may look forward to mutually profitable relations and more cooperative work in the future.

But I promised you to say a few words about some of the new lines of work which the Department has taken up. One of the Western newspapers made a remarkable announcement last March, to the effect that the Department of Agriculture had just "elected a professor of astrology." We have long known that the moon was supposed to have a great influence on some departments of agriculture, but we had never heard it suggested before that the stars had anything to do with crops. It did not take us long, however, to find out that the usually infallible editor referred to our new officer, the "agrostologist"—a title that the country newspapers have been struggling with ever since.

The Department of Agriculture has always recognized the importance of the investigation of our forage resources, and through its Division of Botany it has made many valuable contributions to our knowledge of them. In view of the growing importance of grasses and forage plants at the present time, when the methods and objects of farming in many sections of our country are undergoing a radical change, the honorable Secretary of Agriculture recently decided that this subject required more attention than the Department was able to give it with the present force of the Division of Botany. He therefore employed a special agent to prosecute investigations upon grasses and forage plants.

No country in the world possesses such vast forage resources as ours, and in none are the plants which compose that forage more various. Our botanist informs us that there are over 3,500 different kinds of grasses in the world, of which over 700 are known to grow within our territory. There are, besides, many useful forage plants—not grasses—such as the clovers and alfalfa. The annual hay crop of the country has an estimated value of $600,000,000 and more than 14,000,000 head of cattle are supported upon our grazing lands. The maintenance and improvement of these resources is a matter of importance to every citizen of the United States, and of direct and vital interest to every American family. Upon it depend the vast meat and dairy interests, and to a great extent the more important methods of maintaining the fertility of our agricultural lands.

In our great territory, including lands of many different elevations and climates, much exploratory work yet remains to be done upon our native grasses, and by continued examinations it can not be doubted that useful species new to agriculture will from time to time be found. In the arid regions of the West and Southwest are nutritious grasses and other native forage plants whose introduction into culture, if carefully undertaken, could not fail to greatly benefit these sections. The importation of the native or improved forage plants of other countries has in some cases resulted in much benefit to our agriculture, and doubtless many other plants can be found and tested with regard to their adaptability to our climate and soils. The study of grasses for special purposes, as for example, for binding the drifting sands along our ocean and lake shores; for holding the embankments of our great rivers, which frequently overflow and sweep away farms, while they cover others with destructive débris, materially broadens the interest in grasses and makes this work of practical importance to many other classes of citizens.

Considerations like these have induced the Secretary of Agriculture to recommend to Congress the establishment of a separate Division of Agrostology for investigating grasses and forage plants, with special reference to their use in those sections of our country where they are at present little known. The establishment of such a division would demonstrate to the citizens of this and other countries that our National Government fully recognizes the primary importance of the grasses in the rural economy of the nation. It will be the function of the new division to instruct our people in the habits and uses of these plants; to examine their natural history and adaptability to our different soils and conditions; to import, test, and introduce foreign kinds into cultivation; to identify the plants sent in by correspondents; and to prepare circulars, bulletins, and manuals for distribution. I am pleased to be able to tell you that we have reason to believe that Congress will give us the authority and the means with which to carry on this work.

The Division of Botany, which has been so prolific in giving birth to new divisions—the Division of Forestry and the Division of Vegetable Pathology, as well as Agrostology, are its children—has recently developed several other new lines of work. It has, for example, devoted a great deal of attention recently to a more systematic study of weeds. Among others, that czar of weeds, the Russian thistle, which some of our Congressmen think to be worth its million, has received much careful attention. The Department has done all that it could do in investigating the natural history and methods of distribution of this weed, and in publishing circulars and bulletins relative thereto. There are other weeds which are almost if not quite as dangerous as this, and they will all be studied as rapidly as the means available will permit.

A special expert has been engaged and a laboratory fitted up for the systematic study of seeds with reference to their purity, germinating power, etc. This is an important matter, especially in connection with our studies of grasses, forage plants, and weeds, since our grass seed and seed grain are always liable to be contaminated with the seed of weeds. It is our desire to establish standards of purity and of germinating power for all the chief American seeds, and in this way promote the trade in these seeds and especially the demand for them abroad. Our exports of clover seed are already very considerable, and many seeds of commerce demand the oversight of this Department.

I speak this morning to many agricultural chemists, so that I need not take time to explain the disappointments that we have all felt with regard to the results of the chemical analyses of soils. We must acknowledge now that we can not tell the practical farmer all that he wants to know by a single analysis of his soil; that it often requires many analyses to learn, even approximately, the chemical nature of the soil of a given section and that, even when we have made these, we are unable to explain why one soil is productive while another fails entirely. We all know cases where soils having almost identically the same chemical composition yet differ greatly in the uses to which they can be put. In short, the chemical analysis of the soil does not tell us the whole story. A great deal more is to be learned about it before we can tell the farmer how to make it productive or why he should put one particular crop upon it and not another. Our Department has decided, therefore, to attack this old problem from two different sides; first, from the physical side, by studying its relation to heat, moisture, etc.; and second, from the biological side, by studying its nitrifying organisms, etc. This we hope to do without neglecting the old lines of chemical investigation.

A new division has been created in the Department to be known as the "Division of Agricultural Soils," whose duty it will be to study the rainfall and temperature after they have entered the soil and to keep a continuous record of them in the most important types of soil in our country. Our Weather Bureau keeps a record of the temperature and of the moisture in the air and of the rainfall until it reaches the surface of the soil. It is proposed in this new division to continue the study of the rainfall after it enters the soil. The actual conditions of air, moisture, and temperature which soils are able to maintain largely determine what classes of plants are adapted to them. These things depend in turn upon the texture of the soil. Even with the same rainfall and exposure to heat it is well known that different soils maintain very different conditions. This difference in the meteorological conditions under the surface has an important bearing upon the adaptability of soils to crops, because of the influence on their development, yield, texture, quality, vitality, and time of ripening.

Soils adapted to early truck and small fruits, for example, are sandy, open, and warm, allowing the rain to pass through them very readily and maintaining only a small amount of moisture. This dry condition gives them their peculiar value for forcing vegetation to an early maturity. The tobacco soils of Pennsylvania owe their peculiar value to their close texture and to the fact that they maintain an abundance of moisture for the crop. This produces a large, heavy type of wrapper which competes with the Cuban tobacco. The tobacco of the Connecticut Valley, on the other hand, is grown on a very light textured, sandy loam, and the soil being much drier the crop is much lighter in color and finer in texture. It competes with the Sumatra wrapper.

The work of this new division is to be confined to the study, principally, of the texture of the soils adapted to these different interests. It will be one of the purposes of this division to develop the methods of these investigations and to encourage an extensive study of the soils of the country by State stations and colleges. There is a pioneer work to be done here which you can scarcely be expected to do. This work is based upon geological formations which may cover a number of States and may be found in widely separated parts of the country. Samples from the same formation or the same class of agricultural soils must be collected from all over the country and carefully examined and compared. In many cases it will doubtless be necessary to get samples of soils from foreign countries for the purpose of comparing them with our own.

Congress has also been asked to provide, in connection with our Chemical Division, for the investigation of the chemical characteristics of the various typical soils of the United States, especially in relation to the nature of the nitrifying organisms contained therein and the best condition for the growth of the same. This work has already been begun and promises to be most interesting.

I am in danger, however, of using too much of your time, and must hasten to a conclusion. You will be interested to know that the Department of Agriculture, which is, in part, a great experiment station itself, is pushing its scientific work ahead of everything else. We have made a little table showing the actual expenditures of the Department during the years 1892, 1893, and 1894 for all of its different purposes, and have classified these expenditures so as to throw all money used in the strictly scientific work in one column and all that expended for administrative purposes, for publishing and distributing documents, for distributing seeds, for purely business or strictly educational work, in another column. I will not burden your proceedings with this table, but merely give you the results.

The Department of Agriculture expended for the fiscal year 1892 $2,271,312.72, and 46.2 per cent of that sum was expended in scientific research. For the fiscal year 1893 the expenditures were $2,354,809.56, and out of it 45.6 per cent was expended in the application of science to agriculture. For the year ending June 30, 1894, out of a total expenditure of $1,990,530.70, the Department applied 51.8 to scientific work and investigation. While economy has been practiced in the administration of the Department, this economy has not impaired its scientific work. Comparing the expenditures for the fiscal years 1893 and 1894, respectively, I note that the total expenditures for 1894 are, roughly, $364,000 less than the total for 1893; but the per cent of the total amount paid out for scientific work, as distinguished from the administrative and general business, is 5.6 per cent more, in proportion to the total expenditures during the year 1894, than it was in 1892, and 6.2 per cent more than it was in 1893. It was during this same time that we commenced the new work in agricultural soils, agrostology, and seed investigations, and still further developed that in weeds and many other older scientific lines.

We feel that this report of our stewardship is due you as scientific men, and it is not made in a spirit of boasting. It is simply the natural and proper development of a Department that is, above everything else, a great agency of science. The Department of Agriculture is an agency for the promotion of economic production in our country, and, as such, it must use scientific methods and means.

While speaking of the progress of this Department, it is gratifying to learn from the reports of the colleges and stations, and from the discussions in this meeting, that these numerous institutions are also advancing bravely and doing more each year for the promotion of science and for the education of our people for an enlightened citizenship. What a grand national organization for the advancement of agricultural science and education is this of ours! The system of agricultural colleges and stations in all of our States and Territories and our national Department of Agriculture forms an organization for the advancement of science applied to agriculture without an equal in the world. We may not yet be doing as thoroughly systematic work as corresponding institutions in Germany or other countries, but we believe our organization is more complete, and that in due time we will produce the work. Let us, therefore, take courage to go forward and do our work in the stations, in the colleges, and in the Department more faithfully and more accurately than ever before. The American people have intrusted great interests to us, and have provided us with liberal means. Let us be sure that we do not disappoint them, but strive bravely to give them a magnificent return for their generous confidence and their handsome endowment.

Mr. ATHERTON. I wish to offer a resolution which was suggested by the resolution offered by Mr. Scott and the remark made by Mr. Dabney. I am sorry he has gone, because I want to say in his presence that while I highly appreciate the benefit that comes from the cooperation between the Department and the experiment stations, yet I believe the resolution offered by Mr. Scott is fundamentally a mistake. I shall not discuss it at this time, because the question must come before the convention on the report of the executive committee, but I offer the following resolution to be referred to the executive committee to be considered with the other:

Whereas the act of Congress approved August 30, 1890, providing for the further endowment and support of the colleges established under the provisions of the act of July 2, 1862, expressly committed the administration of that act to the Secretary of the Interior; and

Whereas the Secretary of the Interior, in carrying out that provision, has intrusted the details of administration to the Commissioner of Education: Therefore be it

Resolved, That it is the conviction of this Association that the educational work of the institutions represented by it would be greatly promoted by the establishment in the Bureau of Education of a division or office similar in function to the Office of Experiment Stations in the Department of Agriculture; and

Resolved, That the executive committee be instructed to express their judgment to the Secretary of the Interior, and to offer all necessary cooperation to secure the end in view.

Mr. ALVORD. There are now two resolutions taking different grounds in the hands of the executive committee. It is apparent that there is no time now for the consideration of this important subject, but the Section on College Work has all the afternoon for its deliberation. I move that the two resolutions be referred to the Section on College Work for its consideration.

Ordered.

The convention adjourned at 11.40 a. m., to meet again at 7.30 p. m.

EVENING SESSION, THURSDAY, NOVEMBER 15, 1894.

The Association was called to order by Chairman Morrow at 7.45 p. m.

The chair announced as the committee on admission and courses of study and on correspondence with educational bodies the following;

Messrs. Atherton of Pennsylvania, Harris of Maine, Hunt of Ohio, McBryde of Virginia, Murkland of New Hampshire.

Mr. ALVORD. The committee on resolutions has instructed me to report back, in a modified form, the resolution offered by Mr. Hays on tuberculosis, as follows:

Resolved, That the Association recognizes the importance of controlling and preventing bovine tuberculosis and that it is the sense of this body that the officers of the various stations should use all legitimate means to increase and perfect provisions for further study and experiment in connection with this subject.

Adopted.

Mr. ALVORD. The committee also reports back, in a modified form, the resolution offered by Mr. Goodell regarding seed distribution, as follows:

Resolved, That this Association will approve and cordially cooperate in any plan which may be recommended by the Secretary of Agriculture and legalized by the Congress for improved methods of testing and introducing in the several States new, rare, and valuable seeds and plants.

Adopted.

Mr. TRACY. The Section on Botany and Horticulture reports the following nominations: Chairman, Mr. Tracy, of Mississippi; vice-chairman, Mr. Crandall, of Colorado; secretary, Mr. Lazenby, of Ohio.

The nominations were confirmed.

Mr. GORTON. Two resolutions (by Mr. Scott and Mr. Atherton), referred to the Section on College Work, are reported upon as follows:

Resolved, That this section deems it inadvisable at the present time for the Association to take action on the subject of the two resolutions submitted to the Association, respectively by Mr. Scott, of New Jersey, and Mr. Atherton, of Pennsylvania.

Adopted.

Mr. GORTON. The section also submits the following:

Resolved, That it is the sense of this Association that the executive committee continue their efforts to secure an appropriation for the purpose of furnishing, under proper restrictions, students in land-grant colleges with uniforms and such other equipment as may be necessary for more complete instruction in military science and tactics.

Adopted.

Mr. GORTON. The section further submits the following:

Resolved, That the Section on College Work recommends to the general session that a committee of five be appointed to confer with the War Department relative to the military work in land-grant colleges.

Adopted.

Mr. GORTON. The section further submits:

Resolved, That the executive committee be instructed to secure legislation which shall require one officer of the Army to be detailed to each college receiving the benefits of either of the so-called Morrill acts, which shall require it.

Mr. EMIGH. The committee appointed to draft resolutions of thanks for courtesies extended reports the following:

Resolved, That this convention returns its cordial thanks to the Cosmos Club for the comfortable quarters furnished for the meeting; to the officers of the Department of Agriculture, to the Office of Experiment Stations, and to the press of Washington for the courtesy and kindness received at their hands.

Adopted.

The secretary stated that he had just received from Idaho a letter containing proper remittances for both college and station, which thereby joined the Association.

The chair announced the following as the committee on military affairs to confer with the War Department: Messrs. Alvord, Holladay, Goodell, Fratt, and Silvester.

Mr. Goodell then read the following paper:

WHAT IS THE MISSION OF THE BULLETIN?

This is perhaps the most important question proposed for discussion in this convention, for it opens up the whole question of how best to bring before the public such results as have been secured by careful investigation. The work of college and station is not that of a close corporation, kept to itself and for itself alone. Far from it. The organic law of both demands the utmost publicity. The act of 1862 donating public lands to the States which should provide colleges for the benefit of agriculture and the mechanic arts expressly declares that "an annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with the cost and results, and such other matters, including State industrial and economical statistics as may be supposed useful." The act of 1887 establishing agricultural experiment stations in connection with the colleges reaffirms this declaration and requires "that bulletins or reports of progress should be published at least once in three months, a copy of which shall be sent to each newspaper * * * and to such individuals actually engaged in farming as may request the same, and as far as the means of the station will permit." What the catalogue or report is to the college, the bulletin and annual report is to the experiment stations. They are the official organs established by law for disseminating information. The organ being provided, there remains then to be considered only the kind of information required. This may be of a triple nature. Distinctly technical and addressed only to a scientific public; entirely popular and directed to the average reader; or a union of the two addressed to both classes. Which shall the bulletin be? Shall it be the technical, or popular, or techno-popular? To aid in arriving at a decision, I resolved to invoke the assistance of the farmers themselves, and accordingly wrote to three representative men in the State asking for their views. The one had been lecturer, teacher, and farmer for over forty years; the second a thorough, practical farmer, one of the kind of which the bone and sinew of New England is composed; and the third a graduate of the college, engaged in agricultural work. The replies were straight to the point and unique. I offer them for your consideration. The teacher and farmer first speaks:

"What is the mission of the bulletin of the experiment station? It is to convey to practical farmers facts which have been determined by scientific investigation and which may be guides to the best results in every department of farm operations. Second. It is to convey to practical farmers the methods by which facts are found or proved, and thus gradually to educate them to become acute observers of cause and effect, and to make their practice an intelligent one, and not a mere blind following of rules for which they know neither reason nor law. This touches the technical, and there is no reason why it should be obscure or incomprehensible to any common mind, and an Agassiz would make it so plain that a 'fool need not err therein.'"

The farmer next takes up the discussion:

"To answer your question, one may write out a lengthy essay or small volume, or answer it in a few brief lines. The latter, I have no doubt, you prefer, and it is the only one I have the time or ability to use, for I must jot down my ideas as they happen to 'turn up.' First. To publish such information as may have been obtained at the station which may be of value to the public. Second. It may be its mission to obtain information beyond the technical limits of the station. Under my second clause of the first proposition, much may be said. I should make it very literal, every statement very clear and concise. Conclusions and summaries find much favor while the processes through or by which results are obtained are received with indifference. Let me illustrate this by calling attention to the condensed reports contained in the Experiment Station Record. And right here a 'culling out' of whatever is of special value in that Record to your constituency might make a valuable bulletin. Again, I would not spend much money once a month in publishing the fact of which way the wind blew thirty days previous, or once a month stating the analysis of fertilizers whose commercial value hardly varies in a year. Again, never use a technical term, or any term that is not, or will not, be understood by the common farmer. Such terms are probably necessary. An important mission—very, in my judgment—would be to issue a bulletin periodically that would explain in simplest form, terms used to give results of analysis, such as 'protein,' 'cellulose,' 'crude cellulose,' 'crude fat,' 'nitrogen,' 'nitrogen-free extract,' and so on through the list, making a dictionary or text-book explaining these terms, that not one farmer in a thousand could explain to you or me, although by statements, we 'catch on' to some conclusions. Here is a mission of education to make your bulletins more valuable.

"Without treating my first further either negatively or otherwise, I refer to my second proposition. You are supposed to obtain information at your experiment station from your land, animals, and laboratory. It seems to me that no statute prohibits you from obtaining facts, information, or conclusions from whatever source you can obtain them. In my judgment, it may be a legitimate mission of your bulletin to have those of inquiry. Let me suppose you want evidence to form conclusions as to any line of farm industry—cattle, we will suppose. Take the assessor's report of any given town; at a moment's glance you will notice those most engaged in that line. Send your bulletin of inquiry to them. Your question, I think, is very legitimate, but I fear I have not enlightened you on the subject. The more I think of it, the more its importance appears."

Last of all, the student speaks:

"You ask, Should the bulletins be technical or popular, or both? I think they should be both. That is, there should be a popular form for farmers, and also a technical form in order to preserve the scientific work of the station and for limited distribution. The bulletins should be simple and yet instructive. There should be no use of technical terms when a plain one will express it much better; no use of Latin names to describe ordinary wheat, and a hog should be called a hog rather than by its Roman synonym. It may be well to use these scientific designations in a scientific report, and yet I think even in these simple language is preferable if it describes the subject in hand. To always use the Latin names and scientific phrases even in scientific works is an affectation and a sort of humbuggery belonging, if you please, to the mediæval times, when the monks and the alchemists used to hoodwink the plain people with phrases which they could not understand. I believe, however, in scientific statements of facts when we have facts to be recorded, but there should be no bulletins published, popular or scientific, until we have got something to say. This publishing a monthly bulletin is a lot of cheap business not worthy of a Massachusetts institution or honest men. I do not think our bulletins need necessarily be confined to the work which we do, but may embody the results, especially the popular ones, of work which has been done in other stations, so that we may have the benefit of all *good work* in all the different stations. It may be necessary to issue an annual report, but that report need not necessarily give the details of what has been done each year, because a good deal of what may have been done this year will be kicked over next by the results obtained in that year. My plan would be this: Publish a popular bulletin when you have got something to say either of work done at our own station, or some result obtained at some other station which would be applicable to the agriculture of our State. Publish an annual report stating briefly the finances of the station, what work was in progress, and a thorough digest of any important work which had been completed. This for scientific record for use of scientific men and for future reference. We can not lay down a hard and fast rule of what shall be published as popular and what as scientific; it must be left to the good sense of our station managers."

Gentlemen of the convention, you have listened to the opinions of these three men selected as types of the classes to which our bulletins are addressed. It seems to me there is great truth in what they say. If it is our mission to convey information, it must be conveyed in such terms and with such explanations as will make it intelligible to the average mind. We can not afford to overshoot the knowledge of those we are trying to benefit. So doing, we bring ourselves and our work into contempt and fail to secure the hearty cooperation of our constituents. The average reader does not want the processes of our scientific work. He wants results, and results are all he cares about or looks for. Lists of noxious weeds or useful plants, catalogues of insects, constitutents of feeding stuffs set forth in chemical terminology, without explanations, he will have none of, for they do not appeal to his understanding nor do they increase his bread-winning capacity. And yet all these are proper, legitimate objects of investigation by the different stations, and the results should be communicated to all associated workers.

I am fast coming to the opinion that there should be two sets of bulletins; the one stripped of all scientific garb, setting forth in plain, unvarnished language such facts as have been ascertained and addressed to the laity at large, and the other, in limited edition, addressed only to the scientific worker and putting on record the processes by which results have been secured. We *do* err in not coming closer to the mind of the average man. I shall never forget the lesson taught me in the earlier days of my teaching. I had lectured for four days upon the Crusades. I had thrown myself into my subject and really believed that I had done a good thing. Fancy my astonishment when a few days later, happening to meet one of my class, he said, "You may think it a strange question, Professor, *but what is a Crusade anyway?*"

Mr. Scovell spoke upon station bulletins, indorsing Mr. Goodell's remark that there should be two classes of bulletins and emphasizing the necessity for using plain and simple language in publications intended for farmers.

The following paper from the Section on Mechanic Arts was then read by Mr. Drake:

What Mechanical Work Shall we Give to the Students of our Agricultural Colleges?

In this paper I propose to confine myself to the agricultural side of the question. Courses of work for students of mechanical engineering have been so well marked out by teachers of long experience and keen realization of the needs of the pupils that it would be presumptuous on my part to suggest here this evening anything as original in that line.

From a collection of catalogues of our State colleges we notice that some of them have established mechanical courses of high grade, and we shall also find that the majority of these same colleges do *not* make any special effort to give to their agricultural pupils the benefits arising from instruction in mechanical branches. Other colleges do not offer any mechanical instruction at all, but depend entirely upon the college farm to supply the necessary manual labor. It is certainly true that in many of our colleges manual instruction is regarded as of secondary importance. Thus it happens that the development of the young agriculturist along manual lines may have been neglected. The farmer needs all the skill of handiwork that he can acquire. He needs this work in school just as much if not more than the student of mechanics. If the farmer boy does not acquire manual skill in college he will, in most cases, never get it at all, for his lack of time will prevent him from attaining to any great degree of skill while performing ordinary farm labors. On the other hand the progressive mechanic from the very nature of his calling is constantly developing his powers of delicacy and skill. We may give the student of mechanics principles and theories, but he must get his experience out of school.

Education, someone has said, is the development of *power* in the pupil. This development may take place in various ways. It may be brought about by experience as one goes on in life and comes into contact with bright men of the world. The process may be hastened, however, by submitting the youth to a systematic and graded course of study.

One of the greatest needs of the average farmer to-day is this lesson of system. We know that there is a power in systematized action that can not be successfully opposed either by strength or numbers. If our students are to make the best use of their powers they must early learn the value of system. The college that he attends must be founded on system. He must be encouraged to carry on his college work in all lines according to some system. Class instruction must be given in an orderly and not haphazard manner. The teacher must at all times remember that his manner is influencing the pupils for good or for otherwise. The courses of shop work must be arranged in a regular step-by-step order, and if the arrangement is so well chosen that the pupil himself can recognize the sequence of the various operations as he studies them one by one, he will have a greater respect and confidence in the work at hand. He knows that he is moving forward and that the last step is more difficult than the one just before it.

On the college farm every hoe, shovel, rake, plow, chain, or tool of any kind must have its definitely assigned keeping place under cover, and when not in use should be found in its place. In the carpenter shop, the tools that the student uses commonly at the bench should be kept in a drawer, rack, closet, or other convenient space at the bench. Special tools should be kept in a tool room and may be borrowed by the students as occasion requires. If a tool is missing let the student who is responsible for it do nothing else until it has been recovered. Each tool should be sharpened as it becomes dulled. It is very bad practice to use all of the tools one after another till all become dulled or out of order.

The teacher has a grave responsibility in directing the pupil in his first efforts. With many the first few days means either success and a fondness for subsequent work, or failure and a general dislike for school work ever after. If a boy in learning the carpenter's trade is allowed to work at a bench that is untidy and the tools half buried with shavings and dirt, that boy learns his lesson of carelessness and disorder and becomes a poor carpenter. Teach the students that in order to do good work it is not necessary to chew tobacco, wear an old hat on the back of his head, nor to hold an old black pipe in his mouth, as we might reasonably infer if we were to visit the average shop in this country.

Do not allow the student, at first, to help himself to lumber and other supplies, as it tends to make him wasteful. Keep record and account books in all departments. If the student is engaged in any construction work require him to keep a record of all materials used, as well as his time spent upon it. In this way the student can acquire the ability to estimate, within reasonable limits, the cost of needed improvements at home. If you are supplied with steam power, keep a close account of the amount of coal burned each day, and number of hours of running the engine. Note the boiler pressure every hour, and take the temperature of the feed water. If you use the electric light, record the hours during which the dynamo is used, and take a series of readings of the electrical indicating instruments. This material in itself is valuable for reference and also for historical purposes. Students in doing this record work become observant and quick to notice if anything is going wrong. Introduce a system where it is possible to do so, but never an unnecessary one. Weeks of training might be rendered useless to some pupils by requiring them to follow some purposeless system.

One more suggestion: If the students are given practice in the firing of the boiler and in engine running, offer a prize for the one who shall get along with the least amount of coal consumed, say, in one term. Three or four years of such an atmosphere of systematic work is sure to impress its everlasting mark upon the lives of our students. The farmer of the future must adopt such measures, and it shall be our privilege to equip and send out these new pioneers of this modern age.

The farmer boy comes to the agricultural college with a definite idea of getting such knowledge and training as will enable him to accomplish more work with less exertion. He wants to learn how to operate a farm with the least expense and the largest possible returns. In short, he desires to find out how he can improve his circumstances and at the same time to make life easier for himself and his family. This is not always best brought about by making the farmer more independent. Prosperity, in general, does not mean every man for himself alone, but it is sure to follow if we truly observe the sentiment in the saying "Live and let live." This is in a great measure the secret of business success. One man says to another, "You buy of me and I will buy your goods of you," and in the transaction each one makes a profit. Therefore I do not think it best to encourage the farmer to do by himself too much of his constructive work or repairs. Here and there one may be found who is capable of planning and building a new barn, but in most cases it will be cheaper in the end for the farmer to employ a builder, while he is giving his time to the more valuable operations, to him, of harvesting and marketing his crops.

This is one extreme case, but it serves to illustrate my thought. I do believe in giving the farmer such practical knowledge that he will take good care of his farm machinery and also make ordinary repairs. Let us name some of the various branches of manual work that may be given at college and note their value to one engaged in agricultural pursuits.

(1) Woodworking in all of its forms is of prime importance, and should precede all other mechanical work. A course of joinery at the bench should be followed till the student has acquired a fair degree of skill and accuracy. Then a course of constructive work may be taken up. Every college can afford a varied amount of work outside of the shops. Fences, poultry houses, granaries, and other improvements are constantly required, and a large class may be kept busily and profitably employed. Wood carving may be made elective for the boys, but should be required of all the girls. It is truly valuable, because it is refining in its influence and cultivates the student's interest in beautiful and artistic objects. Wood turning breaks up the monotony of the practically useful and gives a training to the eye for form that is only equaled by free-hand drawing.

(2) I would place forging or smithing second to woodworking in its usefulness on a farm. The pupils appreciate the value of this instruction perhaps better than all other kinds of work. In the forge shop of the Rhode Island State College of Agriculture and Mechanic Arts the agricultural students produce such shapes in iron as are commonly used about a farm. Staples, hooks, hitch rings, whiffletree irons, beetle rings, wagon ironwork, and chains of all sorts, are but a small list of the articles made. The principles of horseshoeing should be taught, but I am as yet uncertain as to the wisdom of encouraging the small farmer to attempt to shoe his own horses. His horse is a vital necessity to him, and a badly home-shod horse might be crippled and rendered useless for an indefinite period.

(3) Steam engineering is now a necessity to the majority of our farmers. Practice in engine running and firing of boilers can be given while our students are taking their wood turning. Agricultural engines should be studied by actual experience in their management, and every college ought to have such an engine, if for nothing more than just such use by the students.

(4) Pipe fitting is a very useful accomplishment and can easily be given to small classes of students at a small cost.

(5) Bricklaying and masonry construction are other lines of useful work, and our farmers might produce better results in that direction if they were acquainted with even the first principles of such work. The old dam that forms the ice pond may be made a permanent affair if constructed of stonework instead of old fence rails and sods, as is usually the case.

We propose to give the agricultural students at the Rhode Island State College some instruction in the mixing and testing of cements and mortars. Various proportions of cement and sand are used and tests for both tension and compression are made. Investigations as to the effect of the age of cement upon its strength will be carried on during the present winter.

Surveying is essential that a farmer may have a clear understanding of legal documents descriptive of real estate and of other matters, such as boundaries, acreage of fields, etc., for which he is usually dependent upon the word of strangers.

The ability to repair shoes and to solder leaky milk cans will often save a trip into town, and likewise save dollars and cents. I have often wished that a course might be produced involving the study of machine construction as applied to agricultural machinery. There may be such courses in existence, but I do not know of any at the present moment. A feature of the next convention may well be a paper upon the above subject.

The first cost of fitting up a woodworking department ranges from $12 to $25 for each bench and its complement of tools. A forge shop can be established for about $25 to $30 per forge and complete set of tools. The expense for materials used in instruction in these branches for a year should not exceed $10, and may be limited to a much smaller figure. In my own experience students frequently wish to keep their own work, and they are allowed to do so by paying only the cost of the materials used.

Mechanical work of an exacting nature should be given to all students of an agricultural college, because it cultivates habits of order and neatness. It encourages original thoughts on the part of the student. It brings out a confidence in one's powers of doing and stating things accurately. It gives the student a greater respect for skilled labor, and puts the future farmer in sympathy and touch with those whose life occupations are the mechanical trades. Moreover, if this instruction is given in a proper manner and by teachers who are experienced and enthusiastic in their work, these results of mental and bodily cultivation must make their appearance. It is right and just that we give our time and put our thought and strength into the development of the mechanical courses of our colleges, but at the same time let us give the agricultural student all the assistance that lies in our power. Let us teach him how to make his life work pleasant and interesting. Let us so lead him in the development of his powers that he will return to the farm with a true realization of the fact that he is to follow one of the noblest callings in God's universe.

On motion of Mr. Murkland a vote of thanks was tendered the chairman for the signal ability and courtesy displayed by him in presiding over the convention.

On motion the convention then adjourned sine die. A social gathering at the Ebbitt House followed.

APPENDIX.

MINUTES OF SECTIONS.

THE SECTION ON AGRICULTURE AND CHEMISTRY.

In the section on agriculture and chemistry Mr. Wing opened the discussion on the scope of the short courses in agricultural colleges. This he considered largely a matter depending on the class of students in attendance. At Cornell University the best class of students in the short course were those from 18 to 25 years old, who were already fairly well trained in the manual work of the farm. With such students instruction should be directed largely toward inspiring them with a thirst for more complete information and inducing them to enter the regular college course. A less desirable class of students consisted of boys not familiar with farm life or with the best methods of farming. For these instruction by rules is necessary to a considerable extent. A short course of twelve weeks should not cover the whole ground of agriculture. The student should be made to realize how little he really knows at the completion of the short course.

Mr. Hills considered the scope of the short course a matter to be determined by local conditions. He believed there was a danger that the short course would divert young men from the regular four years' course. The ideal short course he considered to be one made up of studies taken out of the curriculum of the long course. In Vermont the only successful short course had been that in dairying.

Mr. Plumb stated that at Purdue University all of the dairy instruction had been cut out from the regular course of four years and put into a special course. At this institution there are five lines of agricultural instruction from which the student may choose.

Mr. Hunt believed that the short course should be concerned with a special subject. At the Ohio University the short course in agriculture occupies two years. The first year of this course contains no technical industrial study, unless agricultural chemistry should be so considered, and the studies of this year prepare the student, with unimportant exceptions, for entrance to the freshman class in the four years' course. In the second year of the special course the student gets a considerable portion of the technical industrial studies of the regular four years' course.

Mr. Hays emphasized the need of special courses as a means of attracting students, and mentioned as examples the popularity of instruction in the slaughtering of animals at the Minnesota School of Agriculture and of the agricultural course for girls at the same institution.

Another subject on the programme was cooperation between the experiment stations in field and feeding experiments, but this was widened to include cooperative field experiments by farmers. Mr. Woods, who opened the discussion, considered cooperative field experments with farmers as of value chiefly from an educational point of view and not as furnishing safe data for scientific deductions. He maintained, however, that cooperation in feeding experiments, especially in the formulation of plans for the work, was exceedingly desirable.

Mr. Morrow spoke of the advantage of stations consulting each other as to minor details of parallel experiments, in order that the results of their work might be comparable. He also urged the importance of more careful study of the relation of water to soils and crops, and suggested the advisability of cooperation among the stations looking to the discountenancing of exaggerated claims made by seedsmen for new varieties of plants.

Mr. Flagg emphasized the importance of studying the water content and acidity of the soil of plats used in fertilizer experiments.

Mr. Hays referred to extensive rotation experiments which the Minnesota station proposed to undertake at three substations in the State.

Mr. Smith spoke of the advisability of station workers everywhere being supplied with diagrams of station farms on which experiments were conducted and with data as to the character of the soil, amount of rainfall, etc.

Mr. Frear suggested the need of cooperation among stations in investigations to determine the effect of climate on plants. Mr. Mills explained how in his Province satisfactory results had been secured in cooperative experiments with about 2,000 farmers, most of them ex-students of the agricultural college.

Mr. Henry stated that the past experience of the stations in the line of cooperation has not been encouraging. He believed that "private rather than public methods of affiliation would prove effective."

Mr. Armsby doubted the practicability of the formulation by a committee of plans of cooperation in feeding experiments.

Mr. Redding favored cooperation with neighboring stations.

A motion introduced by Mr. Woods that a request be made that one session of the convention in 1895 be devoted to the discussion of methods of feeding in experiments with dairy animals was carried.

Further details regarding matters presented to the convention by this section are incorporated in the general proceedings (see especially pp. 49, 50, and 52).

THE SECTION ON COLLEGE WORK.

The meeting was called to order by Chairman Harris. In the absence of the secretary Mr. Gorton, of Michigan, was chosen secretary.

Through some misunderstanding, no regular programme had been provided. It was moved and carried that matters referred to this Section by the General Session be then taken up. The subject of securing a bust of Senator Morrill was considered, and it was moved and carried that the Section recommend to the General Session that the subject be again referred to the executive committee, with authority to receive specifications and order casts, and to obtain the marble bust proposed and keep it in a suitable place in Washington for subsequent use. The following States expressed their intention to obtain a bust: Alabama, Wyoming, Maryland, Massachusetts, Minnesota, Michigan, South Carolina, Ohio, Pennsylvania, Mississippi, Rhode Island, Vermont, Delaware, Wisconsin, New York, Maine, Colorado, North Dakota, New Hampshire, and Connecticut.

The subject of the relation of the colleges to the War Department, referred to this Section, was next taken up. It was moved that this Section recommend to the General Session that a committee of five be appointed to confer with the War Department. Moved that the executive committee be instructed to secure legislation which shall require one army officer for each land-grant college. After considerable discussion it was moved that the whole matter lie on the table until Thursday, at 2 p. m. Carried.

It was moved and carried that a committee of three be appointed by the chair to consider the requirements for admission and courses of study in agricultural colleges, and report at 9 o'clock at night. The chair appointed as such committee Messrs. Murkland of New Hampshire, Craighead of South Carolina, and Scott of Ohio. Mr. W. H. Scott then read an admirable paper on the subject of "Faculty meetings." It was moved and carried that Mr. Scott's paper be recommended for publication in the proceedings of the General Session. A communication from the Cosmos Club, extending the privileges of their club to the members of the Association, was received. On motion the invitation was accepted, with thanks. Section adjourned to meet at 9 o'clock at night.

Mr. Murkland, at 9 p. m., reported as follows:

Your committee, to which was referred the matter of entrance examination and standard of scholarship, presents the following report:

In view of the varied standard maintained by the colleges represented in this Association, it is not possible to propose, at this meeting, any detailed system of requirements or any specified course of study.

On the other hand, the subject referred to this committee is so important that it should receive careful consideration at the hands of this Association.

We advise, therefore, that a recommendation from this Section be presented to the Association, to this effect:

That a committee of five be appointed by the Association, which committee shall report at the next annual meeting, and that the executive committee be asked to defray all expenses of the committee.

That the committee be authorized and instructed to confer with the "New England Association of Colleges," the "Committee of Ten," the "National Educational Association," the "Society for the Promotion of Engineering Education," and such other bodies or associations as may be, and to embody the results of such conferences in its report to this Association.

Adopted.

Moved and carried that the committee on programme for next year be instructed to place upon the programme one session of the Section on College Work, for the discussion of the methods of teaching agriculture. It was moved and carried that the chair appoint a committee of five on nomination. Adjourned, to meet at 2 p. m., November 15.

Moved that the two resolutions referred to this Section by the General Session be taken up. Carried.

It was resolved that this Section deems it unadvisable at the present time for the Association to take action on the subject of the two resolutions submitted to the Association, respectively, by Messrs. Scott of New Jersey and Atherton of Pennsylvania.

The following resolution was then considered:

Resolved, That it is the sense of this Association that the executive committee should continue their efforts to secure an appropriation for the purpose of furnishing, under proper restrictions, students in our land-grant colleges with uniforms and such other equipment as may be necessary for more complete instruction in military science and tactics.

Adopted.

It was moved and carried that the Section on College Work recommend to the General Session that a committee of five be appointed relative to the military work in land-grant colleges. It was moved and carried that the executive committee be instructed to secure legislation which shall require one officer of the Army to be detailed to each college receiving the benefits of either or both of the so-called Morrill Acts, which shall request it.

Faculty Meetings.

By W. H. Scott.

The occasion for faculty meetings grows out of the conditions under which faculties exist. To teach and govern jointly requires a mutual understanding and an accepted basis of cooperation. To secure and maintain these, there must be an opportunity to review the situation together, to discuss opinions, to weigh suggestions, to remove objections, and to harmonize differences.

The possible uses of the faculty meeting are many and various. In this paper they will be considered in two general classes: First, those of business; and second, those of conference.

The scope of its business functions is limited by the object of the college as prescribed by its founder, by the general policy of the trustees, and by such restrictions as they may have fixed, either by defining the powers of the faculty or by legislating on special subjects or by vesting certain powers in the president or elsewhere. In most cases the faculty has almost unlimited control over matters of internal government. It adopts programmes, enacts rules, and enforces discipline. Within certain general limitations it frames, adopts, and modifies courses of study, announces times and methods of examination, and determines the methods of recording and preserving results.

In all colleges to some extent, and to a great extent in the larger ones, a number of practical difficulties arise.

The first one grows out of the volume of business. A multitude of details accumulates of which the college of forty years ago with its single course of study and its simple organization contained no prophesy. The administrative work of the college of the present day, with its new departments, its various courses, its elective studies, its large faculty, and its multitude of students, has become vast and complex and in some respects exceedingly difficult. If the faculty must take immediate charge of all the details of it, almost daily sessions would be necessary, and some of them would be very protracted and wearisome. Such a consumption of time and energy would seriously impair the teaching function of a college.

Another difficulty arises from the greater size of the faculty. A large body is almost certain to protract its deliberations and to reach unsatisfactory conclusions. There are many opinions to be presented, to be discussed, and to be reconciled. Some follow the debate languidly; some fail to catch important parts of the discussion; and hence much ground has to be gone over two or three times. And what faculty has not had its sessions prolonged, its interest destroyed, and its patience exhausted by the loquacity of one or two members who were heedless of the boundaries of both reason and courtesy? Happy the faculty whose members all possess the graces of point and brevity.

After all, the conclusion is seldom satisfactory. Corporate wisdom is less to be trusted than individual wisdom. Of any considerable number of persons only a few will investigate carefully the grounds for decision. The rest depend for their information, and even for their opinions, on those who are more immediately interested in the subject or who volunteer to do the talking; and all, even the most cautious and sober-minded, are liable to be swayed by the feelings of the moment. Feeling is stronger and more untrustworthy in a large body than in a small one. Again, it often happens that in order to reach an agreement, or merely to save time or to put an end to a discussion that might otherwise be interminable, modifications are accepted which greatly impair the result. It is endured with the salve, "it was the best we could do." Who wants the judgment of the many on a question of scholarship or diplomacy or a nice question of equity? There are questions that may safely be submitted to a popular vote; but there are others which must always be reserved for select men, chosen for their fitness to decide them. None will be more ready to admit the truth of this position than college professors themselves.

A large faculty is liable to vacillating and inconsistent action through variation in the attendance. At one meeting a question may be decided in the affirmative; at the next, by the absence of some members who were present on the former occasion and the presence of some who were absent before, a similar case may be decided in the negative. The effect is to lower the faculty in the respect of the students and sadly to demoralize the discipline of the college.

Another evil that sometimes besets the faculty meeting is that one aggressive member, or a few, usurp leadership and control business. If these were always the wisest, it would be an advantage; but they are more likely to be the hasty and impulsive, or those who have their own ends in view.

Heated discussions may occur. Severe remarks may be made which leave a sting. They may sometimes produce deep resentment, and even lead to open dissension.

Some of these difficulties may be avoided, and the chance of the occurrence of others may be greatly diminished in several ways.

It goes without saying that faculty meetings should be subject to parliamentary law. A good manual should be adopted as the standard of authority; and, though some latitude may be allowed on ordinary occasions, the remedy which it offers for parliamentary difficulties ought to be promptly applied whenever it may be necessary. A great deal of the business that is transacted in some faculty meetings had better be transferred to individuals. Much should be left to the professor. Let him rule his own department, subject to such general rules as may be necessary to secure a proper degree of uniformity in the administration of the several departments. Much more should be delegated, either by the trustees or by the faculty, either formally or by tacit consent, to the chief executive of the college. In the larger colleges the president should be nearly or entirely free from the duty of instruction, so that he can devote his attention to matters of administration. Power commensurate with such a position should be placed in his hands, and he should be held responsible for its exercise.

A great means of relief is a system of standing committees or subfaculties. Each of these committees should have jurisdiction over the studies of a certain section of students, the members of the committee being selected because they have charge of classes to which these students belong. The committee may have regular times for meeting, but it will usually be found more convenient to meet at the call of the chairman. These smaller bodies can meet oftener than the full faculty can be brought together, and thus business will suffer less delay. There being but few persons to be informed or to be brought to agreement, less time will be consumed in discussion and conclusions will be reached more rapidly. And as those present are already familiar with the students and the work under their special charge, their conclusions will be more intelligent and more just.

The general government of the institution, so far as it is not exercised by the president, might be committed to a small governing body, consisting of the president and a select number nominated by him. The same arguments of promptness and efficiency, economy of time, and sound conclusions which have been given to show the value of subfaculties apply here. The administration would also be more uniform, as the same persons, or nearly the same, would deal with all like cases. A line of well-defined precedents would be established, rendering the government settled, well understood, and easily managed.

While all these advantages of improved method and result would be obtained, there would be at the same time the removal of an unwelcome burden from the majority of the faculty, and the prevention of a great and needless loss of time. What good reason can be given why twenty or thirty or more men should leave their work, perhaps depriving ten times that number of students of instruction to which they are entitled, in order to decide what shall be done with some boy who has copied from his neighbor's paper during an examination?

Such a plan of organization would leave for the general faculty only those business affairs which are of the first importance. These would hardly include more than general legislation for the guidance of the subordinate bodies and the most serious cases of discipline. With this class of its duties so much reduced, it would have time for more frequent and careful consideration of the second kind that I named—those of conference.

There are many topics on which a free consultation together by members of a faculty may be fruitful of excellent results. Though less urgent from a lower point of view than legislative and administrative matters, they are, from a higher point of view, even more urgent and of far greater consequence. They belong to a wide field. Almost any subject that pertains to the welfare of a college or to the relations of its members to it and to each other may on fit occasions be profitably considered by a college faculty. The needs, the defects, the hindrances, the possibilities of the institution; its relations to the public, plans for enlargement and improvement, the welfare of the students—these and many more ought to command the interest and cooperation of every member.

The direct benefits that are likely to flow from such conferences are perhaps sufficiently obvious, and I shall therefore reserve what time remains to me for emphasizing two or three indirect benefits, which to my mind are of even greater value.

One of these is that each professor may thus keep himself informed to some extent of the work of other departments of the college. He can hardly fail to do his own work more intelligently if he is acquainted with that of his fellow teachers. Both from their merits and from their defects he can improve his methods of instruction; and he can modify his requirements in kind and amount so as to afford and to receive the greatest help.

Better than information is stimulus; and no teacher who is alive to the demands of his profession can engage in such conferences without being filled with higher impulses. The methods, the suggestions, the spirit of his associates will sharpen his perceptions and deepen his interest.

But perhaps the highest benefit of the faculty meeting is the feeling of unity which it may foster, and which can hardly be maintained without it. The success of a college, like the success of an army, depends not merely on the faithful performance of individual duty by each member, but no less on the esprit de corps by which it is inspired. Many a college needs more than it needs anything else the cultivation of a catholic mind. There is a tendency to forget the general interest in one's zeal for his own department. If any great success is to be achieved, this disintegration must be arrested. Every man must learn to look not on his own things, but also on the things of others. There must be, and must be felt, a bond of unity. To create such a bond and to make and keep it a living bond, there is perhaps no agency that may be made more efficient than the faculty meeting. Here, if anywhere, a union of feeling may be awakened and a union of effort inaugurated. Here, if anywhere, the college may be converted from a congeries of departments, each confining itself within its own narrow circle, and perhaps jealous or even hostile toward all the others, into a compact and vital organization, each part supported and supporting, and all animated by a common soul.

This result will naturally accompany and follow the common pursuit of an objective end. When a body of men unite heartily to accomplish an object, each one of them spontaneously and almost unconsciously passes into a freer and more sympathetic atmosphere. Mental contact generates a fire that would have slept forever in the separate mind. The oxygen of one mind combines with the carbon of others to create a flame by which all are filled with light and heat. Or by proximity alone slumbering minds, like dying embers, may warm each other, first into a glow and then into a radiant fire. The professor alone in his library, or teaching his class, or surrounded by students in his laboratory, may not be distinctly conscious of this element of fellowship in his mental states and actions; but his thought is clearer and more consecutive, his speech is more limpid and illuminating, and his whole aspect and movement are freer and more effective because he has felt the prolonged touch and received the stimulating force of the men who study and teach around him. The intellectual potential of a college thus charged, compared with that of a single mind working in isolation, is as the enthusiasm of a mass meeting to the torpidity of a solitary plowman.

These, then, are the possible uses of the faculty meeting—the convenient transaction of business, a collective intelligence of the work of the several departments and of the institution as a whole, the awakening of individual interest and power, and the inspiration of fellowship; and the greatest of these is inspiration.

The faculty meeting ought to be the center of strong intellectual and spiritual forces. It ought to develop and promulgate the ideas which form the texture of the academic life. Its spirit ought to be high and magnanimous, and its impress on the student body ought to be a royal impress, set so deep that it can never be effaced. That spirit ought to pervade the atmosphere of the place as a purifying and stimulating force reaching upward and downward from the office of the president to the room of the humblest and most sluggish student, and outward to the utmost boundaries of its sphere. The faculty meeting ought to be the fountain of life to the college—the warm and ample heart whose beat regulates the pulse of the whole body, and from whose outgoing tide the whole body, fitly joined together and compacted, may make increase unto the building up of itself both in love and in power.

When can such conferences be held? This must be determined according to circumstances. If the time of the faculty meetings is taken wholly or partly from regular programme hours, it would hardly be right to extend it for this purpose. But if the faculty meetings have an evening set apart for them once a week, or once a fortnight, or once a month, the latter part of the evening may very appropriately and profitably be devoted to such conferences as are here meant. It might be a still better plan, and one that would suit either case, to give one evening a month to this special object, and to have one or two short papers prepared as a basis for discussion. What is this meeting in which we are now engaged but a representative faculty meeting of the kind I have suggested? If it is worth while for us to come together, at great expense of money and time, from different colleges scattered over the whole country, to hold such conference meetings as this, surely it would repay the slight effort and inconvenience involved in holding meetings of a single faculty for a similar purpose.

THE SECTION ON ENTOMOLOGY.

The following papers were read before the Section:
"Entomological Work in Experiment Stations," by H. Osborn.
"The Economic Value of Parasites," by F. M. Webster.
"Special Insect Outbreaks of 1894 in Iowa," by H. Osborn.
"The use of Arsenites on Tobacco," by H. Garman.

ENTOMOLOGICAL WORK IN EXPERIMENT STATIONS.

By H. OSBORN.

It is the intent of this paper to discuss some of the practical details of entomological work in connection with the experiment stations and point out some of the necessities for such work, and to attempt to make plain the needs of better equipment and greater enlargement in this line of agricultural investigation. Those who have preceded me in this office have taken occasion to indicate the extent and nature of work being carried on in the stations and gathered statistics regarding station workers and the equipment with which they are fitted, and to point out also the necessities of greater facilities. It will be simply furthering this object to discuss some of the particular methods in which such enlargement is necessary.

The station entomologist must have two main objects in view: First, the thorough investigation of such insects as are the most abundant in his territory, and, second, the thorough dissemination of this knowledge and the adoption of whatever preventive and remedial measures are shown to be necessary by the cultivators of his State. It need hardly be said that the latter is the much more practical and difficult part of his duty. In the investigation of the insects of his particular locality the entomologist will naturally give his attention to those which are of particular economic importance, but the multiplicity of the injurious forms and their varying importance from year to year will often make it a difficult question to decide upon the particular species to receive attention. While, in a considerable degree, he should be controlled by the demands of the residents of his vicinity, it will not do to be entirely influenced by such demands, for he may discover that there are insects which attract little or no attention from the average observer, but which have a much greater economic importance than some of the more conspicuous ones, and he must not only undertake the study of such forms, but he must show their importance to the public.

A thorough knowledge of the complete history of the different species of insects of his locality is an essential foundation for economic work, and I believe we should not lose sight of the importance of detailed work in the life history of species. It is no doubt true that there are certain methods of treatment which are applicable to large groups of insects, and that the more thorough study of poisonous solutions and methods of application are promising in result, but there is the danger that too much reliance be placed upon such methods, and that the investigator neglect to inquire into the details of the habits of insects, and that there may be cases where certain peculiarities of habit will render an insect proof against measures which at first sight appear to be entirely practicable. Methods of spraying and combinations of substances for this purpose have been tested and experimented with to a considerable extent by men who are not trained entomologists, and, in many cases, to very decided advantage in the production of mechanical devices for spraying and combinations of insecticidal substances, but in some cases the attempted application of such methods or combinations to certain kinds of insects would be recognized as useless by anyone acquainted with the fundamental structure of insects.

While we would encourage therefore every effort toward the perfection and adoption of spraying devices and spraying fluids, we would urge the importance of referring the application of these to various insects whose habits are not entirely known to trained entomologists who should be able to determine as to the possible value or usefulness of the effort and the direction of practicability for such measures. That the entomologist connected with an experiment station should devote himself to the investigation of the injurious insects in his territory would seem to require no argument, but there are cases in which we see entomologists in their capacity as station workers devoting themselves to studies which, to say the least, have but a very remote relation to the practical needs of their constituency. While a knowledge of the insect fauna of each particular State is a great desideratum and is ultimately of economic importance, it seems to me that to make this the leading subject of study to the exclusion of the study of the habits of the known destructive forms is a mistake. To take up the investigation of monographing of a group of insects, which, in their distribution and habits, have little relation to the industries of his State, is unwarranted. For the person engaged as an experiment station worker to engage in the monographing of a group of marine mollusca would be manifestly absurd, but instances not greatly different from this could be cited from the history of our experiment stations. It must be remembered, of course, that there are a number of instances in which the station entomologist is simply to devote part of his time to station work and part to other duties, and if such work is embraced among his other duties this remark would have no application. It should be understood thoroughly, however, that it is a matter of common honesty for an individual engaged for a certain kind of work to devote himself thoroughly to that particular work.

In the method of work which he investigates the entomologist should aim above all to secure thoroughness and accuracy, and for this purpose he needs a full equipment of apparatus, the particular character of which will depend upon his location and the subject of study, but in the provision of which he should not be stinted. For the full elaboration of life histories some form of insectary is almost essential, although, of course, much work may be done without the complete control of conditions which may be provided by such a building. Of breeding cages he should have a full supply, and these will be constructed in varying degrees of complexity, according to the results to be reached. He must not omit the study of minute details in structure or a careful determination of species and varieties, as this may happen to be an important factor in the determination of methods of work, danger of introduction and distribution of certain species, and other points of importance, all of which can not be exaggerated. A complete equipment for thorough microscopic work is therefore of absolute necessity, and no entomologist should consider his equipment complete, or even begun, without such an outfit. While a great number of insects which he is called upon to examine may be readily determined without the use of the microscope, there are many in which the microscopic characters are an absolute necessity. For instance, the necessity of such work occurs in the recent distribution of the San José scale, which has been of such immense importance in California, and which during the last two years has been recognized at a number of localities in the Eastern States. The extensive notices given to the distribution of this species naturally led to an examination of orchard trees all through the fruit-growing districts, and many specimens of the common native bark lice were sent to our experiment station for identification, and doubtless the same occurred in nearly every State where the orchard is of any importance. The prompt distinction of the San José species from the common forms can readily be seen to have decided importance in relation to the distribution of nursery stock or scions from orchard trees. Another very essential feature of the equipment is an extensive collection carefully determined as a basis for recognition of the species that may be sent in for identification as well as for a knowledge of the local fauna. Such collections must necessarily be the work of time and thorough preparation and their careful identification a matter of much labor and expense, but this should by no means be neglected, for it is impossible to tell when there may be a demand for the identification of some obscure species, and naturally, if it is an insect attracting any attention, the determination must be prompt and certain. Whether the insect be injurious or not the parties noticing it and sending for information want to know what the nature of the insect may be, whether of possible danger or not, and whatever facts may be of importance regarding its appearance. It is an excellent plan also for each entomologist to take up some group of insects having economic importance as somewhat of a speciality, since it is impossible for one to be an expert in all lines, and then, by correspondence and exchanging with entomologists who have given attention to other groups, each may become possessed of collections which are authentic. The careful work on timber insects in the West Virginia station is an excellent example of the value of this plan. The work of Hopkins on *Scolytidæ*, Bruner on *Orthoptera*, and Smith on *Noctuidæ* is directly in line of such study. The enlargement of this feature of the station work upon the part of those in authority would seem to me very desirable.

I desire here to call attention to a phase of our work which I believe confronts the entomologist in all parts of the country and which seems likely to be a perplexing problem in the time to come. I refer to the various insecticides, good, bad, and indifferent, which are placed upon the market and more or less energetically brought to public notice by parties who have simply the commercial phase of the subject in view. It would be entirely out of place to make a general condemnation of these substances or of parties who are pushing their use. Some of them are undoubtedly valuable, and there can be no question that benefit arises from the adoption of these insecticides by parties who, from indifference and ignorance, would not adopt well-known standard preparations that might be used with much less expense. We must recognize the large advantage of the commercial advertiser in placing his wares before the public, and the fact that the average farmer is quite likely to adopt the remedy which is accessible at his nearest supply station when forced to adopt remedial measures by some outbreak of insect injury. An effort to secure the establishment of supply stations for standard apparatus and insecticides in the larger towns of each State might be of practical benefit. Such a movement has been undertaken in Idaho, where the distance from main supply depots renders such a provision particularly necessary. It is an important question whether we should go out of our way to expose fraudulent materials or to condemn those which, as placed on the market, are sold at many times their actual value. Some method of reaching this question is necessary for the protection of cultivators who ask such information and who have not the means of distinguishing the unscrupulous from the honest dealer; also for the protection of the man who gives an honest article for an honest price. We can doubtless gain wisdom from an examination of the history of fertilizer control.

There is, however, need of some uniform plan to be adopted by the entomologists of the various stations, and what seems to me a very excellent movement has been started by the Association of Economic Entomologists, whereby it is hoped that this question can be dealt with in a satisfactory manner. While it may seem unnecessary to test all the different insecticides which may be brought out and which are protected by trade-mark or patent, it is in many cases almost essential that the entomologist should be prepared to give an authoritative answer regarding the value of such substances. For each entomologist to attempt the testing of all such substances would be manifestly impracticable, but the testing of the different kinds being divided among different stations and duplicated at three or more of them not only divides the labor and the responsibility, but makes the results much more authoritative. The same is true regarding the test of insecticide machinery. The various devices for spraying or for the mechanical destruction of insects which in some cases are so expensive that it is impracticable for each station to secure an outfit, while if they are taken as a gratuity from the manufacturers there is sufficient obligation on the part of the station to make the result of less value than where the test can be made with entire freedom from such obligation.

A phase of the station work which does not make any material show, but seems to me to be of as great importance as anything that we undertake, is the attention to correspondence regarding insects. Every letter of inquiry regarding injurious insects or asking the determination of any forms should receive most careful attention, and replies be written with the same care that would be devoted to an article for publication. In many cases such letters may pass from hand to hand to be used by the neighbor or different parties, and indeed where referring to insects of interest in a particular locality, they are very likely to be handed to some local paper and may thus get a much wider circulation than the writer anticipates. Moreover, a careful reply to one letter is very likely to encourage further correspondence, and in this way the entomologist will secure a correspondent who may be of very great service in keeping him informed as to the insects of importance in that locality and who would become a center of information for the neighborhood in which he lives. A personal letter is much more likely to be carefully read and its suggestions followed than a general note published in a general way, so that this personal correspondence may be more effective in bringing about active adoption of remedies than a wide distribution of information in published reports.

The question of what to publish and how to publish the results of investigations is often a very perplexing one. The great majority of the people whom we wish to serve have very meager knowledge of the structure and habits of insects, and great pains must be taken not to bury our information in articles written in language beyond their reach. On the other hand, we will fail in one great purpose of our work if we simplify to such an extent as to not present the evidences on which conclusions may be founded. The reader should be left with some more definite knowledge of the subject in hand than he possessed before, and if possible stimulated to observation, thought, and experiment for himself. The plan of writing plain, untechnical articles, but with every effort to secure accuracy and clearness of expression for the general bulletins, and of publishing more technical matter necessary for the use of station workers in such journals or bulletins as will reach especially the scientific workers, seems an excellent one. Aside from these methods, we must adopt all possible means, such as personal work in institutes, notes in agricultural papers, etc., to reach the greatest possible number.

Entomological work has made gratifying progress, but results so far gained are, I am confident, but a slight indication of what may be accomplished by persistent, faithful, and well-directed effort.

THE SECTION ON MECHANIC ARTS.

The first meeting of the Section on Mechanic Arts was held in the main parlor of the Ebbitt House, November 13.

The meeting was called to order by President J. H. Washburn, of Rhode Island, at 2 p. m.

On motion of Mr. Anderson, of Kentucky, seconded by Mr. Drake, of Rhode Island, a committee was appointed to take some steps to interest all American colleges to send representatives to take part in the meetings of the Section on Mechanic Arts. The committee named by the chair was Messrs. Anderson, Drake, and Tyler.

The secretary was instructed to request Mr. True to send a copy of the next annual report of the Association of American Agricultural Colleges and Experiment Stations to every instructor in mechanic arts in the colleges belonging to the Association.

On motion of Mr. James K. Patterson, of Kentucky, seconded by Mr. Tyler, of Massachusetts, a committee was appointed to define the scope of the work of the Section on Mechanic Arts. A committee composed of Messrs. Tyler, Drake, and Anderson was appointed.

On motion, the meeting proceeded to listen to the reading of the following papers:

"Shop Courses for Mechanical Engineering Students," by J. J. Wilmore.

"What Mechanical Work Shall we Give the Students in our Agricultural Colleges?" by W. E. Drake.

MINUTES OF MEETING OF SECTION ON MECHANIC ARTS, NOVEMBER 14, 1894.

The meeting of the Section on Mechanic Arts was called to order by President J. H. Washburn at 2.20 p. m., November 14, in main parlor of Ebbitt House, Washington, D. C.

On motion of Mr. Tyler, seconded by Mr. Patterson, a vote of thanks was extended President Washburn for the efficient manner in which he had conducted the affairs of the Section on Mechanic Arts during the past year.

The committee appointed to define the scope of the work of the Section offered the following resolution:

Resolved, That the officers of the Section on Mechanic Arts be requested to arrange for the presentation, next year, of papers dealing mainly with those subjects which fall under the designation "Mechanic Arts" in their special relation to the work of colleges of agriculture and mechanic arts, and that they be further requested to secure the presentation of as many such papers as possible before the full Association.

A committee composed of Messrs. Anderson and Silvester was appointed for the purpose of having the papers, read this year before the Section, published in the general convention proceedings.

The following papers were presented:

"Some Problems of Manual Training in our Technical Schools," by J. R. McColl.

"Belt Fastenings," by Walter Flint.

THE SECTION ON HORTICULTURE AND BOTANY.

The chairman, Mr. Goff, of Wisconsin, and secretary, Mr. Pammel, of Iowa, did not attend the convention, and the Section organized by electing Mr. Tracy, of Mississippi, as chairman for the meeting and Mr. Halsted, of New Jersey, as secretary. The printed programme for the Section gave the titles of eleven papers by as many authors, but only two of these authors were present during the whole convention, and only one at the organization of the Section. A committee upon programme was therefore appointed, consisting of Messrs. Mell, of Alabama, Lazenby, of Ohio, and the acting secretary, to report at the next session of the Section.

The first paper read (by the secretary) was by H. N. Starnes, of Georgia, upon "The Proper Position of Hybrids in the Classification of American Grapes." A classification is proposed dividing all sorts of grapes into seven series or species, and all native subspecies are considered as varieties. The mother plant in all cases regulates the series into which the hybrid falls. The vineyard in charge of the writer, Mr. Redding stated, was arranged according to the classification offered. Mr. Lazenby stated that plums and other fruits needed a satisfactory plan of classification. Mr. Burrill suggested that more of botany and the methods of botanists should be used in horticulture.

Mr. Goff sent a paper upon "Plant Breeding at Experiment Stations," which was read by the secretary. The author made a strong plea for the origination of new varieties at the experiment stations, and stated that it was his firm conviction that grand results must come from plant breeding. A lengthy discussion followed, in which Messrs. Mell, Tracy, Burrill, and others took part.

A short session of the Section was held on Tuesday evening, at which there was a discussion upon the general question of how best to make the sectional meetings of greatest value. Methods of teaching horticulture were offered, as, for example, a winter garden under glass by Mr. Lazenby; greenhouse methods by Mr. Rane, of West Virginia. Short courses in horticulture it was thought by some would help to teach the instructor how to do his work. Mr. Waite, of the Department of Agriculture, outlined briefly his experiments with pears.

At the next session, Thursday afternoon, Mr. Green, of Ohio, having arrived, read two papers: (1) "The Position of Greenhouse Benches for Experiment Work," and (2) "Construction of Greenhouse Benches for Subirrigation." Side benches are objectionable and therefore it was advocated to divide the greenhouse space so as to have two benches with an alley 30 inches between them in the middle of the house, and a narrow one running along each side wall. For subirrigation the tile is laid upon the bottom of the bench and the water runs out at the joints, wetting the soil uniformly. If the water runs out the lower end of the tile too freely it may be checked by using small sheets of tin placed between the joints of the tile at any point where more water is desired in the bed.

A plan of field experiments with fungicides was outlined by Mr. Halsted and some results mentioned that had been obtained during the present year. Spraying with Bordeaux mixture for the leaf spot of the beet was successful, and the anthracnose and blight of beans can be controlled. Bordeaux mixture in excess caused a dwarfing of the plants.

A paper by Mr. Pammel upon "Bacteriosis of Ruta-bagas" was read by the secretary. A fatal rot of ruta-bagas was found to be due to microorganisms, a new species of bacillus. Mr. Mell stated that he had met with a similar decay. Two other papers by Mr. Pammel were read by title, namely: (1) "On the Distribution of Some Weeds in the United States, especially *Iva xanthiifolia*, *Lactuca scariola*, *Solanum rostratum*, and *S. carolinense*;" (2) "Notes on Diseases of Plants at Ames, Iowa, 1894."

Mr. Bolley's (North Dakota) paper upon "Effect of Change of Soil upon Growth of Wheat" was read by Mr. Lazenby. Among the conclusions arrived at from the experiments are: (*a*) "That the grain or fruit of wheat is much less subject to variation than its vegetative parts; (*b*) that true varieties under like soil and climatic conditions will approximate a like product without reference to the parent soil; and hence, (*c*) that in general the changing of seed wheats because of supposed advantages to be attained through change of soil is based upon a fallacious supposition."

Mr. Waldron's (North Dakota) paper upon "A New Macrosporium Disease of Squashes" was read by the secretary, as likewise one from Mr. Corbett (South Dakota) upon "Determination of Sex in *Shepherdia argentia* by Bud Characters."

Mr. Rane, of West Virginia, contributed some points upon "Surface Subirrigation." Ordinary tiles are used for conducting the water between the rows of plants. "It is simple, practical, and inexpensive."

PROVISIONAL SECTION ON STATION WORK.

Called to order at 4 o'clock p. m., November 14.

The secretary announced three topics for discussion:

(1) Touching the permanence of the Section, the present Section being provisional.

(2) Touching a communication from the Association of German Experiment Stations.

(3) Touching the classification and arrangement of station accounts.

Upon motion the topics were taken up in the above order.

(1) Mr. Smith moved that steps be taken looking to the formation of a permanent section on station work.

Opposed by Mr. Frear on the ground that too many sections would be undesirable; and by Mr. Johnson, Mr. Mell, and Mr. Myers on the ground that the questions likely to come up before a section on station work could be better discussed before the general body.

The motion was lost.

(2) The secretary presented a communication from Prof. Dr. Nobbe, of the German Association, stating that the participation of members of foreign experiment stations would always be welcome.

Mr. Jenkins read resolutions which he had prepared in response to this communication. It was moved and seconded that they be recommended to the General Session for passage.

Carried.

(3) In order to bring before the meeting the third topic (the supervision by the Secretary of Agriculture of the expenditure of station funds) Mr. Alvord offered the following resolution:

Resolved, That in the opinion of this Association it will be difficult for the Secretary of Agriculture to fully ascertain the facts as to the application of station funds, from the examination in Washington of a financial statement or report to be rendered after the close of the fiscal year, and that some further action by the Department of Agriculture is deemed expedient, such as visits to stations by suitable members of the Department.

Mr. Johnson opposed the motion on the ground that the form of report prepared by the committee in cooperation with the Secretary of Agriculture was quite satisfactory and would enable the Secretary to see clearly what was being done with the funds.

Mr. Plumb said that the new form would cause many changes in the system of accounts at Purdue. He thought it desirable for the Secretary of Agriculture to send on a representative to see just how the funds were expended.

Mr. Jenkins thought there would be great difficulty in classifying station expenditures under the proper heads. How were administrative expenses and those of the scientific staff to be separated? There were many things that could not be found out except by personal examination made by some one sent on for the purpose. He was heartily in favor of the Department authorities, before passing judgment on whether station funds had been properly expended, sending somebody to find out.

Mr. Craighead opposed the motion on the ground that it was a useless expense. Inspectors would be able to find out very little more than could be ascertained from the reports. If the Department was not satisfied that the funds of a station were being properly expended they could send out a man to investigate.

Mr. Goodell thought the stations ought to court the fullest investigation. If the Secretary of Agriculture wished to send around an inspector, the stations should not oppose it.

After some further discussion Mr. Alvord withdrew his resolution, and one offered by Mr. White as a substitute (see p. 47) was adopted and recommended to the Association.

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U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

PROCEEDINGS

OF THE

NINTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

DENVER, COLORADO, JULY 16-18, 1895

EDITED BY

A. C. TRUE, for the Office of Experiment Stations

AND

H. H. GOODELL, for the Executive Committee of the Association

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

U. S. DEPARTMENT OF AGRICULTURE.

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BUREAU OF ANIMAL INDUSTRY—**D. E. Salmon**, *Chief.*
DIVISION OF STATISTICS—**H. A. Robinson**, *Statistician.*
DIVISION OF ENTOMOLOGY—**L. O. Howard**, *Entomologist.*
DIVISION OF CHEMISTRY—**H. W. Wiley**, *Chemist.*
DIVISION OF BOTANY—**F. V. Coville**, *Botanist.*
DIVISION OF FORESTRY—**B. E. Fernow**, *Chief.*
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* Director.
† President of board of direction.
‡ Assistant director in charge.
§ Chairman of council.
‖ Secretary.
¶ Acting director.

Bulletin No. 30 K. 168

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

PROCEEDINGS

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WASHINGTON

GOVERNMENT PRINTING OFFICE

1896

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., April 1, 1896.

SIR: I have the honor to transmit herewith for publication Bulletin No. 30 of this Office, containing the proceedings of the Ninth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, held at Denver, Colo., July 16–18, 1895. The stenographic report of this meeting was made by Mr. J. E. Thomas, of Cheyenne, Wyo.

Respectfully,

A. C. TRUE,
Director.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

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Horticulture and Botany, F. W. CARD, of Nebraska.
College Work, A. A. JOHNSON, of Wyoming;
Entomology, O. LUGGER, of Minnesota;
Mechanic Arts, J. W. LAWRENCE, of Colorado.

Secretaries of Sections.

Agriculture and Chemistry, H. J. PATTERSON, of Maryland;
Horticulture and Botany, H. L. BOLLEY, of North Dakota;
College Work, E. DAVENPORT, of Illinois;
Entomology, G. C. DAVIS, of Michigan;
Mechanic Arts, F. P. ANDERSON, of Kentucky.

PROCEEDINGS

Morning Session, Tuesday, July 16, 1895.

The convention was called to order at 10.20 a. m. in the "ordinary" of the Brown Palace Hotel by President Henry E. Alvord.

Prayer was offered by President J. E. Stubbs, of the Nevada Agricultural College, and addresses of welcome were delivered by his excellency Governor McIntyre, and his honor Mayor McMurray, of the city of Denver. Response was made by the president of the Association.

The report of the executive committee was submitted by Henry H. Goodell, chairman.

Report of the Executive Committee.

Immediately after the adjournment of the convention of 1894 this committee met at Washington, D. C., and organized, making choice of Henry H. Goodell as chairman and John H. Washburn as secretary. To the president of the Association, Henry E. Alvord, was assigned the duty of carrying on the negotiations necessary for procuring casts and a marble bust of Senator Morrill, and to a subcommittee, with Henry P. Armsby as its chairman, that of securing the legislation requisite for publishing the results of the Chicago dairy tests. Their reports will appear in this, as part of the whole, submitted by the executive committee.

The different matters referred to this committee have received due consideration, and, in accordance with instructions, it has called the present convention and made the necessary arrangements therefor. It was not found practicable, however, to carry out the wish of the Association to convene at Denver on the week preceding the meeting of the National Educational Association. At the time the vote was taken it was asserted that the date fixed upon by the National Educational Association was the third week of July. That, no doubt, largely influenced the votes of our Association. To have carried out the instructions would have necessitated attendance during the last week in June, and serious interference with the exercises of commencement in many of our colleges. Furthermore, the only concessions in railway rates that could be obtained were available during the meetings of the National Educational Association and the six weeks thereafter. Under these circumstances it was deemed advisable to depart from the instructions given, and place the date of meeting one week after that of the National Educational Association instead of one week previous.

Of the several questions referred to the executive committee one of the most important was that of securing the publication of the results of the Chicago dairy tests. Every effort was made to bring this about, but without effect.

Shortly after its appointment the subcommittee consulted with Assistant Secretary Dabney, Director True, of the Office of Experiment Stations, and Chief Hill, of the Division of Records and Editing. With their advice and assistance a joint resolution was drawn, providing for the publication of the results of the dairy tests in two volumes—one to be in the form known as "census quarto," and to contain the detailed records of the test, while the other was to be in the ordinary octavo form and to contain the summaries and discussions of the results.

This resolution was submitted to Chairman Hatch, of the Agricultural Committee, and was by him introduced into the House of Representatives, where it was referred to the Committee on Agriculture. Mr. Hatch immediately arranged for a hearing on the resolution, at which the subcommittee presented a statement as to the nature of the tests and the value of the results. This statement was very favorably received by the committee, which shortly afterward reported the resolution favorably. As originally drawn, the number of copies to be printed was left blank in the resolution, but these blanks were filled by the Committee on Agriculture so that the resolution as reported by them provided for 5,000 copies of the detailed records and 200,000 copies of the summaries and discussions.

The resolution was next referred, in the ordinary course of procedure, to the Joint Committee on Printing. These preliminary steps having been taken, circular letters were sent to all the institutions represented in this Association, to the leading agricultural papers, and to such individuals as seemed likely to be interested in the matter, setting forth the value of these tests and requesting them to use their influence with their Representatives to secure a favorable report from the Committee on Printing. This committee was slow to act, and after considerable delay it was found that the chairman of the committee was not favorably inclined to the resolution, his opposition being based chiefly upon the cost of the large proposed edition, amounting, according to the estimate of the Public Printer, to nearly $80,000.

Arrangements were at once made by which a conference was had between the chairman of the Printing Committee and the chairman and members of the executive committee of the Association. As a result of this conference the edition to be printed was reduced to 2,000 copies of the detailed records and 20,000 copies of the summaries and discussions, thus reducing the estimated cost to about $20,000. This arrangement was understood to be satisfactory to the chairman of the Committee on Printing, and it was supposed that the resolution would be speedily reported. This, however, was not the case, and in the meantime considerable opposition to the publication of the tests developed, especially upon the part of the Holstein-Friesian Association, which made very strenuous efforts to defeat the resolutions.

After waiting some time for the Committee on Printing to act, another interview was had with its chairman, when it was found, to our great surprise, that he denied having expressed himself as satisfied with the reduction previously made in the edition of the proposed report, and expressed himself as unalterably opposed to the passage of the resolution. It was found impossible to move him from this position, and as a last resort an adverse report from the Committee on Printing was secured for the purpose of bringing matters before the House. During the last five days of the session effort was made by the friends of the resolution, aided by Chairman Hatch, to secure unanimous consent for the suspension of the rules and the consideration of the resolution. The motion, however, though receiving a majority vote, failed to secure unanimous consent, and consequently the resolution failed.

The second matter referred to this committee was the obtaining of a marble bust of Senator Morrill and plaster casts of the same for such colleges as subscribed. In accordance with the action of the last convention, the land-grant colleges were canvassed for subscriptions for the plaster casts of the bust of Senator Morrill, to cost not exceeding $45 each. Twenty-four institutions ordered the same. Four colleges, namely, those of Vermont, Massachusetts, Rhode Island, and Oklahoma, paid in advance, thus enabling the execution of a contract with the sculptor, Mr. Preston Powers, to make the marble bust, to be owned by the Association, and the casts for the colleges. The work has been reported as progressing, and it was hoped that the casts might arrive in New York City and be ready to forward to the subscribing colleges about this time; but no recent advices have come from Florence, where Mr. Powers's studio is located.

Some of the colleges verbally subscribing for casts at the Washington convention have failed to formally ratify such subscription, and this fact, together with other disappointments, have prevented the casts ordered from reaching the number requisite to reduce the cost to $40 each.

Pursuant to the resolutions that "it is the sense of this Association that the executive committee continue its efforts to secure an appropriation for the purpose of furnishing uniforms and such other equipment as may be necessary for the more complete instruction in military science and tactics, and further secure such legislation as shall require one officer of the Army to be detailed to each college receiving the benefits of either of the so-called Morrill Acts," your committee called several times at the War Department, the Inspector-General's Office, and upon various members of the Military Committee. It was the unanimous opinion that it would be unwise at that time to attempt legislation in furtherance of the objects proposed. The attitude of the Department and of the committee was not such as to encourage success. The only point gained was to obtain the insertion of a clause in the army bill, then pending, detailing officers to high schools, that this should not be to the prejudice of those colleges already enjoying details.

In the last report of the executive committee it was stated that the attention of the Secretary of the Interior had been called to the inadequacy of the provisions in the Bureau of Education for maintaining suitable relations with the land-grant colleges, and that he had expressed his intention of taking decided action at an early date, and that it seemed probable that this matter would receive the necessary attention without further effort on the part of this Association. Such, however, was not the case. Through a mistake in transmission, the message of the honorable Secretary was laid before the wrong body, and failed to receive the attention it merited. Considerable time was spent in trying to rectify this error, and when finally the bill introduced reached its proper committee, it was too late to be incorporated in the regular appropriation bill, and it was found necessary to call it up as an amendment in the very last hours of Congress. That it failed of passage was hardly to be wondered at, and the only appropriation made was for a fourth-class clerk in the Bureau of Education to forward the relations between the Bureau and the land-grant colleges. This was so far below the requirements of the proposed office that the executive committee have taken no steps to carry the matter further.

A question engaging the attention of the executive committee and involving correspondence with the Postmaster-General has been the compensation of those officers handling the free mail of the stations. As is well known, a large number of our experiment stations are located in comparatively small country towns, where the extra work imposed upon the postmaster by handling the numerous bulletins sent and received calls for a very considerable addition to the work of the office without any additional compensation. With a view to collecting data sufficient to present to the Postmaster-General, a circular letter was sent to each director asking for information on the following points: Number of bulletins and reports issued; number of pages in each; size of edition and weight of the same. From most of the stations answers were received, and the accompanying table has been compiled from the returns. The year 1893 was selected for the reason that in many States the annual report for 1894 had not yet been published.

Station.	Number of publications.	Number of pages.	Number of pieces handled.	Weight in pounds.
Alabama	11	1,623,000	51,000	5,930
Arizona	4	134,000	6,500	430
Arkansas	7	180,050	60,075	....
California	6	3,222,000	36,000	9,716
Colorado	5	852,000	29,000	2,525
Connecticut (State)	8	2,455,000	15,000	7,478
Connecticut (Storrs)	3	1,512,000	15,000	2,455
Delaware	5	668,000	35,000	2,584
Florida	....	....	....	....
Georgia	5	1,314,000	46,000	3,100
Idaho	6	408,000	16,000	1,300
Illinois	12	2,967,720	110,220	12,573
Indiana	6	876,500	41,500	2,535
Iowa	4	4,920,000	60,000	12,857
Kansas	9	1,290,000	67,500	5,425
Kentucky	5	1,787,000	53,000	6,164
Louisiana	9	1,177,500	38,000	5,727
Maine	2	1,377,000	8,500	5,000
Maryland	7	720,000	35,000	2,939
Massachusetts	24	4,921,400	107,000	17,009
Michigan	12	6,284,000	119,000	23,550
Minnesota	8	3,780,000	105,000	12,639
Mississippi	8	887,300	39,300	2,636
Missouri	3	988,000	39,000	2,032
Montana	7	815,000	31,000	1,755
Nebraska	11	2,115,000	86,000	8,135
Nevada	5	273,500	11,500	1,653
New Hampshire	7	1,152,000	84,000	4,170
New Jersey	4	1,232,000	41,000	4,100
New Mexico	4	248,500	12,500	637
New York	13	3,624,500	108,750	12,535
North Carolina	....	....	....	....
North Dakota	5	678,000	13,000	2,256
Ohio	6	11,083,000	260,000	37,421
Oklahoma	13	710,000	37,600	930
Oregon	....	....	....	....
Pennsylvania	5	2,844,000	45,000	19,815
Rhode Island	7	1,958,000	35,500	7,149
South Carolina	5	1,181,000	34,000	5,080
South Dakota	6	1,136,000	51,000	3,179
Tennessee	5	610,000	25,000	1,960
Texas	5	585,000	33,500	3,833
Utah	8	2,026,300	40,300	6,874
Vermont	12	678,000	22,000	1,958
Virginia	13	2,204,000	168,000	5,857
Washington	....	....	....	....
West Virginia	....	2,855,000	....	20,000
Wisconsin	5	5,840,000	55,000	22,430
Wyoming	7	1,048,000	24,750	3,905

It appears from the above figures that in the year 1893 there were issued from 45 stations 317 bulletins and reports, containing 89,191,270 pages. There were handled at the offices from which they were mailed 2,351,995 separate pieces, weighing 322,236 pounds.

Respectfully submitted, for the executive committee.

HENRY H. GOODELL, *Chairman*.

Report accepted.

Report of the Treasurer of the Association.

John H. Washburn, treasurer, in account with the Association of American Agricultural Colleges and Experiment Stations.

Received from M. A. Scovell, treasurer	$82.30
Moneys received for dues in 1893 and 1894	20.00
Received for cast of the bust of J. S. Morrill	45.00
Dues for 1894 and 1895	970.00
Total	1,117.30
Expenditures	551.42
Balance on hand	565.88

ITEMIZED STATEMENT.

Receipts.

1894.			
Nov.	16.	University of Idaho	$10.00
	16.	University of Idaho Experiment Station	10.00
Dec.	31.	Oklahoma Agricultural College, for cast of bust of J. S. Morrill	45.00
1895.			
Mar.	20.	Vermont Agricultural College	10.00
	20.	Maryland Agricultural College	10.00
	20.	Connecticut, Sheffield Scientific School	10.00
	20.	Kentucky Agricultural Experiment Station	10.00
	20.	West Virginia University	10.00
	20.	Massachusetts Agricultural College	10.00
	20.	Hatch Experiment Station, Massachusetts	10.00
	20.	Delaware Agricultural Experiment Station	10.00
	21.	Louisiana State University	10.00
	21.	Alabama College of Agriculture and Mechanic Arts	10.00
	21.	Alabama Agricultural Experiment Station	10.00
	21.	New Hampshire College of Agriculture and Mechanic Arts	10.00
	21.	New Hampshire Agricultural Experiment Station	10.00
	22.	Nebraska Agricultural College	10.00
	22.	Arkansas Agricultural Experiment Station	10.00
	22.	North Carolina Agricultural Experiment Station	10.00
	26.	Cornell University	10.00
	26.	Cornell University Agricultural Experiment Station	10.00
	26.	Louisiana State Experiment Station	10.00
	26.	Virginia, Hampton Normal and Agricultural Institute	10.00
	26.	Virginia Agricultural and Mechanical College	10.00
	26.	Virginia Experiment Station	10.00
	26.	University of Tennessee	10.00
	26.	Kentucky Agricultural and Mechanical College	10.00
	26.	New Jersey, Rutgers Scientific School	10.00
	27.	Georgia Agricultural Experiment Station	10.00
	27.	Connecticut Agricultural Experiment Station	10.00
	27.	Maine Agricultural Experiment Station	10.00
	27.	Maine State College	10.00
	27.	Iowa Agricultural College	10.00
	27.	Pennsylvania State College	10.00
	27.	Nevada Agricultural College	10.00
Apr.	1.	Mississippi Agricultural and Mechanical College	10.00
	1.	Mississippi Agricultural Experiment Station	10.00
	1.	South Carolina, Clemson Agricultural Experiment Station	10.00
	1.	Oklahoma Agricultural and Mechanical College	10.00
	1.	Michigan Agricultural Experiment Station	10.00
	1.	Michigan Agricultural College	10.00
	3.	New Jersey Agricultural Experiment Station	10.00
	4.	Delaware Agricultural College	10.00
	4.	Indiana, Purdue University	10.00
	9.	Maryland Agricultural Experiment Station	10.00
	9.	Connecticut, Storrs Experiment Station	10.00

1895.			
Apr.	9.	West Virginia Agricultural Experiment Station	$10.00
	15.	Rhode Island College of Agriculture and Mechanic Arts	10.00
	15.	Rhode Island Agricultural Experiment Station	10.00
	16.	University of Missouri	10.00
	18.	Iowa Experiment Station	10.00
	18.	North Carolina College of Agriculture and Mechanic Arts	10.00
	18.	Ohio State University	10.00
	18.	Missouri Agricultural Experiment Station	10.00
	18.	Vermont Agricultural Experiment Station	10.00
	18.	New Mexico Agricultural Experiment Station	10.00
	18.	New Mexico College of Agriculture and Mechanic Arts	10.00
	18.	Tennessee Agricultural Experiment Station	10.00
	18.	North Dakota Agricultural College	10.00
	25.	Nebraska Agricultural Experiment Station	10.00
	25.	Indiana Agricultural Experiment Station	10.00
	25.	Oregon Agricultural College	10.00
	29.	Colorado Agricultural Experiment Station	10.00
	29.	Arizona Agricultural Experiment Station	10.00
	29.	Arizona Agricultural College	10.00
	30.	Ohio Agricultural Experiment Station	10.00
	30.	University of California	10.00
May	7.	Utah Agricultural Experiment Station	10.00
	7.	Utah Agricultural College	10.00
	7.	New Jersey Agricultural Experiment Station	10.00
	13.	Minnesota Agricultural College	10.00
	13.	Minnesota Agricultural Experiment Station	10.00
	13.	Wyoming Agricultural College	10.00
	13.	Wyoming Agricultural Experiment Station	10.00
	13.	Colorado Agricultural College	10.00
	13.	South Dakota Agricultural Experiment Station	10.00
	14.	Wisconsin Agricultural Experiment Station	10.00
	14.	Wisconsin Agricultural College	10.00
	27.	Oregon Agricultural Experiment Station	10.00
June	3.	Pennsylvania Agricultural Experiment Station	10.00
	10.	Kansas Agricultural Experiment Station	10.00
	11.	South Carolina, Clemson Agricultural College	10.00
	11.	Oklahoma Agricultural Experiment Station	10.00
	17.	North Dakota Agricultural Experiment Station	10.00
	19.	South Dakota Agricultural College	10.00
	24.	Montana Agricultural Experiment Station	10.00
	24.	Florida Agricultural College	15.00
	24.	Florida Agricultural Experiment Station	15.00
	29.	Illinois Experiment Station	10.00
July	15.	Georgia Agricultural College	10.00
	15.	Kansas Agricultural College	10.00
	15.	Southern University and Agricultural and Mechanical College of Louisiana	10.00
	16.	Illinois State University	10.00
	16.	Washington Agricultural College	10.00
	17.	Montana Agricultural College	10.00
	17.	Texas Agricultural College	10.00
	17.	Texas Experiment Station	10.00
	17.	Arkansas Agricultural College	10.00
		Total receipts	1,025.00

Expenditures.

1894.			
Nov.	16.	Paid Ebbitt House, as per voucher No. 1	$14.05
Dec.	31.	Paid H. E. Alvord, for bust of J. S. Morrill	45.00
	31.	Paid H. E. Alvord, for Association expenses	64.75
1895.			
Jan.	1.	Paid H. H. Goodell, in behalf of Association	7.00
Feb.	12.	Paid Ebbitt House, expenses of executive committee	33.50
Mar.	29.	Paid H. H. Goodell, expenses to Washington	80.50
	29.	Paid H. P. Armsby, expenses to Washington	18.47

1895.			
June	29.	Paid J. H. Washburn, expenses to meeting of executive committee and for postage and printing......	$20.11
	29.	Paid M. A. Scovell, expenses for copying dairy test record..	79.75
	29.	Paid Carpenter & Morehouse, for printing...........	20.50
July	15.	Paid M. A. Scovell, expenses to Washington for executive committee..	39.45
	15.	Paid A. A. Johnson, for expenses in arranging for meeting at Denver..	13.20
	15.	Paid Miss J. Paden, stenographer....................	3.60
	15.	Paid Denver Hotel Bulletin Company, for printing..	12.00
	15.	Paid H. H. Goodell, for sundry expenses paid........	36.54
		Total expenditures..............................	551.42

Mr. SCOVELL. I move the usual auditing committee, consisting of three members, be appointed to look over and report upon the annual report of the treasurer.

Carried.

The chair appointed the following committee: Messrs. M. A. Scovell, S. P. McCrea, and A. L. Emigh.

The following resolution was offered for the action of the convention:

Resolved, That no institution shall be entitled to representation or participation in the benefits of the Association unless such institution shall have made the designated contribution for the year previous and that in and for which such question of privilege shall arise, or shall have had said payment remitted by the unanimous vote of the executive committee.

The CHAIRMAN. Only those institutions are entitled to participate, however, in this convention who appear to have contributed to the funds of the Association in accordance with the treasurer's report of last year, which appears in the printed proceedings at pages 19, 20, and 21.

Mr. SCOVELL. I think that one or two stations paid after the report for last year.

The CHAIRMAN. They have been announced by the treasurer and should appear in his report.

The next item of business is to receive the reports from the chairmen of sections. Shall we now proceed with that order? In so doing, I first call upon the chairman of the Section on Agriculture and Chemistry, Mr. Voorhees.

Chairman E. B. Voorhees, of the Section on Agriculture and Chemistry, presented the following report:

REPORT OF THE SECTION ON AGRICULTURE AND CHEMISTRY.

This report of the progress of agricultural and chemical work during the past year must necessarily include much that is not strictly new work. The information arranged and classified here has been gathered both from the reports and bulletins, and directly from the agriculturists and chemists of the various institutions, the latter in response to a circular letter sent out in May last asking for a report of work finished and in progress. The very prompt and generous response to this letter gave abundant and gratifying evidence in respect to the value to scientific agriculture of the work now planned and in progress, the ability and enthusiasm of the scientists engaged, and their interest in the work of this Association.

Of the 54 experiment stations addressed, but 9 failed to report, viz, the State and Sugar Experiment stations of Louisiana, the Cornell Experiment Station of New York, and Hatch Experiment Station of Massachusetts, and those of Missouri, Nevada, Oregon, Delaware, and Kentucky. The failure to make a specific report at this time is undoubtedly due to an oversight, since we are all familiar with the excellent and progressive work of these institutions.

Reports of this sort are mainly valuable in two directions: first, in giving detailed statistics in reference to the number of lines of investigation, the number of workers engaged, and results accomplished; and, second, in showing in addition the bearing of the work of the stations in general, or as a whole, upon the progress of scientific and practical agriculture in the various States.

The detailed statistical work has been well performed by the Office of Experiment Stations, and is a matter of record; I have, therefore, directed my attention more particularly to the general, rather than the statistical features of our progress. It is also plainly evident, because of the intimate relations of chemistry and agriculture, that any attempts to make a distinct separation of the agricultural and chemical work must necessarily result in confusion, hence, in the classification and discussion of the work as outlined in the reports received, the provisions of the Hatch law have been followed to some extent, though not in their regular order.

In the provisions of this law, which come under the purview of this section, the stations are required to conduct original researches or verify experiments on at least eight different lines. The first in order in this discussion is:

I. *The comparative advantages of rotative cropping.*—This work may perhaps be regarded as purely agricultural, since the yield and market value of the crops in a rotation may be readily determined without the assistance of the chemist. In many stations the study of rotation is regarded as incidental to other work, though its importance is emphasized particularly on our stronger lands and in the growth of crops of a high fertility value.

Specific studies are reported as in progress by the Rhode Island, Minnesota, Ohio, Nebraska, Illinois, and Michigan stations. Rhode Island reports six well-planned experiments, the rotation courses ranging from three to six years, with and without the "nitrogen gathering" leguminous crops and adapted to improved methods of cropping. In Nebraska a careful study is being made relative to the place of the sugar beet in the rotation, while in Minnesota the relation of rotation to soil fertility, both as to the form and amount of plant food removed, is the subject of investigation. These investigations may be regarded as new, and it is certain that the data obtained will have a wide application and add much to the somewhat meager fund of exact information on these points. The second division of agricultural work is:

II. *The adaptation of cereals, grasses, and forage plants.*—Studies in these lines occupy the attention of 15 stations, located mainly in the West and South. Those of Arizona, Washington, Idaho, Colorado, Oklahoma, South Dakota, Alabama, and Mississippi are devoting much time to this work. Oklahoma reports that the principal work of the department has been a search for a suitable grass for hay and for pasture, with the result that so far alfalfa comes nearest to filling the demand. Colorado reports flat pea and sachaline total failures, while in Kansas the flat pea gives promise of success. In the Mississippi station special attention has been given to the introduction of new grasses and forage plants, and it has demonstrated that clovers and other legumes can be grown with success, both for forage and for seeds—a very great advantage to the agriculture of the State.

Delaware, Maryland, North Carolina, New Jersey, and Massachusetts are also studying the adaptability and usefulness particularly of new forage plants, and report much of usefulness as a result of their work.

In a sense the results of work of this kind must have a local application, because of variations in conditions. This fact, however, does not detract from its very great practical value, but is rather an argument in favor of more careful work of like character. The benefits conferred upon a State or farming community by the introduction of a new and valuable plant can hardly be overestimated.

III. *The chemical composition of useful plants in their different stages of growth.*—Specific investigations along this line are reported from 10 stations. The Wyoming station is making an extensive study of native forage plants. The Minnesota station reports "a complete chemical study each year of some important farm crop, mainly as to the time of year and stage of development when the food is taken from the soil, the flax plant being the subject of examination in 1895." The composition of the oat plant at different stages of growth to determine its forage value forms an important part of the work of the Michigan and Iowa stations this year, while in Nebraska studies of the chemical changes taking place in the sugar beet during its period of growth is continued. In the other States less elaborate, though important and useful work, is in progress.

IV. *The chemical composition of manures (natural or artificial), with experiments designed to test their comparative effects on crops of different kinds.*—Studies in this line are no longer confined to the older stations of the Eastern and Southern States, but are engaged in to a greater or less extent by nearly all of the States east of the Mississippi River, and to some extent by the stations of the far West and Pacific Slope. Colorado reports experiments with chemical manures in the raw and manufactured state, and also as an interesting fact "that commercial fertilizers are for sale in Colorado markets." The analysis of manures and fertilizers and accompanying experiments is also reported as not an insignificant part of the work of the California station. Among the stations of the East, and South, and Central West, Maine, Connecticut, Rhode Island, Massachusetts, New Jersey, Pennsylvania, Ohio, Maryland, Virginia, West Virginia, North Carolina, Georgia, Alabama, Louisiana, Kentucky, and Indiana report either field or vegetation experiments with fertilizers.

These experiments, while not in any case so elaborate in plan as those in progress abroad, are in a few instances rather extensive, and promise much of value, both in educating the farmer in reference to the character and usefulness of plant food and in adding to the fund of definite knowledge concerning the fertility value and methods of use of the various products.

Ohio reports over 200 tenth-acre plats on the station farm devoted to a series of tests with commercial fertilizers, besides a number on outlying farms for the purpose "of making a complete test of commercial fertilizers on the different soils of the State." The Pennsylvania station reports 144 eighth-acre and 12 twentieth-acre plats devoted to the study of the effects of different forms and kinds of manures and of different methods of application for the different crops, and in addition a series of experiments in cooperation with local organizations to test the effect of different forms and kinds of commercial fertilizers on the yield and quality of tobacco.

Plat experiments, while on the whole forming a very useful line of work in the past, are subject to many inaccuracies, because of uncontrolled conditions. In a number of States, therefore, these experiments are being supplemented and controlled by vegetation or pot experiments. Maine, Massachusetts, Rhode Island, and Connecticut especially report progress in these lines, as well as important additions to their equipment for future work.

V. *The analyses of soils and waters.*—Nine stations, with one exception located west of the Mississippi, report more or less study of soils and waters. The Idaho station has undertaken "a complete soil survey and analysis, as well as a study of the irrigation waters of the State, the investigation to cover a series of years." In North Dakota the analysis of water for sanitary purposes is a prominent feature of the work. In Arizona "a series of water analyses is in progress, with a view to finding the relation of irrigation to alkali under the conditions that obtain in the Territory." The Montana station is studying the effect on plants of waters containing salts derived from the reduction of silver; in South Dakota the waters of shallow artesian wells and of streams flowing over the outcrops of sandstone are being studied. In the Utah and Oklahoma stations the analysis of irrigation waters occupies the attention of the chemists. In California "the alkali problem of the State is in process of investigation, including analysis of soils, waters, and salts;" while in Indiana and Minnesota the humus content of soils is being carefully studied.

VI. *The composition and digestibility of food for domestic animals.*—Digestion experiments are in progress at seven stations. The Storrs station is conducting experiments with sheep, which include a study of the fuel values of the digested nutrients. The Maine station has reported much valuable data secured from digestion experiments with sheep and pigs, and the work is continued, consuming much time of the officers, both in the stables and laboratory. Pennsylvania reports "digestion experiments in progress with milch cows, in connection with which the fuel values of the samples of feed and excreta are to be determined by the bomb calorimeter, besides careful observations concerning the effect of nutritive ratio; also experiments upon cotton-seed meal, covering its digestibility by steers and comparisons of its nutritive effect for dairy cows with that of ordinary feeds."

The Illinois station is studying the digestibility of corn, cowpea, soja bean, silage, and corn fodder by steers. The Massachusetts station is determining the digestibility of various forage plants and concentrated feeds by ruminants, and has tabulated the results of digestion experiments obtained by American stations. In Minnesota the effect of one food upon the digestibility of another is one of the questions involved in an interesting study. In North Carolina much valuable data recently secured will soon be published.

The very considerable amount of excellent work already done, and the promise of that now in progress, because of the high degree of skill, scientific training, and expensiveness of equipment required to successfully carry it out, gives strong proof of the standing and permanency of our institutions.

VII. *The economic questions involved in the production of dairy products.*—The importance of the dairy problem is clearly recognized, and is studied in some of its phases by nearly all of our stations. I shall, therefore, not attempt to do more than to outline briefly the work of those stations in which it assumes a prominent part. Feeding experiments to determine the relative influence of different foods and the preparation of rations upon the yield and quality of the milk are in progress in Illinois, Connecticut (Storrs), Massachusetts, Pennsylvania, New York (Cornell and Geneva), North Carolina, Texas, Iowa, Michigan, and Minnesota. The influence of breed in the economic production of butter fat is a special feature of the work at the Geneva station, from which much valuable data has already been gathered.

Ohio reports the beginning of an experiment with six different breeds, in which it is proposed to study in detail their relative value for the dairy. In Michigan, the effect of the individuality of the animal, of changes of food and of temperature, and of kinds of food and methods of feeding are prominent lines of investigation. In Pennsylvania, in addition to a comparison of the actual feeding value of silage, sugar beets, and mangels, the influence of these classes of foods upon the market and keeping quality of the milk and butter is studied.

The Connecticut station is devoting much time to a study of the economic management of creameries, involving many analyses of milk and cream, and instruction in methods of purchasing the cream. At the Geneva (N. Y.), Minnesota, and Wisconsin stations extensive and most valuable investigations concerning the manufacture of cheese, and the relative value of different milks for the purpose, are in progress.

Studies concerning the health of dairy animals and the purity and healthfulness of dairy products which involve the detection, prevention, or eradication of disease, particularly tuberculosis, and the pasteurization or sterilization of milk and cream also occupy the attention of a number of stations. In North Carolina, Nocards's treatment for abortion has been carefully studied. The Mississippi station reports "the use of the tuberculin test on 62 cows of the station herd with wholly negative results, and that this work is being continued on other herds to ascertain what, if any, foundation exists for the common statement that Southern cows are rarely affected with tuberculosis." The study of this disease is also being continued in Wisconsin, New Hampshire, New Jersey, Pennsylvania, and other States.

VIII. *Other researches bearing directly upon the agricultural industry of the United States.*—Under this heading a very large part of the work of the stations is included, and in order to bring out the essential features we have divided it into five subheadings:

(*A*) *Variety tests and methods of seeding and culture of farm crops.*—Very extensive variety tests are in progress mainly in the corn, cotton, and wheat States, and in those showing a wide variety of soils. Texas leads with tests of 249 varieties of wheat, 49 of field corn, besides tests of a large number of varieties of oats, rye, barley, grasses, clover, and cotton. In Ohio 70 varieties of wheat are being tested at the station farm, and samples of varieties grown there are sent to different sections of the State for a further test of their adaptability to the varying conditions of soil practice.

In Kansas extensive experiments with corn and oats are in progress; in Washington large areas are devoted to testing varieties of wheat, oats, corn, barley, pasture grasses, and forage and hay plants. In Mississippi the station has made an exhaustive study of the several types of American cotton, and their adaptability to the different soil regions; the Georgia station is also engaged in similar work.

The stations of North Dakota, Illinois, Michigan, Minnesota, Iowa, Louisiana, Maryland, and Pennsylvania are also engaged in this work. In most of these stations the study of varieties is also accompanied by careful experiments relative to the time and methods of seeding and cultivation.

(*B*) *Animal nutrition.*—Studies of the nutritive effect of foods and the economical production of beef, pork, and mutton, or energy, as distinct from studies of digestibility and the production of dairy products, are in progress in 10 stations. In North Dakota and Utah careful experiments in feeding horses, both for work and for maintenance, and including several kinds of rough and concentrated foods, occupy a large part of the time of particular officers. In Maine, in connection with the experiments in animal nutrition, "the entire bodies of four steers, fed differently from calfhood, are being analyzed to determine what effect the feeding has had upon the constitution of the body. In Ohio an elaborate feeding test with five breeds of sheep is just begun.

Experiments in pig feeding are in progress in Washington, Wisconsin, and Maryland, and those in the feeding of sheep and lambs at Cornell (N. Y.), Michigan, Wisconsin, and North Carolina stations. In these, too, careful attention is given to crossing of sheep, with a view to developing and improving special characteristics in the production of wool, mutton, and early lambs. Studies in this direction are extremely valuable. Colorado also reports studies in sheep feeding that will cover the whole subject from the range to the market, as well as experiments in the breeding of both sheep and cattle.

(*C*) *The development of natural resources and improvement of industrial interests.*—The stations of Florida and South Carolina are making careful studies of their phosphate deposits. Arizona is studying the fiber plants, and in connection with Texas and New Mexico is continuing experiments to test the growth and value of the cañaigre plant, with a view to its use as a commercial source of tannin. Georgia is studying the starch content of the sweet potato and its suitability as a commercial source of starch. Alabama is conducting investigations relative to the composition and characteristics of sugar cane grown on the elevated lands of the State, besides studying the manufacture and preservation of sirup, with a view to developing the industry, and reports highly satisfactory progress.

The very valuable work of the sugar experiment station of Louisiana, and the extensive studies of the sugar beet in Washington, Nebraska, Utah, Arizona, and other Western States with a view to further development of the beet-sugar industry, are being continued. In New Hampshire, Vermont, and Michigan the maple-sugar industry is materially assisted by the studies of the stations.

(*D*) *Irrigation, drainage, and soil improvement.*—Experiments in irrigation are in progress in a number of the States of the far West, though in many it has passed beyond the experimental stage, while in the East a few stations are planning experiments on this line. The drainage question is not largely studied, though interesting and careful experiments are reported from Illinois, Wisconsin, and other States. Experiments relating to the improvement of soils which are poor both in physical and chemical properties, by means of green manures and chemicals, have been recently begun in many States, notably Maryland, North Carolina, and New Jersey.

(*E*) *Miscellaneous studies and experiments.*—In addition to the specific lines of investigation thus briefly outlined, much work is accomplished in the study of local problems; the preservation and improvement of farm manures, the analysis of fertilizers, fodders, feeds, muck, peat, soils, waters, ores, dairy products, etc., all of which is of very great direct usefulness to the citizens of the various States, and adds materially both to the value and popularity of the stations. In a number of stations research work along many lines and of a highly scientific character is being prosecuted; the study of methods of analysis also occupies the attention of nearly all of the chemists. This is of very great value, and has already resulted in increasing both the accuracy and rapidity of chemical analysis.

During the past year, too, the funds of a number of institutions have been increased, either by generous grants from State treasuries or from the contributions of local organizations, which is gratifying evidence of the appreciation of their work.

In conclusion, it must be remembered that agriculture and chemistry are but two of the many branches of work, and therefore represent only a part of the whole now in progress by the stations.

EDWARD B. VOORHEES, *Chairman.*

The CHAIRMAN. The next in order is the report of the Section on Horticulture and Botany. Mr. Tracy, the chairman, is absent, but I understand that Mr. Lazenby, the secretary of this section, has his report, and it will now be read.

REPORT OF THE SECTION ON HORTICULTURE AND BOTANY.

MR. PRESIDENT AND GENTLEMEN: To itemize the work of the 80 men who are now doing botanical and horticultural work at 50 stations is an impossibility in the twenty minutes assigned for this paper, and therefore the report of progress will be made by subjects rather than by States, hoping that this may give a more comprehensive view of the work in hand.

The work of the true botanist can not be separated from its higher practical development, horticulture, and work in neither line can be made efficient without calling in the entomologist, and also frequently reaching over the undefined boundary between horticulture and agriculture. This is frequently seen in the notes which form the basis of this report, but I quote only from notes sent by those who are officially named as the botanists, mycologists, or horticulturists of the several stations.

Work with fruits is evidently receiving more attention than is any other one subject, as it is mentioned in the reports from every station. The origination of new varieties by crossing and selection is a part of the work of the Indiana, Louisiana, Minnesota, Missouri, Cornell (N. Y.), South Dakota, West Virginia, and Wisconsin stations, while the effects of pollination, both immediate and secondary, are being studied in Florida, Georgia, Maine, Geneva (N. Y.), and Oregon. The spraying of fruit trees has been the subject of special work at the Florida, Louisiana, Mississippi, Cornell (N. Y.), and Texas stations, and is practiced to a greater or less extent at nearly every station. The effects of different fertilizers on the growth of the trees and on the quality of the fruit are being studied in Florida, Mississippi, Texas, and Washington; while the effects of pruning at different seasons is receiving attention in Nebraska, and methods of cultivation are being tested in Maine, Cornell (N. Y.), Oklahoma, South Dakota, and Washington. Missouri and Oklahoma are making large plantings of nut-bearing trees, and Florida has given us the only bulletin on the pineapple.

That the mycologists are cooperating with the horticulturists is shown in the fact that Connecticut, Michigan, Mississippi, both New York stations, Ohio, Tennessee, Virginia, Washington, and Wisconsin each report work on "Diseases of fruits," while Alabama and Connecticut specialize on pear blight, Connecticut and Mississippi on apple scab, and Cornell (N. Y.) and Oregon on "Diseases of stone fruits." Connecticut and both the New York stations are also studying bacterial diseases of plants.

The testing of varieties, both new and old, holds an important place in station work, being mentioned in the report from nearly every station, and as one of the leading lines of work by no less than 16. Many stations report 300 to 500 varieties of fruit in cultivation, while others mention much larger numbers, the New York State station reporting no less than 1,776 varieties. The value of these variety tests has often been questioned, and is a matter which might well be discussed here. One man says, "We are pushing this work at four different stations." Another says, "Our main effort in horticultural work has been given to the testing of varieties of fruits and vegetables." Another says, "Testing varieties is a very minor matter," and still another says, "Incidentally, novelties in fruits and vegetables receive due attention, but 'variety testing' is not made an important feature of our work." I trust that this matter may receive your attention, and that we may have the benefit of your advice.

Work with garden vegetables also claims a large share of attention, as is shown in the fact that 13 stations mention the testing of varieties as being one of the more important lines of work. Seven report work on diseases of vegetables in general, but the greater number confine their work to a few specialties, as at Connecticut, Indiana, Kentucky, New York State, North Dakota, and Wyoming stations, where the work is given to a study of the development and prevention of potato scab, and in Florida and Mississippi, where diseases of the tomato receive special work. The Louisiana, Cornell (N. Y.), and West Virginia stations are doing somewhat extensive work in the forcing of vegetables under glass, and two stations seem to have demonstrated that the electric light may be made an efficient assistant in commercial greenhouse work. Georgia is testing the sweet potato with reference to its value as a basis for the manufacture of starch, and the Louisiana station has introduced a large number of foreign varieties which now promise to be of considerable value.

Not all of the stations confine their work to supplying the wants of the inner man, for Massachusetts and Minnesota are doing good work in the introduction of new varieties of flowering plants, while New Jersey, New York State, and Vermont are doing special work in studying the many diseases which affect both the flower garden and the greenhouse.

Eleven stations report work with diseases affecting wild plants in general, while two have taken a hint from the entomologists and are studying the practicability of using fungi as weed destroyers.

In their studies of plant diseases, and in crossing and hybridizing, many of the station botanists are of great assistance to the agriculturists. Kansas is doing much to prevent the losses caused by the smuts of grains, and Wyoming is also engaged in the same work. North Dakota is making a study of some of the physiological problems which confront the wheat grower, while Kentucky, Louisiana, and Wisconsin are doing a similar work for tobacco growers. Alabama, Florida, and Mississippi are naturally working with cottons, examining the types of native varieties and introducing foreign sorts, from which they now have some thousands of hybrids in cultivation. Diseases of cotton claim attention in Alabama and Mississippi.

Ten station botanists report special work with grasses and forage plants. Several of these are saving seeds from selected plants in an endeavor to establish improved races, and the experience so far gained seems to indicate that this may be a fruitful field for work. Georgia, Louisiana, and Oklahoma are all engaged in working out the difficult problem of the botanical and cultural varieties of the cowpea, a study which will require some years of careful investigation for its completion.

Several of the Western States, including Arizona, Minnesota, Oklahoma, Utah, and Washington, are studying forestry problems, and are testing both varieties and methods.

Local conditions often call for special crops, and we find Louisiana making extensive cultures of fiber plants, and Nebraska of honey plants, while the North Carolina station, located near the greatest herb market in the country, is giving special attention to the methods of cultivation for medicinal plants.

The farmers and gardeners are not the only ones who have to contend with weeds, for we find no less than 9 stations reporting a study of their distribution and the simplest means for eradicating them as being important lines of work. Several bulletins on the subject have given excellent means for the recognition of dangerous new arrivals, but we are sorry to say that as yet we have no bulletin which enables us wholly to dispense with the old-style hoe.

In seed testing, North Carolina is perhaps doing more than any other station in testing the purity and vitality of commercial seeds, and Michigan is doing a great amount of work on the longevity of weed seeds when exposed under different conditions. Indiana, Louisiana, and Maine are studying the effects of climate on the amount, vitality, and successive generations of seeds, and when their work is completed it is hoped that we may know something definite as to the real importance of the common practice of changing the location of the seed supply as compared with careful and continued selection of seeds grown continuously in a single locality. In the same connection may be mentioned the work of Nebraska in studying the effects of local factors, wind-breaks, soil moisture, etc. Indiana is studying plant nutrition and the physiology of plant growth, and pot work with fertilizers is being done at the Connecticut, Georgia, both New York, and Washington stations.

Although the dairymen long ago came to the chemist for help, it is only quite recently that they have learned that they must come to the botanists to secure desirable flavors for their products, and the "Bacteriology of the dairy" now holds a prominent place in the work of the North Dakota and the Wisconsin stations.

Five stations are largely engaged in the introduction of foreign plants, both for their possible value for cultivation here and for use in crossing and hybridizing with our present varieties for the establishment of new sorts. Many of these introductions promise to be of great value, though in most cases years must elapse before we shall know their true standing. Arizona evidently favors the protection of home industries, and not content with showing us the value of dock as a field crop is now engaged largely in the cultivation of cacti.

The horticulturists and the entomologists are naturally working together in devising means for the control of insect pests in nearly every station, and in Michigan they are making a study of the fungoid diseases of insects, while in Washington the value of bees in the orchard is receiving special attention.

There is scarcely a station which is not doing more or less original work in the use of fungicides and insecticides, and every effort is being made to find combinations of the two which will obviate the necessity for the double sprayings which have been necessary heretofore. Several such combinations are in rather common use, which, with the greatly improved nozzles and spray pumps now in the market, have greatly decreased the labor of spraying. This cooperative work of the botanists, horticulturists, and entomologists has been of inestimable value to the fruit and vegetable grower in giving him practical immunity for his crops with a minimum amount of labor.

The Louisiana and West Virginia stations are making their work felt through their respective States by the propagation and free distribution of plants and seeds of such new varieties of plants as have been found desirable, and that line of work seems to be accomplishing good by making the stations better known and more popular.

The stations in Alabama, Colorado, Louisiana, Mississippi, Nevada, and Wyoming are pushing botanical surveys in their respective States, in part for the botanical interest of the work and in part for the great value of the information which a record of plant growth and distribution will give concerning the soils in different sections. With this work of course comes the accumulation of an herbarium, which is essential for the recognition of the hosts of plant fragments which are sent to every station botanist for identification. New Mexico is carrying this survey one step further than is usually done, and is studying the effects of elevation with a view to the establishment of "plant zones," of which several are plainly recognizable in that region of snow-capped mountains and arid plains.

Irrigation, both surface and subearth, is yearly claiming more attention, and, somewhat strangely, we find that fully as much work is being expended in that direction in the East as in the West, which may be partially from the fact that it is a new line of inquiry in the Eastern States. This matter received considerable attention at our last meeting, and a number of station workers have come to this meeting principally to learn more of a subject which promises to become of great importance to the market gardeners of the East.

This brief outline would be very incomplete were no mention made of the extensive and valuable work which is being done for both botany and horticulture by the Department at Washington. In the purely botanical work the botanical survey of the whole country is being vigorously pushed; special assistants are being employed in the investigation of commercial seed supplies, in germination tests, in the investigation of pharmacological and poisonous plants, and in several other lines. The newly established division of agrostology is not only working for the agriculturist in testing the hay and pasture values of different plants, but is preparing a handbook of grasses, which has been so greatly needed by every botanical worker. The mycologist has always been the pioneer in the work of spraying and in the preparation of fungicides, and his assistants are now engaged in studies of several obscure bacterial diseases, diseases of citrus fruits and other subtropical plants, diseases of grapes, diseases of cereals, and several other important subjects.

The work of a station can be of but little value if results are not published and distributed to the public, and that this is realized by our workers is shown in the 117 bulletins on botanical and horticultural subjects which have been issued during the year, and this in addition to perhaps a still greater number of pages in the various annual reports. These bulletins have been, almost without exception, carefully digested papers, containing definite original information which has been gained by the several workers, and which is of value to the working farmers as well as to the fruit growers and gardeners. No one who has watched the station bulletins since 1888 can have failed to note the great change and improvement in their character as long-continued and intricate lines of investigation have been completed, and their appreciation by the public is shown in the greatly increased personal correspondence which is mentioned in nearly every report. In several States, and notably in New York, special State appropriations have been made for the purpose of increasing the scope of the horticultural work of the respective stations, and we all know that such appropriations are not made until they are called for by a strong public sentiment.

All experiment work is cumulative in its value and its effects. The botanists and horticulturists have already secured practical results of great interest in nearly every line of investigation which they have undertaken, and there is every reason to believe that each succeeding year will show results of still higher merit.

Respectfully submitted.

S. M. TRACY, *Chairman.*

Mr. C. P. Gillette, chairman of the Section on Entomology, presented the report of that section, as follows:

REPORT OF THE SECTION ON ENTOMOLOGY.

Previous to the passage of the Morrill bill for the establishment of agricultural colleges in the various States, the number of economic entomologists in this country could be counted on the fingers of one hand. In fact, if we mention the names of Harris, Fitch, and Walsh, the number is practically told. When the Hatch Act passed in 1888 the number of living men who had gained some prominence as economic entomologists would hardly treble the above list.

With the introduction of a larger number of cultivated plants, the increased area of cultivated lands, the destruction of native food plants, the introduction of foreign insect foes, and the necessity of more intensive agricultural methods, came the imperative need of a better knowledge of our insect pests and the methods of subduing them. In response to these demands there has been a constantly increasing number of workers devoting their attention to the subject of economic entomology in its various phases, and each year there is being accumulated a large amount of information of permanent value upon the habits, life histories, and methods of combating our insect enemies, mostly stored away in the bulletins of experiment stations and the publications of the Division of Entomology. Each year our methods of investigation have improved, insectaries are built, and new remedies or methods of applying them are discovered, and yet there is large room for improvement.

When the first organization list of the various agricultural colleges and experiment stations was published in 1889 there were 20 stations having officers whose duty it was to devote some time to entomological work. Since then the number has increased so that now we have 42 station entomologists and only 12 stations not so provided. In these 42 stations and colleges there are 57 entomological workers, 15 of whom are assistants, and there is a gain of 4 entomologists this year over last year. This number seems too large, and so it should, for there are but 7 of these workers who represent whole numbers, and 4 of them are assistants. The fraction of their labors that these men devote to entomology is in many cases very small, varying, according to their own estimates, from one twenty-fifth to nine-tenths. The entomological time of all of these fractions added together amounts to 17. If to this number we add 7, which represents the number who are devoting their entire time to entomological work, we find that we have an equivalent of 24 whole men doing entomological work, but this work is distributed in 42 localities among 57 laborers.

There are 9 station entomologists who have no college work to do, but there are only 2 entomologists of agricultural colleges not connected with station work. The amount of ground that some of these men have to spread themselves over is appalling, and readily explains why more original work is not being done. Let me cite a few examples of what they have to do. One has entomology, botany, horticulture, landscape gardening, and forestry; another, botany, horticulture, entomology, and general zoology; another, arithmetic, word analysis, physiology, zoology, histology, and entomology; one is director of the station, and is horticulturist, entomologist, and mycologist at the same time. And so it goes through nearly the entire list, and usually with both station and college work to do. No wonder that the prevailing cry among these men is for more time to devote to entomological work. One, in answering my question as to what was the greatest need of his department, answered, "Ability to do three days' work in one." In two other cases the answer was, "An entomologist." These latter, having so little time to devote to entomology, felt that they ought not to be called entomologists. Better libraries for reference, better collections of determined insects, and means of transportation seem to be among the most pressing needs of the station workers.

But with all the drawbacks that station entomologists have to contend with, there have been published the past year 29 bulletins that were wholly or in part entomological, and which contained 1,336 pages of printed matter. If to this we add the 790 pages published by the Division of Entomology, we shall have enough to make over 5 octavo volumes of 400 pages each.

Seventeen of our college and station entomologists find time to carry on purely technical work, some of them working in two or three different orders. The Hemiptera and Hymenoptera seem to be the favorite orders for special study. From the reports sent in to me the workers are distributed as follows: Workers in Hemiptera, 6; Hymenoptera, 4; Neuroptera, Orthoptera, and Lepidoptera, 2 each; Thysanura, Odonata, Siphonaptera, Mallophaga, Diptera, Coleoptera, and Acarina, 1 each.

A number of the institutions have excellent collections, but it is to be regretted that so many—and some of them in the older and wealthier States—have no determined collection worth mentioning. The following will indicate where some of the best collections in the different orders may be found. The numbers given are the approximate numbers of determined species in each case.

In Hymenoptera: Michigan, 1,500; Cornell (N. Y.), 667; Kansas and Colorado, 500 each; West Virginia, 470.

In Coleoptera: Michigan, 7,500; Cornell (N. Y.) and Kansas, each 3,000; New Jersey, 2,500; Iowa, Nebraska, and Colorado, each 2,000.

In Diptera: Cornell (N. Y.), 580; Nebraska, 250; Iowa and Kansas, each 200.

In Lepidoptera: Michigan and New Jersey, each 3,000; Cornell (N. Y.), 1,626; Colorado, 1,000.

In Hemiptera: Iowa, 1,000; Colorado, 650; Cornell (N. Y.), 518; Michigan, 500.

In Neuroptera: Cornell (N. Y.), 200; South Dakota, 100; others small.

In Odonata: Nebraska, 50; South Dakota, 20.

In Thysanura: Cornell (N. Y.), 100.

In Arachnida: Cornell (N. Y.), 338.

These numbers do not include the private collections of specialists, which in some cases exceed the collection of the institution where they are situated.

It should be said that the University of Illinois and the Massachusetts Agricultural College were not heard from in regard to their collections, which we know are large.

In response to my question asking the names of 10 insects causing heaviest losses in the different States, over 90 species have been named, aside from such terms as "cutworms," "wireworms," "plant lice," etc. I give below, as a matter of record, 20 of these, with the number of times each was reported:

Carpocapsa pomonella, 22; Cutworms, 19; *Heliothis armigera*, 12; *Doryphora 10-lineata*, 9; *Aspidiotus perniciosus*, 8; *Pieris rapæ*, 8; *Conotrachelus nenuphar*, 7; *Chrysobothris femorata*, 7; *Schizoneura lanigera*, 7; *Blissus leucopterus*, 7; *Diabrotica 12-punctata*, 7; White grubs, 7; Plant lice, 6; Wireworms, 6; *Cecidomyia destructor*, 5; *Macrodactylus subspinosus*, 5; *Hæmatobia serrata*, 5; Grasshoppers, 5; *Diabrotica vittata*, 4; *Saperda candida*, 4.

The number of students that received instruction in entomology in the agricultural colleges of the country the past year is about 775, and the number that have taken advanced work is about 75. Professor Popenoe, of Kansas, can boast of the largest class, consisting of 120 students, and Professor Osborn, of Iowa, comes next with a class of 81. Professor Popenoe also had the largest number of special students, 10, while Dr. Fernald, of Massachusetts, had 7, the second largest number.

The New York State Station has published the largest number of entomological bulletins the past year, which is 6. The stations publishing the largest number of pages of entomological matter are: New Jersey, 255; Colorado, 137; Geneva (N. Y.), 118.

It is difficult to say what the most important advances in the economic entomology of the country for the past year have been. Probably none are really more important than the extensive experiments carried on by Dr. Forbes to determine the practicability of using chinch-bug diseases for the extermination of the bugs by artificial means. The invention by Professor Weed, of the Mississippi Experiment Station, by which kerosene can be applied with water directly, without first making an emulsion, is worthy of special mention; and the use of arsenate of lead by T. C. Moulton, in cases where the other arsenites are liable to do injury to foliage, is a matter which promises to be of no small importance.

C. P. Gillette, *Chairman*.

Mr. F. P. Anderson, of Kentucky, secretary of the Section on Mechanic Arts, presented the report of that section, as follows:

Report of the Section on Mechanic Arts.

During the past year an effort has been made to develop, practically, but one side of the Section on Mechanic Arts, viz, the correlation of mechanic arts and agriculture.

The Society for the Promotion of Engineering Education covers the broader field of engineering, and we believe that our range of work in this Association should be a limited one.

By well-directed efforts the Section on Mechanic Arts can be made a valuable adjunct to the agricultural side of this Association by bringing more intimately in contact the agricultural and mechanical work in the colleges.

We believe that some steps should be taken to send at least one delegate from the colleges of the Association to represent the mechanical side of our institutions, but if such a move is to be made the agriculturists must take the initiative.

Most of our men interested in mechanic arts are indifferent toward doing work for the Association, claiming that the Association is essentially agricultural and it is the intention of the agriculturists to keep it within such limits.

Mr. BURRILL. I rise to make an announcement and to offer a motion, which, perhaps, in character is not usual in our Association, but which I am sure I will be excused for presenting here. Some forty years ago Dr. Norton S. Townsend, of Ohio, commenced giving instruction in agricultural topics in the school which he established, and he has continued it from that time in one capacity or another until a very recent date. He was connected from the beginning with the State University of Ohio in the same capacity, that of agricultural instructor in that institution, and, although 80 years of age, was still enjoying very fair health and possessing a goodly degree of activity. Quite suddenly he was taken sick, and died since most of us left our homes last Saturday evening. He is to be buried to-day. I move you, sir, that a committee composed of three of those best known and most intimate with Dr. Townsend be appointed to present fitting resolutions in this case.

Mr. COOKE. I second the motion.

The motion was adopted, and the chairman appointed as a committee Messrs. T. J. Burrill, W. W. Cooke, and L. B. Wing.

The CHAIRMAN. The chairman of the executive committee wishes to make an inquiry or announcement.

Mr. GOODELL. There have been received two or three invitations from different bodies here in Denver extending various courtesies to the delegates of this convention, and of these the one seeming most practicable to the executive committee is that tendered by the Chamber of Commerce to take a car ride through the city on Thursday afternoon at 4 o'clock. The executive committee, out of the different invitations that have been extended, recommend this and offer it for your adoption. In case it is accepted, the cars will be in front of the Brown Palace Hotel at 4 o'clock, returning in two and one-half hours, so as to enable us to be present at the business meeting in the evening.

Mr. ELLIS. I move that the very courteous invitation of the Denver Chamber of Commerce be accepted.

Mr. MCCREA. I second the motion.

Motion adopted, and the chairman of the executive committee requested to communicate the fact to the secretary of the Chamber of Commerce.

On motion of Mr. Myers, the session adjourned at 12.20 p. m.

EVENING SESSION, TUESDAY, JULY 16, 1895.

The general session convened in the Denver Chamber of Commerce at 8 p. m., Vice-President A. A. Johnson presiding.

Mr. GOODELL. To the executive committee there has come a petition, signed by eleven delegates, asking that a section on irrigation may be organized as one of the sections of the Association. The executive committee understands that this means a permanent organization. Under the rules of the Association that will require due notice to the Association, and come up at the next annual meeting. The executive committee makes no recommendation, as it is to come up in due course before the next convention.

The PRESIDING OFFICER. The provisional section, however, if it should be requested, could be formed for this present meeting.

Mr. REDDING. I desire to refer to the report of the executive committee. A portion of that report had reference to an effort being made on the part of that committee toward procuring extra compensation for those fourth-class postmasters at experiment stations who handle large amounts of the franked matter of those stations. I move to refer that portion of the report to a committee of three to be appointed by the Chair.

Carried.

The PRESIDING OFFICER. I will announce the names of the members of this committee a little later during the session.

According to the programme the hour has arrived for the annual address of the president of the Association. I need not take any time to introduce to you the president of this Association, so long and favorably known, but I do desire to say, for the benefit of the younger members, and citizens of Denver who may be present, that the president is the father of this Association; and it is with great pleasure that I now introduce Prof. Henry E. Alvord, president of the Association.

ANNUAL ADDRESS BY THE PRESIDENT.

In approaching the duties of this occasion, it has been noted that the Association meets for the first time in the western half of our country, among people to whom the organization must be comparatively unknown, and that delegates are here present from institutions never before represented at the annual gathering, although this is the ninth convention. Under these circumstances, it seems appropriate to consider the origin of this Association, review its work to the present time, and make some suggestions as to its future policy.

For nearly twenty-five years after the land-grant act of 1862, there seemed to be no special bond of union between the institutions established or enlarged upon the Morrill foundation. While nearly all were popularly known in the early years, and are still, as "agricultural colleges," they were, in accordance with the terms and very intention of the law, so diverse in organization, management, and general character, as to possess few common features. They could hardly be recognized as belonging to a special class, or forming an educational group by themselves, aside from the single fact of all receiving benefits in greater or less degree from Federal land grants. Some gave no technical instruction in agriculture, others none in mechanic arts, and even the one specific requirement to include military tactics was entirely ignored by some and by others accorded a perfunctory and very reluctant recognition. On three occasions, several years apart, there were fairly representative gatherings of officers of these institutions, and a few days were passed each time in pleasant and profitable intercourse and discussion, but without lasting results. Even the repeated efforts of Senator Morrill to secure further endowment for these institutions failed to arouse any lively interest or develop cooperation on their part in any systematic or cohesive form.

On the 8th and 9th days of July, 1885, another meeting of land-grant college officials was held at the United States Department of Agriculture, upon invitation from the Commissioner. This was a well-attended and earnest gathering. It was conducted in much the same way as the conventions of this Association,[1] and may be regarded as the forerunner of this organization. The first business presented, and that which occupied the most time, was "the Cullen bill" (H. R. No. 7498, Forty-eighth Congress), for the establishment of agricultural experiment stations, and for which the Hatch bill was substituted in the next Congress. This bill had been already explained to Congressional committees by some of the early and enthusiastic station workers of the country who volunteered for this service,[2] and the convention of 1885 appointed three representative college presidents[3] as a committee on legislation, to advance the interests of the agricultural colleges in this connection. These gentlemen, with others whom they invited to cooperate, assisted in preparing the Hatch bill and making its purposes known to Congressmen. They labored continuously and effectively, defraying their own expenses, until the passage of the act.

The advantages of conference and cooperation became so apparent at the convention of 1885 that a permanent organization representing the land-grant colleges was proposed, and an executive committee[4] was appointed, with authority to call the next convention, an advisory committee being added, of one from each State and Territory. But these committees never acted, and no later convention was called by them.

The Hatch Act became a law in March, 1887, and was expected to go into effect at once. But it was soon discovered that no appropriation had been provided to make it operative, and it was thought that all action under it must be postponed for a year or more. This was a great disappointment and was then regarded as quite a calamity; but we can now see that the delay was a fortunate one, giving time needed for organization, maturing plans, and starting in the right way. During the summer of 1887, the officers of the institutions to become beneficiaries under the Hatch Act, and upon

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[1] Committee on order of business and resolutions: Messrs. Alvord, Lee, Knapp, Fernald, Atherton, Willits, and Dabney.

[2] Presidents Atherton, Willits, and Lee.

[3] Messrs. George H. Cook, Brewer, and Atherton.

[4] Messrs. Atherton (chairman), Cook, Knapp, Peabody, Curtis, and Newman.

whom devolved the duty of its execution, realized the necessity for conference and an agreement upon some basis for uniformity of action, within reasonable limits. This led to calling the convention at which this Association had its birth.

On the 18th of October, 1887, representatives from land-grant institutions in most of the States and Territories, met at the Department of Agriculture, Washington, and for three days earnestly discussed the Hatch Act and the duties and responsibilities which it involved. Cooperation and some organic union was recognized as important, and hence a permanent organization was effected and the Association came into existence, which has since held an annual convention and is here assembled.

Serious misapprehension has existed in some quarters as to the real objects and actual work of this Association, and selfish and mischievous motives have been assigned to it. As a result, a few of the institutions eligible to membership, and which should actively participate, have held aloof.

Especial attention is therefore now invited to the record. It is practically all in print. There has been nothing to conceal, or of which anyone should be ashamed. It may be broadly and positively asserted that from the first a most creditable spirit has animated all its proceedings. In both college and station matters an earnest purpose has been evinced to faithfully and efficiently execute the great trust reposed in the institutions concerned by the Congress of the United States, to use the instrumentality and influence of this Association in the interest of true economy in the large annual expenditures made, to raise the standard of the work and extend the field in which it is applied.

This is not an association of individuals, but of institutions, created and endowed by national, State, and Territorial laws, and united for the purpose of mutual aid and the promotion of common interests, which are public interests. The institutions are represented by delegates, including trustees or members of the governing boards, college presidents and professors, and station directors and staff officers. The Association has two ways of accomplishing its work. First, by delegates assembled in annual convention, and, second, by committees chosen from these delegates to represent the Association and its interests between succeeding conventions. The proceedings of the eight conventions heretofore held have been published by an Executive Department of the Federal Government from notes taken by official reporters and edited by a departmental officer acting jointly with a representative of the Association. Although the published record of the first meeting is incomplete, these pamphlets may surely be regarded as constituting an authentic record, and, indeed, an official one. At every convention since the first, the executive committee has reported all action taken in the name of the Association since its last gathering. These reports are incorporated in the proceedings, and I claim to be a competent witness to their completeness and accuracy. The receipts and expenditures of the Association, and the nature of the latter, are also included in these printed records. The whole history is therefore open to inspection. It comprises about 1,000 octavo pages, and can not, of course, be reviewed in detail at this time. But it may be well to briefly present some of its prominent features.

First, let it be noted that this Association did not come into existence until some months after the Hatch Act had become law by a very large majority of the votes in both branches of Congress and been approved by a President, who stated to the Association representatives last November that he had become fully convinced of the wisdom of that approval seven years before. President Cleveland added that of all the annual appropriations of money from the Federal Treasury which had come under his observation, none seemed capable of more useful results, provided the application was honestly and judiciously made in the several States and Territories.

If a few gentlemen who have since been more or less identified with this Association saw fit to voluntarily contribute their time to promote that wise legislation in an entirely legitimate and proper way, they simply exercised the right of every American citizen, and should be credited with having performed an eminent and lasting public service.

The first meeting of the Association was occupied mainly in considering how the Hatch Act could be best executed, and after mature consideration, a declaration was adopted as to the organization of experiment stations and maintaining the integrity of station funds. This declaration will be later recalled. A special committee was appointed, composed of three of the most experienced directors of State experiment stations,[1] and the Department published and distributed the report of this Committee on Station Work, which was replete with suggestions and advice to the stations just organizing, as to material equipment, lines and methods of work, and means for disseminating information. The important assistance of a good library of reference was recognized, and a list of books desirable as a basis for such a library was kindly prepared by Professor Johnson, at the request of the Association, printed and furnished to all interested.

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[1] Messrs. Atwater, Johnson, and Cook.

The Hatch Act had been approved during the closing days of the Forty-ninth Congress, but no money appropriated to carry it into effect. It was admitted by all that such an appropriation would be made at the first session of the Fiftieth Congress, but under the usual course of procedure this would not occur until June or July—too late to be available for station work during the agricultural year of 1888. Accordingly, when Congress met in December, 1887, the executive committee, acting in behalf of the Association, made a full presentation of the subject to the proper committees, and this resulted in a special act of appropriation, approved February 1, 1888—in ample time for every organized station to use the whole of the growing season of that year and derive full benefit from the first station annuity of $15,000 for the fiscal year ending June 30, 1888.

It became necessary to arrange, also, before the Association met again, for the appropriation for the fiscal year of 1888–89, and to get this annual station supply placed, as a precedent, in charge of the most suitable and best informed Congressional committee. In accordance with the expressed wish of the first convention, provision was secured in the second appropriation bill (approved July 18, 1888) for establishing the Office of Experiment Stations in the United States Department of Agriculture.

During the year 1888 various questions of considerable consequence arose as to the interpretation of the Hatch Act by Government officials, and attention was given, on behalf of the Association, to obtaining satisfactory decisions by the Treasury Department and Post-Office Department. All these matters were promptly communicated by Association circulars to the officers of all institutions concerned, and the subjects were fully explained in the report of the executive committee to the second convention.

This second convention was held at the University of Tennessee, in Knoxville, the first days of January, 1889. It had been agreed in advance that the sessions should be mainly given to experiment-station questions, and a recital of the topics discussed will show how the convention occupied its time, viz:

"The Relation of Colleges and Stations."

"How can Stations reach and interest farmers?"

"How can the Department of Agriculture assist the Stations?"

"How can Stations cooperate?"

"The substance and form of the Annual Station Report."

"The practical work of Colleges and Stations."

A very important action by the Knoxville convention, was one which led to a long and satisfactory conference in February, 1889, between the President-elect of the United States and representatives of the Association, and in the month following between the latter and the newly installed Secretary of Agriculture. Four years later this action was repeated. It is undoubtedly due to the existence of this Association and its active influence that the scientific divisions of the Department of Agriculture hold their present satisfactory status and that Assistant Secretaries of that Department have been selected so fully in harmony with the Association itself and with the work of investigation and instruction which it represents.

The third convention was held in Washington in November, 1889. Among the general questions discussed were the following:

"The annual report of institutions organized under the act of July 2, 1862."

"The primary obligations of Colleges and Stations under the Hatch Act."

"The relations between colleges and experiment stations and the agricultural exhibitions, institutes, and other public meetings in their respective States."

"Uniformity in the methods and records of chemical laboratories."

This convention differed mainly from those preceding in giving less time to general questions and more to special subjects, considered in conferences of the specialists interested. The constitution of the Association was amended to provide for both permanent and temporary sections, to be assigned an appropriate part of the time at every annual gathering for the consideration of topics not requiring the attention of delegates in general. But in order that all might know from time to time what matters the sections deemed important, provision was made for the several sections to periodically present in the general sessions of the convention a portion of the subjects coming before them. Experience demonstrated that too many permanent sections caused confusion and waste. Hence amendments which brought the constitution to its present form, which has proved so satisfactory that further change should be avoided as long as possible. Delegates who find that their particular wants are not provided by the regular sections have a constitutional remedy, as they can secure through the executive committee the organization of a temporary section at any convention.

In connection with its later years, it should be noted that without radical changes our organization has made a natural and healthy growth, adapting itself, its rules, and methods to its developing needs so as to economize the time of delegates, and make its deliberations and action useful and effective in advancing the great interests which it represents.

The year of 1890 was one of unusual activity on the part of this Association, its agents, and representatives. The organization aided in accomplishing four things worthy of special mention, two for the stations particularly and two for the colleges:

(1) The original "Cullen bill" provided that the payments of appropriations to stations should be made quarterly in advance. This feature was accidentally omitted from the Hatch Act, and stations were greatly hampered in their work for two or three years by the necessity for long credits or of paying interest on loans. Through proper representations made to the Agricultural Committee of the House of Representatives, the wording of the annual appropriation under the Hatch Act was changed in 1890 so as to secure quarterly payments in advance, and this desirable and truly economic change has become a permanent feature of the annual act.

(2) Negotiations at the Post-Office Department secured an entire revision of the regulations for free mailing of station reports and bulletins. The existing regulations are liberal and convenient, but although accessible in print, they do not seem to be fully understood. Station publications may be sent singly or in parcels, the latter to be opened and distributed by postmasters. Envelopes may be sealed or unsealed. Publications mailable free by the United States Department of Agriculture or by any station may be so mailed by any other station. If station reports "be printed by State authority, and consist in part of matter relating to the land-grant colleges to which such station is attached, then said report may be mailed free entire." But the whole must, in the judgment of the director, consist of useful information of an agricultural character. With this very general limitation large discretion is vested in the station officer to whom the free-mailing privilege is accorded, and whose signature, or facsimile thereof, is responsible for what it covers and must be so used as to guard against abuses.

(3) A special committee, after prolonged conferences at Washington, concluded very satisfactory arrangements with the War Department as to its relations with the colleges having army officers detailed as instructors. General orders were promulgated accordingly, and these have not since been materially changed.

(4) The Association contributed materially to the early enactment of the law for "the more complete endowment and support" of land-grant colleges. Senator Morrill expressed by letter his appreciation of the valuable service rendered in promoting the passage of the act of Congress approved August 30, 1890.

These matters were fully reported by the executive committee to the fourth annual convention held at the University of Illinois, Champaign, in November, 1890, and, with the discussions thereon, appear in the record of that gathering.

Criticism has been made at times upon the part taken by this Association in the promotion of legislation affecting the interests it represents. Some institutions have even declined to participate in the annual gatherings and contribute to the necessary support of the organization upon this ground. Great misapprehension as to the actual facts can alone account for such opinions and action. The record should be made so clear that mistakes of this character can not occur again.

The fact that the Association did not come into existence until some months after the passage of the Hatch Act has been already noted. The action of the Association in helping to secure rational interpretation of that law and its early and efficient administration, has been also explained and shown to have had as its commendable object the honest, economical, and effective application of the public funds. In the same line may be mentioned the later and repeated efforts of the Association, finally successful, in having ample authority given to the Secretary of Agriculture to regulate the accounts, inspect the work, and supervise the expenditure of the money annually granted to the stations. The only just criticism of this organization as related to experiment-station legislation and administration, is that it has been an earnest and active agent for improving this branch of the public service.

As to college legislation, the second Morrill Act is the only matter with which the Association has had any connection, excepting minor points relating to military departments in the several institutions. This new legislation was neither asked nor suggested by this Association and but few of its representatives, if any, knew that the author proposed to introduce the measure in the Fifty-first Congress. It is a matter of public record that but a few years elapsed after the passage of the original college land-grant act (1862) before Senator Morrill realized the necessity of strengthening the work founded thereon by further endowment. At sundry times during twenty years preceding 1890, bills having this object were introduced by Mr. Morrill and in several instances passed one or the other branch of Congress, or both, without any particular agitation or extraneous effort. In the spring of 1890 Senator Morrill believed the time had come for another trial and introduced his bill in April. The new Morrill bill had such inherent merits and the subject was so familiar to Congressmen and so favorably regarded by them, that it would doubtless have become a law, in some form, in the course of time, if left to pursue the usual routine of unaided legislation. But after the measure came before the Senate this Association was invited by its author to assist in its passage, by explaining the needs of the institutions to be "further endowed" and the benefits to be derived from the act proposed. Just this was what the several representatives of this organization did, who were in Washington at frequent intervals during the four months between the introduction of the bill and its passage and approval. The influence of the Association was exerted in an entirely unobjectionable manner to put the bill into practical and useful form and then to secure action upon it. An overwhelming majority in favor of the measure was apparent in each branch of Congress, but, in the pressure of various matters for priority on the Calendar, a friendly and active interest was necessary and proper to obtain consideration, and a record of the votes waiting to be cast for it. (The bill passed the Senate on June 25, and the House on August 19.)

The action of this Association, connected with the new Morrill Act, and of all who represented it in this matter, was open and honorable in all respects, and rather than adverse criticism deserves the commendation which it has generally received. This action aided materially in securing timely assistance for the improvement and extension of this great scheme for "the liberal and practical education of the industrial classes in the several pursuits and professions in life."

One phase of the land-grant college act of 1890 deserves special notice in this connection. The House of Representatives adopted one amendment to the bill as passed by the Senate, by adding to the first section the familiar clause which limits the application of the annuity. ("To be applied only to instruction in," etc.) This has been most erroneously called "the granger amendment," and it has been frequently asserted by high officers of the Order of Patrons of Husbandry, in public addresses and in print, that this amendment was secured in the interest of agricultural education by "The Grange," despite the opposition of "the college presidents," and without this amendment the new Morrill bill could not have been passed. It is to be hoped that these statements have been honestly made and yet it is hard to understand how anyone could be so misled. In every essential particular they are at variance with the truth. History demands a correction of this serious error. With a full knowledge of the facts and personal responsibility in formulating them (which can, however, be verified by ample evidence), I wish to here place the subject accurately on record.

The officers of the National Grange and the National Farmers' Alliance showed an interest in the pending Morrill bill and were freely consulted by the Association committee and invited to attend the public hearings at the Capitol. The Alliance officials cooperated heartily and unreservedly. The Grange officials appeared distrustful, feared the phraseology of the bill was too general, and wanted guaranties as to the use of the proposed new endowment. To show their good faith, and as a wholly voluntary act, the Association representatives proposed this now famous amendment, while the bill was before the Committee on Education of the House of Representatives. I have the original draft of that amendment in my possession; it was first written by one college president who cared more for object than form; was carefully trimmed and punctuated by another college president, and cordially adopted by the others on the committee, none of these being grangers, although entirely friendly to that order and its general work. The Association committee did not believe this amendment necessary, but willingly proposed it and supported it consistently until adopted. The House Committee on Education did not like the amendment and the House itself was inclined to reject it. The slightest intimation or even indifference on the part of its authors and supporters would have led to its rejection and the passage of the bill just as framed by the Senate. Nothing could be further from the truth than the allegation that "the agricultural college presidents" (as the committee was called) were insincere in this matter. They worked faithfully for its adoption when inaction or absence would have caused its defeat. Therefore, instead of this limiting amendment being of Grange origin, opposed by the colleges, and the salvation of the bill, the plain facts are that it originated with college men and had their honest support from first to last, although this actually delayed the passage of the bill. Truth requires it to be stated that the only serious delay and obstruction encountered by the friends of the Morrill Act of 1890 in its progress through Congress, apart from the rivalry of other measures, was the unreasonable suspicion and otherwise unaccountable opposition of the officers and legislative committee of the National Grange.

Of the fifth, sixth, seventh, and eighth conventions of the Association held, respectively, in Washington (August, 1891), New Orleans (November, 1892), Chicago (October, 1893), and Washington again (November, 1894), it is needless to speak in detail. These gatherings resembled the earlier ones, with certain modifications. The number of institutions, and of States and Territories represented, has increased, and year by year more time has been assigned to and used by the sections in the consideration of technical matters of interest to different departments of the colleges and the stations. As a rule, three-fourths of all eligible institutions are represented by delegates at the annual meeting.

It is evident that a large part of the time at every convention must be occupied by the general sessions. The business of the organization for one year must be reviewed and that for the next prepared; now and then there seems to be some waste of time, but less than might be expected and no more than is inevitable, under all the circumstances. Much time has been necessary in the past to consider questions concerning the relations of the institutions to Congress and the Executive Departments, and matters of organization, administration, and accountability. These have been subjects of serious concern, demanding patient and careful attention. Such deliberations have been essential to the existence and usefulness of the organization and have brought it to its present position. As expressed by one of our past presidents, the hundreds of workers in a common cause, who are submitting their labors to the scrutiny of science on the one hand and of practice on the other, and who render an account of their stewardship to the public, round up each year by coming together in convention to discuss the best methods of carrying on this great work. "At such a time, it is impossible not to be impressed with a serious sense of the responsibility of the position occupied by this Association,"[1] and while giving as much attention as possible to technical subjects, the important general questions of organization and unity of action must not be neglected.

The printed proceedings of successive conventions become more and more interesting. Reexamination of these pamphlets impresses one with the value of their contents. The presidential addresses, the annual reports of the chairmen of sections, the business features of the conventions, and the abstracts of discussions in sections, are not only worthy of preservation, but of frequent reference. The reports of the chairmen of the sections, as we have seen to-day, furnish most interesting and valuable epitomies of the yearly progress of the entire work. These pamphlets deserve a place with the historical and technical literature of the colleges and stations, and should be indexed with similar publications.

These pages contain a record of two important pieces of public work carried through under the auspices of this Association, but which can only be mentioned here: (1) The collective exhibit of the agricultural colleges and experiment stations, in cooperation with the United States Department of Agriculture, at the Columbian Exposition of 1893; and (2) the comparative tests of dairy breeds of cattle, also in connection with the great Chicago Exposition. Both were formidable, laborious, and expensive undertakings, but executed with public spirit and most creditable to the Association and the many individuals contributing to this result.

The history and doings of this Association show that it has been eminently a business organization. Its annual gatherings have been working bodies, bent upon systematizing the discharge of the duties intrusted to the associated institutions and increasing the beneficial results of the work as a whole. As instances not yet mentioned of improving methods and securing uniformity, the Association has effectively cooperated, through regular and special committees, with the executive officers of the Departments of the Interior and of Agriculture, in determining the forms of reports required by the Morrill Acts of 1862 and 1890 and the Hatch Act of 1887, and the application and accounting of the respective appropriations and annuities granted by Congress.

The value of the organization as an agency for improving the work, at least so far as the experiment stations are concerned, has been emphatically and formally indorsed by the Department of Agriculture. The attendance of station officers and workers at the annual conventions has been encouraged, the expenses necessary for this purpose have been allowed as proper charges against the "Hatch funds," and the annual contribution of stations to the general expenses of the Association has been specifically approved. Further, these decisions have been officially reviewed and confirmed by the Comptroller of the United States Treasury. This is a most gratifying indorsement of the use which the Association has made of its limited income, as reported from year to year. The proceedings are annually reported, published, and distributed as a bulletin of the Department of Agriculture.

On the college side, the Association has been cordially recognized and its objects and work commended by the highest officials of the Department of the Interior. Although evident that no part of the annuity under the act of 1890 can be used for such purposes, it is admitted by all that contributions to the wants of the Association, and the proper expenses of delegates to these conventions, may be paid from income of the land-grant fund or any miscellaneous receipts of the colleges.

In view of all these facts, it seems strange indeed that any institution, in State or Territory, eligible under our constitution, should refrain from full participation in this Association, and especially from sharing in its very moderate annual expenses. These institutions are beneficiaries of a common foundation, and have like obligations and responsibilities. There can be no doubt that every college and every station has upon several different occasions been directly benefited in money saved, more than anyone has been asked to contribute to the Association since it was organized. The advantages derived from the existence and action of the Association, which can

[1] President Atherton, at third convention.

not be measured in money, have been of still greater value. These benefits and advantages, direct and indirect, have been actually received by all alike, whether in affiliation with our organization or not. Every eligible institution must admit that the Association has been its servant and helper, doing things which it needed, better, easier, and cheaper than it could have done them alone. Does any station doubt the direct money value of advance payments of the quarterly allowance, or fail to appreciate the advantages of the liberal construction of the free-mailing privilege? Has any college declined its annuities under the Morrill Act of 1890? Has not every college and station usually represented at the annual conventions felt the benefit derived by itself and by its delegates from their attendance and participation in the proceedings? The only possible answer to these questions seems to plainly indicate a moral obligation on the part of every college and station on the common beneficiary list to become an equal factor in this single recognized and authorized agency for promoting the common cause. It can not be possible that the correct view of this subject has been yet presented to the authorities of the few institutions which do not send delegates nor help support the Association. (It is suggested that there is here a proper field for missionary work, and that the Association may well authorize its executive committee to further endeavor to bring into the fold these few estrays from the flock, who are so backward in coming forward.)

It will be necessary to explain still further that, for manifest reasons, the constitution of the Association recognizes the college and the station, in every State and Territory, as two institutions, no matter how closely they may be connected, allowing each a voting delegate, and asking an equal annual contribution from the college funds and the station funds.

It is also a singular fact that some of these associate institutions, in full and regular standing, which are particular to fulfill to the letter all the requirements of law, national and State, seem unwilling or negligent in regard to complying with the declared sentiment of the Association in matters not legally defined, but wherein uniformity of action is manifestly desirable. Take, for examples, the general character and form of annual reports and of bulletins, applications to Washington authorities for rulings which will affect others as well as the applicant, and attention to requests made in the name of the Association for its interests. Can not the officers of the colleges and stations, including the governing boards, be convinced that it is expedient not only to recognize this organization as a convenience, but, by common consent, to grant it some measure of authority as a legislative and administrative body concerning matters not regulated by law, nor by national or State officials, and not conflicting with the autonomy of the respective institutions? This would be useless unless all consented to conform to the will of the majority, as expressed at the annual convention.

On a number of different subjects, where the lack of uniformity in action or the probability of variation was seen to be detrimental to common interests, the Association, after proper consideration, declared its opinion by formal resolution or otherwise. The records of such action are scattered through the published proceedings of the successive conventions. In a good many instances, cheerful conformity on the part of the majority has led to a fairly fixed custom; in other cases, the tacit agreement seems to have been forgotten; and in some, little attention was ever paid to the action of the Association. Now, as a step in the direction just indicated, and by way of trial, it is recommended that the executive committee, or a special committee, be authorized by this convention to collect and codify such of these various votes and declarations as may be considered still operative, and report them in print to the next convention, with suggested amendments or modifications. Then let this report be given place as an important item of business in general session, where the several sections of the code (?) may be reaffirmed, revised, or rejected. This done, and the result being promulgated, it can soon be ascertained how far the associated institutions will consent to be governed by the judgment of the majority.

The Association can not realize its full sphere of usefulness until it is empowered to speak with some greater degree of authority for its members and to them, and thus govern, within carefully guarded limits, and always by the consent of those governed.

There can be no doubt of the excellent effect produced by what may be called the declaration of principles as to the Hatch Act, made by the representatives of the beneficiary institutions at the first Washington convention, in October, 1887. It must be remembered that at this time a good many of the land-grant colleges were barely existing upon an income wholly inadequate for the work expected of them. In several cases this new endowment for research considerably exceeded all other resources. There was a sore temptation so to manage the anticipated Hatch funds as to materially increase the college force and facilities for instruction. But the assembled delegates of the colleges about to come into possession of this new income, without division upon any material point, declared most honorable intentions in unmistakable terms. Here is the document, in the form of the adopted report of a special committee appointed to propose to the convention "A system for the organization and management of agricultural experiment stations":

"(1) That all appropriations received under what is known as 'the Hatch bill' should be applied in good faith to agricultural research and experiment and the dissemination of the results thereof among the people, and that any diversion of funds to the general uses of the colleges would be a direct violation of the plain spirit and intent of the law, and an inexcusable disappointment of just public expectation.

"(2) That the experiment stations specially referred to should be so far separate and distinct from the colleges that it shall be possible, at any moment, to show to any authorized inspector or investigator that all the funds derived from the United States under the Hatch bill have been expended solely for the purposes of agricultural experimentation, according to the intent of the law.

"(3) That every department to be known and designated as an agricultural experiment station should be distinctly organized, with its duties and control clearly defined and with a recognized official head, whose time shall be chiefly devoted to this department, who should be on an equal footing with the other heads of departments or professors of the college, and whose compensation should recognize the fact that the duties of the position occupy every month of the year.

"(4) That the publications of the stations should be entirely separate from those of the colleges. The quarterly, or more frequent bulletins, should give their readers the results of experiments as fast as completed, and only as completed or as distinct chapters are completed. These bulletins should enlarge on those practical points, such as the improvement or restoration of soils, the development of plants, and the breeding of stock, when suggested by work done, even to the extent of repeating well-known principles and facts when these need to be taught."

It will do no harm for all to read this declaration again, and it is especially commended to the representatives of institutions established since that time and to whom it may be new. The committee which framed the report,[1] after mature deliberation, was composed of five men who were then or have since been presidents of agricultural colleges, three also directors of experiment stations, and two have been Assistant Secretaries of the Department of Agriculture. The assertion is ventured that this convention, or a still more complete gathering of its kind, would not hesitate, after eight years more of experience, to reaffirm these principles without material change and by almost unanimous vote.

Nevertheless, a decided difference of opinion prevails as to some points apparently settled at that time, and it must be admitted that some of the institutions concerned have not fully complied with the course of procedure then agreed upon.

During the present year an agricultural journal, edited by an ex-director, has sharply arraigned stations for publishing in bulletins matter other than the record of their own investigations. Yet here is this old declaration, ex cathedra, that bulletins should enlarge upon practical points, even to the extent of repeating well-known principles and facts when these need to be taught. The issue of bulletins is obligatory, and there seems to be little doubt that a station may meet this obligation and render valuable service, as some stations certainly have done, by publications in no way related to its own work, or even directly suggested by that or the work of others. Stations do not always find their experiments producing results of value even in a negative way, and the perfunctory record of such work can not reasonably be regarded as diffusing useful and practical agricultural information among the people as well as a chapter on commercial fertilizers, a description of noxious weeds, a statement of the principles of economic feeding, the latest methods in successful dairy practice, or directions for making good roads. Where an exceptionally good piece of work is done by a station in one State which is equally applicable in others, there is a positive public loss in not having this information more widely diffused than it can be done by abstracts which necessarily have a very limited distribution.

Take, for example, a good bulletin upon diseases of the potato, equally applicable and useful in many States. This originates at a station in one State, but it is at the cost of the people in all the States. All should share alike in the benefits of the work. The station system, as a whole, should be developed to reach this stage of broader usefulness. If it can be done by cooperation, very well; but, if necessary, let it be done by law, recognizing that every State has a right to whatever advantage may be derived from prompt information of the work in every other State.

Further, it seems to me that the several stations should contribute, as the results of their operations, the greater part of the Farmers' Bulletins which are now published in such large editions—hundreds of thousands—by the United States Department of Agriculture. This has already been done to some extent, and it is understood to be the policy of the Department to progress in this direction.

The primary purpose of the Hatch Act was undoubtedly provision for research and experiment, but the duty of diffusing information is declared in the same sentence

[1] Messrs. Dabney, Chamberlain, Alvord, Lee, and Willits.

with that of acquiring it. This diffusion involves the function of instruction, although the methods may necessarily differ much from those of the class room and college. What these methods shall be seems to be still a debatable question. A liberal construction of the matter and manner of conveying useful information to the people can not fail to increase the power for good which the stations possess. It is to be hoped that the Association may soon find time to review the whole question of the station bulletin, and that it may at the same time consider, as coordinate means of instruction, participation in farmers' institutes and like meetings and in public agricultural exhibitions. The only time the latter subject ever came before the Association no conclusion was reached. Some stations seem to doubt the propriety of availing themselves of these useful adjuncts, and a declaration by the Association is therefore desirable.

If, as some believe, there was during the early years of the operation of the Hatch Act a tendency on the part of a few of the weaker colleges to lean heavily upon their stations for support, it is charitable to cloak this evidence of poverty by supposing that the instructional function of such stations was first developed; but since the act of 1890 has made the income of every college considerably more than that of its attached station, the last excuse has been removed for any college encroachment upon station funds. Some of the younger institutions have practically no income outside the two annuities under the acts of 1887 and 1890. The special restrictions upon the new Morrill annuity and the greater latitude allowed in the use of the station appropriation make it the more important that care should be exercised and justify this word of warning. There is some danger that where college and station have been established and started at the same time the line of demarcation between the two has not been kept sufficiently distinct. The early declaration of the Association on the subject of scrupulous separation and application of the different funds should be strictly observed. Recent legislation confers full authority upon the Secretary of Agriculture to guard the integrity of station funds granted by Congress. The Association should cordially cooperate in the enforcement of the law.

Those who stoutly maintain the principle of the reserved rights of the States concede that it is not only the privilege but the duty of the Federal Government to follow all moneys leaving the public treasury by act of Congress and provide machinery to insure their application to the objects for which they are appropriated. There is no reason why this system of experiment stations in the several States, largely independent yet subject to the one organic law, should not be as regularly and as thoroughly inspected by Federal officials as the Postal Service, the Indian Service, or the national banks.

It is notable that the institutions assumed at the outset that such inspection would be made, and advised starting the work in such manner as to be always ready for it. And the stations were hardly under way when the Association began, first in 1890, to yearly propose that full authority to supervise station expenditures should be given to the Department of Agriculture. The forms proposed to the Fifty-first and Fifty-second Congresses were much more drastic than the authority finally conferred by the Fifty-third Congress. And the Association at last secured the phraseology which gives force to the whole clause. Prescribing forms for reports and examining returns in an office would do very little good; the command to "ascertain" the facts carries with it, necessarily, the power to inspect and investigate. One can not tell whether the expenditure upon a certain piece of work is right until he sees the work itself, or the results; and judgment of quality as well as quantity is necessary in order to determine the question of value received. As it now stands, the authority of the Department to scrutinize station accounts and enforce the proper application of station funds is broad enough, but none too broad. It should be actively exercised; and this can be done without in the least interfering with that independence of action as to character, plan, and execution of work which is essential to good results and which is assured to every station by the last few lines of the second section of the Hatch Act. It must be admitted that this supervisory power is needed. The station funds have undoubtedly been honestly and efficiently administered as a whole. There has been far less ground for complaint than some have seemed to believe. Cases of waste, incident to inexperience, have been largely outgrown in the progress of the work. Yet there have been a few instances of inexcusable looseness, irregularities, and abuses in the financial management of stations, and these errors have not wholly ceased. With the existing power of correction these few sore spots should be promptly cured. Considering the apparent desire of the Department for this new authority, the tardy and mild manner in which it has been exercised has naturally caused surprise. There seems to be special care lest the feelings of someone should be hurt.

It is said that corporations have no souls, but they certainly have manners and customs. Some behave and some misbehave. Like individuals, corporations are subject to corrections, and as they increase and associate, discipline becomes necessary. In the exercise of discipline errors are repressed and prevented through the force of example. One pronounced case of merited and recognized punishment, so judiciously managed as to be borne on the wings of the wind without any apparent publicity, is, for general and lasting effect, worth a whole host of private admonitions. Despite modern views of the subject, "Spare the rod, spoil the child," is a good old adage, and the point of it lies in its application.

The institutions forming this Association are very closely related, although widely separated. Subject to local control and adaptation, each in its own State or Territory, they still depend upon a common foundation and form a distinct group, which as such must sustain a good reputation with the general public. They are so interdependent that serious mistake, failure, or wrongdoing on the part of any one has an injurious effect upon all. This Association, as the self-constituted representative and guardian of the common interests, has a duty to perform in helping to strengthen the weak spots and raise the general average. Thus far its record is a good one as to both theory and practice. It has not only advocated the wisdom of general supervision and led in securing the needed legislation, but while the authority was in doubt it lent its influence toward accomplishing what could be done by moral suasion. In the only three cases known in which the Department of Agriculture used its advisory powers to lead erring stations to mend their ways, the need of action was first pointed out by officers of the Association, and its representatives were the agents employed by the Department to accomplish the desired ends. The results were satisfactory. Other cases needing attention have been brought to the attention of the Department in like manner, and if equally efficient action has not followed, the Association has at least done its part. The Association officers have in numerous cases called the attention of institutions or their officials to instances of neglect or minor errors which needed looking after, as in the abuse of the free-mailing privilege. Indeed, if the supervisory work of the last few months, the result of which has not yet developed, is excepted, the Association stands away ahead of the Department on the record, as a corrective and disciplinary agent. From the necessities of the situation, the institutions collectively, through the Association, must be their brother's keeper to some extent. Whenever any action is known likely to injure the cause, those cognizant of it should promptly report the facts to the officers of the Association. These officers should notify the proper Government authorities, if the case requires such attention, and should directly or cooperatively do what is possible in the way of remedy. Such a course is not meddlesome; it is in the interest of the common welfare. It is simply a matter of insurance, a sanitary measure, perhaps unpleasant to the individual but necessary for the public health. It may become expedient to give formal recognition of this duty and provide for its execution. There is evidence at times that the censorial function should be lodged somewhere and fearlessly exercised.

At the convention of 1885, and again in 1887, a central agency at the Department of Agriculture was discussed, and this resulted in procuring the means which enabled the Office of Experiment Stations to be established. With all due respect to those who have directed that office, and with a full appreciation of its excellent work, it is still true that it has conspicuously failed, in some respects, to meet the expectations of those who first advocated the need of it. The advisory powers conferred by the first half of section 3 of the Hatch Act might have been more broadly and vigorously exercised, with good effect, and without any assumption of centralized authority. And it was certainly expected that the office would act as an expert critic of the work of the experiment stations—a valuable service, which has been entirely lacking. In the discussion of the Cullen bill at the convention of July, 1885, the president of the oldest agricultural college in the country thus expressed himself on this particular point:

"That bill is weak in one respect. There should be incorporated in it an appropriation of $5,000, to be given to the Commissioner of Agriculture to select some good man to consolidate these reports and arrange them so that we can send them out through the country. Let him have $5,000 to select a brainy man who can take charge of the whole matter; a man who can consolidate, a man who can reason, a man of genius, who can draw conclusions from these reports and can say annually what failures and what successes have been made."

Admitting the difficulties in finding the man described, it is to be regretted that the gentleman quoted did not attempt to put his principles here stated into practice, to some degree at least, during the four years when it was a part of his duty to supervise the working of the Office of Experiment Stations.

This office not only declines to directly discriminate, but in the manner of its reviews and abstracts, in all particulars save quantity or space, it places on a par the good work of one station, the commonplace of another, and the still lower-grade production of a third. A serious degree of responsibility seems to attach to this course. It has the effect of indorsing poor work and tends to its increase and repetition.

The Office of Experiment Stations has grown rapidly in men and means. Would it not come nearer to the ideal adjunct of the stations if more of its time and money were applied to visiting, advising, and criticising, and less to the manufacture of bulletins, which, however well done, is encroaching directly upon a special function of the stations?

Yet this "clearing house" of the stations has done so much good work and become so indispensable that we are again reminded of the need of a similar central agency at Washington, organized and supported by the Government, as an aid to the colleges. The executive committee reports progress in the efforts of the Association in this direction, but no satisfactory results as yet. This work should be revived and vigorously prosecuted. The origin, growth, and usefulness of the Office of Experiment Stations furnish at once illustration and argument which are almost certain to insure ultimate success.

During the last few months a good many of the stations have been visited by representatives of the Department of Agriculture. (Why not call these "visits" by the more significant name of "inspections" at once, that all may become accustomed to the object and recognize its propriety?) The opinion is ventured that the two things which have been and will be found lacking oftener than any other at the stations are good business management and, what is closely related, proper executive control. The Association was sound in its declaration of 1887 as to the station organization. Every station should have its executive officer, and it should be a director who directs. This is as necessary as it is for the college to have a president who presides. This does not mean the annoyance of professors nor interference with scientific workers, nor assumption and irritation anywhere. On the contrary, the capable and energetic executive is a reenforcement, a helper, and base of supplies for every department of college and station, while at the same time he plans, advises, trims, adjusts, and fits all together, so the result is a symmetrical, harmonious whole. The publications of different stations are evidence in point. As those from one station come to hand, one after another, no matter how diverse in authorship and subject, you at once recognize them, the station to which they belong, and the uniformity and finish which characterize the application of editorial skill and executive control. Half a dozen consecutive publications from another station may be handled together without a suggestion of having the same source until closely examined, so diverse are they in appearance and other particulars. The one station is a power; the influence of the other is little felt. The "go as you please" plan is not suited to station management, and I have yet to see a station conducted successfully by a council of administration, unless it also had an executive officer to round out and finish off the proceedings. The concentration in one person of the responsibility for general management almost always results well.

The declaration of 1887 on this point was none too strong. If to be now changed at all, in the light of experience this declaration should be made stronger and more specific.

The union of the duties of college president and station director in one person seems to be expedient only in exceptional cases. Certainly this is bad policy unless that person is wholly relieved from all duties other than those of an executive character. To make a college president also director is equivalent to assigning a president full charge of one of the leading departments of instruction, or rather more than this. In olden times it was expected that the college president would perform the full duties of a professor, but this custom has been found inexpedient, and has largely disappeared. College departments as well as college administration at large have been the gainers. There can be no doubt that station administration is improved where there is a single recognized head responsible for this department in all its affairs, and, of course, subordinate to the president of the institution to which the station is attached. I know that this form of organization is highly favored at Washington, and it may be wise for the Association to declare again its approval of the plan.

Should a similar system of visiting the land-grant colleges be instituted, I apprehend that the point most susceptible of criticism would be the grade of work performed. This would by no means be general, but in a number of cases it would be found that instruction was in progress which could not possibly be regarded as of college grade. Yet no one can read the original Morrill Act and its supplement, and the debates in Congress upon those measures, without being convinced that the intention was to found institutions of college grade, and nothing less. We all know what that means. As the distinguished author of the law has expressed it, "institutions offering courses of study of not less than three years, and preferably four, leading to a degree, as authorized by State law."

It is certain that Congress never intended by land grants or annuities to relieve any State or Territory from the duty of providing its own high schools and grammar schools. The legality of applying the so-called "Morrill funds" to the support of preparatory departments, excepting only "institutions of like character for the education of colored students" (act of 1890, sec. 1), is to be doubted in any case. In a few exceptional instances, the circumstances may justify a land-grant college in making temporary provision for preparing students for its college classes. But the expense of such work should certainly be met from other funds as soon as possible, and the responsibility of public-school service of all grades thrown upon local authorities. The institutions in affiliation with this Association should in all respects be colleges in fact as well as in name.

The more I see of the administration of colleges and experiment stations, the more convinced I am that the one thing which contributes above all others to the smooth movement, successful progress, and effective result of an institution is an experienced man of affairs at the head. The accomplished man of letters, the successful teacher, the accurate student, and the true scientist and investigator are all essential in their places; but an institution may have all these and yet fail from the lack of a capable executive. As a rule, it is easier to fill any other place in a college or station than it is to find just the right man for its head, able to conduct its affairs in a thoroughly businesslike and successful manner.

This Association has done many different things in its conventions and between them. It seems to me that its most valuable feature has been the practical, businesslike way in which its work has been conducted. Even after the "office of land-grant colleges" has been put in successful operation, and the Office of Experiment Stations has been further developed, it is not unlikely that it will be found necessary and prove a piece of true economy for the Association to establish and maintain a regular business agency at the seat of Government for the use and benefit of its members, jointly and severally.

To say that this Association is a necessary adjunct to the colleges and stations but feebly expresses the estimate I place upon the past and present value to the work and the possibilities of its future usefulness. Its operations may be greatly extended, bringing about desirable cooperation and in many ways being of assistance in a business capacity. But its chief end and aim will be to improve the administration of these great trusts, to render more effective the bounty of the people, and to maintain this union, ever ready to meet any emergency. I look for the time when the Association will have a legal status and defined functions and authority, with regular provision for its wants and for periodically bringing a certain part of the workers together as a matter of duty, for the good of the service.

The name of the Association will be jealously guarded in the future, as in the past; used only when the object is worth the effort, always in a good cause, and appealing to intelligence and mature judgment. Thus will be husbanded its reserved power, which can hardly be overestimated, and which will ever be potent in the promotion of higher and technical education and the progress and prosperity of American agriculture.

I can not close without again assuring the associated institutions, through the delegates here assembled, of my full appreciation of the kindness so long shown to me personally, and particularly for the honor conferred upon me the present year. The latter is especially gratifying, as this is likely to be, much to my regret, the end of my active participation in these notable, profitable, and enjoyable conventions.

Mr. WHITE. I desire to offer the following resolutions, which, I am sure, will receive the support of all present:

Resolved, That the Association returns thanks to Professor Alvord for his valuable and interesting address, and orders its publication in the proceedings.

Resolved, That the president's address be referred to a special committee of five, to be appointed by the presiding vice-president, with instructions to report to the Association, during the present session, resolutions embodying such action as may be desirable upon the suggestions therein contained.

The PRESIDING OFFICER. You have heard the resolutions offered by Mr. White. Are you ready for the question?

Upon vote, the convention adopted the resolutions as read.

The PRESIDING OFFICER. The Chair will now appoint the committee of three to whom was referred that part of the report of the executive committee touching upon the matter of compensation for post-offices that handle large amounts of the bulletins and other franked mail matter of the experiment stations. I will name as that committee Messrs. Redding, Myers, and True.

I will name as the committee requiring appointment in the resolution just passed Messrs. White, Flagg, Bryan, Armsby, and Schweitzer.

Now, by the programme already adopted by the Association this morning, the hour has expired for this meeting; and at 9 o'clock this evening the meetings of the Sections on College Work, Horticulture and Botany, and Entomology will convene.

Mr. NORTHROP. I beg your indulgence just a moment, in view of the fact that I shall be obliged to leave the hall before the convention closes. I have not had an opportunity to confer with my associates, but I rise simply for the purpose of saying that it would give us in Minnesota very great pleasure to have the convention of this organization meet with us, and I extend to this convention a most cordial invitation to meet at Minneapolis next year. I suppose it is highly probable that the National Educational Convention will, under the circumstances, meet at Duluth, and it will be possible to obtain rates the same as that organization for our convention, if held at Minneapolis. I can only say, sir, that we will do everything in our power to make it pleasant for you, and I think it will be profitable for the Association to see our station and see our work; not that we will be able to instruct you, sir, but that it may be profitable to see the way in which the work is carried on at our Minnesota station. I recognize the fact that I am not in order in making this application at this time, but I am sure the convention will pardon me for speaking, under the circumstances, and I hope that our invitation will be welcomed as heartily as it is given by us.

Mr. GOODELL. Mr. President, I move that we do now adjourn.

Carried.

MORNING SESSION, WEDNESDAY, JULY 17, 1895.

Convention called to order at 9.30 a. m. by President Henry E. Alvord.

The CHAIRMAN. As unfinished business from yesterday morning's session, we will now call for the report from the chairman of the Section on College Work.

Mr. Connell presented the following report:

REPORT OF THE SECTION ON COLLEGE WORK.

Mr. CHAIRMAN AND GENTLEMEN OF THE CONVENTION: I was given notice about the middle of June that the duties of chairman of the Section on College Work would fall to my lot as vice-chairman of that section. As soon as possible I set about sending out a circular letter of inquiry to the president of each college, asking that a report of progress upon certain points be made at his earliest convenience. Unfortunately some of these inquiries were received after summer vacations had begun, and it was impossible to give full and satisfactory replies to all of the questions propounded. We are fortunate in having fairly complete reports from the States of Maine, Montana, Colorado, Wisconsin, Idaho, Rhode Island, Arkansas, Pennsylvania, Tennessee, New York, Massachusetts, New Mexico, Florida, Minnesota, Kentucky, Maryland, Wyoming, Oklahoma, and Texas. These institutions have presented some important information concerning the methods of their work and courses of study, the number of instructors employed in several departments, the number of graduates in various courses, the success of graduates as farmers and mechanics, the additional cost of equipment added during the past year, etc. Time will not permit the reading of the questions which were submitted to the various institutions, but I beg leave to call your attention in another portion of this report to a few of the more important questions and replies that go to make up the systematized answers from the 20 colleges replying.

In the reports from the 20 institutions it is interesting to note that more than $75,000 has been spent in permanent equipment during the past year. Massachusetts reports the maximum for any one institution ($13,000), while several report no greater expenditure than $2,000. We would judge from this that the colleges are making steady progress and are adding materially to their permanent equipment.

Information was sought as to what important changes in curricula had been made. I note a few of the answers which indicate the greatest progress along this line. Maine, "Entire rearrangement of both agricultural and mechanical courses." Montana, "Short two years' agricultural course and more shop work added in mechanical course." New Mexico, "Less farm work in lower class and increase in farm work and study in higher classes. An increase in shop work, English history, and languages." Minnesota, "The dairy school enlarged, department of domestic economy for women added, special course in mechanics and physics added." Kentucky, "Some additional studies in electrical line, and more physical laboratory work." Other changes of more or less importance are reported from several States.

The constant tendency to increase the number of instructors in agriculture and mechanics in the various colleges indicates that these two subjects are receiving much more attention than formerly. The question was asked: "What addition has been made to faculty or force of instruction in agricultural department, mechanical department, and other lines of instruction?" Maine reports having added 3 instructors in agriculture and 2 in mechanic arts. Wisconsin, 1 in agriculture. Idaho, 1 in mechanics, other departments 1. Rhode Island, agriculture 2, mechanics 4, other departments 2. Arkansas, other departments 4. Massachusetts, agriculture 1. New Mexico, 2 substation superintendents, other departments 2. Minnesota, mechanics 1, several instructors in other departments. Maryland, mechanics 1, in other departments 3. Oklahoma, other departments 2. Texas, 1 new substation superintendent.

The answers to the inquiry for the "number of officers now employed in the agricultural department, mechanical department, and natural sciences" show that of the institutions reporting the departments are equipped with the following force of salaried men: Agriculture averages 6.3 men; mechanic arts average 5.8 men per institution. The natural sciences (upon the average) are equipped with 5.5 men. Of course, in some of the institutions the agricultural or the mechanical department is entirely lacking, but this is true in but four cases reported. The greatest number of men serving any agricultural department, as reported, was 35 from Cornell (N. Y.), while 20 are employed in Wisconsin and 16 in Minnesota. The greatest number of men serving in the mechanical department of any institution is 45 at Cornell, 15 in Minnesota, and 8 in Rhode Island. The greatest number of men serving in natural science departments was reported to be 18 from Minnesota, 10 from Rhode Island, and 6 from Wyoming.

It has for a long time been a question with this Association, "How can the students of the lower classes be induced to undertake the last two years' work of the four-year B. S. course?" Statistics from various States show that in but a few of our colleges does a satisfactory number of freshmen graduate in agriculture or mechanic arts. In seeking information upon this subject, Maine reported to your chairman that 90 per cent of the students spending two years in that college graduated. Massachusetts stated that 80 to 90 per cent of such students graduated. Minnesota reported that nearly all of the agricultural students who remain two years finish the four-year course, and 70 per cent of the mechanic art students in this class graduate. Would it not be interesting to learn from the representatives of those colleges just how they make their work so strongly attractive that students complete the work of four years if it has only been well begun? Would it not also be interesting to learn the conditions which permit the colleges of Maine, Massachusetts, Colorado, Wisconsin, Rhode Island, Minnesota, and Maryland to employ more than 90 per cent of their graduates in agriculture and mechanic arts in those particular callings? It is very likely true that there are local conditions of one or more kinds that assist them in reaching this highly desirable percentage; nevertheless it is evident that there is something peculiarly strong in their curricula, methods, or men which produces such satisfactory results.

In seeking for information as to the prevailing customs of our military feature in all of the colleges of this country, it was developed that the States of Idaho, Pennsylvania, and Tennessee excuse senior and junior classes from drill. Kentucky excuses her senior class. Some interesting information was obtained concerning uniforms worn by the students of our several colleges. The price varies from $10 to $20 for complete suits. A fair idea was gained of the number of hours devoted to drill in each institution. It is noticeable that where no barracks or dormitory privileges are had the time given to drill and other military exercises is often perceptibly increased. This is no doubt largely due to the air of military discipline, which strongly pervades all of our land-grant college student bodies where "barracks" are used. The presence day and night of a superior officer, surrounded by military setting, the guard duty daily, marching to and from meals, usurp the place of much of the time given to drill in other institutions where barracks are not had.

The fourth question asked was, "What has been done to increase the number of students taking the agricultural course in your institution?" I append all replies given to this.

Montana, a short course added; Colorado, nothing; Wisconsin, by short courses we have brought up attendance to over 200 students; Idaho, only preparatory work attempted in agriculture; Rhode Island, nothing; Arkansas, prizes of different kinds for practical work, and prizes for essays; Pennsylvania, a farm home has been provided agricultural students; Tennessee, nothing unusual; New Mexico, everything we know how to do; Florida, greater emphasis has been put upon the course, improvements have been made; Minnesota, a school of practical agriculture has been established and is very popular; Maryland, whole influence so directed; Wyoming, general improvement of facilities; Oklahoma, nothing; Texas, paid-student labor system in operation and improvements in course of study.

I believe it will be interesting to note in this connection the active part taken by the colleges here reporting in the work of instructing farmers in their several States by active participation in institute work, by use of instructive exhibits at fairs, and by acting as bureaus of agricultural information. It is pleasant to note that each college without exception does institute work in its State where there are institutions. The Maine college and the Montana college participated largely in fairs and institutes in those States last year. Colorado college reports all farmers' institutes attended and exhibits made at fairs; Wisconsin, all institute work is under control of the college; Idaho, the college has led the way in such organizations; Rhode Island has done all that was possible; Arkansas reports 4 institutes attended last year; Pennsylvania sends one or more of the staff to such meetings, expenses paid by station; Tennessee college gives annually 50 lectures throughout the State; Massachusetts college attended 24 institutes last year; New Mexico college takes part in the Territory fair; Florida college takes part in the few meetings held in that State; Minnesota college originated the institutes and frequently participates in them; Kentucky occasionally exhibits at fairs, State agricultural meetings attended; Maryland college represented at all fairs; Oklahoma college attends all institutes and fairs; Texas attends farmers' institutes frequently, no attendance on fairs.

From the foregoing we must conclude that the colleges in the several States are active agencies for the upbuilding of agricultural interests by their institute work, by exhibits at fairs, and by acting as bureaus for the dissemination of agricultural information in their respective States.

Allow me to briefly call your attention to the results of an inquiry which was put to learn the proportional amounts of time given to class-room instruction of students taking the agricultural course, (1) as to scientific agriculture in class rooms, (2) as to practical agriculture out of class rooms, and (3) as to scientific laboratory work.

The average number of hours per year (in the four-years' course) devoted to the study of agriculture in the section room by the colleges reporting is about 120 hours, the maximum being 198 hours. For agricultural work out of the class room the average for the year is about 150 hours, the maximum being 600 in Pennsylvania. The average number of hours for scientific laboratory work is about 180 hours for the year; the maximum reported is 240 hours in the Montana college. Correspondingly, the instruction in mechanic arts in the class room amounts to about 150 hours' average per annum. Their work out of the class room is 200 hours' average per annum. The work of mechanic art students in laboratory, with few exceptions, does not run over eighty hours per annum. Upon the whole, it would appear that students of mechanic arts do not receive as many hours scientific instruction annually in the colleges reporting as do the agricultural students, but obtain more technical industrial training.

One of the questions asked was, "What are the results of your efforts to procure employment for your graduates in the mechanical course?" I append some of the answers received:

Maine, entirely satisfactory; Colorado, they obtained places readily; Idaho, nothing has been done; Arkansas, graduates are almost all employed; Tennessee, a large per cent find positions; Florida, very good; Minnesota, secure employment without effort on our part; Kentucky, nearly all secure employment; Maryland, no graduates, work just begun; Oklahoma, no mechanical department; Texas, no special efforts, results satisfactory.

It has been suggested at some former conventions of this Association that it would probably be advisable (in the near future) to provide some systematic means for the employment of the graduates of our colleges, but should the success of the colleges here reporting upon this subject be taken as an index of the experience of all our colleges, such a step, for the present at least, is unnecessary.

No doubt it is largely through this organization that so much of uniformity in methods and results have been obtained. A report similar to this in some respects made to this body will not only mark something of the progress of our colleges but will afford opportunity by comparisons for each to measure up to the standard of the very best in certain essential features.

The CHAIRMAN. We also laid over yesterday reports from special committees of the Association. Are any of the committees appointed at the present convention ready to report?

Mr. BURRILL. Mr. President and members of the Association, your committee appointed to prepare a statement concerning the life and services to agriculture of Dr. Norton S. Townsend, just deceased, beg leave to present the following brief report:

Dr. Townsend came to mature manhood upon his father's farm in northern Ohio, and, though he then chose as a profession the practice of medicine, he never lost his first love for agricultural sciences and pursuits. Such was his ability and energy that he became prominent in various lines of activity as a citizen of his adopted State, and he held at different times high and important offices in the State and in the nation.

But as we knew him, he was especially preeminent as a teacher and worker in agriculture. In association with the late Dr. J. P. Kirtland he established, in 1854, the first school in America in which instruction in agricultural topics was made a leading feature. He may, therefore, be termed the first professor of agriculture in the country, though others held the formal title earlier than he did.

Onward from the date mentioned he was continuously connected with agricultural organizations and instruction; a member, and, at a critical time, president of the State board of agriculture; one of the first board of trustees of the State University of Ohio, and continuously an honored member of the faculty of that institution from the time of its organization until his death.

He was several times a delegate to the meetings of this Association, and was known to us all, at least by reputation, as a successful worker in the specialties of this organization, and as a man of wide attainments and great executive ability.

His broad humanity and abiding interest in his fellow-man were as conspicuous as was his professional eminence.

On all sides he was one of nature's noblemen. He died, after a very short illness, on the 13th of the present month, and was laid to rest upon the day of our assembling—the 16th.

We recommend that this report be entered upon the minutes of this meeting of our Association, and that a copy thereof be forwarded to the family of our deceased brother.

T. J. Burrill,
L. B. Wing,
W. W. Cooke,
Committee.

On motion of Mr. Hunt the report was adopted.

The Chairman. Are there any other committees ready to report? If not, then the order is general business. We now have the consideration of the proposed amendment to the constitution as the next on the order of business.

Mr. Goodell. I understand that a letter has been received from the mover of the resolution, which you will find incorporated in the general programme. I will call for the reading of that letter by the secretary.

The secretary then read that portion of a letter from President R. W. Silvester referring to the proposed amendment to the constitution introduced by him at the Washington convention in 1894, and expressing the wish that the consideration of the resolution might be deferred till the next convention.

Mr. Goodell. In accordance with the request of the introducer of this resolution, I move that this amendment to the constitution be laid on the table.

After some discussion the motion to lay on the table prevailed.

The Chairman. The Chair desires to notify members that this question must be reintroduced upon the programme for next year if it is to be considered at the next annual meeting. The next order of business, according to our programme adopted yesterday, in this morning's session is "Discussion of Methods of Instruction in Teaching Agriculture." This discussion will be opened by Mr. Thomas F. Hunt.

Mr. Hunt then presented his paper, entitled

Methods of Instruction in Teaching Agriculture.

I trust that an examination of the programme will convince you that I have been chosen to open this discussion on the theory that in battle the junior officer is sent first. I must necessarily be brief and I trust you will understand that in referring to the work of the department with which I am connected, as I must do, I do not do so for the purpose of parading the work of that department, but because it is the work with which I am familiar, and it is the only experience that I could give which would be of value. I have not had time since being notified, even had it been expected, to collate the work of other institutions.

I have no theories with regard to methods of instruction in agriculture. As Miss Lydia Hunt, superintendent of Indian schools, San Carlos, Ariz., said last week with regard to the Indians, I believe in doing the best you can under the circumstances.

Two agricultural college men fell to talking about two institutions. One said, "I do not understand how it is that the university has so many students in regular courses in agriculture. University A has splendid facilities and excellent specialists, in both respects superior to University B, and yet has practically no students except in the short winter courses." The other person replied, "There are probably several reasons, but the following seems to me an important one: University A teaches that it is a good thing to have a good education, but a much more important one to make good butter. University B constantly holds before its students the idea that it is a splendid thing to be a good butter maker, but much more important to be an educated man." This is not quoted to discuss the propositions involved, but to emphasize the fact that in my own teaching and in this discussion I keep the latter proposition prominently in mind. My attempt is to train as well as to inform, to give power as well as knowledge, to make men as well as educated farmers.

While I am unalterably committed to instruction in technical agriculture, I would prefer a man well educated in Greek to conduct a farm for me to a man poorly educated in agriculture.

The method of instruction in agriculture depends largely upon the previous training of the student. Twenty-five to thirty students in the agricultural courses of the Ohio State University take forging and woodwork in the mechanical department each winter. These students possibly constitute one-fifth of the students that take this work, the rest being mostly from the engineering courses. The director of the industrial department and the instructor in the forge shop are emphatic in their statements that the agricultural students do more and better work in the same time than any other students who come to them for instruction.

On the other hand, when we consult the instructors in mathematics and physics, we find that as a class the agricultural students do less work in a given time than their neighbors. Without making too much of this, I think it is clear that the previous training of the agricultural student has taught him to do much more proficiently than to think. It is not necessary in this audience to insist that students be taught both to do and to think; not only because in after life they must both do and think, but because the two faculties assist one another and make each more proficient and accurate. To my mind, however, our methods of instruction should recognize that the agricultural student needs especially to be trained into habits of thought. For this reason I prefer poor text-books even to good courses of lectures. Most of the students who come to me for instruction have had at least one year's training in the institution before entering my classes, yet I prefer as far as possible to assign definite daily lessons, to be prepared either from text-books or library references, or by the giving of special problems to be worked out. I like to get these students upon their feet in the recitation room and tell what they have learned. If I wish to add anything to what they have found in the text-book or elsewhere, I prefer to do it by asking them questions which will enable them to think it out. I am aware this is considered old-fashioned, and is no longer popular as a university method. I believe, however, that such a method, followed systematically and consecutively three to five days each week, week after week for nine months, will produce a growth in your student which is substantial and lasting and quite as rapid for this class of students as any other. With seniors and advanced students, they may be profitably thrown somewhat more upon their own resources, and here lectures and seminary methods may be profitably employed.

Methods of instruction are modified by the fact that it is not desirable to teach students that which they know already. We may for this reason teach students to judge cows, but not to milk them. By growing small plats for the purpose we may teach students to judge of the character and value of varieties of corn, but generally speaking, it would be wasting their time to teach them to plant or to husk it. We may teach students the manual operation of butter and cheese making, of the laying of tile drain, of budding and grafting, but, speaking generally, not those of plowing, sowing, or harvesting.

The methods of instruction are, like the pleasures of Colorado tourists, largely modified by the weather. I believe I could arrange a practicum for one-half day each week in the year which would be of distinct value. These practicums, however, must be held at definite and regular times to fit the university schedule. Indeed, if there was no university schedule they should be regular and systematic. If reflection does not convince you that this is impracticable in any country where it rains on an average one day out of three, try it.

Agriculture is a comprehensive term, and the method of instruction will depend upon whether the instruction is on farm equipment, soil physics, farm crops, stock breeding, stock feeding, butter making, or rural economics. The best way to learn to judge live stock is to judge them. The best way to get a clear understanding of the history of agriculture is by reading and reflection.

It is with considerable hesitation and trepidation that I have brought with me some illustrations of the methods employed in teaching agriculture. The crudeness of these attempts will certainly shield me from the charge of egotism. I know of no other way in which we can get at some common ground along specific lines of instruction. Here, for example, are a set of student score cards and report cards on the subject of animal mechanism, stock judging, butter and cheese making, similar and in some cases identical with those used by other institutions. There is nothing original about these, but some of you who are not familiar with them may be interested and perhaps benefited. (Student's work in soil physics, in planning farms and farm buildings, in rural economics, and descriptions and researches in cultivated grasses were here shown.)

In fact, the besetting sin of agricultural education has been, in my judgment, its originality. Every instructor has prided himself on his own methods. The instructors of agriculture, instead of consulting together and formulating systematic methods that they might become a drilled army of workers, have remained isolated, and to this day know little of each other's work in teaching. In experimentation it is quite different. Instead of being a drilled army working along definite lines, the aggregation reminds one of nothing more than the curiosities which frequently travel from place to place and are exhibited under canvas for a 50-cent admission. Nothing is more needed than a classification of the subjects to be taught, the amount of time to be devoted to each, and the methods to be employed. For example, the following are definite branches of instruction in agriculture, viz, farm equipment, soils and soil physics, farm crops, rural economics, history of agriculture, breeds of live stock (which may include animal mechanism and judging), stock breeding, stock feeding, butter making, and cheese making. In a four-year B. S. course in agriculture, how much time should be given to each of these subjects, and how much time should be devoted to laboratory and practical work? These are questions which some committee of this Association should consider and determine. It would probably take several years and considerable hard work for a committee to formulate a schedule that would be satisfactory, and it would take a good many years for the several institutions to adjust themselves to this schedule, but the importance of the result makes the attempt desirable, for the subject of agriculture will never have the standing in our American colleges and universities that it should have until this is done. In language, mathematics, and some of the sciences, the amount, the method, and the place of the several branches of the subject in the curriculum, and the preparation necessary before entering upon them is well recognized by educated people. We should work toward a similar result in agriculture. A beginning must be made before the end can be reached.

The CHAIRMAN. General discussion will be postponed until the end of the presentation of papers.

Mr. WHEELER. I would like to ask why it is that the men who study agriculture can not think, or that the men who study mathematical problems choose the mechanical course?

Mr. HUNT. In my judgment, those students who take the agricultural courses are farm boys who have been trained to *do* rather than to *think*, and this is the thing that they take to and the thing that, relatively, we need to lay least stress on. They know pretty well how to *do;* now, what we want to do is to coordinate their studies.

Mr. W. M. Hays presented the second paper upon the topic "Methods of Instruction in Teaching Agriculture."

In some colleges the term professor of agriculture has become well-nigh obsolete in the much subdivision of the work into specialties. Professors of horticulture, botany, entomology, agricultural chemistry, dairy chemistry, agricultural physics, bacteriology, mycology, dairy husbandry, animal husbandry, and other more or less clearly defined lines have developed as offshoots from the original comprehensive chair, and the subdivision can go a long way yet and still leave ample fields for each specialty. With only farm management and crops as my specialty, and the ability to work twelve hours daily, I must either subdivide my work or use assistants to meet the demands of over 300 agricultural students.

Our school of agriculture, virtually an agricultural high school, our dairy school, and our agricultural school for women have led all our teachers into making their work concrete and practical, and have laid a foundation for scientific work in the college course, the students of which have received the equivalent of a two years' agricultural high school preparation. Most of us shrank from teaching students two years in the school of agriculture and then taking them forward in the same studies in the college course, but it only makes it necessary for each professor to build up the methods and matter of our instruction to meet the demand, and each teacher is becoming the stronger for it. The most important feature of our instruction is that we have arranged a high school for boys and girls who are going to continue in the farm life, and very few besides those who wish to enter professional agricultural lines are choosing to proceed with the four years' college course, which has over two hundred hours more of scientific recitation and laboratory work than any other scientific course in our university.

I divide the instruction given by myself in the school of agriculture into three terms' work of twenty-five to sixty lessons each. In the first term something is given of the great sheet of geological drift with which our State is covered. Drainage is taken up in lectures, and illustrated in the fields, and practice is given in laying tile drains. Enough of soil physics is taught to give some knowledge of the movements of water in soils, and the general facts regarding cultivation. The physical condition of the soil is followed from the turning of the native sod, and backsetting, dragging, pulverizing, rolling, methods of planting, intercultural tillage, stubble plowing, and fallowing are all discussed in relation to the mechanical condition of the soil to weed eradication and to profits. Road building and repairing are taught by means of lectures, models, observation, charts, and even some practice is given with some of the modern road machinery. Fence building is also taught, as are farm planning or laying out farms, and each student is required to do some drafting and observing of farms.

During the term following I assist in the drawing class, where our architect teaches the planning and drafting of farm buildings. Here each student presents a plan of his father's or his own farm, made during the holiday vacation. If the erection of a barn or other building is contemplated by the owner of the farm the details of what is wanted are brought to the drafting room, and the building is located on the student's plat of farm, and together the teacher and student work out a practical building, and the student makes working drawings. Should no buildings be needed at home it is easily assumed that one or more have been burned and plans for a new one must be made. This line has proved very interesting and valuable to students. In one term of general drafting and one term in drafting buildings the young men gain an ability with the use of the pencil and confidence in it.

The second term's work is devoted to grains, grass, and other forage crops, roots, and to weeds. Our school of agriculture being of necessity in session in winter, when our farm boys can attend and still retain their place in the farm work, we are at a disadvantage in giving practice. This work is, of necessity, done mostly by means of lectures. Reading and even some text-book work are required, and each student writes papers, the best of which are read to the class. Bundles of field crops and of weeds are preserved, and the students are required to make themselves botanically familiar with them by dissecting them. Each crop is discussed in detail, the entire method of cultivation being reviewed, and illustrations are given, where practicable, of operations. We need and have planned for this purpose an indoor garden floor, where many things may be illustrated in the ground. While we are in a great machine-using State, we have difficulty in giving laboratory practice in field and garden work to our school of agriculture boys. I hope others will discuss this part of the subject.

In the third term, jointly with Professor Snyder, our chemist, I discuss the management of fields and their fertility, though the major part of the work is left to him.

Our professor of animal husbandry, Professor Shaw, divides his live-stock instruction into breeding, breeds, and feeds. He makes it a strong point to train the eye, and even the hand, on types, and in the judgment of individuality, usually having one or more specimens before the class, when talking of breeds and breeding, and sometimes in lectures on feeding. The amphitheater lecture room, with an area for animals, is a necessity, and our many students demand that we keep a large number of specimens for illustration. Professor Haecker, who is present, trains the students to size up the digestive and lacteal departments of the cow, and then turns the student's attention to the fact that he wants as little cow besides as is decent. By repeatedly passing judgment on cows, they learn the meaning of the ruffed and fluted spine, the sweenied crops, the attenuated neck, and the cat hams of the dairy cow, which gets so much internal exercise in making milk that she is much less liable to contract tuberculosis than the round, fat, indolent beef animal that does no work and is restrained from her natural exercise. It is constant practice that trains the boy's eye and builds up in his mind the revolutionary ideas of the professor. Studying such noble forms as the cow's is considered worthy of long time by the sculptor or painter, and how can we breed animals without long eye and mind practice? It is as easy to learn Greek in six easy lessons as to learn the arts of agriculture at one sitting of a farmers' institute. In feeding the dairy cow Professor Haecker does most of the work in the class room, and if anyone can tell him how to give laboratory practice and not lower the records of his pet cows I am sure he will be thankful.

Dairy manufacturing is taught to all our farm boys and farm girls by a series of lectures, and enough practice so that each student can learn how to make good butter or good cheese, as the case may be. In this work it is practicable to give an abundance of laboratory work of a clean-cut kind, that enables each student to take up the dairying successfully at home. Besides the care of milk, the creaming and care of cream, the churning and packing of butter, and the making and curing of several kinds of cheese, of course each student gets also the supporting work in testing milk, and the chemistry and physics related thereto. But the practical part, that will give the farm-school student when he gets home the grip on the business, is the practice, continued till there is no longer luck but certainty in his operations. We need to give these practical things plenty of time. The boys enjoy the practice.

Our meat house, erected a year ago, has proven a very valuable feature, and in it my foreman, Mr. Boss, has developed a practical line of instruction, which is of great interest and profit to the students. The students are taken in groups of about five; each group manages the meat house for a week at a time. The dormitory and the professors' tables are furnished with meats, which Mr. Boss purchases of the station or of outside parties, sometimes feeding for a short time, and sells at cost. The groups of students kill and dress the cattle, sheep, swine, and poultry for about 300 people, usually doing this work on the weekly holiday. They meet in the cutting room of the meat house daily, and, under the instructor, with charts at hand, fill the orders for the day. The instructor talks to each group of boys and, besides, gives a number of lectures to the class. Instruction and practice are given in the making of wursts, sausages, etc., and in preserving meats. Here also is taught some physiology, and many of the lessons of conformation in the breeding and feeding classes are here illustrated by inspecting the live animal and its carcass, in whole and in parts.

In our four years' course for college students all of whom have taken the course in the school of agriculture, we offer to juniors and seniors twenty-two subjects directly relating to agriculture, and of these the student must elect at least twelve, or one-fourth of the entire course. The professors of agriculture, animal husbandry, and dairy husbandry each offer two or three terms, and the other heads of divisions in the experiment station, all together comprising the special faculty of the college of agriculture, offer the rest. This work is being reduced to system, and thorough work is required, though the method of instruction is much after the style of post-graduate work. This is becoming the most enjoyable part of our work, and some of it can be done in connection with experiments. Preliminary experiments may often be done with this class of student labor, and the students learn much of methods, and especially of the importance of care, honesty, patience, and of well-defined plans in experimental research. These students learn by practice how to independently study subjects, as distinct from books, and are required to prepare papers and perform work of a laboratory nature, rather than hear lectures. Our school of agriculture gets less of literary education than students who come from high schools of the State, but it is recognized in the university that these young men have a practical training to think as well as to do. Each of the half dozen professors making up the special faculty of the college of agriculture at the experiment farm is developing a scheme of studies for college-course students. Our agricultural chemist, for example, offers five or six terms' work after the two terms given in the school of agriculture.

Having the two distinct courses, as we now have, makes the classification of our work more difficult, in that some of the subjects covered in the college course are taught in the agricultural high-school course; but when once finished the classification will be more complete, because of the greater number of terms into which the subjects may be divided. Two of three terms offered to the college students in my line are designated field agriculture and rural economics. The professor of animal husbandry naturally divides his subjects, much the same as in the school course, under breeding and feeding animals. The professor of dairying has each student take up certain lines of dairy study and research, and, now that a class of several are starting into the college course with a view to specializing in dairy science, he will need to work them in groups or classes.

We make farmers in our high-school course, and professional agricultural workers in our college course. On the side, we educate a lot of factory dairymen, and for the farmers we train a lot of wives who know cooking, dairying, sewing, gardening, fruit raising, and home making, as a class of farm women never knew these things before. Our farmers' institutes are a power to send us students and to arouse our farmers to hunger after knowledge, as well as to teach them technical agriculture.

I can not refrain, in passing, from saying that our State agricultural, horticultural, dairy, and other like associations are in line and speeding forward the good work, and our agricultural press is a power in our land.

The CHAIRMAN. The next gentleman designated to continue the discussion of this subject is Prof. W. W. Cooke.

Mr. COOKE. In the ten minutes allowed me for continuing this discussion, I wish to present the phase of it brought to our attention during the discussion in the College Section of "What studies should be embraced in the four-year B. S. course," in which you have the whole time of the student, forenoon and afternoon and evening if you want it, for two years, to be devoted principally to agricultural work. That is not the problem that is presented to us in a large part of the colleges of the United States. We have coming to us a class of men who say they want to take an agricultural course—the four years' agricultural course. Now, shall we undertake to teach them straight agriculture for four years, or shall we try to make of them well-educated men with, in addition, some theoretical and practical work in agriculture? There have always been two classes at variance in answering this question. When the agricultural college first started, thirty years ago, the idea in the minds of a good many at least of those who favored the proposition was what we call a farm school. It was subject to a great deal of criticism. I hope and believe that the agricultural college has gotten far enough along in its course to justify its existence without being a farm school; to justify its existence in giving agricultural students a good all-round general education. Now, what is meant at the present time by a good all-round education? It covers a multitude of topics, and there is much difference of opinion as to what studies ought to be taught. We have just heard from the last speaker how they took twelve terms of agriculture during the four years' course. I think that is just about the average at the present time. We have heard what he says, in addition to that contention of those specialists in agriculture who want to give an additional two, three, or five terms of work to the student; and the field is so large that I do not know how we are going to adjust the pressure from the two sides. But this much has been brought out very clearly by the work and experience of the different colleges, that we shall have to give up the idea of manual training in agriculture, in its pure sense of cultivating the soil, in a four years' course. We have got to confine our work; concentrate it into the class room, instead of spreading it over a large amount of work that must necessarily be to a large extent a repetition of what the student has learned before he comes to the college. There are certain phases of it that are still capable of being taught by the hand. Dairying is perhaps the best example we have, and to a large extent we can teach the feeding and breeding of animals; but there is so much to be crammed into the student in that four years that we have got to do almost the whole of it in the class-room work; and that professor of agriculture does the best who has most learned to concentrate that work, to teach his student to think, to exercise his mind, at the same time that he is pouring into that mind the information of technical agriculture.

The CHAIRMAN. This question is now open for discussion. It would appear that about twelve minutes remain to consider this subject.

Mr. TRUE. Just a word on this subject from the standpoint of one who has never taught agriculture, but who has had considerable experience in teaching, and has made something of a study of methods of teaching. I believe Professor Hunt struck the root of the matter in one or two things which he said. It seems to me that in agriculture, as in other subjects, the college professor has given too little attention to his work as a teacher. If he will devote himself to the work of teaching—to the methods of teaching—I believe that he will be able to develop a course in agriculture which will be along the right line. The other point is, that agriculture as a department of college instruction needs to be more carefully defined, as Professor Hunt said, and the subject-matters to be taught and topics to be selected should be very carefully considered. It is along these two lines, the consideration of methods of teaching and the careful selection of topics to be taught, that we are to work out a proper course of instruction in agriculture, as in other subjects that are taught in our colleges.

Mr. CLUTE. In the meeting in Washington last held there, Mr. Harris, of the Bureau of Education, in a very learned talk, said that in his observation of methods of teaching, the subjects of agriculture and horticulture had not yet been reduced to pedagogic form. This morning, as I listened to Professors Hunt and Hays, it seemed to me that at least those gentlemen were reducing the subject of agriculture to pedagogic form. They are mapping out definite lines of work and are showing just how that work may be done in the hands of the clear-headed agriculturist and teacher. I was very much interested in the remarks made by those gentlemen. It would seem that the laboratory side of agricultural work is, in their hands, and I hope in the hands of others, being so carefully elaborated that we shall have these as precedents to guide the various departments of agriculture throughout the country. It strikes me that while there may be a very large amount of valuable work for their students in chemistry, in physics, and in some of the other sciences, the laboratory work is so directed that the minds of the students are at once aroused. In the course of the discussion here, as regards mechanic arts, the students become immensely interested because they have laboratory work with the machinery and tools, and they are able to accomplish something by the aid of those tools. Now, formerly in agricultural and horticultural colleges, the laboratory methods have been often meager; there has been nothing of interest or beauty to attract students in those directions. But in the last few years, especially under the leadership of such men as Professors Hays and Hunt, these laboratory methods are being thought out. And there is another, too, in the dairy school, the school of horticulture, as outlined by Professor Hays, and various methods of that kind. This whole subject is getting into such form that we may hope very soon that the criticism of Dr. Harris that the methods of teaching agriculture and horticulture have not been reduced to pedagogic form will no longer apply to those branches. Now, just one word further as regards the subject of manual training. I do not regard it an essential to introduce very much of manual training into the course of instruction in agriculture and horticulture; but it seems to me, Mr. Chairman, that what the laboratory worker needs is the manual training. Then, indeed, the laboratory work is educative. The student is put at his mowing machine and he has to take the machine all apart and put the whole thing together again and then run that mowing machine as it ought to be run; and when we have taught the laboratory work in that way we have the right kind of manual training, and the quicker we get over the fetish that has been held up to us for the last twenty-five years, that in order to educate a boy for a farmer you must put that boy to hoeing, chopping, or cleaning out the stable, the better it will be for the instruction of agriculture everywhere. That is is not the kind of labor we need especially to teach in the agricultural colleges.

Mr. Davenport. I would like to add a word to these remarks upon methods of laboratory teaching of agriculture. We must reduce somewhere, we must draw in; there are so many lines. I long ago gave up the idea of teaching the whole subject of agriculture to any one student. When we approach the technical work I hold that it is not necessary, in order to give discipline, that we put student A through all the labor system, through all the instruction in dairying, stock feeding, soils, and cropping. To build upon President Clute's illustration, if he takes apart and thoroughly studies a mowing machine is it necessary for him to take apart and study a reaper? No. A portion of it well driven in and nailed down is worth the whole thing smattered over.

Mr. Hays. I believe this morning is an opportune time to emphasize a matter that has been brought to my mind. I have never seen a lot of students—take the boy who has sort of got tired with study, the country boy who has failed to get a grasp on things in the country school—I have never seen a class of students who take as much interest as the boys who go into this kind of school where there is united some general text-book work with considerable manual training in our carpenter shops. These students not only get waked up, but during the few winters they stay with us they get a development that is remarkable. And these classes, when they graduate from this school of agriculture, with what training they have had, know something about raising corn, making roads, and raising chickens, even though they may not be able to electrify audiences with brilliant graduating speeches. It is the way this education takes hold of and develops the student which seems to confirm the wisdom of adopting this method of training. I should like to hear from Professor Smith upon this topic.

Mr. Smith. I am a crank; I am radical. In the first place, I believe that the only time to hold an agricultural course of instruction is in the summer. You may be ingenious enough, too, in substituting for actual farm work in some meager way the methods of house culture. We find in Michigan another thing; we believe in the old-fashioned idea, now so unpopular, that the best way to get a boy to working is to let him work. We strive as far as we can, Mr. Chairman, to make this work educational. We are second to none in this matter; where others give this instruction in words, we give it in deeds. We do not consider, however, that the work in farm mechanics is in itself an end any more than, as I said yesterday, the ability to use the forceps makes the botanist, or the ability to use the test tubes makes the chemist. The boy that will reap must plow; a boy that would harvest a crop must sow it. We teach soil physics—all of physics—and this relieves us of the necessity of teaching the purely elementary part. Let it be understood that the Michigan Agricultural College was one of the first to adopt the student-labor idea. Understand that we, as a faculty and as a board, thoroughly believe that the student-labor system as there practiced is the essential backbone of our agricultural college work.

Mr. Rane. I am but a recent graduate in agriculture, and it seems to me there is an opportunity for perfecting the departments of agricultural work in our various colleges. You will find that in many of the institutions we have agricultural courses that really run for three years, and in others four. Now, in Professor Hays's institution at Minneapolis, they have the full course of four years. After finishing the course there, many of his students go into the university; they go into an institution in which they are thrown in with men that have considerable brain capacity, and it is here that the agricultural college young men especially wish to come in contact with men. It is a sort of drawback to these departments to endeavor to carry such men in universities. I believe in institutions like the Minneapolis institution, which I visited in coming here, and I think that this is the practical solution of the problem. Now, men taking the three years' course necessarily have not got as much practical education as those who have taken four. The basis of agricultural education is the scientific work, and we must use that as a basis, and that is the reason at the present time that we have no system of books—we have no real arrangement by which students in agriculture are taught at the present time according to any standard. Everyone has his own ideas of teaching. Now, if we could make some arrangement by which we could have a standard of teaching agriculture, the present state of things would be reversed. We have, for instance, in the various courses of mathematics and sciences which we teach, a basis for an agricultural education; but they are not up to the standard that the purely scientific course is, and it seems to me that the graduate in agriculture should have fully as much work as the bachelor of science. Under the present arrangement men have passed the work and come out as college men with a degree that is not a degree on a two or three years' course.

The CHAIRMAN. The Chair calls up for consideration the next item upon the programme, "Some Elements of Permanency in Experiment Station Work," introducing, to present that subject, Director A. C. True, of the Office of Experiment Stations.

Mr. TRUE. Mr. President and gentlemen of the Association, before proceeding to a statement of some thoughts suggested by the topic formally given me, I wish, in an informal manner, to say something about the work of the Office of Experiment Stations during the last fiscal year. I deem it my duty, in coming annually to meetings of this Association, to present a summary of what the office has done in the interests of the great system of experiment stations in this country. As you well know, our work, to a very large extent, consists in collating and summarizing the publications of the experiment stations in this and other countries. During the year just past the office has issued twenty-four regular publications, not counting circulars and miscellaneous papers. The Experiment Station Record has been continued through another volume. Its form has been somewhat changed. It has reached, I might say, another stage in its development, in which all the matter presented is arranged in one series of topics, so that the work of foreign institutions is included with those of our own under one general series. The scope of this work has also been considerably enlarged, and we have therefore published in the Experiment Station Record considerably more matter in the same space than we did a year ago. In this work we have also had this year, more definitely than ever before, the cooperation of the scientific divisions of the Department of Agriculture and of the abstract committee of the Association of Official Chemists. Some idea of the work involved in the preparation of the Experiment Station Record may be given, perhaps, in a few statistical statements. Taking into account only the abstracts of articles in that publication, you will find that we have abstracted somewhat over 1,600 articles, which in their original form, in the different languages, contain just about 29,000 printed pages. These have been condensed into about 800 pages of the Record. In addition, we have given 2,100 titles of articles without abstracts. The number of publications of American stations abstracted is 295 bulletins and 42 annual reports. We have also included 70 publications of the Department. The editorials, special articles, and notes have made 200 additional pages and the index, 155 pages, making in all about 1,200 pages in the volume. The editions of the Record have been 8,000 copies. There is a constantly increasing demand for this publication, but at the same time the publication is growing increasingly technical, and it is probable that after the current volume is issued we shall restrict the circulation. A greater effort will, however, be made to supply the demand for information about the work of the stations in this country and abroad through our publications of a more popular character. In addition to the Experiment Station Record, the office has issued five bulletins, comprised of 824 pages, besides the Annual Report of the Director and an article for the Year Book Department for 1894. We have also done considerable work on three bulletins which we hope to issue next year. The work on the Index of Experiment Station Literature has steadily progressed. During the year about 3,000 cards have been printed at the Government Printing Office and distributed to the stations. In the Farmers' Bulletin series, the office has issued this year seven bulletins, comprising about 200 pages. Of these seven, three have been prepared by men engaged in work in the experiment stations or the colleges. Of the thirteen Farmers' Bulletins thus far completed in the office, six have been by men outside the office, directly connected, with possibly one exception, with the experiment stations of the country. The Farmers' Bulletin work of the Department has, as you know, greatly enlarged. Until the present year very limited funds were at the disposal of the Department for this purpose. Now that we have larger means, it is the intention to greatly develop this line of work. As one feature of the office work, it may be interesting to know that our correspondence, as compared with two years ago, has more than doubled. We received during the last fiscal year about 18,000 letters and sent out some 20,000. It is probable that during the year not far from a million copies of publications issued by the office, and representing very largely the work of the experiment stations, have been distributed throughout this and other countries. The library in charge of the office has been increased during the year by the addition of 720 books and pamphlets, besides a large number of periodicals. The exchanges from foreign stations have largely increased in number. Congress, as you know, laid a new duty upon the Secretary of Agriculture with reference to the expenditure of experiment station money; and the work on this line has been intrusted to the Office of Experiment Stations. The financial schedules were issued as soon as practicable after Congress passed the bill last autumn. It should be clearly understood that the enlarged powers of the Secretary of Agriculture in this direction have been confined to the fiscal year just past, and that any examination of accounts which he might make under the law would pertain to that year exclusively. This, perhaps, will suggest one reason why the work of visiting the stations was not entered upon earlier in the year. It was thought best to wait until the stations had matured their plans for the expenditure of the appropriation for this year.

It has seemed desirable, not only that we should have the publications of the stations to show what has been done and the financial schedules made out in the form prescribed by the Department, but also that we should learn more definitely regarding the work and expenditures by a personal visitation. The office has entered upon this work, and a considerable number of the stations have already been visited. These visits, I might add, are intended to be more than mere inspections regarding expenditures; they are rather in a larger sense to be conferences with station officers to learn the conditions and needs of their work, to get their views on many of the complex problems involved in the management of the station work, to ascertain how the funds intrusted to them have been expended, and also how the work of the stations may be made more effective and useful. It is believed that only by taking into account the local environments of the stations and the circumstances under which their work has developed that a just estimate can be formed of what they have accomplished, as well as of the proper limits of their work.

Another line of work which has been imposed upon the office during the year, under a special appropriation, has related to the investigation of the nutritive value and pecuniary economy of foods. This work has been under the immediate direction of Prof. W. O. Atwater, and studies have been carried on at Middletown, Conn., New York City, New Brunswick, N. J., Chicago, the University of Tennessee, in Alabama in connection with the Tuskegee Institute and the Alabama Experiment Station, at Charleston, S. C., Purdue University, the University of Missouri, and at Pittsburg, Pa. These studies have involved the consideration of food supply, the determination of the constituent elements of food by analysis, and inquiries regarding methods of work, the improvement of apparatus, and special studies. There has also been compilation of the results of European studies. Two bulletins on foods have been issued during the past year, and others are in preparation.

The office, I may say, in general, has endeavored as far as it was able to do what seemed to be useful to promote the general interests of the experiment station enterprise. It is our desire to understand, as fully as we may, the needs of the stations, what we can do to help them, and how we can improve our lines of work. We shall always welcome suggestions from station and college workers regarding the work of the office, and shall endeavor to do what we can to promote their interests in the Department.

Permanent Elements in Experiment Station Work.

Americans have hardly yet grasped the idea of permanency in institutions. For a time, the rapidly rising tide of population was held back by the Alleghanies, and it seemed as if society would assume definite shape in the New World as it had in the Old. Fortunate epoch—for it gave us independence from European control and a Constitution of marvelous strength and flexibility. But when once the barrier of the Eastern mountains was passed the surging crest of the tidal wave of emigration swept onward and outward with ever-accelerating rapidity, until the farthermost limits of the great West were reached, when the eddying currents ran hither and thither into the fertile valleys, and even up on the arid highlands. It has been a period of perpetual change and motion, and is not yet closed. Every now and then a President's proclamation removes the artificial dam built across some Indian reservation and the "boomers'" flood covers the land in an hour. Under such conditions, how is it possible for individuals or communities to settle down to a calm and steady life or to realize that what they build to-day will not be torn down to-morrow? To "hustle" seems to be the highest virtue, and it is well-nigh impossible to make men see that "haste makes waste." "Act in the living present" is the only motto that seems worth regarding. To plan for the great future requires room and opportunity for quiet thought and patient endeavor, but where can one find either when cities and States are being built in a day? There has been no past. And what, after all, is the future? Magnificent achievements, marvelous development! Yes; but let us try to get our breath in this rarefied atmosphere and consider whether the life of society has any other elements than enterprise and energy. Whether, in fact, the body politic should not have a solid skeleton, as well as swift-coursing blood and highly sensitive nerves. While naturally the most extreme examples of the unrest and shifting of American affairs are found on our most recent frontiers, yet the same spirit is manifested to a large degree even in our oldest communities. How few of our business houses last beyond a single generation. Most of the churches, even in our great cities, are located and constructed without reference to the requirements of the coming centuries. Our schools and colleges too often are living from "hand to mouth," with no apparent realization of the measures necessary to the growth and development of institutions which are to mold the thought and activity of the ages, apparently forgetful of the fact that it is as much the atmosphere of Oxford and Rugby, or even of our own Harvard and Yale, redolent with the wisdom of a long past, which gives form and vigor and the indefinable grace of a true culture to the youthful mind and heart as any prescribed course of training or even the influence of the living teacher. The American loves politics, and may even be said to have a special genius for government, but one might imagine from current newspaper talk that many among us believe that our nation's fate is trembling in the balance all the time and that total destruction may come with any passing strike or Supreme Court decision or Presidential election. We sometimes shout, "The Union forever!" but we go on building post-offices and custom-houses with such hideous architecture and flimsy construction that the stranger landing on our shores is led to inquire how soon the Federal Government expects to give way to the autonomy of the States. Even in Washington we have a great Pension building which is usually mistaken for a railroad depot, and a Department of Agriculture largely housed in wooden buildings made out of second-hand lumber. It is becoming fashionable to possess what are nowadays called "altruistic tendencies," but I fear that much of our current altruism is confined to efforts to make the world in which we now move more comfortable, to save ourselves the pain of beholding misery and distress ever present before our own eyes. Altruism which takes posterity into account has little place in our midst. We are perfectly willing that as many of us as possible shall enrich ourselves by cutting down the forests. It is none of our concern whether the men of the next century have material for houses or sufficient rainfall for agriculture. And yet there are some promises of a better day. I have lately been deeply impressed with the fact that the young and often thoughtless West has conceived one of those great ideas which permanently affect nations and bless all ages. In the development of great systems of irrigation the arid region has undertaken a task which argues well for the permanency, not only of her agriculture, but of her manifold institutions. These great reservoirs and waterways imply strength and endurance for the States which build them.

It may seem that I have indulged in a lofty preamble to the discussion of a humble theme. But I am convinced that the experiment station enterprise in this country has in it the potency of a vast influence on the greatest of our industries; that it is to be an important permanent feature of our system of institutions for education and research, and that its lines of operation run so close to the life and thought of millions of our fellow-citizens that its development will ever depend on the national appreciation of the proper equipment, operations, and atmosphere of those institutions which are established to promote the advance of civilization and to confer benefits accumulating in number and importance with the lapse of time. The experiment stations of to-day represent the best thought of our generation regarding agriculture, and their defects are largely the reflection of the current mistakes and ignorance of our times regarding the functions of institutions working in the interests of those departments of human life which have had a long past and are to have a long future.

When once we have consciously adopted the idea that the experiment station is to be a permanent institution having distinctive functions, our first effort, perhaps, will be to give it a form of organization which will make it stand out sharply as a distinct entity and at the same time permit it to develop gradually and steadily as its work grows in strength and importance. The station is very properly a department of the college or university, but for that reason it should not be split into as many separate pieces as it has different lines of work, so that we shall have an agricultural section of an experiment station, and a horticultural section, and a chemical section, but no solid experiment station. While it may be advisable under certain conditions that the professors of agriculture, horticulture, etc., shall be at the same time members of the station staff, they should not be allowed to regard their station work as simply an addendum to the other work of their college departments—to be shifted about as circumstances suggest. The station should be a department of the college as clearly defined as the medical school or the law school; it should have its definite programme of work, and its different lines of effort should be coordinated and systematized so that the public will feel that there is really a permanent agricultural experiment station—an organized effort of science to help the farmer. All this may be effected in such a way as not to interfere with the proper liberty of the individual investigator—indeed, his efforts may be stimulated to greater achievement with the aid of that esprit de corps which connection with an important and well-defined organization greatly promotes. Unity of purpose, aim, and organization will do much to secure the permanence of the experiment station.

Under our system, the control of experiment stations, as of colleges, is committed to boards of management variously constituted, but perhaps most often appointed by the governor of the State. The functions of these boards are, as a rule, loosely defined in the statutes creating them. In a general way, however, it may be said that their proper duties consist in determining the general policy of the station, appointing its chief officers, supervising its expenditures, and standing between the people and the station workers to prevent popular clamor and caprice from interfering with station work and to secure adequate results from the disbursement of public funds. These boards, properly constituted, are composed of eminent citizens who have manifested deep interest in agricultural education and research and who understand the needs and duties of the institutions they are called to supervise. In this country good men for such boards are usually very busy men. They have neither the time nor the training which fits them to make detailed plans of station work or to closely supervise the progress of the investigations. When they have carefully selected the proper agents to conduct experimental inquiries in agriculture, with the aid of such expert advice as they can secure, they must be content to wait until results may reasonably be expected before they attempt to sit in judgment on what has been done. It will be perceived that our ideal member of a board of control of an experiment station must be a wise and patient man, and that his functions are of such a delicate nature that experience in the management of such matters ought to make him increasingly valuable to the station and to the community. It is quite essential, therefore, to the permanence and efficiency of the experiment stations that their boards of control shall be stable bodies. The tenure of office should be such that violent and abrupt changes of station policy and work will be out of the question. Wherever political, personal, or other unworthy motives play any considerable part in the selection of members of boards which are to govern experiment stations, there is little hope that sufficient permanence in station work will be maintained to produce the best results. Our people have yet to learn that failure to secure good results from investigations in agriculture rests primarily with the governing boards. They are to be held responsible for the efficient management of these institutions. In their hands lies the destiny of the stations to a greater extent than we have perhaps imagined. It is of the highest importance, therefore, that a righteous tradition regarding the membership and permanence of these boards, shall be established in our different communities. That it shall come to be a matter of course that honest, intelligent, and experienced men shall be kept on these boards and that the lines of station policy once fixed in right directions shall not be turned aside for trivial or improper reasons.

The idea of permanence should be prominent in the minds of the governing boards when they select the officers of the station. Of course, there will inevitably be more or less shifting about in the subordinate positions, but the responsible officers of the stations must have long tenures if the station work is to be what it ought to be. All the formalities of introduction to office and of continuance therein should be such as to facilitate the choice of able men and to make their positions secure and comfortable. It needs only a superficial survey of our institutions for education and research to discover that in what everybody would consider the best ones there is extraordinary permanence of official tenure. Who expects that a president or professor of Johns Hopkins or Harvard University is to continue in office only for a year or two, or be subject to the cruelty of taking his chances of reelection annually or biennially?

Considerable pains are taken to get good men for these places, and then they are allowed to settle down to work in security and make the most of their opportunities. Of course many men of mediocre ability get into the faculties of even our greatest institutions, but on the whole that plan which secures the greatest permanency in the personnel of educational and scientific institutions gives the best attainable results. No doubt the American spirit of change often leads the individual workers to voluntarily go from place to place, on insufficient pretexts, to their ultimate disadvantage, as well as to the injury of the institutions they serve. A truly great or useful man is after all not altogether dependent on his surroundings. It may even be better for him to remain in a smaller institution. When the importance of permanent work at experiment stations is more firmly fixed in the minds of both governing boards and station workers, we shall expect to have far fewer changes than at present, to the mutual benefit of the station and the investigator.

Another permanent element of the experiment station is its records. Hitherto this has been much neglected. It rarely occurs that institutions become alive to the desirability of a complete record of their transactions until the time for making such a record is past. I have known several educational institutions which finally awoke in great surprise to find that they had nothing like a complete record of the students who had attended them, or even of their graduates—that anything like an adequate history of the institution was out of the question. The accumulation of data which may be of service in the interpretation of nature's laws is one of the important functions of an experiment station. Many facts and phenomena will be observed of no apparent value now which may have great significance after the workers of to-day have passed away. If we really believe we are not working simply for our own day but for all time, we shall carefully record what we do and see, and arrange as far as in us lies to have those records transmitted intact to those who come after us. Time and thought should be given to the form of station records, that they may be orderly, compact, and intelligible, and sufficient clerical assistance should be provided to make them reasonably complete. Of course, such records are the property of the institution and not of the individual, and the authorities should see to it that they are not removed from the custody of the station. There may easily be extravagance in the preparation of unnecessarily elaborate records, but on the other hand what seems to be a saving of a few hundred dollars for a clerk may result in an ultimate loss which can not be calculated in figures. Besides the records of individual experiments, there should be certain general records, such as those regarding the station farm, a history of the different fields and plats, the soil, the climate. Some stations in the West are beginning with almost virgin soils. What a grand opportunity to record the changes in the physical and chemical properties of soils due to various known influences. Soil science demands the accurate recording of facts for many years. In this way alone is there any hope of discovering principles or building up a true science of the soil. What is true here is equally true in other lines. I wish simply to emphasize the necessity of more attention to the planning and keeping of station records. I know some of the difficulties, but I believe they may be overcome. I know something of the good work in this line which is being done. I am now presenting the other side.

I suppose that we will all agree that the station records should be more than a series of notebooks. Specimens, photographs, and drawings should illustrate and complete the written records. These should be gathered and arranged on some consistent plan, so as to be far more than a heterogeneous mass of material. Proper provision should be made for the housing of these records. If they can not be kept in fireproof buildings, then at least safes should be provided in which to store them. They should be made and kept under such conditions as will secure them from alteration or destruction.

The printing of these detailed records should not be thought of. Indeed, much that is now put in station bulletins and reports might more wisely be left in the manuscript books in the station safe until enough data have accumulated to make some sort of a satisfactory conclusion possible. Instead of more leave to print, the stations need, perhaps, more compulsion to record and to wait.

As regards the printed matter issued by the stations, I am inclined to think that if the idea of permanency had been more prominent in the minds of the authors there would have been more care in the composition, editing, and typography, and even in the subject-matter. That concise Latin motto, *Scripta manent*—what is writ sticks—should be pinned up in a conspicuous place in the desk of every station writer.

Each station should have a few investigations which it proposes to carry on for a long term of years. In regard to these, what care should be taken in planning, what faithfulness in executing, what accuracy in recording. What a test of the real manhood and greatness of the investigator is presented here. He does not expect to see the end of his labors. What he sows another shall reap. Yet into this work he puts more of wisdom, earnestness, and painstaking than into all his other labors. It is a great and permanent work, therefore it must be done well. It is a cathedral of truth—deserving a great architect, wise master builders, cunning workmen. Each arch and pillar, every beam and architecture, every curve and decoration must be the best that can be made. However out of sight, each part must have its true finish. The reward of the workers is not in having their names blazoned on the portal, but in the thought that their work shall rejoice and bless the coming generations.

I have no fear that we shall fail to embody the permanent elements in experiment-station work in suitable form and dress when once we have become possessed of the idea that these are permanent institutions. The needs of the present hour have necessarily occupied most of the attention of our station workers. These needs are pressing still and must be met, but in some way we must find space and opportunity for permanent work. When the station enterprise seemed of doubtful usefulness and likely to continue only a brief time, there was perhaps some excuse for transient effort and irregular, fragmentary records. Now, when the usefulness of agricultural investigations is absolutely determined, when no voices are raised to abolish but all true friends of agriculture seek to uphold and strengthen the stations, it is hardly less than criminal to let the years slip by without making those arrangements and writing those records which will secure the most lasting benefits to the cause of agricultural advancement. Not in the sand of the desert but on some rock-hewn pyramid let us write what may now be only the hieroglyphics of truth. One day the interpreter will come, and we shall be found to have inscribed there a prophetic revelation full of comfort and blessing to our fellow-men.

On motion of Mr. Wheeler, of Rhode Island, Dr. True's paper was referred to the committee to which the president's address was referred.

The CHAIRMAN. The attention of the convention is called to a portion of the constitution which provides that "the annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the programme. The section meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them." Two such subjects are now to be presented from the Section on College Work. First, "What Studies Should be Embraced in the Four-year Bachelor of Science Course?" This question is to be opened by President Ellis.

Mr. ELLIS. I deem it exceedingly unfortunate for my subject and those who are interested in the discussion that the subject comes up at the noon hour; for it strikes me that after we have remained on these seats three hours it is rather an inopportune time to enter upon a long discussion of this topic. I have neither had time nor inclination to prepare a paper, consequently I have no excuse to present for not having prepared a production on this question. I feel that the topic is a very important one, and I shall ask your indulgence as I proceed to the discussion of it in such manner as I may be able. I am not responsible for the fact that I stand in your presence at an hour when, as it was said of Burke in the House of Commons, "he pursued his subject while his auditors were all dining," and whether my auditors shall be dining or not I am going right ahead just as though I were the first on the exercises of the day. I am to discuss what are the requirements for a four-year course leading to the degree of Bachelor of Science. I will let my mind run back to my own college days. Nearly thirty years ago this year I received that degree from the State University of Ohio, and I have been trying to think what were some of the branches over which I passed and from which I received that degree thirty years ago. That course embraced algebra, geometry—descriptive geometry—surveying, navigation, trigonometry, and integral calculus; that was the course in mathematics that entitled me to the degree of Bachelor of Science. In the course of English, I had, as near as I remember, as follows: Watts on the Mind, and I wish to say that if all of us had a little more of "Watts on the mind" it might be a good thing; then we had Liddell's History of Rome; we had something of Hume's History of England—it began at the fourth volume, in the reign of Queen Elizabeth, I think; Perry's Evidences of Christianity, Butler's Analogy, and something in the way of the history of civilization as found in the little condensed text-book of Guizot. We had something of physiology, something of physics, something of chemistry, something of geology and mineralogy, and something of biology and botany; and all we received in the way of science we received from one man, who was designated in the catalogue as "professor of natural sciences."

Now, that is the course which I had that entitled me, thirty years ago, to the degree of Bachelor of Science. But I wish to say to-day, without fear of intelligent contradiction, that there was far more of culture in connection with that course than there is in three-fourths of the courses to-day that we have in our agricultural colleges and technical schools. I verily believe that the hands of progress in respect to culture have turned backward. Of course, it is a fact that our instruction in science was of a very rudimentary character; yet I believe to-day that that course would not be a very bad course, with one or two amendments, to lead to the degree of Bachelor of Science. That course took us about four years. We had access to a library of 9,000 carefully chosen volumes; we had access to the regular college classes—sat side by side with them and pursued those studies under the same instructors. The advantages extended to the students of both classes were the same. Now, coming back a little more practically to the subject, I might remark that the number of studies to be included in the four years' course will depend very largely upon the requirements for admission to that course, for, as you can readily see, if the requirements for admission are of a very rudimentary character the subsequent courses must be limited; while, on the other hand, if we can require of students who seek admission to that four years' course leading to the degree of Bachelor of Science a more extended preparation, then the four years' course can be made more fruitful, both in the way of practical work and in the way of cultural work. I am pretty much in the position of the wise man of old; of this we may be sure: "Of the making of books there is no end, and much study is a weariness to the flesh." I think I saw, some two or three years ago, in type, a list of the degrees conferred by the various American colleges of high and low degree; and, if I am not mistaken, that list was so extensive that it would occupy the whole time allotted to me this morning in merely enumerating the degrees conferred in American colleges. As to the meaning of the degree of Bachelor of Science, one puts one interpretation upon it and another another interpretation, and the practice of the different institutions by which this degree is reached is as various as the number of institutions themselves.

It is customary in some of our agricultural colleges, the institution that I have the honor to represent, for instance, to confer the degree of Bachelor of Science upon all graduates of the institution, although we have four clearly differentiated courses of instruction. Now, is not the culture of each of these four courses of study equal to the culture of each of the others? And yet the only degree conferred by the institution is the degree of Bachelor of Science. Now let me ask your attention for a moment to some of the requirements for admission to these courses. In some institutions, for instance the Michigan Agricultural College, the institution at Manhattan, and others, these requirements are made rudimentary, not by action of the faculties of the institutions themselves, but by action of the legislatures. It is a legislative enactment that they shall receive pupils who have passed with fair credit through the courses of the common schools and have reached the age of 15 years. Now, that is the qualification on which we must admit students to our preparatory classes. We have some students who, under a strict interpretation of the law, would be entitled to freshmen standing, and by making the course five years instead of four we are enabled to round up a fairly good course of instruction, and when we confer the degree of Bachelor of Science we should endeavor not to confer it altogether without the person upon whom it is conferred being entitled to it. Other colleges require a much more extended preparation in the lower courses leading to the four-year course for the degree of Bachelor of Science, in the way of American and English literature and in the way of the study of the English language. It will take, possibly, algebra through quadratic equations. It would require of students in the same cases a little preparation in the way of Latin and German. I believe that these are about the highest requirements by the institutions of which I have knowledge at this time for the course leading to the degree of Bachelor of Science. There is some slight difference between the requirements for admission to these different classes of schools.

It will take a student some time to acquire a knowledge of English and American literature, for instance. We know what it is to conduct a class in algebra so that the members will be familiar with all the operations of algebra up to quadratics, and to take them through a course in what we might call about six books of plain geometry; that the time required for the mastery of these subjects, at least, would possibly be equivalent to one and one-half or two years of ordinary instruction. Now, there is a gap that we will have to bridge in some way; there is a gap that we will have to eliminate in some way. Now, what I have to say upon this course of study (in the preparation of this course, we have followed the ideal course, not my own), we give the degree of Bachelor of Science to four different courses built upon the attainments of the student in the public school course. Of course I am not here to say that this is the rounded course that should be required for the degree of Bachelor of Science, and, as has well been suggested, our environment, our circumstances, seemed to make it necessary at this time that we should hold our course to about the subjects that are now included in it. My ideal course leading to the degree of Bachelor of Science would be a thorough acquaintance with all those branches which we know and designate as "common-school branches," in addition some culture derived from the study of English and American literature, the study of some elementary text-book on civil government. I should require of the student a thorough knowledge of algebra as far as quadratics, and he should have all the culture that would naturally follow in the wake of such instruction as would lead to that work.

Now, having that as a preliminary basis or as the qualification for admission, I should build upon that a four-year course, and that course should take into consideration the clearly recognized nature of the human mind. I believe that if we need to enter any protest, it is against overzealousness in prosecuting specialties. I am of the opinion that we want to have a man well rounded before he begins a course of study leading to some special degree. I do not believe in allowing a young man just entering upon a college course to choose some special course of his own when he shows by every appearance that he has not the faintest conception of what a college course means. He desires to pursue a course in chemistry. You will ask the young man what he knows about chemistry; he answers that he does not know very much about it, but he has heard the word "chemistry;" he thinks that it is a pretty nice thing and he wants to study chemistry; it may be that he can not spell; he can not write an English sentence correctly; he does not know anything at all about the fundamentals of an English education. When we have a young man of this character apply for admission we try to beat some sense into his head; try to get him to consent to go right down and sit at the foot of the college course before he attempts to go to the top of it.

Another student, a young lady, will come into the college, and she says: "I want to become a stenographer; you teach stenography, and I want to pursue the study of stenography." We ask her: "What do you know about English grammar? Are you a good speller?" She answers, "Oh! I haven't thought much about that; I want to study stenography!" And every question you ask is answered by the plea, "I want to study stenography." We say to her: "Do you not know that the stenographer must know how to spell? That a stenographer must have some idea of the construction of an English sentence? That a stenographer ought to be a well-read person? That he could not possibly take down the address of anyone in which there is involved the expressions and allusions employed by those who have acquired an English education unless he also has a fairly good education and is able to know what a quotation is and to put it down in an intelligible form." She says you are entirely too practical for her, and she leaves, much to her own disgust and much to your satisfaction. Now, this is what I want to protest against. I would not allow any student to enter upon such work as that under any circumstances whatever unless he had the foundation of a good, common-school education. This new institution, it has a tendency, I say, to let down the bars and to allow admission under that kind of work too easily. Now, as I said before, I have an idea that an education can be too much in the line of specialties. There are certain studies that are absolutely needed to round it out properly. There is so much of history that every scholar ought to have; there is so much of civil government that every scholar ought to have, and so much of literature and general culture of the imagination and uplift of soul that comes from the theoretical and intimate acquaintance with these studies that we can not dispense with them in any well-rounded system of education; and I have been—and you will be—surprised in this convention to hear, on more than one occasion, the members addressing the convention speaking about "equivalents." My friends, there is no equivalent for any of that kind of work. You can not study agriculture as a science ten years and take it as an equivalent for that general education that every citizen ought to have.

I do not believe, my friends, that it was the intention of the law to which these institutions owe their existence that the instruction to be given in them should be along little, narrow, special lines. I only wish, from my knowledge of matters as an educator, that it were possible for us to defer all kinds of specialties until the student had accomplished an all-round course leading to the degree of Bachelor of Science; but this idea of taking a boy or girl who has just the rudiments of an education as taught in a country district school and turning him out as a specialist in mechanics, agriculture, horticulture, chemistry, and other lines in science, I believe is detrimental to sound learning, and I believe there is nothing to-day that is driving the agricultural colleges of this country into such just disrepute and just contempt as the idea of them which many people have that a mere smattering of education will do. I would have this course, then, begin upon the kind of cultivation that I have attempted so imperfectly to present in your presence. I should have it embrace all the scientific work that we now have; I should have it include history and literature, and I should by all means have it include at least two years of German and French. Now, I believe that when the student has accomplished that course under proper instruction, under instructors of wide experience, that that student will go out entitled to the degree of Bachelor of Science and with the amount of advancement and accomplishment that will bring honor and credit upon the degree and the institution that confers it. It seems to me we ought not to make this degree too cheap. Give your degree of Electrical Engineer and Mechanical Engineer, but in the Bachelor of Science degree, as I see it, it means more than that special work; it means an all-round, well-guarded scientific course, in which the humanities are not excluded, and that is the kind of a course I would have in the course which is intended for the degree of Bachelor of Science. Now, my friends, I do not believe that the use of such a course would in any wise detract from the importance and value of the work that we may now be doing in the way of special scientific agriculture or in training in the mechanic arts. I believe that with such a course of study as that assigned as the central course in your institutions, that the student will have greater incentive for the highest attainment of intellectual work. I am heartily in sympathy with the idea that we want to have a great deal more of the cultural in our college work. I wish to say here that I am giving away no secret when I say that every one of us knows that the colleges of liberal arts offer more systematized work in the way of building up the cultural in the minds of the youth of the land, and most of you know how difficult it is for us to come into competition with them, and our short courses and short cuts, and our degrees of "Bachelor of Agriculture" and "Bachelor of Scientific Agriculture" afford them grounds for criticism and comparisons unfavorable to our institutions, and we ought to be willing to make a long step in advance, I tell you, if these agricultural colleges are ever again to ground themselves in the confidence of the people of the country. They are going to do more work than they have ever done before. I verily believe the more of mind culture, the more of soul culture, you can put into the mind of a young man, the more you have done to build up work along specific lines.

Mr. ANDERSON. After the eloquent discussion that we have just listened to, it is almost needless for a young man to attempt to add anything. I have listened to the discussion of President Ellis, and I agree with him in almost every particular. It seems to me that this is the right method, and I believe that every man in the convention agrees with President Ellis. We need more culture; we need more science. How are we going to strike a happy medium? So far as the multiplication of degrees is concerned, I think the American colleges are making a mistake. I believe we should have in our American colleges scientific courses that perhaps are identical up to the junior or sophomore year, and after that time specialize. I think we might arrange a course to be known as the mathematical course; we might arrange another course and call it the biological course, each leading to the degree founded upon that course; a chemical course leading to the same degree. It is a very difficult problem to determine what studies ought not to be comprised in these courses. I question whether the scientific courses as at present organized are able to carry on the cultural. It seems unfortunate that our scientific courses are so organized now that we are compelled to gradually cut out the humanities. I hope that the movement in that direction will stop. We do not get enough of culture studies, but with the immense development of scientific lines, how are we going to crowd into the four-year course all the culture studies and scientific studies we need? A great deal has been said about developing ideal courses of study, and the attempt has been made and more papers written to develop a course of study in mechanical engineering, for instance, and that will apply to all the colleges of the country. Now this is a useless waste of energy. The conditions for admission and the amount of money at the disposal of the college and various other things have to be taken into consideration. I am not versed in scientific courses, and I have no authority to speak upon them, and perhaps what I say is of no value whatever, but the same thing would apply to scientific courses that applies to the mechanical engineering course. A college can not hope for the State to do better for them in agriculture, perhaps, than has been done for the State College of Kentucky. I will outline briefly what I would consider an ideal course in science. A course of mathematics running, perhaps, through analytical geometry, with an additional five months of calculus; two years of English literature, five months of physiology, five months of chemistry, five months of biology, five months of botany, five months of metaphysics and logic, two years of English, and perhaps one year of German, and one year of French. I would give at least one year to history if such a general course of study could be arranged for a Bachelor of Science degree. We want to specialize. I think it is the tendency to specialize. I believe in specializing to a certain degree, although I have great confidence in what President Ellis has said, and agree with him thoroughly. We are tending toward specialists in science. If a man wants to devote himself to chemistry, you have enough time left to fill up the course with chemical studies. If he wishes to devote himself to mathematics, put more mathematics in the course. There you would have three separate lines to eliminate the culture studies, and if any other line of work is necessary to be developed, the course could be so extended along special lines. As far as the special courses are concerned, I believe we ought to have a degree in agriculture. I am in sympathy with the Bachelor of Agriculture degree. The thing for the agricultural men to do is to dignify that degree. I believe we ought to have degrees for the mechanical course. There is a tendency, I will admit, to multiply the number of degrees, but I believe that this is one of the things that will be a necessity. In general, then, for all technical courses of study give special degrees, but for all science, as I have outlined in these three courses, give the Bachelor of Science degree.

The CHAIRMAN. The next speaker upon the topic under discussion is Professor Hilgard.

Mr. HILGARD. Mr. President and Gentlemen of the Convention: I can first say that I agree most thoroughly with everything that has been said by President Ellis. There is one point of view, I think, which has been somewhat neglected or overlooked by the previous speakers, and that is this: What are we aiming at in the education of the students at our colleges? The Morrill Act says that these colleges are designed to teach science, meaning the agricultural and mechanical arts. If the idea is that we are to educate the rank and file of the farmers' boys to be farmers it is one thing, but I think that is simply impossible, and so long as the colleges try to do that I think they will simply fail to accomplish anything that is really worth doing. I have put myself on record in regard to that matter so often that I am afraid I shall tire others by repeating that I do not think that these colleges were intended to educate the rank and file; that in educating the leaders they do the best possible service, and that this was the purpose which was intended to be subserved by Senator Morrill himself. Now, while I say "leaders," I mean that it will be better for these colleges to educate a few thoroughly, who will be shining examples to their fellow-farmers, than to educate a number poorly and have them go out as a reproach to the system of these institutions which was forced upon them and which has to be taken as a guide. Now, then, if we are to educate the leaders, what kind of leaders do we need? I think there are two chief classes (I mean those apart now from the farmers themselves); there are two classes, I think, that need to be educated, and those are the officers of the colleges and experiment stations—of which there are far too few—and then we want to educate a very large number of men who will be able to teach the agricultural sciences in the schools, which I consider, of necessity, will have to be a link between the college and the common school. I am not prepared to say that the common school will not ultimately take part in the education of the farmer; but it is quite certain in my mind that from what we have heard from Mr. Hays in regard to the high-school course which they have adopted there that that institution is a fine example of what ought to be done in other parts of the country. In fact, I rejoice to hear from Professor Hays of the condition of things in that institution; it is ideal, in my mind. We have there the agricultural student, who is to be an all-round man, and can hold up his head everywhere alongside of the student from other universities, and that, if the agricultural student has relegated the farmer to the ranks, is simply putting the farmer just where the farmer ought not to be, namely, relegated to the ranks. Let us educate the men who are to represent us effectually; and here I wish to put in something which struck me during the discussion in this room.

We are a republic, which rests upon the farmer as a population. The largest portion of our industries are based upon farming, and yet it is a remarkable fact that the farmer is looked down upon in this country; he is called a "hayseed," he is called a "granger," and everything else; and while the politician seeks his vote, he gives him the cold shoulder as soon as he gets where he does not need his support. But I ask the farmers, "Whom do you send to your legislatures; whom do you send to Congress by your own votes? Are they the men who are in sympathy with you? Send your sons to the agricultural college, so that they can hold their own alongside of any lawyer or any doctor or other professional man." So far from segregating from the university the means for obtaining the highest education in the State, I would put in another attic with a good dormitory and kitchen for the accommodation of the farmers' boys; I would have the agricultural college furnish the highest education in the State. It is one of those mistakes which the farmer makes; it is still contended—and he simply gives himself a black eye by contending—that the farmer is not worthy, as it were, to be associated with the higher education of the State. Then will the farmer get his rights if that is done. And why? Because he has got as much general culture as has any other class. We will invariably do precisely what we wish to do. I think I made it understood last evening that I believe in short courses, but I believe in them only as such, and I do not believe in giving any degrees in short courses.

I believe the degree of Bachelor of Agriculture is an unnecessary degree; but I do mean this: That in every institution that has an agricultural course there should be a great deal of leniency and liberty in the admission of those who wish to study this subject, as far as educational qualifications are concerned. I will give you an example. In the University of California we have at this time as regular prescribed four-year-course students, I do not suppose over a dozen. Now, these do not go into the record as agricultural students, but they have attended the lectures and the college of agriculture is giving the benefits of its instruction to those students. Now, a large number of these could not have passed the required examination, and had we refused to admit them to instruction in the college of agriculture on that ground, when they went away, perhaps, finding that they had not accomplished what they hoped, they would probably have gone with this conviction: "If we had only known in time what was necessary to become good farmers we would have begun at the bottom." Now, a good deal of discussion has been had in the faculty meetings as to conferring the degree of Bachelor of Agriculture. Agriculture is not a single science; it is so many that it takes the broadest kind of a mind to overlook it all, and there is where the difficulty arises in the short courses. They must be men far broader than a great many of those who now occupy those positions. We have chemists, botanists, and physicists, and the biological and botanical laboratories with their specialists, but the all-round men are more needed in agricultural courses than in any other. I am delighted to know that there is one institution in the United States that can say that they have a course in agriculture which is accessible to the high-school graduates, such as are the courses in Europe, and at the same time be regular students in agriculture up to the full quality of the students in the scientific and classical courses. If we can not educate these men let us keep the courses high and not low. Is not it possible to prepare a four-year course in such manner that the young man or woman attempting to take it shall get the best possible results? I have arranged for the large number of special students that come to us a two-year special course; and this two-year special course produces very good results. I have found that those who are fairly well prepared in the public schools make very satisfactory progress in our special two-year course, but of course it is only a partial preparation, and is not what it should be.

A MEMBER. I should like to ask if that two years' course is of the first two years or of the second two years' course?

Mr. HILGARD. It is of the second two years' course.

The CHAIRMAN. Shall the discussion of this topic be pursued further?

Mr. JOHNSON. Under items 3 and 4 of the constitution, relating to membership of the convention, provision is made for extending the privileges of the convention, except the right to vote, to visiting friends. We have with us this morning an interested listener and friend of the Association, the Hon. David Boyd, of Colorado.

The CHAIRMAN. By vote of the convention yesterday, Senator Boyd has the privileges of the floor.

Senator BOYD. I do not wish to say anything in particular on this subject. I am a graduate of the Michigan University. I understand a large proportion of the graduates of the Agricultural College of Michigan are engaged in professional work. Since graduating in 1866 in the University of Michigan I have engaged in farming, and have succeeded in making a living. I have found my practical experience in the art of agriculture by getting it in the field. Indeed, instead of getting training in the field at the agricultural college, I was getting field training in the summer on my father's farm. Now, on the whole, I admired very much the discussion opened by President Ellis. If we begin with a Bachelor of Science degree, I know that our agricultural college course is very unevenly adjusted for that degree, as President Ellis has told you. It is not the fault of the board of trustees; it is not the fault of the faculty. It is the fault of the State legislature in forcing upon students from the common schools a curriculum deficient in the culture studies, and it is utterly impossible to turn out men and women of broad and liberal culture in the four years' course as now arranged. In fact, you can easily see that they have just the intellectual training that graduates of high schools are receiving—that is to say, they are not as well prepared as those who go through the graded course of the common school to the high school—who have the advantage of the former by the addition of the general information which they get, and the result is that agricultural college students are exceedingly defective in the mental discipline derived from the culture studies. If they attempt expression in any way you will find it in their expression. If they attempt address in any way you will find it in their addresses. I think this must be the result with those students who have only four years in the agricultural college, and is the best result which they can give as long as they have the present studies in the curriculum.

The CHAIRMAN. It is moved and seconded that the general session do now adjourn. Carried.

EVENING SESSION, WEDNESDAY, JULY 17, 1895.

The session convened at 7.30 p. m., Vice-President A. A. Johnson presiding.

The CHAIRMAN. The first thing is reports on resolutions.

Mr. MURKLAND. The committee on entrance requirements, appointed at the last annual meeting of the Association, having organized by electing Charles S. Murkland chairman and Dr. A. W. Harris secretary, proceeded to carry out the instructions of this Association. Those instructions were, to confer with the New England Association of Colleges, the "committee of ten" of the National Educational Association, the Society for Promoting Engineering Education, and such other bodies and associations as might be; and to embody the result of such conferences in a report to this Association. Attempting, in accordance with these instructions, to find what were the common courses of study in our colleges, and to come at some means of equalizing these courses, we were preparing a series of questions to be submitted to the proper authorities in each college belonging to this Association, when we received a similar series of questions submitted by the Society for Promoting Engineering Education. That society held its meeting three or four months before ours, and I suppose that early in the coming year the conclusions derived from those questions and their answers will be available for consideration by this committee.

A little later, the Commissioner of Education, acting in behalf of the Department of the Interior, also forwarded a similar list of questions, and it seemed to this committee advisable not to incur any unnecessary expense by going over the ground thus already covered, or by acting before the reports from the Society for Promoting Engineering Education and from the Commissioner of Education were at hand. Therefore your committee suspended operations, waiting until such time as might make it advisable to proceed with its work.

It is probable that the report from the Society for Promoting Engineering Education upon this matter, which is absorbing so much of the attention of that society this year, will be received in time for some concerted action on the part of our colleges next year. If so, it will, perhaps, give us some basis upon which we may formulate a tentative system of entrance requirements for our colleges. And this is the important matter which was contemplated when this committee was appointed.

We have, therefore, to report simply progress. It is recommended that this work be carried on during the coming year, either by continuing this committee or by appointing a new one, so that at the next meeting of this Association some definite report may be presented. And with this recommendation, your committee respectfully submits its report.

Mr. STUBBS. I move that the report of progress of the committee on entrance requirements be received, and that the committee be continued, with instructions to report at the next annual convention upon the following points:

(1) A plan for uniform entrance requirements to the first year of agricultural and mechanical colleges.

(2) The extent and variety of the courses of study which may properly be offered by such colleges.

(3) The academic degrees which may be conferred upon students who have completed one of the several collegiate courses offered.

Carried.

Mr. JESSE. Since our Washington meeting last November, this Association has suffered the loss of one of its oldest and most valued members, Dr. Edward D. Porter, of Missouri. I move that a committee of three be appointed to draw up resolutions in memory of him, and as he was identified long and honorably with agricultural education in Delaware, Minnesota, and Missouri, I would suggest that the Chair appoint a committee from those three States. I request, however, that the representative of Missouri be not myself, but his friend, Dr. Paul Schweitzer.

Adopted.

The CHAIRMAN. The Chair appoints as this committee Messrs. Schweitzer, Raub, and Hays.

Mr. MYERS. It is time, I think, that the convention should be considering its officers for the next term, and I therefore move that a committee of seven be appointed as a committee on nomination of officers for the next year.

Adopted.

Mr. GOODELL. I have here a letter which I have received from the bibliographer of the Association, Dr. Johnson, which he desired me to lay before the convention, and in which he presents his resignation as bibliographer.

The CHAIRMAN. There being no objection, this letter will be referred to the committee on nominations after their appointment.

Mr. Armsby offered the following amendment to the constitution:

Amend section 2 of the articles of membership by adding at the end of the section the following:

"No delegate shall vote in more than one section, and each delegate shall, when presenting his credentials, designate the section in which he desires to vote."

The CHAIRMAN. This proposed amendment is in the nature of a notice, and under the terms of the constitution lies over for one year before it can be incorporated.

Are there any reports from committees appointed at this convention?

Mr. REDDING. The committee to which was referred that portion of the report of the executive committee in regard to its efforts to secure adequate compensation to those postmasters who handle large amounts of the franked mail matter of experiment stations, beg leave to submit the following resolution:

Resolved, That the executive committee be hereby requested and instructed to continue efforts on this line.

R. J. REDDING,
A. C. TRUE,
J. A. MYERS,
Committee.

Adopted.

Mr. MCCREA. I would like to ask if it would not be possible, very soon after the adjournment of this convention, for the executive committee to issue a brief circular stating the officers of the sections? I have thought that would be a very quick and easy method of bringing that matter to the attention of the colleges after we get home.

Mr. GOODELL. I will say, on behalf of the executive committee, that it would have been done this year, but for the fact that the notes of the convention could not be obtained in time.

The CHAIRMAN. It is understood that the suggestion will be followed without further action.

Mr. SCOVELL. The auditing committee begs leave to submit the following:

Your committee, appointed to audit the treasurer's accounts, begs leave to report that it has examined the same and finds them correct, with vouchers for each item of expenditure properly approved.

Respectfully submitted.

M. A. SCOVELL,
A. L. EMIGH,
S. P. MCCREA,
Committee.

The CHAIRMAN. It is moved and seconded that the report of the auditing committee be adopted.

Adopted.

The CHAIRMAN. The next business in order will be reports on the legislative action taken by different States for the control of tuberculosis.

Mr. GOODELL. Mr. President, I move that the roll of the States be called by the secretary, and that each accredited delegate be allowed to report what legislative action has been taken in his State.

Mr. JOHNSON. I would further amend that motion by adding that there be no discussion on this subject.

Motion seconded as amended.

The CHAIRMAN. It is adopted, and the subject is open for presentation under these conditions.

The secretary then proceeded with the roll call of States as follows:

Arizona? Mr. Comstock. I have to report that the legislation has been very slight during the last year. I think it was stated at the convention at Washington last fall that nothing had been done. I learned on my return that there had been some legislation. I also found that there was a slight amount of tuberculosis in the Territory. We have no veterinarian. The United States has done some work along the border in Mexico.

Colorado? Mr. Carpenter. We have had no special legislation in regard to tuberculosis. There is an appropriation made by the legislature for the culture and investigation of this disease, limited to $1,000 a year, and our State veterinarian has the power to suppress and quarantine. During the last three years we have only had three cases to report. We have not investigated all the dairies, but of all the cases reported, over twenty suspected cases, we have had but three definite and distinct cases. Our law gives the veterinarian and sanitary board authority to quarantine.

Connecticut? The legislature of Connecticut has at length provided a suitable law for the suppression of bovine tuberculosis in the State. It is not to any great extent a new law, but rather the very efficient old one rendered more complete and efficient by alterations and amendments. Briefly stated, the law as it now stands provides for the inspection of cattle, the quarantine of suspected cows or herds, and their products, the testing for tuberculosis with tuberculin, only with the written consent of the owners, the slaughter of condemned animals, the cleansing and ventilation of stables and premises where stock is confined, empowering the cattle commissioners to do all this and to make and enforce all needful regulations to secure and maintain a healthful condition of the dairy animals of the State. No specific appropriation is made to meet the expenses of the execution of the law, but it is left with the governor of the State to approve whatever expenses may be incurred by the commissioners. Practically, therefore, in lieu of a few thousand dollars, or any specific sum, the entire State treasury is at the command of the commissioners, but subject to the discretion and approval of the governor.

Iowa? Mr. Curtiss. No legislation, I believe, except that power is lodged with the State board of health to quarantine against it. If this refers to any legislation that may have been had heretofore, I would say that this is controlled under the general law for the appointment of a stock commission; but no special commission and no special legislation with reference to tuberculosis any more than that which covers all contagious diseases of stock, which is under the control of the live stock commission and the State veterinarian, and answers all the requirements upon that subject.

Kentucky? The quarantine regulation; not made this year, but made heretofore.

Louisiana? We have never tested for it, and since the dairy interest in this State is so small, we have thought it not necessary to stir the matter in Louisiana.

Massachusetts? Mr. Goodell. In Massachusetts there is, first of all, a cattle commission, consisting of five persons, having jurisdiction over the entire State. By law, in each village, in each town, in each city, the selectmen or other authorities of the place are required to appoint one or more persons who shall be inspectors of animals under such regulations as may be laid down by the cattle commission. This year, in addition to that, specific legislation has been taken which provides that: "When the board of cattle commissioners or any of its members, by an examination of a case of contagious disease among domestic animals, becomes satisfied that the public good requires it, such board or commissioner shall cause such animal or animals affected therewith to be securely isolated, or shall cause it or them to be killed without appraisal or payment. Such order of killing shall be in writing, and may be directed to the board of health, inspector, or other person, and shall contain such direction as to the examination and disposal of the carcass and the cleansing and disinfecting of the premises where such animal was condemned as such board or commissioner shall deem expedient. A reasonable sum may be paid out of the treasury of the Commonwealth for the expense of such killing and burial. If it shall subsequently appear, upon post-mortem examination or otherwise, that such animal was free from the disease for which it was condemned, a reasonable sum therefor shall be paid to the owner thereof by the Commonwealth: *Provided, however*, That whenever any cattle condemned as afflicted with the disease of tuberculosis are killed under the provisions of this section the full value thereof at the time of condemnation, not exceeding the sum of sixty dollars for any one animal, shall be paid to the owner thereof out of the treasury of the Commonwealth if such animal has been owned within the State six months continuously prior to its being killed, provided such person shall not have, prior thereto, in the judgment of the cattle commissioners, by willful act or neglect, contributed to the spread of tuberculosis; but such decision on the part of the commissioners shall not deprive the owner of the right of arbitration as hereinafter provided." "Until June first, eighteen hundred and ninety-six, the use of tuberculin as a diagnostic agent for the detection of the disease known as tuberculosis in domestic animals shall be restricted to cattle brought into the Commonwealth from any point without its limits, and to all cattle held in quarantine at Brighton, Watertown, and Somerville: *Provided, however*, That tuberculin may be used as such diagnostic agent on any animal or animals in any other portion of the State upon the consent in writing of the owner or person in possession thereof, and upon any animals condemned as tuberculous upon physical examination by a competent veterinarian."

Michigan? Mr. Smith. No specific legislation this year. The matter rests in the hands of a stock sanitary commission who have power both of quarantine and sale or use of tuberculin.

Minnesota? Mr. Hays. We have no special law. We have a State board of health who deal with these matters in a general way. In the station we have been experimenting on some cattle that were suspected of being affected with tuberculosis; we condemned about 25 head out of 75. The director estimated that there were 8, 9, or 10 head that really responded to the test, and he has been treating them with tuberculin during the year. Whenever one has quit responding it has been killed. Whether we will be able to do it in a larger way or not I do not know yet; it takes considerable money. He has tested a good many horses and found tuberculosis; in some of them a good deal of it; in others none at all. One herd of shorthorn cattle had a number of infected animals, and a number of these have been offered to the station to work with. Of course, that gift may be on the other side. I do not know just what provisions our State board of health have made for taking hold of the matter.

Missouri? Mr. Jesse. Missouri has a State veterinary service, the object of which is the suppression of all epidemic and contagious diseases. By act of the legislature the State veterinarian can slaughter animals suspected of disease, and with the aid of the governor the State can proclaim a quarantine. Any citizen of the State can call for inspection of animals at any time. There has been no special legislation on this subject of tuberculosis.

New Hampshire? Mr. Murkland. The bill passed both houses of the legislature appropriating $100,000 for two years to establish a commission for the purpose of stamping out this disease; but in the concluding days of the session this bill was vetoed by the governor, so that the matter stands now as it did a year ago, there being a cattle commission having full power to investigate and to destroy animals and being authorized to pay one-half the value computed for the animal in a healthy state, and to expend not more than $20,000 in one year. That seems to comprise the state of affairs as they are in the legislation of our State. In our station herd we had two examinations during the year, and found out of about 60 cattle 9 diseased. The second examination disclosed that those passed by the first examination were undoubtedly affected. Every animal killed as a consequence of the reaction of the tuberculin test was found to be infected with the disease. We have not found any evidence that the milk from cattle undoubtedly diseased is necessarily dangerous to man.

New Jersey? Mr. Voorhees. The law passed last winter simply allows the commission to employ a secretary, the necessity for whose employment is to be determined by a committee consisting of the governor, comptroller, and president of the State board of agriculture, who is, by virtue of that office, chairman of the tuberculosis commission. The law in other respects is the same as reported last year. Much good work has been done during the past year and is now being continued.

New Mexico? Mr. McCrea. The recent session of the legislative assembly empowered the cattle sanitary commission of New Mexico to quarantine against tuberculosis. I think the information came to me shortly before coming to this meeting that some animals had been destroyed in the northern part of the Territory on account of being affected with tuberculosis. I am not positive that this is a fact; I think I have such information.

I would like to add something further that I have since learned from New Mexico, if I may be permitted to do so. The matter had come to my attention about the killing of some cattle in the northern part of the Territory. We have no veterinarian in our Territory, either for the Territory or for our station, and this case was attended to by the State veterinarian of Colorado.

New York? Mr. Atkinson. I understood when leaving Ithaca that Professor Roberts would forward a report to the executive committee. There is a law upon the subject.

North Carolina? Not represented here.

North Dakota? Mr. Bolley. North Dakota has a veterinary board, consisting of three district veterinarians and the State veterinarian. They have, as I understand, a general supervision, with power of quarantine, of what they consider contagious diseases, and do not need to have any special power or instruction to authorize them to act in cases of tuberculosis. We have had some cases of tuberculosis among the horses in the Northwestern States, but the horses in other States have shown a much higher percentage of cases than among those of our own State. The farmers in North Dakota seem very much alive to the work, and allow their animals to be killed in order to check the spread of this disease.

Oregon? Mr. French. There is a very effective law in the State of Oregon controlling the disease of tuberculosis and other contagious diseases. The State veterinarian is empowered to destroy all infected animals, and I believe the law provides that the person losing such animals will be recompensed to the amount of the value per head and perhaps the cost of killing the animals. The city of Portland alone has paid out within a few years past for infected animals slaughtered about $50,000. Since that time there has been an outbreak among Shorthorns; during the past year there have been two or three outbreaks in isolated parts of the State, but not extensive. The State veterinarian is using the tuberculin test, and he says that in every case where he has had a reaction he has slaughtered the animal infected.

Pennsylvania? Mr. Armsby. There has been no legislation in Pennsylvania directly aimed at tuberculosis. All existing laws have been somewhat modified to enable the authorities to deal with contagious diseases. The chief addition, however, has been made in the matter of organization. The last legislature provided for the organization of a department of agriculture, under a secretary of agriculture, who has an office in this State; a live-stock sanitary board was established, composed of the secretary of state, the secretary of agriculture, and the State veterinarian. This board has full power to inspect and quarantine animals and to kill when they find any infected animals. The board has practically an unlimited appropriation for this purpose, the bills for animals killed being paid after the approval of the governor and secretary of agriculture.

Rhode Island? Mr. Flagg. Previous to 1892 the provision of the law relating to contagious diseases vested the control of this matter in the State board of health, but since then it has been turned over to the State board of agriculture, with an appropriation of $15,000. Here is a brief review of the work:

The board has power to appoint a veterinarian, and its work is carried out by appointing a cattle commissioner in each county and an appraiser at large. For cattle that are killed, if found diseased, one-half the appraised value is paid; if the animal is found healthy, the full value is paid, and a limit of $50 is placed upon any ordinary or grade animal and $100 upon any pure bred animal; and the animal must have been owned at least six months in the State before the owner can get any appraisement. In 1892 there were 237 animals killed; in 1893, 261; in 1894, 401; and up to May 1, 1895, there were 193 killed, making a total of 1,092 animals killed from

June, 1892, up to the 1st of May, 1895; and in June, 1895, 37 were killed. Of these 401 head killed in 1894, 363 were cows, 5 oxen, 6 bulls, 2 sheep, 25 hogs. In 1895, to June 1, 230 animals were killed under this board's direction, and 121 in 1894, I think it was. The board is given authority to seize carcasses of affected animals in the slaughterhouses and condemn them, paying the full appraisal value the same as though the animals were killed by the board, and quite a large number of animals have been so seized and condemned. The legislation this year has been in the shape of an additional appropriation, the appropriation having been increased from $15,000 to $25,000.

Texas? Mr. Connell. We have no special law, but we have a State live-stock commission, which is believed to be sufficient for all purposes.

Utah? Mr. Mills. There has been no special legislation. We have a law which provides for the regulation of contagious diseases, but it has never been enforced. There is no officer or organization with authority to enforce its provisions. The only tuberculosis we have known in the Territory has been out around the station, and, with one exception, has been confined to imported cattle.

Vermont? Mr. Hills. The legislature of last year gave us a law which had no limit whatever as to the amount which should be expended. It gave one-half of a disinterested limited appraisal of $40, the full appraisal, to the owner of the animal killed in case it was found to be infected with disease, and the carcass and the full appraisal in case the disease was not found. The law is enforced by the board of agriculture in the State, who have employed several assistants in connection with the tuberculin tests, and the State veterinarian. There have been about 3,700 injections thus far. The law also gives quarantine privileges to all animals coming into the State. The tuberculin-test provision of the law has been executed, and the farmers, without exception, help the commission, and when I left home there was two or three months' work ahead, all of which was at the request of the farmers.

Virginia? Mr. Goodell. Virginia has no law for the control of any contagious or infectious disease.

Washington? Mr. Bryan. The last legislature enacted a law by which the professor of agricultural science was made State veterinarian. He was empowered to slaughter any animal affected with tuberculosis or other contagious or infectious disease.

West Virginia? Mr. Myers. No recent legislation.

Wyoming? Mr. Johnson. No special legislation on the subject of tuberculosis; general quarantine regulations. The application of these quarantine laws is under the control of the State veterinarian.

Mr. Comstock. I ask unanimous consent to address the convention a second time upon this topic.

Consent given.

Mr. Comstock. I stated that we have no veterinarian. There is a Territorial veterinarian and a live-stock sanitary commission, which have all the powers under the law. The last legislature passed a law upon this subject.

The Chairman. The consideration of the subject is now closed. The Chair will announce the committee on nominations as follows: Messrs. J. A. Myers, Alston Ellis, Austin Scott, E. W. Hilgard, R. J. Redding, J. L. Hills, and T. L. Haecker.

The next item on the programme commanding attention at this hour is "Development and Modifications of the Mouth Parts of Insects," by Prof. J. B. Smith.

(Professor Smith then gave his lecture upon the "Development and Modifications of the Mouth Parts of Insects," illustrated with stereopticon pictures.)

Upon motion, the convention adjourned at 9.50 p. m.

Morning Session, Thursday, July 18, 1895.

Session convened in "ordinary" of Brown Palace Hotel at 9.30 a. m., President Henry E. Alvord presiding.

The Chairman. As this is a business meeting, we are ready for committee reports, action on resolutions, business of sections, and other special topics that are to be assigned.

Mr. Wells. I would move the appointment by the chairman of a committee of three for the acknowledgment of courtesies received by this Association during this meeting.

Adopted.

The Chairman named Messrs. Wells, MacLean, and Anderson.

The CHAIRMAN. Are there any resolutions to be offered for reference to the executive committee? Any business from the sections?

Mr. CONNELL. I desire to offer the following resolution:

Resolved, That a standing committee be appointed from the Section on College Work, whose duty it shall be to report to that section annually the best methods used in the various colleges of the world for teaching the practical and scientific facts relating to agriculture.

The CHAIRMAN. Reports from committees are now in order.

Mr. SCHWEITZER. Your committee to which was referred the duty of drafting resolutions upon the death of Dr. Porter begs leave to report as follows:

Resolved, That we deplore in the death of Dr. E. D. Porter, which occurred after an illness of a few months on January 5 of the present year, at his home in Columbia, Mo., the loss of an active and enlightened member of the Association, whose knowledge and wisdom, joined to great kindliness of heart and indomitable energy, will long live in our memory.

His investigations for the advancement of agriculture are laid down in numerous bulletins; his work as a teacher lives in the hearts of men and women engaged in the successful pursuit of their vocation, and at least two States bear, in the organization of their agricultural colleges, evidence of his work as an efficient and able organizer.

We shall miss him from our councils, and the Association is distinctly made poorer by his death.

P. SCHWEITZER.
A. N. RAUB.
W. M. HAYS.

Adopted.

Mr. WHITE. The committee, to which was referred the president's address, begs leave to report for consideration of the Association the following resolution:

Resolved, (1) That a special committee of three, of which the retiring president shall be chairman, be appointed to codify the resolutions and declarations of previous meetings of this Association concerning uniformity in action on the part of the colleges and stations in matters of common interest, said committee to report at the next annual convention of the Association.

(2) That the executive committee be requested to prepare a circular letter embodying such extracts from the president's address as may be proper to set forth succinctly the objects and utility of this Association, and to forward the same to such colleges and stations as may not now be members of this Association, with a view to securing active membership in the Association of every college and station eligible thereto.

(3) That the executive committee be requested to take into consideration the advisability of assigning a place on the programme of the next annual convention for the discussion of the matters of station bulletins and the participation of the stations and colleges in farmers' institutes, agricultural exhibitions, etc.

(4) That the executive committee be instructed to continue the effort to secure the establishment of an office of land-grant colleges in the Bureau of Education, Department of Interior, on the line recommended by this Association at the eighth annual convention and approved by the honorable Secretary of Interior, it being the opinion of this Association that the provision made for this purpose by the last Congress is inadequate for such an office as was contemplated in the recommendation of this Association to the Secretary of Interior.

(5) That this Association emphasizes the importance of so administering and accounting for the "Hatch" fund as to preclude any charge that it is being diverted from its sole legitimate objects, viz, agricultural experimentation and research, and the dissemination of the results thereof; and to that end heartily indorses, and reaffirms such portions of the report of the committee of this Association, of date October 19, 1887, as refer to this subject.

The committee further recommends that the following resolutions be printed and lie on the table for one year:

(1) That this Association cordially approves and indorses the sentiments expressed by the president in his address, as follows: "It is certain that Congress never intended by land grants or annuities to relieve any State or Territory from the duty of providing its own high schools and grammar schools. * * * The legality of applying the so-called 'Morrill funds' to the support of preparatory departments * * * is to be doubted in any case. In a few exceptional instances the circumstances may justify a land-grant college in making temporary provision for preparing students for its college classes, but the expense of such work should certainly be met from

other funds as soon as possible, and the responsibility of public-school service of all grades thrown upon local authorities. The institutions in affiliation with this Association should in all respects be colleges in fact as well as in name."

(2) That it is the opinion of this Association that the efficiency and success of station work will be most effectually secured and the business affairs of the stations most efficiently conducted by the organization of each station with a single executive head, responsible to the governing board of the institution and representing the station in its relations to the public and to the Department of Agriculture.

The committee, as instructed, has also had under consideration the valuable paper of Director True, of the Office of Experiment Stations, and reports by resolution as follows:

Resolved, That the Association heartily indorses the suggestions contained in the address of Director True upon "Permanent Elements in Experiment Station Work," and that in particular it regards reasonable permanence in the tenure of office of the governing body and the station officers, and the preparation and careful preservation of full, systematic, and accurate records, as essential elements of successful station work.

H. C. White,
C. O. Flagg,
E. A. Bryan,
H. P. Armsby,
P. Schweitzer,
Committee.

Mr. White. I am directed by the committee, Mr. Chairman, to move the adoption of the resolutions.

After prolonged discussion the report of the committee, as presented above, was adopted.

Mr. Wheeler. Mr. Chairman, I have a resolution which I desire to introduce:

Resolved, That it is the sense of this Association that a great saving in the time required for the education of the people of the country might be made, and that the business of the country would be facilitated by the early adoption of the metric system as the only legal standard of weights and measures for the United States; and furthermore, that the country is now as well situated as it probably ever will be for the adoption of this system.

The Chairman. The resolution introduced by Mr. Wheeler is referred to the executive committee, under the rules on the order of business.

Mr. MacLean. I wish to offer the following resolution:

Resolved, That the convention request the executive committee to accept the cordial invitation extended by President Cyrus Northrop of the University of Minnesota, to hold the next annual convention of the Association at Minneapolis.

The Chairman. I understand the motion is offered for reference. The motion is accepted and referred to the executive committee.

Mr. Myers. Your committee, appointed to nominate officers of the Association for the ensuing year, have the honor to present the following recommendations:

For president—S. W. Johnson, of Connecticut.

For vice-presidents—(1) Cyrus Northrop, of Minnesota; (2) J. H. Connell, of Texas; (3) S. W. Robinson, of Ohio; (4) E. A. Bryan, of Washington; (5) R. H. Jesse, of Missouri.

For secretary and treasurer—J. H. Washburn, of Rhode Island.

For executive committee—H. H. Goodell, of Massachusetts; Alston Ellis, of Colorado; H. C. White, of Georgia; E. B. Voorhees, of New Jersey, and the ex officio members provided for by the constitution: H. E. Alvord, of Washington, D. C., the retiring president; S. W. Johnson, of Connecticut, the incoming president, and J. H. Washburn, of Rhode Island, secretary and treasurer.

For bibliographer—A. C. True, of Washington, D. C.

Respectfully submitted.

John A. Myers,
Alston Ellis,
Austin Scott,
E. W. Hilgard,
R. J. Redding,
Joseph L. Hills,
T. M. Haecker,
Committee.

The report was accepted and adopted, and by ballot the officers nominated were elected.

Mr. PATTERSON. If reports from sections are now in order, I will report the following nominations of officers for the Section on Mechanic Arts for the ensuing year: Chairman, J. W. Lawrence; vice-chairman, S. Fortier; secretary, F. P. Anderson.

The CHAIRMAN. It is moved and seconded that the report of the committee on nominations for officers of the Section on Mechanic Arts be confirmed.

Nominations confirmed.

Mr. Gillette presented the following report of officers nominated for the ensuing year in the Section on Entomology: Chairman, Otto Lugger; secretary, G. C. Davis.

Nominations confirmed.

Mr. Voorhees, chairman of the Section on Agriculture and Chemistry, reported the following nominations for officers of the section for the ensuing year: Chairman, C. C. Georgeson; vice-chairman, C. F. Curtiss; secretary, H. J. Patterson.

Elected.

Mr. GEORGESON. Your committee, to which was referred the matter of recommending a convenient factor for expressing butter-fat records in approximate equivalent of butter, begs leave to report as follows:

The ninety-day Columbian dairy test is the most elaborate and carefully conducted on record. In this test 96.67 per cent of the fat in the whole milk was saved in the butter. This butter on the average contained 82.37 per cent of butter fat; in other words, 117.3 pounds of butter were made from each 100 pounds of butter fat in the whole milk. The exact conversion factor would therefore be 1.173. As this is an awkward number to use, and as $1\frac{1}{6}$ is so nearly the same (the difference in computing the record of a 14-pound cow for a week by these two factors being only 0.07 of a pound of butter), it has seemed best to recommend that the latter be used as the conversion factor, and we further recommend that this section recommends to the Association the adoption of the following resolution:

"*Resolved*, That this Association recommends to the several stations that the results of tests of dairy cows or herds be expressed in terms of butter fat, and that when desirable to express these records in terms of approximate equivalent in butter that such equivalent be computed by multiplying the amount of butter fat by $1\frac{1}{6}$."

On motion of Mr. Hilgard the resolution was adopted.

The CHAIRMAN. We now proceed to the order of business as printed, being a consideration of the subject named in the programme: "Uniformity of Nomenclature in Station Publications." The discussion of this topic will be opened by Mr. Armsby.

Mr. ARMSBY. I desire to say that the subject is one that was called to my attention by the chairman of the advisory committee of our station. There is considerable diversity in the nomenclature of station bulletins. They employ various synonyms which are perfectly justifiable, but which are liable to produce difficulty. This gentleman who brought the matter to my attention says himself, "Let me assert it that I found considerable difficulty in ascertaining just what certain stations meant by certain terms." Now, it is obvious that the convention can not at this time take any definite action upon such a question as this. I suggested to the chairman of the executive committee to place it upon the programme, simply looking toward greater uniformity in this particular.

Mr. HILGARD. Do I understand that the object of this arrangement is the adoption of particular terms or a form of printing?

Mr. ARMSBY. For the use of terms or a system of terminology.

Mr. HILGARD. I move that a special committee be appointed, to report a year hence on the subject named.

Adopted.

The CHAIRMAN. The motion prevails; the committee will be named later. The next subject on the programme is, "How Shall We Teach Horticulture," by W. R. Lazenby.

HOW SHALL WE TEACH HORTICULTURE?

I presume we will all agree that particular subjects or special types of studies require special treatment. Language may be taught by one method, botany by another, chemistry by another, engineering by still another. While the methods of instruction in these and other subjects are somewhat varied, there is one general plan which the opinion of the competent or universal experience has pronounced best for each. So there may and should be one best way to teach horticulture.

In solving a problem in geometry or calculus the conditions are ever the same. In horticulture this is not so. The matertials he horticulturist works with are living things and the conditions affecting his work are constantly changing. You can tell a student how to measure and lay off a piece of land, how to build a bridge, or how to make a dynamo. If he correctly follows correct instructions he reaches definite and correct results. But horticulture can not be taught in the same way, because there is nothing exact; there are no permanent conditions. No one can tell why of two equal areas of soil of the same chemical composition and apparently of the same mechanical structure, one will yield a generous and the other a scanty harvest. We can not tell why of two fruit trees of the same variety, receiving the same treatment, one is barren and the other is fruitful.

One fundamental difficulty in teaching horticulture is because of this variation and uncertainty. No strictly practical question in this art seems capable of exact solution.

Another difficulty is the fact that we have little experience to guide us. There were no teachers of horticulture in past generations. Like pioneers, we must adapt ourselves to the situation and develop methods of our own. As beginners I fear we have too often fallen into the mistake of trying to teach horticulture under the guise of the various sciences closely related thereto. However close the relationship, and however necessary as a preparation, these sciences are not horticulture. All the science in the world, while it might powerfully help, could not of itself cause any young man or woman to become a skillful fruit culturist, florist, nurseryman, or landscape gardener.

Horticulture is an art and must be taught as an art. It can only be mastered by training and practice. If we are teachers of horticulture, we ought to teach the art of horticulture.

Botany and chemistry may teach much regarding the growth and feeding of plants, but they do not teach how to select varieties, propagate, transplant, cultivate, fertilize, prune, or, what is often still more essential, how to harvest and market the product to the best advantage.

Horticulture may be compared to a wheel in which the hub or foundation of the structure may represent an ordinary English or common school education. The spokes radiating from the hub may represent the various sciences, geology, chemistry, botany, physics, physiology, entomology, meteorology, political economy, etc. But a wheel consisting of hub and spokes alone is not a very useful structure. It needs the felly and tire, and these may represent technical training by the scientific method.

In teaching horticulture, therefore, it should always be considered an art whose true substantial base is science.

But the question before us is, How shall we teach this art?

The problem, stated briefly and in a very general way, is this: Given a class of from six to twenty students, varying from 16 to 30 years of age, who are to receive instruction from two to six hours a week for from one to six or eight college terms, to find the best possible division and methods of work for the following ends: (1) Technical training; (2) acquisition of knowledge; (3) intellectual culture.

The main factors which enter into this problem are (1) that the students possess very unequal ability and attainments, especially in a knowledge of the elementary principles of the sciences; (2) that some can remain only part of a year, others one year, others two, while a small percentage will complete the course; (3) that the students require instruction and training adapted to their ability and needs each successive term, thus permitting progress; (4) that the equipment and facilities for thorough technical training are usually scanty and wholly inadequate for the work to be done.

It is also to be kept in mind that in a course, department, or school of horticulture the question involves the best possible training and instruction, not in the art of horticulture alone, but in those other branches which are essential to a well-rounded education.

In the Ohio State University, of which I have the honor to be a representative, instruction in horticulture is required in three distinct courses of study, viz, in the four years' course in horticulture and forestry, the four years' course in agriculture, and in the two years' course in agriculture. There are six distinct courses of instruction offered, as follows: (1) What is termed "The elements of horticulture;" (2) vegetable gardening, including the winter forcing house; (3) small fruit culture and the nursery; (4) pomology and viticulture; (5) arboriculture and forestry; (6) floriculture and landscape gardening.

The work in the elements of horticulture is almost wholly practical and is done in the laboratory, greenhouse, and gardens. It consists, for example, of such subjects as the mechanical examination and testing of seeds; propagation by seeds; trans planting, irrigating, pruning, budding, grafting, cross fertilization, judging vegetables and fruits, and similar topics.

The more important basal or fundamental operations in horticulture, like those named above, are selected because their successful performance requires technical skill and a knowledge of the elementary principles of science. The skill is acquired by practice, and the necessary scientific knowledge has already been gained, for before entering upon this course the student is expected to be well prepared in agricultural chemistry, botany, geology, and physics.

The practical work of this course is supplemented by one or more lectures a week on some more general topics. The following are illustrations of some of the subjects treated: "A historical sketch of horticulture;" "Different divisions of the art;" "Its relation to science;" "The advantages of horticulture as a profession;" "Location for horticultural work;" "The great horticultural States of the Union;" "Horticultural organizations;" "Some of the successful horticulturists of the United States." It will be seen that these lectures have no direct reference to the special technical work in hand. Their object is to convey knowledge and to inspire a respect and enthusiasm for the art. They give the student a broader, truer conception of the real meaning and mission of horticulture, and show him that he is entering upon the study of a grand, useful, and ennobling industry.

Another feature of the work of this course which was introduced last spring is the keeping by each student of a daily journal, in which is briefly recorded the more important operations and incidents of each day's occurrence in the department. In these journals notes were made regarding the weather, the date of planting, cultivating, and harvesting the principal crops; the time of blooming of the garden and orchard fruits; the appearance of weeds, insects, and birds; the amount of product sold and prices received, etc. These daily calendars or record books were examined every Monday, and suggestions for making them more complete and useful were given from time to time. This keeping of a daily journal was a signal success, and I believe its value can scarcely be overestimated. It developed the faculty of observation and elicited an interest in the various divisions of the department that was an equal pleasure and inspiration.

This course in elementary horticulture which I have briefly outlined may not be the wisest or the best. I believe, however, that it has some good features and is fairly well adapted to the conditions existing at our State university. While it is more or less complete and self-contained, and is thus adapted to those who can spend only a year or less in the study of horticulture, it forms an excellent preparation for the courses which succeed it.

The special points I would urge in its favor are, (1) that it is a flexible course of study, and (2) that it serves the three distinct ends of education, viz, technical training, acquisition of knowledge, and mental discipline.

I will not weary your patience by discussing the methods of instruction in the succeeding courses. In these the number of students is smaller, and thus far the plan of individual instruction has been largely followed.

It may be thought by some that the demand for horticultural education and training is not sufficient to give it an extended place in the curriculum of our land-grant colleges. It should be remembered that while horticulture is one of the youngest, it is one of the most rapidly developing arts in this country. The fruit interests alone of States like California, New York, Ohio, Michigan, and others are great and constantly growing.

The forcing of winter vegetables and the cultivation of finer products of the garden are rapidly extending and are becoming more and more profitable. Commercial floriculture is developing with marvelous rapidity and bids fair to soon become one of the most important branches of horticulture. According to the census of 1890 the annual product from this business is over $26,000,000. The Society of American Florists, one of the strongest distinctively horticultural organizations in this country, has for years persistently urged the importance, the necessity, of a school or department of floriculture. It is doubtful if there is any industry of equal extent and usefulness so entirely wanting in opportunity for advanced study and scientific training. With the exception of the Shaw Botanic Garden—and there the number of students is limited to six or eight—I know of no place where the practical florist can turn for guidance and instruction. I have received letters the past year that testify that young men and young women are looking toward floriculture as a vocation which offers many and signal advantages. It is an industry especially adapted to women, and several thousands are already engaged in it. We should also realize that a general home interest in flowers and ornamental gardening is rapidly developing.

It will thus be seen that broad and liberal horticultural instruction embraces many different divisions, and our departments of horticulture should be prepared to meet the growing demands.

One very essential feature in the way of needful preparation is a better material equipment. It is possible that this department in a few highly favored institutions like Cornell, the University of Wisconsin, the Agricultural College of Michigan, and perhaps one or two others, have all that could reasonably be expected or even wisely desired. But I am quite sure this is not the situation in many other land-grant colleges. Some, I am pleased to say, have fairly good facilities for teaching and illustrating pomology, small-fruit culture, and vegetable gardening. But how many have well-equipped divisions in floriculture, landscape gardening, or forestry? Without the proper equipment but little can be done along these lines, yet their importance can scarcely be overrated.

Although the opportunities for studying horticulture in its various branches are better than ever before, the appropriations for the use of these departments in our various colleges have been, as a rule, wholly inadequate for anything like good equipment and broad, progressive work.

Under reasonably good management a college or university advances and prospers just about in proportion to the means at its disposal. Its progress depends mainly upon the capital it can command. If this be true of the college or university as a whole, it is no less true of each particular department.

If one department has two or three times the means at its command that another has it ought to advance or develop twice or thrice as fast. While it may require more to equip one department than to equip with equal completeness another, there is less difference than may appear at first sight. The actual difference in requirements in the different technical departments is comparatively slight.

The amount of capital necessary to thoroughly equip and conduct a well-appointed department of horticulture is just about the same as that necessary to equip the agricultural department or the department of mechanic arts.

It has been asserted that we do not need this expensive equipment and enlarged facilities until we have the students. But the fact is we shall never have the students until we have the facilities. How many dairy students did we have in the various colleges until thousands of dollars were spent in thoroughly equipping and furnishing our dairy departments?

I do not understand that there is now any lack of students in our dairy schools where they are amply and generously supplied with facilities for instruction.

So it will be in horticulture. Given a properly equipped department or school and the students will be on hand. I urge upon the trustees and presidents of our different State colleges or universities, and especially upon those connected with horticultural departments, to demand large things for horticulture. We have a right to so demand. Education by the State is something more than a business enterprise or mere commercial speculation. True education is based upon philanthropy. It is the duty of the State to provide and extend it; to furnish the education adapted to the needs of our citizens, be the demand great or small. The cultivators of the soil outnumber all other classes of our population. Never before in the history of our country have so many small holdings of land been used to such advantage. In these times of business depression, many are anxiously seeking for instruction in the various branches of horticulture. Institutions founded for the special purpose of providing the industrial classes a liberal and practical education in the various pursuits and professions of life ought not to neglect those which engage so large a number of our citizens. It is true that many who desire this education can not come to our colleges and universities. Fortunately, the whole tendency of modern educational methods is toward bringing the results of education and training before the whole people.

Our mission as teachers of horticulture is first to teach those who come and join our classes, and second to give as much instruction as possible away from the college, choosing those places where special needs exist. What do the people of my State most need to know in the way of horticultural instruction is a question we should keep constantly before us. We can and ought to do some good missionary work at our farmers' institutes through our State and county horticultural societies and university extension methods. I believe that no class of our population is giving more earnest, original thought to the different economic problems connected with the successful cultivation of the soil than are the horticulturists of our country. I am certain that no class is more eager to receive the instruction and inspiration of science.

Permit me to call attention to a new line of work inaugurated and put in operation the present season by the horticultural department of the Ohio State University. It is the judging of samples of standard and new varieties of fruit, flowers, and the finer products of the vegetable garden. Just a bare beginning has been made in this work, but it promises to become a useful feature of the department. Briefly outlined, the plan is this: Professional and amateur growers of fruit, flowers, and vegetables are invited to send samples of the same to the university, where they are carefully examined and judged. By this means we expect to be able to learn what sections of the State produce horticultural products of the finest type and who are the most skillful growers. It will give our students an opportunity to become acquainted with different varieties and with the effects produced by variations in soil, climate, exposure, and different methods of culture upon the same variety. It will tend to stimulate the selection of better varieties and the production of finer specimens. Above all, it will keep those interested in horticulture in touch with the university. If the work of judging should become too burdensome, it can easily be restricted to certain classes of products.

Although, as already said, this is a new feature, I believe it will prove of great value to the horticultural interests of our State.

I close this suggestive rather than exhaustive paper with the avowal of a joyful trust that the future of American horticulture will evince rapid and marked improvement over its past, and that the earnest, intelligent efforts of the workers in our agricultural colleges and experiment stations will impel it toward a perfection such as we have scarcely dared to dream. If those of us who love the art will intelligently resolve that we will do our share in its advancement, it will not be long until we have a horticulture that is worthy of our country and worthy of the age in which we live.

The CHAIRMAN. Before proceeding with any discussion of this paper it may be desirable to state that the Section on Mechanic Arts asks to have its time assigned to this programme postponed until this afternoon, and at that point upon the programme we will have presented the paper of Mr. Hilgard, on "The Distribution of Salts in Alkali Soils."

Mr. BRYAN. I merely want to ask Mr. Lazenby of what the equipment of a horticultural station should consist?

Mr. LAZENBY. They should have an equipment of a greenhouse, and I think also a laboratory where work can be carried on irrespective of the weather.

Mr. GOFF. In my own work, in giving instruction in horticulture, I have found some difficulties. We have one class made up of students belonging to our four years' college course. These students come to us at the end of the second year; they have had some considerable training in natural science; with them it is a comparatively easy matter to give profitable and interesting work in horticulture. But we have another class, which in our institution predominates, that is made up of boys who come to us from the farm and from the district school. They have had no higher training than such as can be had in the district school. They know nothing of botany; they are not accustomed to assimilating lectures; they are not accustomed to taking notes; they are not accustomed even to pursuing abstract thoughts, and it is with this class that I have been compelled to exercise my ingenuity. My first attempt was by lectures, but I found that this was not a marked success; for a time they were interested; later some of them seemed to become drowsy. While I tried to make my matter as elementary as I could, I found that I was failing to reach a part of them. I go on the assumption that inasmuch as the young student is without the knowledge of botany, without much knowledge of physics or chemistry, I can do more for such a student by beginning and teaching him a few elementary principles of science and then helping him to apply those principles to practical work than by beginning at the other end and pounding in a lot of desultory facts; and I find, also, that it is much easier to interest this class of students with their hands than it is with their ears, and this led us to found a department which we call "Horticultural laboratory work."

Now, I have said that I begin by stating a few of the principles that underlie the science of horticulture. I am careful first not to state those principles in a forcible manner. To illustrate what I say specifically, I want to teach a student in regard to the germination of seeds; I first state this principle, that seeds in order to germinate must have oxygen, but the real emphasis of this principle is given through a little experiment which I have each student perform for himself in the laboratory. I have attempted different methods in demonstrating this principle, but the one which I find the most useful is this: I give each student two flowerpot saucers; these saucers I first wet; then I give each student a small quantity of our loamy clay soil; I also give each student a small quantity of sand and a few seeds, and each student has a place at the laboratory table. Now, I instruct the student to take a small quantity of this wet soil and flatten out a quantity of it and place it over the bottom of his flowerpot saucer. I next instruct him to put on, say, twenty navy beans upon this moistened soil and place over the seeds another layer and carefully press the soil down about the beans. Then I have him treat the other saucer in the same way, using sand instead of loam. These we put in a greenhouse in a place where the air is moist and leave until the next day or the second day. Then I have the student examine this little experiment; he finds out, very often to his surprise, that the beans between the puddled loam have not germinated, while the others have germinated nicely. I find that it excites a good deal of interest on the part of the students, and various reasons are offered, but soon the right one is generally hit upon, and then we have the principle established in a way which will never be forgotten, that a seed if planted in a way that the air can not have access to it, will not germinate.

Now, I say to the students, "If you have some beans to plant in your garden, will you plant them at a time when the soil is very wet, or only moderately wet?" Then I ask them, "If it were necessary to plant when the soil is very wet, would you pack it down, or would you put it on lightly?" They are able to answer this question from their thought; they understand it now, and they understand the reason. I carry this system from the teaching of a first term just as far as possible; we do not, of course, confine it to seeds, but to the development of roots, etc. Then, there is another question of laboratory instruction that is different from this. This one, you see, is intended to demonstrate the principles; the other is intended to instruct in the art of certain processes in horticulture in which skill is necessary in addition to knowledge. For instance, in the manufacture of root grafts: First we show them the model of a graft, and explain it to them; let them handle it, and have them observe carefully the manner in which the cuts are made. After they have thoroughly examined it, then we give them the tools and grafting knife, the scions, and the seedlings, and, first, with very careful instruction, have each student make a few grafts; after that, as an inducement to practice the work, we furnish them the materials and allow them to graft a certain quantity on shares. We give them a certain percentage for their work, simply to interest them in it; and it is a matter of pleasure to us to receive letters from our students, telling us how much they have grafted, and the profit they have made out of it. We are constantly finding that we are needing more apparatus. Most of this apparatus is not of an expensive kind. With the exception of our magnifying glasses, which, perhaps, are our most expensive minor apparatus, it consists of such things as flowerpot saucers, flower cups, a little pair of accurate scales, and things of that kind, which will enable the students to do their work. In our winters in Wisconsin the ground is frozen from early in December very often until the 1st of April. In order that our students may be taught something of the practice of horticulture in the open ground, we have provided a plat expressly for this purpose. There we give our students instruction in making hotbeds, the planting of root grasses, the hilling up and protection of shrubs, etc. We are finding these houses very useful indeed in our sectional work.

Mr. Card. Previous to this year we had not made much progress in horticulture, especially in the line of laboratory work; this comes from the fact that our laboratory was not open and fully equipped. Of course we can supplement that to a certain extent with greenhouse work. We find this especially so in our own case, because we have one regular course in greenhouse work, and those students are well able to handle the greenhouse work. Of course students who enter in the middle of the year can not take the same interest in it. In my own work this year I have tried to provide for irregular laboratory work. In another line of work I have found what may be termed seminary work of advantage and tried it during a term; the next term we combined that with laboratory work. The difficulties must be overcome at every one of those periods; if there is work at the farm, we take them there and go through with that work; otherwise we have to do this seminary work, and instead of spending time in experimenting, the students are given a topic and turned loose among the books of the library to hunt up and rummage through the literature relating to it. Now, while that is the most satisfactory method of getting students, it is not the most satisfactory way to educate students. It has worked admirably along the line of forestry this year. I usually recommend a slip system to the student for keeping his notes, so that they are arranged alphabetically. Now we are, in our work, coming to the plan of garden herbariums, not only in the matter of teaching, but in experimental work; we know that most of our students are unfamiliar with many varieties of plants and know nothing about them, and if we have these specimens to show them it is a great help. The camera and the darkroom are the next necessary equipment of a horticulturist's office; as a recorder of results to place before our class, they do a work which instruction can not do. The less instructing we can give the better. Give experiments. For instance, one topic was the treating of the poison of plants; another of evaporation beds. One was mulched, one was left untouched, packing without stirring; but though these were not accurate experiments, they were useful to the students in that they were getting information from it all the time. The greatest trouble comes, of course, from the younger students, those who have had no training. In my own case at least the horticulturist is not capable of teaching plant physiology. We give next year a course of plant physiology adapted to horticulture. That will only be given to those who have had botany.

Mr. Rane. There is no system at the present time upon which we can all unite in teaching horticulture. Every one has his own ideas in teaching. It seems to me that, in the first place, we should in every instance base our horticultural teaching upon botany. But I find one great trouble is that the students are never prepared for taking up horticulture; they have never had sufficient training in botany to take up the horticultural work. It seems to me that the botanists might develop some system of teaching botany better adapted to preparing students for a course in horticulture. Now, this work that Professor Goff speaks of could be done to a great extent in our country schools. We have, especially in our agricultural colleges, men not prepared to take horticulture. In our institution Dr. Myers, who is director of the station, is glad to have me bring horticulture men into the station; therefore we turn our station work into the laboratory for their instruction, and many of the young men are receiving training every day during the year in taking up work along this line. I think this is one way in which we can take up the horticultural work—along the line of laboratory work in experimental work. As for the two classes of men, we must have, if we continue to seek students, those who take the four years' college course, and those who take the short course Professor Goff speaks about, and I think this laboratory work should be arranged for, either in preparatory years or should be begun before they are thrown into the general college courses. If they take up this sort of investigation or laboratory work, they should take up some additional work—some sort of scientific herbarium work. We must begin with some kind of system.

The CHAIRMAN. The next topic on our programme is the paper of Professor Hilgard, on "The Distribution of Salts in Alkali Soils."

THE DISTRIBUTION OF SALTS IN ALKALI SOILS.

As time progresses the importance of the alkali question—i. e., dealing successfully with the cultivation of lands more or less largely impregnated with soluble mineral salts—becomes more and more obvious. It is to be greatly regretted that the mistaken efforts of landowners to suppress or at least to ignore this matter, for fear of injuring the selling value of their lands, interpose additional difficulties in dealing with an intrinsically sufficiently difficult problem. In view of this circumstance we bear patiently the disappointment we have undergone in finding that, unexpectedly, one of our geographically most important culture experiment stations is located upon ground subject to all the difficulties inherent in the cultivation of alkali land; we are thus enabled to study the problem independently of any private interests.

The culture experiment station near the town of Tulare, originally intended to represent the upper San Joaquin Valley, has thus instead become the station for the study of the alkali problem in all its phases, from the mildest to the worst. Until this problem is solved, no certain conclusions for the region at large can be drawn from the cultural results observed there, since we know that all the vegetation on the station grounds is under more or less stress from the alkali in the soil. If, however, we shall be successful in overcoming this influence—as we hope to be—the station will have rendered, not only to the San Joaquin Valley and the State at large, but to the entire region west of the Rocky Mountains, a most important service.

For an understanding of the situation it may be necessary to restate here that in their natural condition the lands for several miles around the station, as in hundreds of localities elsewhere in the valley and the State, show only occasional alkali spots, while outside of these spots, during the spring months, the country is covered with a luxuriant growth of native (largely annual) herbaceous plants, many being showy flowers and affording a most attractive sight; also proving beyond question the great inherent fertility of the land. As the season advances, from April to June, those plants go to seed or dry up, leaving the land more or less bare, or with only a sparse growth of hardy, drought-resisting, partially perennial plants. There is not in ordinary seasons any perceptible increase or decrease in the area on the interspersed alkali spots.

When such land is put under cultivation without irrigation, it will in years of unusual moisture bring very heavy crops of grain, which easily make up for at least one other season of almost total failure, when the rainfall is light or unfavorably distributed. It is this "fighting chance" of a highly remunerative crop that has in so many cases induced the investment of entire fortunes in such ventures, frequently with a total loss and financial ruin as the result; a kind of agricultural gambling, little better in itself, and with as many chances against success, as that at the faro table, but now happily almost a thing of the past.

With the advent of the irrigation ditch the heavy grain crop becomes for a few years a matter of certainty. Then there is a gradual change for the worse. First it is noticed that the alkali spots increase their area outward, often merging neighboring small spots into one large one. Then new ones begin to appear, at first "no larger than a man's hand," but enlarging each year and finally often so cutting up and reducing the producing area that the land is abandoned in disgust.

The "rise of the alkali" thus brought about by irrigation was very generally at first attributed (and sometimes justly) to the saline character of the irrigation water used. But as in time it became apparent that even the purest waters, such as those of Kings and Kaweah rivers, would produce the same result, the conclusion that the alkali salts are simply brought up by evaporation from the soil itself forced itself upon the most superficial observers.

Then arose the question, How much of these salts does the soil contain, or where do they come from? If it could be shown that the soil, subsoil, and substrata were equally impregnated with alkali and would continue to supply indefinite amounts, the reclamation of such lands for permanent cultivation would be almost hopeless.

We at first approached the problem by the examination of "bottom waters" in cases where the latter had risen from a considerable depth in consequence of a filling up from leaky ditches. It was found that in the vast majority of cases such water contained relatively small amounts of alkali salts only; not more than many waters successfully used for irrigation. It thus became evident that the main mass of these salts exists in the soil and subsoil within a few feet of the surface. The chemical examination of the "alkali," moreover, showed that it consists, as a rule, of such compounds as are known to be formed in all soils in consequence of weathering, and that it contains all the ingredients useful, as well as those useless, to plant growth; substances which in rainy countries are currently leached out and carried out into the country drainage and finally into the ocean, but which in regions of scanty rainfall remain in the soil mass.

We are thus led to the vitally important conclusion that the amount of the salts in these lands is but limited; and if once removed or rendered innocuous to crops in some other way, it will take thousands of years in the future, as in the past, before another such accumulation can occur from the very gradual weathering of the soil mass.

In view of the extraordinary intrinsic and permanent fertility of alkali lands when once reclaimed, it has seemed desirable to study in detail the manner of the distribution of the soluble salts, as well as their kind, at different depths in the soil and at different seasons, so as to gain an insight into their migrations and transformations, and thus determine the best and cheapest methods of dealing with them.

The problem is a very complex one and involves a great deal of labor, hence can not be solved in one or a few seasons, because of the great diversity of soil conditions. The investigation has already, however, yielded such striking and practically important results that it seems best to bring them to public notice at once.

For more ready understanding, these results are platted so as to show by means of curves, or lines drawn from point to point of actual determination, the increase and decrease of the total soluble alkali, as well as of the several salts composing it. As will be seen on the face of the plate, the samples were taken (by means of a post-hole augur) so that each represented a vertical column of 3 inches of soil, continuing thus to the depth of 4 feet. Each of these samples was then leached of its salts and every leaching analyzed separately. It was at first attempted to leach only the average of each foot, but this proved quite unsatisfactory.

In the diagrams the depths are shown by horizontal lines at intervals of 3 inches, as marked on the margin to the left, while the vertical lines represent differences of two hundredths of 1 per cent in the saline contents of the soil layers, as marked at the top of the diagram, increasing from left to right.

Inasmuch as each sample represented the average of 3 inches of soil in vertical depth in drawing the connecting lines or curves, the result of the analysis is assumed to represent the middle portion of each 3 inches. Hence the changes of direction always appear as occurring in the middle, vertically, of a 3 by 3 inch square. The area embraced between each curve and the vertical line to the extreme left represents, of course, the aggregate amount of each ingredient enumerated, viz: Common salt, Glauber's salt, and salsoda as the chief ones, with Chile saltpeter (nitrate of soda), also mentioned on account of its fertilizing value.

The predominance of carbonate of soda seen in these diagrams shows at once that the Tulare alkali is very "black," so that the use of gypsum is the first thing needful in attempting any reclamation or preventive measures. But aside from this, the diagrams suggest very instructively the explanation of many points not well understood heretofore.

Effect of the rainfall.—It is well known to residents that in Tulare and northern Kern counties the greatest depth to which the soil is wetted by the winter rains rarely exceeds 3 feet. This, then, is the depth to which the soluble salts in the soil may be washed each successive year by the natural rainfall; and from this depth it may partially or wholly reascend toward or to the surface during each dry season. It is reasonable to expect that near the lower limit there will be a gradual accumulation of the saline matters, which reach it in the form of strong solutions. Fig. 1 illustrates this strikingly. It shows the condition of the natural, unirrigated land at a point half a mile north of the experiment station, which was at the time covered by the native spring growth of herbage and flowers, and which during the dry season shows no signs of alkali on the surface. Evidently, at the time represented

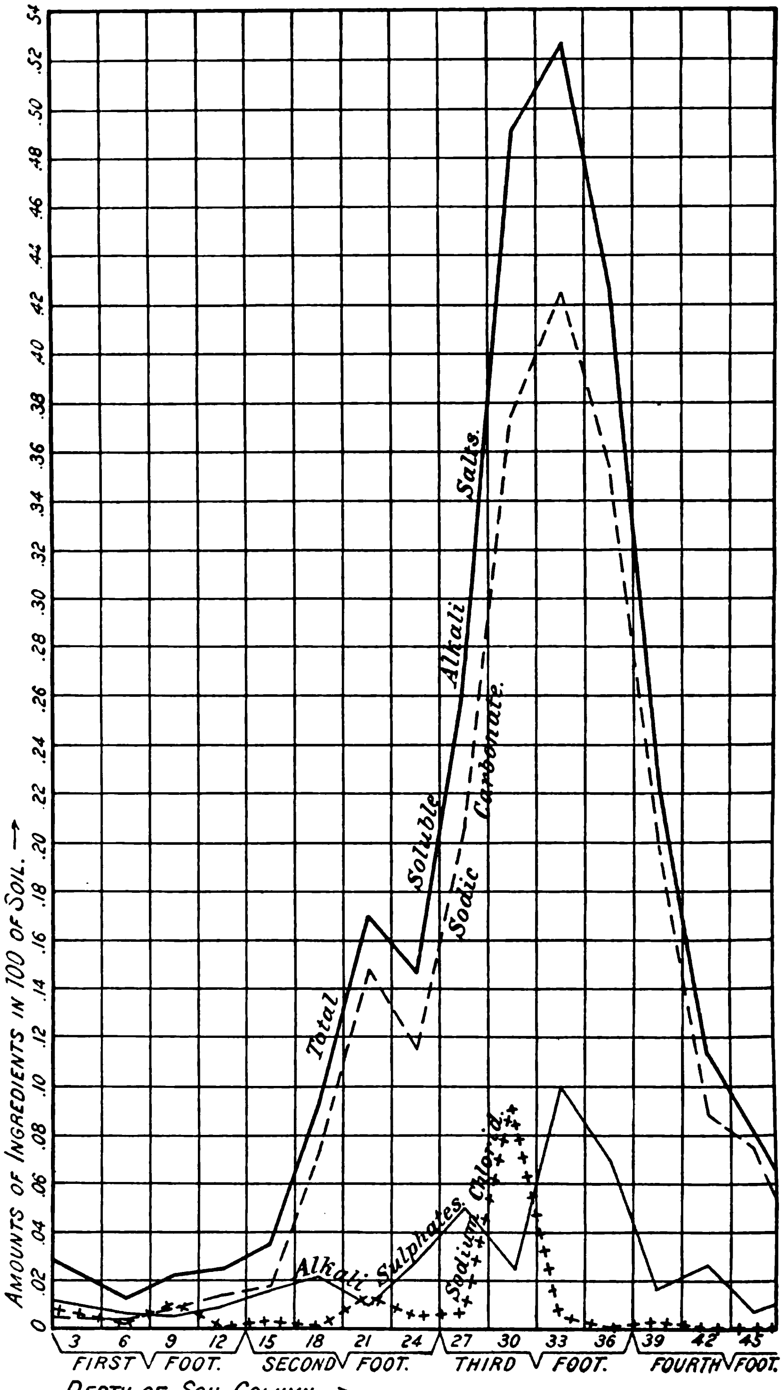

FIG. 1.—Average composition of alkali salts at various depths in unirrigated alkali land at Tulare Experiment Station, California, March, 1895.

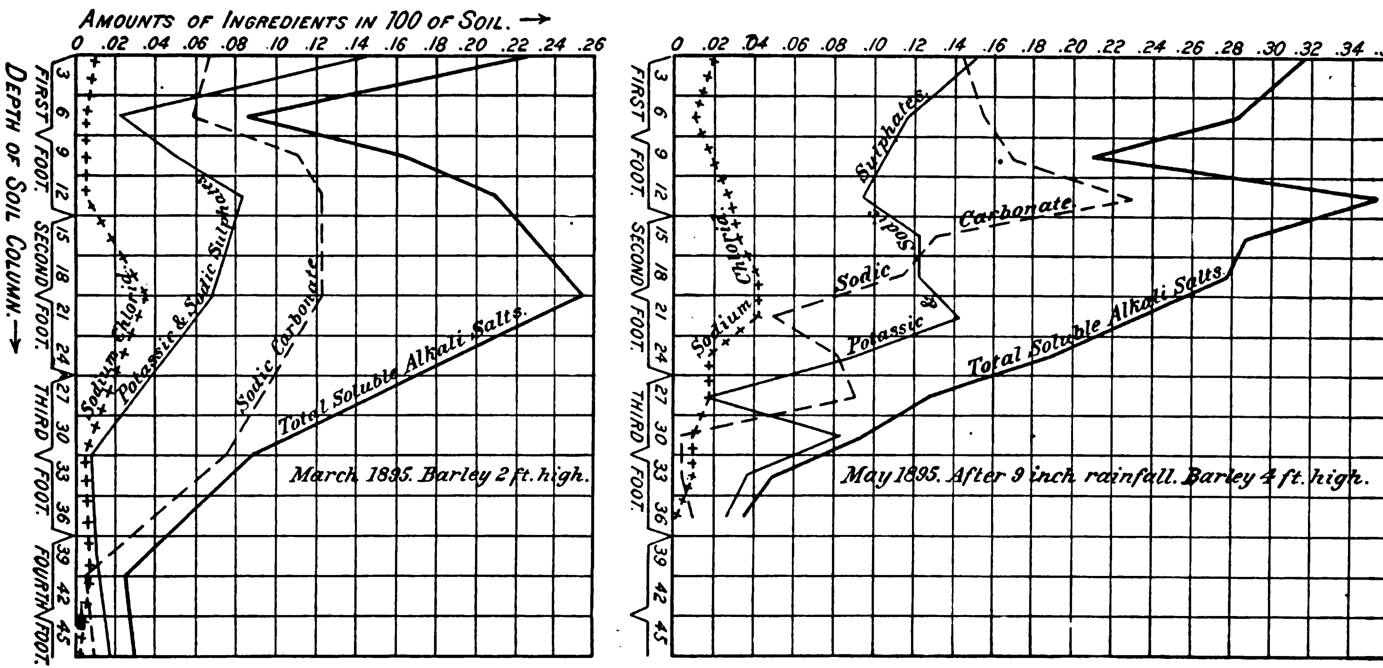

FIG. 2.—Average composition of alkali salts at various depths in partly reclaimed alkali land, Tulare Experiment Station.

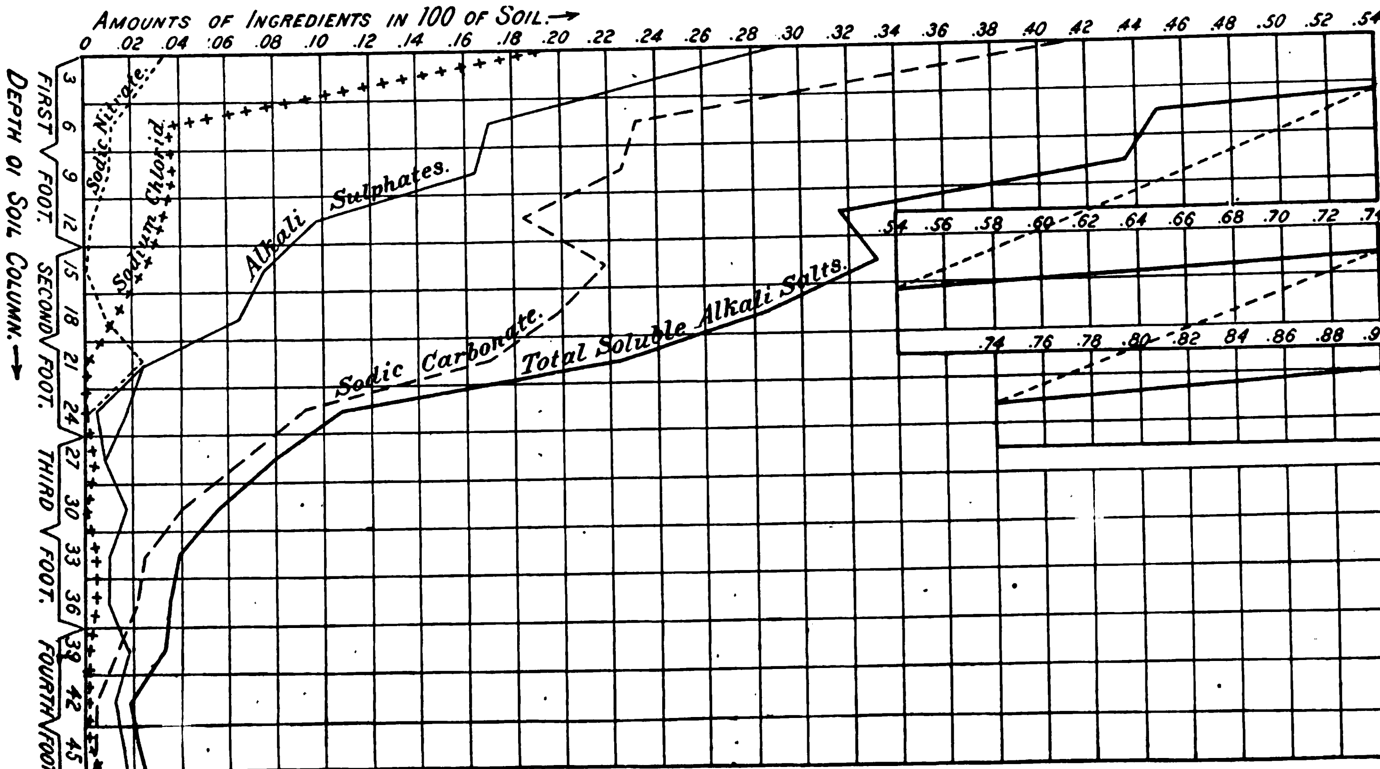

FIG. 3.—Average composition of alkali salts at various depths in bare irrigated alkali land, Tulare Experiment Station, May, 1895.

here, the winter rains had washed the alkali salts so far down into the subsoil that the seeds had no difficulty in germinating near the surface, and as the growing herbs covered the surface, practically all the evaporation took place through the roots and leaves, and the alkali did not move upward to any great extent. The roots only reached to the level (18 to 24 inches), where the impregnation is not strong enough to hurt them. The soil moisture being pretty nearly exhausted by the evaporation through the plants during their growth, evaporation from the soil could not thereafter bring any perceptible amount of salts to the surface. Thus the first rain would next season again enable the seeds to germinate without injury from the alkali, despite the heavy impregnation farther down, which is seen to be greatest about the last half of the third foot.

As a matter of course, not only the native growth, but also any crop of which a good stand has been obtained on an alkali soil, will similarly tend to diminish or prevent the rise of the alkali. Hence a crop of alfalfa, once established, may flourish for years on ground that, so soon as it is left bare during the dry season for the fall sowing of a grain crop, may prove altogether too strong and may kill the grain.

From the 15-inch level down we see a sudden and very rapid decrease of the salts, so that toward the end of the fourth foot they are reduced to a little more than is shown at the end of the first foot from the surface.

Those familiar with "black alkali" lands will at once recognize the 3-foot depth as the one at which in punching or digging post holes or ditches a very tough, intractable clay hardpan is frequently encountered, which, when exposed to the air, soon becomes covered with abundance of white salts. This is the cause of the thick layer of salts often seen alongside of irrigation ditches in the alkali regions.

We see thus demonstrated beyond any possible cavil the correctness of the conclusion we have previously drawn from the examination of the bottom waters, viz: That the bulk of the alkali salts is even in natural alkali lands accumulated within easy reach of the surface and of underdrains, and that if this accumulation is once removed, no more, or at least not enough to do any harm, will come from below. This points to underdrainage as the ready and complete corrective of all alkali, as has been long ago recommended by us.

But it does not follow that the indiscriminate use of underdrainage is to be recommended, since, as we have abundantly shown, enormous amounts of valuable soil ingredients would thus run to waste. In the majority of cases other means, presently to be referred to, will accomplish the reclamation.

Effects of cropping.—Fig. 2 shows the effect of a growing crop on the same land as that in fig. 1 within the station grounds, the two samples having been taken within 5 feet of each other; but a heavy dressing of gypsum had been applied, with good irrigation, and barley was sown in January, 1895. Some rather abundant rains fell afterwards, which naturally leached the alkali salts away from the surface, so as to leave it quite weak within the first foot. Evidently the barley germinated and made its first growth under these conditions, but as it failed to cover the ground, some surface evaporation took place and the alkali began an upward movement, the effect of which in increase of salts at the surface is seen in both figures, but modified in the latter one by the contrary effect of a light, late rain, which diminished somewhat the salts at the surface. The two profiles are clearly the transition phase between the natural condition of the land as shown in fig. 1 and that of an alkali spot as exemplified in fig. 3, and illustrates well the effect produced upon evaporation and the consequent movement of the alkali salts, even by a cereal crop, with its shallow roots and thin foliage. It is obvious that a crop of alfalfa, once established upon this land and bringing to bear upon it the action of its deep roots and dense shade, would by the repression of surface evaporation, tend to restore the natural condition as shown in fig. 1.

Effects of irrigation.—Let us now see what effect irrigation, or the establishment of leaky ditches in a pervious soil, will produce in land circumstanced as shown in plate 1.

As regards the latter case, anyone can see for himself that as the ditch water, filling up the land from below upward, comes in contact with the alkali-sodden subsoil or hardpan layer it will dissolve the salts and carry them up toward the surface. Evaporation from the moistened surface will then go on all the year to a greater or less extent, and the alkali will keep steadily moving upward until in the course of a few years the maximum will be found, not 3 feet below, but right at the surface. This is one phase of the "rise of the alkali," very easily understood in the light of fig. 1; and its extreme outcome is graphically shown in fig. 3, which scarcely requires comment.

This diagram shows the condition of land originally similar to that represented by fig. 1, which has been irrigated for four or five years, and quite lately has also been influenced by a neighboring leaky ditch outside of the station inclosure. Here we see that the alkali has moved bodily upward, and has accumulated near the surface to such a degree that any useful growth of ordinary crops has become impossible. Seed sown (except those of salt bushes) are quickly corroded or "rotted" by such alkali as this, and fail to sprout; anything set out ready grown may live while the rains last, but will be promptly killed by the corrosion of the root crown, or lower end of the stem, from the effect of the strong solution formed around it whenever a light rain or heavy dew falls, even if the root should be able to resist the action of the alkali in the soil itself.

It is not quite so easy to understand why surface irrigation should produce the same general result as the rise of the bottom water from below; and yet a little consideration readily explains it. Under irrigation the land received many times more water than in its natural condition, but rarely enough to leach the alkali salts into the country drainage. Practically all this irrigation water, therefore, ultimately evaporates in the course of the year. As it penetrates the soil to a greater depth than the natural rainfall ever goes, it completely dissolves the alkali salts in the subsoil, and in the progress of its evaporation throughout the season, carries them with it toward the surface, instead of leaving most of them accumulated at between 2 and 3 feet depth, as in their natural state. In the course of time, especially in orchards where the soil remains bare, therefore exposed to evaporation throughout the season, the accumulation near the surface becomes so great as to injure even the bark of full-grown trees and vines, while ordinary herbaceous vegetation becomes impossible. If the alkali should be of the "black" kind—i.e., carbonate of soda—the soil will soon begin to settle, and puddles of inky water will remain for some time after rains or irrigation, and sometimes form permanent "alkali ponds," with a bottom of tough, impervious hardpan.

That these worst effects can be suppressed by the conversion of "black" alkali into "white," by means of gypsum, I have already sufficiently explained in former publications. The "white" or neutral alkali is many times less injurious than the "black," which is so corrosive that it dissolves not only the humus of the soil, but also the bark of plants; always excepting the wonderful "saltbushes" and their kind. But there are limits, varying for different plants, beyond which even the white alkali becomes incompatible with cultivation, so that its accumulation near the surface must be prevented as much as possible. Fig. 3 shows the conditions of bare irrigated land in May; at the end of the dry season we find nearly the whole of of the alkali concentrated within less than a foot of the surface, and if we could afford to remove that first foot of soil, we would have no more trouble from alkali; but we would have seriously damaged the land's productiveness.

Counteracting evaporation.—From what has been said, it is obvious that since evaporation from the soil surface is the cause of any "rise of the alkali," one of the chief preventive measures must be the reduction of surface evaporation to the lowest possible point. This can be done either by mulching, or, less effectually, by shading.

The best mulch, available in all cases, is a well and deeply tilled surface soil on which a crust is never allowed to form. Then evaporation will be reduced to the minimum, and whatever does take place leaves the alkali distributed through the whole of the tilled layer instead of at the surface, where the bulk of the damage is usually done. For a loosely tilled soil will take up little or no moisture from a denser or more compact subsoil, which it protects quite as effectually as would a straw mulch.

Of course the depth or thickness of this protective tilled layer is of the utmost importance, not only for the sake of preventing evaporation and accumulation, but also because, since the maximum of alkali in irrigated land at the end of the dry season is always near the surface, the intermixing of the strong surface alkali with as large a mass of subsoil as possible is important in order to dilute and diffuse it, so that it may not be strong enough anywhere to hurt the root or root crown. After such an intermixture, say to the depth of 10 or 12 inches, it takes some time to bring the salts to the surface again to a sufficient extent to hurt the crop. An instinctive recognition of this principle has led cultivators of alkali soil in some cases to resort to sanding the surface, and with temporary good results.

But the mainstay in the cultivation of alkali land must always be the maintenance of deep and loose tilth throughout the times when evaporation is active. This implies the growing on them of hoed rather than grain crops, unless drill culture (which at present prices would hardly pay) were resorted to. The growing of corn, beans, beets, and possibly of cañaigre, always choosing preferably the deep-rooted crops, is therefore indicated, and experience at Chino has conclusively shown that the best of beets may be grown on light alkali soils in which common salt is not too prominent.

"Black" and "white" alkali.—Deep and loose tillage, however, is practically impossible on lands tainted with any considerable amount of "black" alkali. It will remain cloddy, and will crust over, even with dew, despite all cultivating, harrowing, and clod crushing. The first need is the neutralization of the black alkali with gypsum, by which operation other important benefits are also secured. The saving in cost of cultivation on heavier lands will alone soon pay for the purchase of the gypsum, aside from increased and improved products. It must always be remembered that little or no benefit is to be expected from it in cases of purely "white,"

neutral alkali; but there are tens of thousands of acres of alkali land now lying idle, lightly tainted with "black" alkali, that would be definitely reclaimed and rendered profusely productive by the use, once for all, of a ton of gypsum per acre. But it is not absolutely necessary to use the entire amount at once. It can also be done by annual installments of, say, 500 pounds per acre, put in some time before the seed. The latter will thus be protected from being killed by the black alkali and secure a stand to shade the ground, preventing an injurious rise of salts for the season at least. It must be remembered, however, that gypsum can not act on alkali without water; and that the action itself takes several weeks for completion before immunity is secured.

Senator BOYD. I understand the Doctor to say that the sugar beets have the vitality to reject the alkali. I would like to ask if other roots or vegetables have that power?

Mr. HILGARD. I do not know, sir.

The CHAIRMAN. The Chair names the following committee to consider the matter of uniformity in the nomenclature of station publications: Messrs. Armsby, Jenkins, Tracy, Hunt, and Gillette.

Morning session adjourned at 12.40 p. m.

EVENING SESSION, THURSDAY, JULY 18, 1895.

Convention called to order in "ordinary," Brown Palace Hotel, at 8.15 p. m., Chairman Henry E. Alvord presiding.

Mr. GOODELL. Mr. President, the executive committee offers the following resolution, and recommends its adoption:

Resolved, That the executive committee be authorized to call upon every institution eligible to membership in this Association for a contribution of $10 to defray the necessary expenses for the next year, the same to be payable as soon as practicable after the 1st of January, 1896.

Adopted.

Mr. GOODELL. The executive committee reports back without recommendation the resolution offered by Mr. Wheeler regarding the adoption of the metric system, as follows:

Resolved, That it is the sense of this Association that a great saving in the time required for the education of the people of the country might be made, and that the business of the country would be facilitated by the early adoption of the metric system as the only legal standard of weights and measures for the United States; and furthermore, that the country is now as well situated as it probably ever will be for the adoption of this system.

The CHAIRMAN. The convention hears the resolution offered by Mr. Wheeler reported back without recommendation. What is the pleasure of the convention?

Mr. MILLS. I move the resolution be not adopted.

Motion seconded, with the amendment that this resolution lie on the table.

Motion adopted as amended. Resolution laid on table.

Mr. GOODELL. The executive committee reports back in a modified form the resolution offered by Mr. Connell, regarding the appointment of a standing committee to report on methods of instructions abroad, as follows:

Resolved, That a standing committee of five be appointed, whose duty it shall be to report annually upon the best methods used in the various colleges of the world for the instruction of students in the practical and scientific facts relating to agriculture with a view to bringing instruction in agriculture into pedagogic form.

Adopted.

Mr. GOODELL. I am instructed by the executive committee to offer the following resolution:

Resolved, That the executive committee be authorized to edit and procure the publication of the proceedings of this convention in cooperation with the United States Department of Agriculture.

Adopted.

Mr. GOODELL. The executive committee, to which was referred the resolution of Mr. MacLean, touching the place of holding the next annual convention, refers the same to the incoming executive committee.

Resolved, That the convention request the executive committee to accept the cordial invitation extended by President Cyrus Northrop, of the University of Minnesota, to hold the next annual convention of the Association at Minneapolis.

After considerable discussion the reference of the resolution was adopted.

Mr. GOODELL. I am instructed by the committee on order of business to now offer an opportunity for the members of this convention to give expression of opinion as to the place of holding the next annual meeting.

Mr. ARMSBY. I wish to tender the Association a cordial invitation to hold the next annual convention in Pennsylvania.

Mr. MYERS. I desire to extend an invitation, upon the part of West Virginia, to the members of this Association to hold their next meeting in West Virginia.

Mr. BRYAN. I should like to invite the convention to meet in the West next year, and therefore extend the Association a cordial invitation to meet in the great State which bears the name of the "Father of his country."

Mr. HAYS. We did not want to establish the precedent of carrying such motions; we concluded that the precedent had been established last year, and we naturally felt entirely justified in bringing the matter up in the same way. This action of the convention does not in any way detract from the matter of coming from Minneapolis, so far as I see or feel, and I assure you that the invitation is just as hearty a one as President Northrop put it the other evening, and we hope and expect to see you at Minneapolis next year. You may see some of the lakes and some other things while there, and you will be treated nicely.

The CHAIRMAN. Are there any other remarks to be made as to the time and place of holding the next annual convention?

Mr. BOLLEY. I would like to say that North Dakota would be glad to see the convention meet at Minneapolis next year. We will treat you royally if you will take an excursion to the Red River Valley in North Dakota.

The CHAIRMAN. The resolution just passed by the convention, providing for a standing committee upon the subject of agricultural instruction, failed to state the number of the members of the committee.

Mr. CONNELL. I move that a committee of five be appointed by the chair.

Motion carried.

The CHAIRMAN. The committee will be appointed.

Mr. LAZENBY. The Section on Horticulture and Botany has nominated Messrs. F. W. Card, chairman, and H. L. Bolley, secretary, of the section for the ensuing year. The section also presents the following resolution:

Resolved, That the formation of the proposed section on irrigation is inexpedient and uncalled for.

The CHAIRMAN. It is moved and seconded that these nominations for officers of the Section on Horticulture and Botany be passed.

It is a vote, and the officers nominated for the ensuing year are elected.

Mr. CONNELL. Mr. President, at the afternoon session of the Section on College Work the following were selected as the officers of the section for the ensuing year: Chairman, A. A. Johnson; vice-chairman, J. E. Stubbs; secretary, E. Davenport.

Confirmed.

The CHAIRMAN. The resolution coming from the Section on Horticulture and Botany, relating to the formation of a section on irrigation, and reported back by the section as being inexpedient and uncalled for, is before the convention for its action. What is the pleasure of the convention?

Moved and seconded that this resolution be laid on the table.

Adopted. Resolution laid on table.

The CHAIRMAN. The next order of business is reports of committees.

Mr. HAYS. The committee on indexing agricultural literature recommends the following:

Resolved, That the Department of Agriculture be requested by this Association to compile and publish a list of agricultural literature other than station publications, and that the feasibility of making and publishing a subject index of this literature be further investigated, and if found feasible that this also be made by the Department of Agriculture and published; and that a committee of three be appointed to confer with the Office of Experiment Stations and to urge the importance of this matter upon the Department of Agriculture.

The CHAIRMAN. The special committee of last year, appointed by this Association, for indexing agricultural literature, makes, through its chairman, this report, recommending the appointment of a special committee—as I understand it the appointment of another committee of three. What is the pleasure of the convention? This report, coming from a committee of the Association appointed last year, is in the hands of the convention for action.

Mr. GOODELL. I would offer as a substitute the following:

Resolved, That a committee of three be appointed to confer with the Department of Agriculture with reference to the preparation and publication of a catalogue of literature for the use of teachers and students of agriculture, with power to arrange for the publication of such catalogue, if this is found to be practicable.

The CHAIRMAN. The question now is upon the substitute. What is the pleasure of the convention?

Mr. HAYS. Mr. President, this substitute is entirely satisfactory to me. I have put a great deal of work upon this subject. We hope that we have nearly worked out a scheme that will make the subject index practicable. I have worked out about 3,000 cards, covering nearly all questions or subjects of interest included in agriculture. I have put about all the time into it that it was possible for me to give to it, and although I have met many difficulties, I feel that some of them have been overcome. No one else has suggested a plan for doing this kind of work.

Mr. GOODELL. My object in offering this substitute is that we feel that this part of it can be carried; the second part does not seem to be feasible just at this time.

The CHAIRMAN. The question, then, is upon the substitute, which takes the place of the original resolution.

Resolution adopted.

The CHAIRMAN. The chair will appoint as this committee, with all due deference to the original committee, the chairman of the new executive committee, Prof. W. M. Hays, and the secretary of the Association (Dr. John H. Washburn).

Mr. WELLS. I am directed to present the following resolutions prepared by the committee on courtesies extended to the convention:

Resolved, (1) That we express our appreciation of the full and accurate reports of the proceedings of the convention by the press of Denver.

(2) That we extend our thanks to the management of the Brown Palace Hotel for entertaining the convention so handsomely.

(3) That we acknowledge the many favors extended by the Chamber of Commerce and the citizens of Denver in general.

(4) That we acknowledge the efforts of President Johnson of Wyoming, President Ellis of Colorado, and the Western men in general, in making the convention such a success.

(5) That we express in advance our appreciation to President Ellis, the faculty, and trustees of State College of Colorado, for the trip to Fort Collins on Friday, July 19.

(6) That we recognize the efforts of the National Educational Association in securing cheap transportation that this Association was able to take advantage of.

(7) That we desire to express our appreciation of the valuable work of our retiring president, Major Alvord, in developing the interests of the Association.

FRANKLIN WELLS.
F. PAUL ANDERSON.
G. E. MACLEAN.

The CHAIRMAN. Gentlemen, you have heard the resolutions offered by the committee on courtesies extended to this convention; what is your pleasure?

Resolutions adopted.

The CHAIRMAN. The next order of business, as I understand it, is a paper from the Section on Mechanic Arts, by Prof. L. C. Colburn, of Wyoming.

Mr. TRUE. Mr. Chairman, you will excuse my remarks at this time, but I merely wished to say that the Secretary of Agriculture has to-day called my attention to a matter which illustrates a class of questions which are continually arising in the Department and which relate to the propriety of the conduct of station officers. The particular question which has arisen at this time is as to whether it is proper for station officers to give out analyses or testimonials for advertising purposes? There seems to be in some cases a doubt in the minds of station officers as to whether they are really public officers or not, and therefore what seems to be an attempt on their part to act sometimes as public officials and sometimes as private individuals. I think we can all see that it is impossible for a station chemist, for example, to give out an analysis or testimonial as a private individual, and that he ought not to do so as a public officer; and the answer which the Department would have to make to such a question would be that it is an improper thing for the station officer to do this. I brought this matter up, however, especially that officers of stations might give thoughtful consideration to matters along this line, as I think they deserve some attention.

Mr. HAECKER. I would like to ask just one question upon this point, and it is a point that nearly all the officers of stations will be interested in: Would it be proper for a member of a station staff to indorse a certain machine—to say that it does good work in the station? As I understand it, we are public officers; and a committee comes to me (as has been the case not less than forty times since the beginning of this year) and they say, "What separator do you use in your station creamery, and would you recommend that we buy that kind?"

Mr. TRUE. Well, in such a case as that, I think it is hardly wise for the station to recommend any particular piece of machinery which is a patented article. It seems to me the best way would be for the station officer to describe to that committee the qualities of a good separator and let them decide the rest.

Mr. HAECKER. We have found that there is only a certain kind of a separator that will do satisfactory work and the others will waste more cream than they are worth.

The CHAIRMAN. I have already started on the programme of the evening, the first paper being that of Prof. L. C. Colburn, of Wyoming, entitled "The Theoretical *v.* Practical Work of an Engineering Course."

I should like very much to invite the members of the Association to discuss this paper, but we have three other papers to be presented. As I hear no objection from the members we will pass to the next topic, which is "Some Undefined Duties and Methods of Station Horticulturists," by F. W. Rane, of West Virginia.

SOME UNDEFINED DUTIES AND METHODS OF STATION HORTICULTURISTS.

The general duties of the station horticulturist are familiar to us all, and I doubt not that every worker knows his particular field. In some lines of work and investigation, however, his duties do not seem to be clearly defined, which fact is evident from the various treatment of these questions by our horticulturists. Doubtless similar problems have been discussed and solved at previous meetings, but as the occupation is a progressive one, and conditions are different, owing to the formation of new departments and the changing about of horticulturists, perhaps at this time it would be well to reconsider some questions of interest.

While the stations form a great network throughout the United States and Canada, each one is necessarily solving its own individual needs. As far as I am able to judge, every station horticulturist has his own methods and solutions. While this is perhaps necessary in many cases of local interest or value, yet there are many questions of equal importance and of common interest.

The past year I desired to do something in the way of testing garden vegetables and fruits. As horticultural work is new in West Virginia, and realizing that many station horticulturists differ in their estimation of the value of such work, I concluded to obtain an expression from each of the stations. (Many present doubtless remember receiving this request.) Possibly the questions asked were not sufficiently clear, but at any rate the replies were very discordant, ranging from unimportant and unsatisfactory to those of unquestionable value. At first reading it seemed as though no two horticulturists were of the same opinion, but further consideration revealed several somewhat similar expressions. It did not seem to be clear as to what should be considered a variety test. Such answers as these came: "We endeavor to get everything new and grow them, so as to know something about them should inquiries demand such knowledge, but we do not attempt to test varieties." This, it appears to me, is nothing more than a testing of varieties. It may be necessary, when testing for the first time, to select all the older and more common varieties in use, together with the introductions of that year, using the former as a basis for comparison. After this is once done, it seems to me that it is necessary to test simply to determine the value of later introductions.

Variety testing is done yearly at most of the stations, at least to the extent of the new introductions. One horticulturist expressed himself thus: "The work must be constantly maintained, but is really the trifling incident of hard horticultural work." Still others:

"(1) I do as little as possible and use only those I think worthy."

"(2) We make no attempt to test novelties. We get in all the varieties we can of any subject which we take up for serious study, but we never make any miscellaneous tests of anything simply because they are new."

"(3) We endeavor to get all of the latest and best things in one way or another."

"(4) I select varieties always with this thought when reading the description: Suppose it is true; of what account would it be to my State?"

"(5) I have about come to the conclusion that it is best to look with suspicion upon all new introductions unless they are brought to the notice of the public through some of the regular channels, and accompanied by statements of disinterested horticulturists who are recognized as authorities."

"(6) I am devoting less and less time to variety tests each year. Let us reverse the engine and originate new varieties for others to test, instead of exerting our energies in hunting up the things that nonprofessional horticulturists are developing for us."

"(7) I think that if the greatest part of the work that has been done in the way of variety testing had been left undone, we would have been just as well off, and a vast amount of work saved for more important things."

I might give extracts from others, but I think that these give a fair idea of the diversity of opinion. It seems to be the prevailing opinion that the testing of varieties demands the consideration of the horticulturist, although some few believe it of little value. This having been settled, several other questions naturally arise, which I state here to provoke discussion:

(1) Where should we get the specimens for testing? Should we not be governed by some definite rule? Is it advisable to test seeds or plants which come from other sources than the originator or introducer?

(2) Should we not have a definite understanding with seedsmen or nurserymen? At present seeds are sent for trial purposes to the various stations, many of which are totally worthless for the purpose. They are often flower seeds, which many stations do not bother with, or seeds that have arrived so late that they can not be used that season; or again, some varieties are not adapted to the section or State to which they are sent. Why would it not be a good idea for each horticulturist to have a standing list stating just what seeds or plants are desired, and no others; also giving the dates when the seeds must be received in order to include them in that year's test? By this means a great deal of the misunderstanding and unpleasantness that arises at present would be overcome.

(3) Is it ever our place to recognize unknown introducers? I have done this in our own State, but it is questionable whether even this should be allowed, much less recognizing those from other States, unless they be recommended by members of the county or State horticultural societies. One writer says: "An unknown man may have as valuable and rare a variety as a prominent firm." While this may be true, it seems to me that if these valuable and rare varieties are thought to be worthy of a test on the part of the stations, the introducer could very easily obtain recommendation from the members of the horticultural societies. By this means we would be freed from undesirable tests, and, too, the societies' effectiveness would be increased. The past year numerous pamphlets from various States have come to me claiming great things for certain new varieties, and asking a correspondingly high price; for instance, strawberries at \$3 per dozen, and potatoes at 50 cents per pound. Not knowing the introducers, what am I to do in such a case? One station worker says: "Purchase those thought to have merit, also all humbugs." Which case do the above examples come under? Another horticulturist says: "I request them for trial, and if upon a request its donation is refused, we purchase it, if not too costly. If too much is asked, we simply do without, arguing that its test would not be of practical benefit to the public until its cost was reduced to a reasonable figure." In considering

this the question naturally arises, What should be donated and what purchased? One station horticulturist says: "On the whole, those sent in are an evidence of some value," while another in almost an adjoining State says: "Those things which want testing are seldom donated." Still others claim they find it best to always purchase, that they may have the right of disseminating. Thus, again, it is a perplexing question. It seems as if legislation of an interstate nature were needed. An unknown man or firm, not backed by his State horticultural society or the horticulturist of his State experiment station, should not be allowed to ask high prices for novelties in other States. It appears to me that when we, as station horticulturists, purchase of such dealers we are aiding frauds. Anyone could print a very neat 2-leaf folder, claiming everything for a certain variety, as, for example, strawberries at $3 per dozen. Those possibly purchased by the stations would pay for his expense in printing, while the sales to amateurs and enthusiasts would probably realize him a neat sum. Even should the stations expose him as a fraud, what difference would it make after he had worked his scheme? Does it not look reasonable that if a man or firm is desirous of placing a novelty on the market on its merits, it is for his advantage to be assisted by the experiment stations? On the other hand, would we not be anxious that the people of our State derive all benefit from worthy introductions? Therefore, it seems as though it should be required that specimens of novelties be sent to the stations for trial, or that the horticulturists of the introducer's State be requested to visit him. One of our Canadian brothers says: "Introducers should send products free of charge, and growers should be taught not to purchase until tested."

(4) When should we eliminate the test of various flowers, fruits, and vegetables? One station worker says: "Never carry on tests for years as a museum; two reports are sufficient." Another says: "Discard only those not worthy after tests, and retain others after two years."

(5) How many plants should be considered a fair test? This question, it seems to me, needs a solution. By examining our bulletins, one easily sees there is no uniformity; for example, at the West Virginia station we have considered ten plants of each variety of tomatoes a fair test, while other stations range from five to twenty-five plants. We usually take twenty-five plants when testing the brassicas, twelve of strawberries, six of raspberries and blackberries, and from two to three for currants, gooseberries, etc. Each station, as far as I know, has its own methods; but ought we not to have a standard number?

(6) Do plants under test need spraying for both fungus diseases and insects? One naturally would think this necessary, but in many States spraying is comparatively new, and the results are misleading to those who do not employ them. It seems necessary to me, provided we are to show the possibilities of varieties.

(7) What is the station horticulturist's place in disseminating plants? Does our duty cease when we have proved the merit of certain varieties and have published, say, two reports upon them, stating where they may be obtained; or is it permissible for us to disseminate them ourselves, either donating or selling them? There, perhaps, would be no question as to the disposition of our own original varieties, but in case they are already on the market at reasonable prices, what should our alternative be?

(8) Is it advisable to give reports of tests to individuals or firms in any way other than through published bulletins? One station horticulturist says: "I never under any circumstances report to him (the donator) individually."

Many other questions might be presented in this paper, but these few are perhaps sufficient for the present. They have confronted me in my work, as I venture to say they have others. We as horticulturists should meet yearly to combine our efforts toward the solution of the best ways and means of handling the different phases of our work. Last year was the first time I ever attended this Association, and that meeting proved of value in many ways. We can well afford, it seems to me, to hand over subjects of a technical nature to our more purely scientific societies and in this meeting discuss those questions of general and practical value.

The CHAIRMAN. We are approaching so near the hour of adjournment, I think I will have to announce the paper on "Cheese-Curd Inflation: Its Relation to the Bacterial Flora of Foremilk," by H. L. Bolley, of North Dakota.

CHEESE-CURD INFLATION: ITS RELATION TO THE BACTERIAL FLORA OF FOREMILK.[1]

It is at this time scarcely necessary to make mention of the varied effects, beneficial and detrimental, induced by the bacteria and fungi upon a cheese product during its different stages of manufacture. In general, these effects are recognized as being of economic importance but a few years since scarcely imaginable. Aside from its body

[1] Preliminary investigations and direction of the work by H. L. Bolley; final cultural tests upon foremilk by C. M. Hall.

substance of casein and fat, cheese, it is well understood, owes its value to fermentations and decompositions occasioned by microorganisms, and the product, as to kinds produced, has been fixed through methods based upon biological conditions now known to have been necessary.

To date, the flora of cheese manufacture has been essentially accidental, except, perhaps, it be admitted as otherwise in the establishment of certain biological conditions which must obtain in the proper making of special types, such as Emmenthaler and Roquefort. Pure-culture cheeses are as yet matters of experimentation.[1] Fermentations and decompositions are thus accidental, and with the possible exception of a few which are pronouncedly efficacious in good or evil effects, one can not be certain as to the valuation to be placed upon individual results.

Of these modifications and changes, gas formation in the curd during its manipulation and subsequent ripening is peculiarly active and worthy of close investigation. Certain it is that in the factory it is an efficacious originator of troubles. However, it may not be said that Emmenthaler would have its present value without the holes (Lochern). But gas formation in cheese is not specific,[2] i. e., due to the action of a specific organism; hence one may properly, as has been indicated by Adametz,[3] group these gas generators into normal and abnormal cheese types, i. e., good and evil originating forms. It is also possible that some of these, while troublesome in the time of the curd manipulation, may be found of extreme value in the sum total of the cheese process. If so, it becomes but the more certain a matter of scientific factory processes, based upon studies into methods of control. At best, it may be said that there are some types of gas formation which, under present methods, are very detrimental and costly in effects occasioned, the active curd conditions being variously designated as "Käseblähung,"[4] "Le boursouflement des Fromages,"[5] "Lochbildung und Blähung der Käse,"[6] "floating curd," and "pin-hole curd formation."[7] Adametz[8] has estimated that the Swiss manufacturers of Emmenthaler alone sacrificed annually millions of francs to these curd troubles. To appreciate these losses, one has but to visit manufactories of hard cheese in this country, observing similar troubles resulting in "floating curds," cheese inflation during the green period, and often ripened, distorted, and tainted final products.

Through the kindness of Dr. H. L. Russell and of Director Henry, of the University of Wisconsin Experiment Station, I was enabled during the months of July and August of 1894 to aid in some investigations of these matters under the bountiful facilities of laboratories, dairy, and factory there afforded.[9]

Cheese curd inflation, a biologial phenomenon.—Though as early as 1890, Weigmann[10] and Freudenreich[11] had called attention to the fact that they had discovered a few individual species of pathogenic bacteria which by attacking the milk sugar gave rise to gas formation, which results in "Blähung der Käse," their conclusions had not been accepted as general. Indeed, even yet, some of our chemists may have a lurking suspicion that the origin of "pin-hole" formation has its inception in peculiarities inherent in the milk, and that the trouble may be incident to the methods of curd manipulation. Experienced cheese makers have quite generally affirmed that its chief origin is "dirty milk." The work upon which this paper is based reaffirms this belief. In the factories curd inflation seems everywhere general. It is only a matter of degree from curds but slightly if at all injured by the presence of minute, evenly distributed gas openings, to types quite troublesome to valueless because of toughened, tainted, inflated, and distorted conditions.

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[1] Upon these points see general literature of the subject by Adametz, Baumann, Duclaux, Freudenreich, Weigmann, and others.

[2] This is substantiated by these investigations. Also see Adametz résumé, "Ueber die Ursachen und die Erreger die Abnormalen Reifungsvorgänge beim Käse. Das 'Blähen' oder 'Gären' der Käse," Milch Ztg., 1893, Nos. 12, 14, and 15.

[3] Loc. cit.

[4] Adametz, loc. cit.

[5] Freudenreich, Ann. Micr., 1890, p. 553; cited from Koch's Jähresber. Gährungs-Org., 1890, p. 95.

[6] Weigmann, Landw. Wochenbl. Schles. Holst., 1890, No. 37.

[7] Russell, Outlines of Dairy Bacteriology, pp. 39–41.

[8] Milch Ztg., 1893, No. 12, p. 187.

[9] Assisting Dr. Russell, the facts accumulated there belong rightfully within his publication of continuous investigations. My thanks are here due to his guidance and introduction to this interesting field of work. I hope, however, at this time, to use only such parts of the work as directly connects with the later works of Mr. Hall and myself.

[10] Ueber die Lochbildung und Blähung der Käse (Milch Ztg., 1890, p. 741).

[11] "Ueber einen neuen im geblähen Käse gefundenen Bacillus (Bacillus Schafferi)." Landw. Jahrb. Schweiz, 1890, p. 17; and "Sur quelques bacteries produisant le boursouflement des fromages" (Ann. Micr., 1890, p. 553. Cited from Koch's Jahresber. Gährungs-Org., 1890, p. 95).

General facts suggestive of a biological origin of the trouble may be given as follows: (1) It is certain to occur in milk known to contain much dust and dirt of a stable type; (2) It is most damaging in results from over-ripened milk; (3) aeration of milk is beneficial, and may at times even prevent its occurrence; (4) the conditions of curd manipulation are particularly favorable to bacterial growth, and the evolution of gas is always most rapid as the temperature approaches the optimum for such growth; (5) heavy growths of bacteria always line the cavities of curd and cheese holes; (6) the same sample of milk always gives "pin-hole" formations.

These points are self-explanatory, except perhaps that of aeration. To this it may be suggested that most gas-evolving types are markedly lovers of conditions approaching those of complete or semi-anaerobiosis.[1]

Working upon the assumption of a biological origin of the troubles, numerous experiments, the details of which do not properly fall within the province of this article but which were inclusive of bacteriological exclusiveness, demonstrated that solid curds could be made from the worst types of "pin-hole" forming milk, provided the original bacterial flora was eliminated. Perhaps the best proof of the biological nature, aside from the results just given, rests in the fact that when antiseptic methods were resorted to "pin-hole" formation was checked in direct proportion to the value of the bactericide used.[2]

Having thus become satisfied as to the cause, and that rapid tests of individual samples of milk were possible, the economic question of germ sources was open to consideration, and the important results bearing upon the exclusion of milk furnished by untidy patrons came into view. It was found that such tests could be made and were reliable for an individual sample, but here there is a halt. Creameries and factories and accessories thereto are found to be generally infested by miscellaneous microorganisms, and the gas generating types are no exception.

While at Madison I separated and have made careful cultural studies of six distinct forms of the latter from one vat of mixed milk—one oospera-like fungus, three bacillus, and two micrococcus types. All of these were quite constantly present in the factory, and at different times were taken from different locations, as from separator slime, milk in the vats, separated milk, milk from the cows of special patrons, from the whey in the gas cavities of green curds, and one, a spore from No. 36*c*, from pasteurized cream.[3]

We may thus, in consideration of these facts, together with the notations of the comparatively large number of separate species described by the European workers Weigmann[4], Adametz[5], Freudenreich[6], McFadyean[7], and Baumann[6] as being capable of curd inflation, assume that these troubles are generally distributed and due to a miscellaneous number of specifically different organisms.

The foremilk as a possible source of factory infection.—Knowledge of the sources of these troublesome organisms thus becomes of first importance. Aside from actual filth, the foremilk has been shown to be a source of abundant bacterial infection. As has been stated by Russell[8] under conditions of cleanliness in milking, this is probably the predominant source of germ content. Lehmann[9] estimated for first milk drawn 50,000 to 100,000 per cubic centimeter, and Schults[10] found a content ranging in separate tests from 55,566 to 99,600 per cubic centimeter. If, then, it be found that the normal udder is but a well-regulated incubator for such organisms, relief seems somewhat more distant than common cleanliness in the stable.

The following points are given as indicating that the foremilk is not above suspicion: (1) Germs are always present in the first milk drawn. (2) Gas-forming types heretofore studied are of such nature as to be associated with stable filth. Adametz[11]

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[1] This is substantiated by the characteristics of the species here studied. See also Fraenkel Text-book of Bacteriologie, Eng. ed., pp. 24, 115, 217, 222, and 334. Also Beyerinck "Zur Ernährungsphysiologie des Kahmpilzes," Centbl. Bakt. und Par., 11, p. 68. Pasteur (Studies on Fermentation, Faulkners' Eng. ed., p. 269).

[2] This work has been duplicated at Fargo; and I am also informed by Dr. Russell that the results of the same type of work carried into tests upon full-sized cheeses, made at Madison at the time of the above-described tests, have confirmed the more limited trial tests.

[3] These organisms will receive special consideration in a following paper.

[4] Russell, Outlines of Dairy Bacteriology.

[5] Milch Ztg., 1893, Nos. 12, 14, and 15.

[6] Landw. Vers. Stat., 42, p. 214.

[7] Landw. Jahrb. Schweiz, 1890, p. 64.

[8] Outlines of Dairy Bacteriology, 1894, p. 40.

[9] Cited from Grotenfelt, Principles of Modern Dairy Practice. Woll's Eng. Ed., p. 24.

[10] Ueber den Schmutzgehalt der Würzburger Marktmilch u. die Herkunft der Milch Bacterien, Arch. Hyg., 14, p. 260; cited from Koch's Jahresber. Gährungs-Org., 1892, p. 176.

[11] Milch Ztg., 1893, No. 15, p. 240.

has also listed sixteen similar organisms, including yeasts and bacteria of general decomposition. (3) Under stable conditions there are also apt to be forms capable of growth at the body temperature. Of such Adametz's résumé lists ten species of pathogens shown to be capable of "Käse Blähung," by various investigators. These include such forms as *Bacillus coli commune*, Escherisch, and the various urine-loving micrococci. (4) The milk-moistened openings of the teats come easily and often in contact with such germ-bearing matters of the stable and animal body. (5) Gas-producing bacteria seem inclined to anærobiosis, and it seems possible that conditions approaching these demands exist in the normal udder. (6) Contrary, also, to the considerations of Adametz,[1] I find that some forms, markedly of the lactic-acid type, may be capable of heavy curd inflations.

Under these considerations it seems that foremilk might be concerned in cheese-curd inflation from a broader basis of kinds than that represented by infections due only to such disease-producing types as *Bacillus guillebeau* of Freudenreich[2] or *Bacillus lactis ærogenes* and *Micrococcus mastitis* of Adametz.[3]

Gross tests of foremilk, preliminary cheese curd, and fermentation tube tests.—This study was made upon two cows at Madison, Wis. At the time, August 28, the animals were under the continuous pasture conditions, and were, bodily, very cleanly. The cheese-curd tests were each made under same conditions after allowing the milk to stand for twelve hours at 18° C. The fermentation tube tests were made by infecting same with one thirtieth cubic centimeter of the milk immediately following the milk taking.

Test No. 1. Full milk of Shorthorn cow, used, bottled, direct from sterile milking pail, without other precautions than exclusion of the foremilk. Result: Heavy gas inflation, curd, a leathery "floater;" in the fermentation tube heavy gas formation, culture practically exhausted in the first twelve hours.

Test No. 2. Strippings from Shorthorn cow taken with following precautions: Flank, belly, and udder of animal washed and dried with moist cloth, and the hands of the milker likewise treated; the milk stripped direct into a sterile bottle. Results: A very few large "pin holes" in a solid nonfloating curd; no gas formation in fermentation tube after forty-eight hours.

Test No. 3. Foremilk from all the teats of a Jersey cow "Bessie." All precautions observed as in No. 2. Results as in No. 2.

Test No. 4. Strippings from "Bessie." All precautions observed. Results as in last. A solid curd with a few "pin holes;" fermentation test, slight evolutions of gas began after twenty-four hours.

Test No. 5. Foremilk from Shorthorn cow; no special precautions, save only that the milk was drawn direct into a sterile bottle in such manner that but slight dirt might fall into the neck of the bottle. Results: A good curd like that of 2, 3, and 4. The fermentation test gave a slow evolution of gas after twenty-four hours.

This work was duplicated October 10, at Fargo, upon two cows with essentially like results, the general full milk at the time giving a bad type of floating curd. The evidence from these tests is that the gas-originating organisms were not located in the udders either in the fore or last milk, and that the few "pin holes" or curds 2, 3, 4, and 5 must have had an external origin. This is made more evident by the results from the general milk of No. 1, though it was taken under conditions of more than ordinary neatness.

Qualitative determination of the bacterial flora in the normal udder.[4]—To the above described results a qualitative investigation must give much added work. To this end, such facts of Mr. Hall's studies as bear directly upon the question are here given.

The examinations were made upon 10 healthy cows living under cleanly stable conditions during the period between the dates of January 22 and April 25. The method was kept uniform, 20 cubic centimeters each of fore and last milk were drawn from same single teat and subjected to Petri plate culture analysis upon neutral gelatin at room temperature. The milk was always drawn through a sterile silver milk tube into a sterile narrow-necked ounce bottle. The milk tube was always extended completely into the milk cistern, after first excluding 1 to 2 drops of milk. Results:

(1) From 30 different examinations of fore and hind milk made upon 9 different dates, 16 distinct species of bacteria were isolated. (*a*) Of these, 5 were found only in foremilk, 4 of them occurring only once each in separate samples. (*b*) Six occurred only once each in separate samples of last drawn. (*c*) Five were found common to both fore and last milk. (*d*) One of the last-named lot, No. 30, was found common to the fore and last drawn milk of 5 different cows upon 5 different

[1] Milch Ztg., 1893, No. 12, p. 188.
[2] Ann. Micr., 1890, p. 56.
[3] Milch. Ztg., 1893, No. 15, pp. 237, 238.
[4] Work done by Mr. Hall, senior student at the Agricultural College, Fargo, N. Dak. In so far as I am aware this is essentially new work.

dates. (e) Species No. 20 was twice found in the foremilk of cow No. 27, dates January 22 and January 29. No. 28 occurred in the last milk of cow No. 25, January 23, and in her foremilk on date of April 25. No. 84 was found in the foremilk of cow No. 24 February 15, and again common to fore and hind milk April 25. No. 72 occurred in foremilk of cow No. 20, and was also common to fore and last milk of cow No. 21 upon date of March 9. No. 30, the most common species, occurred in udder of cow No. 25 upon January 22 and April 25. In the case of cow No. 27 it was present on dates of January 22 and January 29.[1]

(2) Five species, Nos. 20, 23, 25, 28, and 65, are gelatin liquifiers; eleven are solid forms.

(3) Seven species are facultative anærobes; nine seem to prefer ærobic conditions.

(4) Three species, 66, 83, and 75, fail to vegetate at a constant temperature of 35° C.; thirteen develop rapidly at that temperature.

(5) Twelve species produce an acid reaction in milk, three are alkaline curdlers, and one, No. 30, leaves milk apparently unchanged.

(6) Twelve are actively motile, four nonmotile.

(7) Only two samples of sterile milk were drawn, one from cow No. 24, April 15, and one from cow No. 26, April 19, but samples of last milk containing only No. 30 remained unchanged.

(8) The greatest number of species present in one examination was four, most often two, but at times only one.

(9) Only bacteria were ever found.

(10) No gas-engendering organisms were found.

This work is perhaps too limited in the number of cows investigated, and the number of duplicate cultures made from same animals to assert any conclusions as to constancy of species, or of physiological types present in fore milk. The work, however, is given as a preliminary study, and may be said to indicate (1) no bacterial flora common to the animals investigated, save one peculiar nonmilk-affecting species, No. 30; (2) that a given form, when once present, may be quite constant in its occupancy of the udder of an individual animal.

Finally, the absence of gas-producing organisms remain unexplained, but adds significance to the previously described curd tests. It may yet be found that these results may not hold good even at Fargo, for it is a possibility, though I think hardly probable, that during the period covered by Mr. Hall's investigations, the months of January, February, March, and April, the stables may have been free of gas-generating organisms. They were there, however, by my own observation during the months of October and November, as per the evidence of cheese-curd tests made from full mixed milk.

If later and scattered investigations confirm this absence of gas-producing organisms in normal foremilk, the economic importance of the matter becomes self-evident.

The CHAIRMAN. We still have a small amount of business to transact. The Chair has yet to announce two committees under the orders of the convention: First, the standing committee of five to report on new methods of agricultural teaching—Messrs. J. H. Connell, A. C. True, T. F. Hunt, H. T. French, and L. B. Wing. There is also a special committee of three on the codification of the resolutions and important acts of the Association in previous years. As this committee I will appoint Messrs. H. H. Goodell, A. C. True, and, by order of the convention, the retiring president, Henry E. Alvord, is also a member of that committee.

Mr. COMSTOCK. I now move that this convention adjourn, subject to the action of the executive committee of this Association.

The CHAIRMAN. The Chair wishes to congratulate the Association upon the success of this convention. It is not a state secret that the executive committee felt some embarrassment from the fact that they were directed to recommend this city as the place of meeting this year and that the meeting was to be held at this season of the year, but nobody seems now to have any cause for regret. We have had, I think, a convention as largely representative, perhaps with one exception, as any heretofore held by the Association, and although not quite as largely attended by regular delegates numerically, yet I think you will all agree that this has been in many respects our most successful meeting. I think we have done more solid work, and work of a higher grade, than at any previous meeting. I think we may resolve ourselves for a moment into a mutual admiration society. Those in favor of adjourning sine die say "aye." Those opposed, "no."

The convention is adjourned sine die.

(Final adjournment had at 9.50 p. m.)

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[1] Cows No. 24, 25, and 27 are the only ones upon which tests were made upon different dates.

THE SECTION ON AGRICULTURE AND CHEMISTRY.

The section was called to order July 16, 1895, at 2 p. m., by Chairman E. B. Voorhees.

The question of the formation of a section on irrigation was raised, and after brief discussion it was moved that the subject of irrigation be discussed by this section, and thus, if possible, obviate the necessity for the formation of a separate section on irrigation.

It was then moved that the discussion on irrigation be set for the 17th.

The first paper was presented by W. C. Latta, as follows:

FORM, SIZE, ARRANGEMENT, AND TREATMENT OF PLATS IN FIELD EXPERIMENTATION.

There is a tendency to undervalue the results of field experiments. That there are difficulties to be met and overcome in this method of experimentation is freely admitted. The importance of such work, however, as an indication of what may be expected in farm practice should lead field experimenters to carefully scrutinize their methods, in order to eliminate as far as possible the various sources of error in such work.

Assuming, at the outset, that the soil and climate in which a field experiment is to be performed are fairly representative of the locality, it is the purpose of the writer to very briefly suggest the form, size, arrangement, and treatment of plats that will conduce to accuracy of results. The views herein expressed are not given as final conclusions, but are held tentatively subject to revision upon receiving new light. It is hoped, therefore, that there may be a full discussion on the questions involved, in order that settled and well-defined conclusions may be formulated for the guidance of workers in field experimentation.

Form.—In form it is desirable that the field plats should be long and narrow, lying side by side, in actual contact with each other or with interspaces between plats, which should be cropped the same as the plats. In width the plats need not exceed 1 rod. Long, narrow plats can be brought near together and thus reduce largely the variation in the character of soil from plat to plat. The writer has found plats 14⅔ feet wide by 297 feet long and containing one-tenth acre very satisfactory. He has also employed spaces between plats one-half the width and the same length of the plats proper. These spaces are essential in tests of fertilizers, as they not only demonstrate the fact of diffusion of fertilizers or cross feeding, but they also measure the amount of the same by the increased yield of the crop produced thereon.

Size.—If it is the purpose of the experimenter to secure a result indicative of the returns per acre which may be secured in farm practice, the plats should seldom be less than one-twentieth of an acre in area, and one-tenth-acre plats would be better as a rule. The unavoidable errors in plat work would not be so greatly multiplied if the plats were even larger, say one-fourth acre each; but in the latter case the series of plats would probably be too extended for uniform treatment in point of time. It therefore seems desirable that the individual plats of the series should be not less than one-twentieth and not more than one-tenth acre in size as a general rule.

Arrangement.—The plats should be arranged in series so that a reliable average of treated and untreated plats may be obtained. For example: Let Nos. 1, 4, 7, 10, etc., of a series of plats be without special treatment for comparison with Nos. 2, 3, 5, 6, 8, 9, etc., which may receive the desired treatment. Better still, let each alternate plat be without treatment for comparison with intervening treated plats. The number of plats in a series should be limited only by the ability of the experimenter to subject the series to uniform treatment in point of time. That is, it would be very unwise to so extend a series of plats as to make it impossible to cultivate the entire series within one day. It is believed, however, that a series of ten plats for the investigation of a particular subject will, in most cases, be quite sufficient. It is desirable, and the writer considers it essential, to have all the plats of a given series entirely inclosed by a border along sides and ends of plats and intercropped the same as the plats.

Treatment.—It is essential that the several plats of any series should receive treatment uniform in all respects except the one under investigation. In order that this may be, the crop grown at any time should be the same on plats, spaces, and borders. This will give like exposure and environment to the several plats of the series. With uniformity in the cropping, the plats may be plowed at the same time. The plowing should be across the plats so as to subject equally all the plats and spaces to the influence of dead furrows and back furrows and leave all the plats of the series in an equal stage of preparation at any given time. In harrowing, the team should, as a rule, go the long way of the plats. This seems especially important in case any of the plats have been previously fertilized, in which case cross harrowing would tend to the diffusion of the fertilizers on to the unfertilized plats or intervening spaces.

In order to have exactly the same amount of seed on the several plats of a series, hand sowing or planting would be necessary, but this is so great a departure from the present methods of farming that it seems better to employ the usual farm machinery for putting in the crops. Care should be taken that the same number of rows and hills—in case the seed is disposed in hills—be placed in each plat. The width of the plats should previously have been calculated for the purpose of securing an equal number of rows in each plat. In the case of small grains a single hoe of the drill may be closed at the edges of the plats so as to permit the separate harvesting of the plats by the self-binder, mower, or other harvesting machine. Before harvesting the crop, all vacancies in the stand should be counted, or determined by accurate measurement, in order that the yield may later be reduced to a perfect stand. This may seem unwise, as in farm practice a perfect stand is seldom, if ever, obtained. It is believed, however, that the liability to inaccuracy of results will be reduced by this method of procedure. If, for any reason, the gradual harvesting of the crop should be necessary in order that partial curing may take place, the work should proceed across the plats so that equal portions of the same will be harvested at the close of any day. In gathering the crop—especially if it be corn—it is highly important that this rule be observed, as the corn fodder is quite subject to variation in weight, owing to changes in condition of atmosphere.

What has been said is but a mere outline of the subject and must prove highly unsatisfactory, but the writer does not feel justified in going further into details, as an extended discussion, without charts and verbal explanations, could hardly prove interesting or profitable to those present.

W. M. Hays read the following paper:

Methods of Plat Experimenting.

Many things have conspired to discredit field experimenting. This class of research is so environed by changeable climatic conditions, varying soils, the irregular attacks of insects, and the greater or less activity of microorganisms in the soil and plants that we can not control conditions, even when supplied with expert assistants and trained laborers. Our averages must be made up of a larger amount of data than in most other classes of research. The great expense of this line of work, when properly done, and the unsatisfactory results when we too hastily make conclusions have kept it from reaching that degree of respect among scientific workers, or among farmers, that it should have reached. The classes of research which most closely deal with the everyday routine of the farmer's business and home life are latest to receive their merited attention, because most difficult, and the most truly scientific work and great expense are necessary for their proper solution. We would not undertake them if it were not for the large material interests at stake in the raising of all our general agricultural crops and the large amount of labor employed, too often poorly directed.

Lawes and Gilbert, with wonderful patience, have devoted a goodly portion of their time for more than half a century to questions of field management, yet in this country we have had few who were ready to take up those questions relating to field management aside from fertilizer questions, which require for their solution a few or many decades of work on the same plats of land. The farmers of the Mississippi Valley, as well as of other sections, have been slow in studying field management, and the station workers there have a great opportunity to inaugurate new methods of rotations and new methods of cultivation and handling crops, and to tell which of the old ways of farming pay best.

We need to look upon the field as one unit, the acre unit, with which to deal; the class of crop, as the acre of corn or wheat; and the variety, as Fife or Blue-stem wheat, as another unit. We need to study the business questions, as well as the philosophies or theories.

Facilities for plat experimenting are too often meager or poor in quality. The most important is land of the desired richness and geological formation, and uniform, so that series of uniform plats may be laid out. Our Minnesota legislature is providing us with funds to procure lands in the distinctive parts of the State where field work suited to the respective soil and climatic conditions may be prosecuted. I am well pleased with the plan of dividing each field up into series or subfields, 8 rods wide, with rod-wide alleys between on which even a reaper may be turned. These series are subdivided by narrow cross alleys into plats 8 rods long by 1, 2, or 4 rods wide, thus making plats of one-twentieth, one-tenth, or one-fifth acre. Fields are designated by capital letters; south and east lines are in all cases used as base or initial number lines, and the series of plats are numbered from these with Roman numerals, while the plats are numbered from the base lines with Arabic numerals and subplats with small letters. We thus have a handy system for our crop records, and it gives us a history of the treatment of each smallest subdivision of the series and plats for each year. We try to have only one kind of crop growing on each series and to disturb the uniformity of each series as little as possible by different ways of treating each crop. We compost our manures by daily mixing together the product of all our barns in the same load, pile it systematically in long, flat piles, and when composted we take off loads in slices along the sides of the heap. These loads are then spread in narrow strips lengthwise on the series, thus crossing each plat with the manure from several loads, that each part may receive a similar amount of the fertility. We need a manure spreader for this purpose.

Laborers trained to do the field work are a necessity. It is a business learned only after years of practice. I would far prefer to leave the planting of our rotation experiments to our good German teamster, who has had several years' experience, than to myself, or even to my foreman alone. He may need the foreman or myself to help and watch him, but we make that his business and he becomes expert. He does not forget to properly adjust his seeder with each change to a different crop or plat. We must learn to better recognize and remunerate this kind of skill. We must change until we get good men and then treat them well, so that they will not only continue, but improve in efficiency from year to year.

An abundance of the most suitable machinery should be provided. We have a large number of small grain plats in our experiments, with varieties, rotations, and tillage experiments. We have reduced the annual expense so that now the actual labor on a one-tenth acre plat of small cereals is only one dollar and a quarter, while a few years since it was two or three times that amount, and very unsatisfactory as to the method, much of the work then being done by hand. We sow most of these crops with chain or press shoe drill. We clean the cups of the seeder box out with air, driven through a 1-inch rubber hose by the lungs or by a small bellows. To get the amount of seed sown on each plat, we fill the cups in the bottom of the seeder box, strike with a straightedge, and weigh the other seed put in the box, and with a straightedge again strike the grain off at the top of the cups, and weigh that taken out and subtract for the difference, or that actually planted. We have a drill half a rod wide, machine widths, making convenient fractional acres; stopping cups and using partitions, we sometimes make plats only several drills wide, with 12 to 16 inch alleys between. We harvest these plats, which are at least a foot apart, for the grain board to separate them, with a self-binder, a helper being always on hand to take off any incomplete bundles when finishing the plat, and to gather up any scattering grain left on the machine, and at once to shock on the plat every bundle cut from it.

We thrash as soon as possible from the shock, after each class of crop is dry enough. We have had a 28-inch thrashing machine made to order, in which all shelves are made slanting, all elevators and spouts self-cleaning, and in which hardly one ounce of grain remains between plats. We thrashed out 111 plats in one day, simply turning the governor on the engine so as to run the separator at a third greater speed for one or two minutes between plats. Each wagon takes from the plats to the thrashing machine, crossing the wagon scales to get the weight of the bundles, one or two plats of bundles, and by subtracting the weight of the grain we get the weight of straw. The plat stakes go on the wagon with the bundles from their respective plats, and follow the crop to the bag, where the plat numbers are transferred to tags wired to the bags in which the grain is placed. We used the so-called wired tag, never tying with the tag string, but fastening the tag permanently into the side of the bag. Samples of the grain from every plat are saved for future notes in case the whole is not preserved. Our rather dry climate makes our results in ripe straw and grain fairly accurate without determining water-free substance, and doubtless our averages would be little changed by drying, and the added expense would be considerable.

Our methods of getting the yields of cereal forage crops are much the same, while we are only now experimenting on methods of getting at the acreage yields or capacities of different kinds of pastures. Ample storage capacity in buildings is an essential for seeds and for grain in bulk, and in moister climates than ours it is doubtless economy, or, in some cases, necessary, to have large storage capacity for nearly all unthrashed crops from plats. But facilities for at once thrashing, without piling up and subjecting to mistakes, mixing, and destruction by vermin, are of far greater importance. A seed house should have many small compartments, some small and some large bins, a seed-cleaning room, and, in our climate of moist, cool autumns, a room in which seed corn and other seeds needing it may be dried by artificial heat. This building, like every other around our experiment station, should have walls made vermin-proof by a liberal use of brick and mortar and wire cloth in the angles between walls and between floors and walls, and at many of the openings, such as ventilators. As a rule, such buildings should be well ventilated, and should be separate from stables and general grain bins and storage bays for fodders, as nothing makes our reports of plat work more unreliable than unevenness in stand and vigor of plants, caused by unevenness in vitality and vigor of seeds. Where practicable, seeds of our own preserving should be used in preference to the too often unreliable seeds procured from seedsmen or from farmers.

Chemical and physical laboratory control work are very profitable in connection with field experiments.

Several plats annually, if properly planned and managed in each of the Western States, would return to our farmers a very fine percentage on their cost, as much experimenting on farms would be saved. Let us not think less of bugs and tuberculosis, nor of compounding chemical manures, and balanced rations, but more; and let us get ourselves into a mood for greater respect for experimenting out in the fields. We have had but little schooling in field experimenting in our colleges. Many of our agriculturists are obliged to start into work in States where they are little acquainted with the agriculture of the various parts of their States, and, by the time they have learned the State, they are called up higher by some institution, or are called down by some trouble, possibly more or less political in its nature. That State is fortunate whose agricultural college and station combined is making for her a number of practical experimenters; to insure that, in the future, she has competent work done in teaching and experimenting with the part of our work which must be learned by experience in the State.

While I venture to give below something of a classification of plat experiments, it is most wise to confine the work to only those lines of greatest moment in each State, unless funds are ample for experiments along many lines, as a few things done to a finish are very valuable, and many things but poorly done are simply opportunities wasted.

Under the subject of raising each class of crops, many practical things can be reduced to scientific form, which the farmer does as his father did, with but little knowledge of its philosophy or of its business outcome, and too often in a manner to get very poor results. How to apply barn and commercial manures is little understood in the West, and there are a thousand and one questions regarding how best to plant each crop on each soil in every State, and the only way the farmers will ever know the facts is through scientific experiments.

Applying water under irrigation is a most interesting line in which our Western agriculturists are working, and which we further East must study. But a question touching a far wider scope of country and of far greater monetary importance is the conservation, in our soils, of the water from rains and snows, and getting from it the greatest net value. The preparation of the soil and intercultural tillage in reference to controlling soil moisture have come to be most prominent questions in the middle Northwest, where we recently have occasional droughts.

Methods of harvesting and preserving crops offer quite as honorable lines for experimenting as do the study of clover nodules or the antennæ of insects, though too few of our new college graduates have set their sentiments in that direction. Methods of raising crops have been improved mainly through the efforts of machine men, who, under our most beneficent patent laws, profit by studying the raising of crops, and the sale of machines adapted to improve the crops or to save labor.

Next to methods of raising crops, the testing of varieties has progressed. The newly appointed agriculturist too often bases his fond hopes for undying fame and transcendent glory on this class of work. But it is a necessary and most important line of our work in every State, and not without considerable credit, as in case of our good friend, William Saunders, of Ottawa, Canada, and his grains, or of Professor Blount, or Dr. Hillgard, and the numerous field crops sent out over their States. It is necessary to test, in every State, the most promising varieties of each class of crop which may be procured within and without the State, discarding, as soon as possible, all but the comparatively few best, that the most of our energies may be expended upon the promising sorts. When the best are decided on, they may so cheaply be improved by breeding them, that the State which does not provide for this work is neglecting an opportunity of being of great assistance to her farmers. If pansies can be bred into so many beautiful varieties, and if Europeans can raise the percentage of sugar in the juice of sugar beets from 6 to 15 per cent in a little over half a century, I have the strongest faith that we can add 10 to 30 per cent to the yield of Minnesota's famous No. 1 hard wheat, which is not a very large yielder. In this work we reduce the size of plat to 1 foot square and deal with individual plants, each under the same conditions as is every other, as would the breeder of dairy cows or the breeder of trotting horses, and our record yields, or, if you please, performance records, are becoming far more numerous and quite as interesting as are the performance records of milkers and trotters.

From one kernel of wheat, oats, barley, field peas, or timothy, selected because of its inherited tendency to yield a large crop of grain, and used as a basis of variety, we can have enough grains for a twentieth-acre field test in three to five years. These newly originated varieties must be tested in a field way in comparison with the standard sorts most generally used in the State. All but the best old and new sorts can be rapidly eliminated, else the work will become bulky. It would seem practicable to raise a hundred bushels of each new, excellent variety of wheat, for example, on our own lands. Furnish this seed to a farmer who has good land, clean of weeds, and have him grow it for us at a slight premium over ordinary market prices; then we can have the farmer deliver the one or more thousand bushels to the freight companies, bagged, and bill it to farmers to whom we sell it in quantities of, say, 5 bushels or less, at cost of seed and packages. Thus we can inject into the State annually one or more varieties of a superior grain, the farmers paying all of the expense except the experimenting to find or improve the kind. Varieties which endure, proving their value to farmers and millers when put to practical test, will be very rapidly spread. Some plat work may be needed in seed control to prevent seedsmen from sending into the State varieties that are not profitable. So many of the best yielding varieties and subvarieties have no identifying features, and if we do not increase and distribute the original stock with which our best yields were made, we do the State little or no good—maybe harm.

Some of our best-yielding Fife wheats, for example, which have a performance record of male and female parents for several generations and have averaged best in a dozen plat trials, may look like other Fife wheats. We must distribute it to perpetuate our work of breeding it up.

In general field management, such as rotation experiments, the management of meadows and pastures, etc., plans have developed slowest and are yet crudest. Which agriculturist here could give us a statement of the best rotation for a dairy farm, a sheep farm, or a farm devoted to diversified agriculture, in the different parts of his State, and sustain his position with carefully collected facts? We do not know which crops to collect in the rotation, nor in what order of succession to place them. We have only very dim ideas of which crop best prepares the land for each other crop. We have very crude knowledge of which rotation gives the farmer the largest net average annual profit above cost of production. We have not made a study of which rotation best keeps the weed and insect enemies at a minimum. We have done too little at calculating the ultimate result on the fertility of each way of managing the rotations on the field or farm. Nor have we the facts or figures with which to emphasize the importance of live stock and the raising of those crops which will be turned into manure on the farms rather than shipped away.

Those responsible for experiments on plats need to study methods more and to consult with each other more on methods of this kind of research, and to spend more time in laying out the scheme of their own experiment work.

A brief discussion of both papers followed.

It was moved by Mr. Armsby that the section recommend to the Association that Mr. Hilgard's paper entitled "The Distribution of Salts in Alkali Soils" be read before the general session. Carried.

The third subject, "Shall the results secured in dairy tests be stated as butter fat or its equivalent in butter? The adoption of a conversion factor" was next taken up. The discussion was opened by Mr. Armsby, who was followed by Messrs. Cooke, Curtiss, and others. After the discussion, Mr. Armsby presented the following resolution:

Resolved, That the section recommends that in tests of cows or herds by fat tests the results be stated in terms of butter fat and also in terms of its approximate equivalent in butter.

The resolution was carried.

Mr. C. F. Curtiss moved that the section recommend the adoption of a conversion factor of 16⅔ in converting butter fat into butter. This was amended by Mr. W. W. Cooke, who moved to refer the question of adopting a conversion factor to a committee of three, said committee to report to the section at the next session, on the 17th. The amendment was accepted and the motion carried. The chair appointed as such committee Messrs. Curtiss, Armsby, and Cooke.

Mr. Armsby next addressed the section on the subject, "A practicum in stock feeding," in which he detailed his method of giving practical instruction in stock feeding to dairy students. The section then adjourned.

JULY 17, 2 p. m.

The section was again called to order by the chairman. The committee on conversion factor reported through its chairman, Mr. Curtiss, the report being in favor of adopting the factor of 16⅔ in converting butter fat into butter.

On motion of Mr. Myers the report was accepted and adopted.

Mr. J. H. Connell next presented a paper on "Practical Methods of Maintaining Fertility," which was followed by a spirited discussion in which many delegates took part.

The chairman appointed the following committee on nominations: Messrs. C. D. Smith, J. L. Hills, and A. A. Mills.

Mr. Smith next read a paper entitled, "Individuality as a Prime Factor in Experiment Station Feeding." The subject was illustrated by charts showing the remarkable variation in yield of milk and butter fat to which individuals are subject. He was followed by Mr. Cooke, who spoke on "Objects and Methods of Experimenting on Dairy Feeding," and Mr. Mills followed with a paper on "Length of Periods in Experiment Station Feeding." These papers created much interest and developed a discussion in which many of the delegates took part.

Mr. Armsby addressed the convention on the subject of "Digestion experiments." He showed some apparatus used and explained his methods of procedure. Mr. Hilgard next presented the following paper, which was illustrated by charts showing the results obtained by different reagents on many samples of soils:

LATE PROGRESS IN SOIL ANALYSIS.

The revival of interest in direct soil examination for practical purposes is fast bearing its fruits in the development of new methods of analysis, as well as of modes of interpretation of the results obtained by former methods; and this movement is no less pronounced in Europe than in the United States. The great difficulty experienced in the practical carrying out of culture experiments to definite conclusions under any but the most rigorous scientific supervision is becoming more and more obvious; and so is, correspondingly, the desirabilty of direct methods for determining the needs of a soil without losing at least one year's time in culture experiments.

In the discussion of this subject it is too often forgotten that two distinct questions call for solution by chemical soil analysis. One is to ascertain the total store of plant food which may become available by the weathering process within periods of time in which we are interested, involving essentially the durability of the land. The other is the ascertainment of the plant food immediately available for the growth of crops. The former aims to determine a maximum; the latter, a minimum. Much fruitless discussion has arisen from a confounding of the two problems, which clearly can not be reached directly by the same means. The determination of immediately available plant food interests specially the agriculturists of countries long settled; while those intending to settle on new lands of unknown cultural values are specially interested in knowing how long it will be before the soil they cultivate will call for fertilization, and when it does, what fertilizers will be needed first. It is still further desired by them to know what are the special adaptations of their lands; and while these are as much determined by physical as by chemical factors, yet a knowledge of the latter is indespensable to an intelligent judgment.

It is hardly necessary at this stage of the discussion to do more than to recapitulate briefly the points that chemical soil analysis as usually practiced can fairly claim to have established, in respect to its direct bearing on cultural experience, before discussing those that as yet have not been fully tested.

(1) As regards soils in their natural condition there can be no question that an unusually small proportion of any one ingredient important to plant nutrition indicates that a deficiency in that ingredient will make itself felt, if not at once certainly within a few years after cultivation is begun, and can be remedied by the use of that ingredient as a fertilizer.

As a corollary to this, those who claim that analysis can not appreciate the differences caused by the withdrawal of soil ingredients by crop production must admit that the same maxim holds true of soils cultivated in crops definitely known for any length of time without the addition of any fertilizers. This brings a very large proportion of American lands now under cultivation within the pale of those which can be successfully investigated, and therefore practically benefited, by the lights afforded by soil analysis.

(2) Conversely, any ingredient shown by analysis to be present in very large proportion in any virgin soil may fairly be presumed to be the last to become deficient under ordinary modes of cultivation.

Both the above propositions not only commend themselves to common sense, but have been over and again abundantly verified in practice. Conjointly they point the way to a third, viz, that as between soils of essentially similar nature or origin the amount of plant food which is made currently available by the various processes of "weathering" is sensibly proportional to the relative amounts present and shown (or presumed to be shown) in the analysis.

It seems to me that as regards these simple propositions, the burden of proof rests with those who deny them; always provided that the analyses have not been made by too incisive a method, and upon an absolutely uniform plan. The ultimate analysis of the soil mass (by hydrofluoric acid or by carbonate fusion) is to all intents and purposes practically worthless; while on the other hand too light an action, such as that of carbonated water, is equally valueless in presence of the fact that plants themselves have long been known to employ as solvents acids exuded from their roots, sometimes of sufficient strength to engrave the form of the root fibers upon the smooth surface of feldspar and hornblende crystals in the course of a single season.

The practical utility of the interpretation of soil analyses depends essentially, of course, upon the correct ascertainment of the percentage and relative figures which may be considered as constituting deficiency, adequacy, and abundance of any ingredient. To this I have devoted a great deal of labor, the results of which, so far as then developed, I have given in former publications. It was but reasonable to expect that the figures for the several degrees of deficiency or abundance would not be the same for soils of every class, and I so found it, the most potent determining factor in the premises being lime, actually or virtually, in the form of carbonate.[1] The general statement made by me fourteen years ago, that in the presence of abundance of lime much smaller percentages of plant food prove adequate than when lime is deficient, is abundantly verified by all the work done since, whether by myself or others; but the causes, according to modern research on bacterial action, are shown to be even more complex than I had foreseen at the time of my former publications. In the course of a closer personal study of the soils of Europe I have also recognized one reason at least why this dominant function of lime has remained almost unrecognized in the Old Continent. This is simply that calcareous formations (including the drift areas) are so predominant in Europe that few soils are what can properly be called noncalcareous; that is, not containing at all times a sufficient excess of calcic carbonate to produce the characteristic important effects upon the soil. With us such large areas are deficient in lime in the soil that the contrast between them and the adjacent calcareous areas becomes patent at a glance. It was this that in the first place led me to consider the claims of soil analysis as worthy of consideration. Added to this accident of the almost uniformly calcareous character of European soils comes the fact that only such as had been long cultivated came under the consideration of investigators there, who thus wrestled with the problem in its most complex form. This explains very simply the discredit which was there so long thrown upon the very name of soil analysis, a tradition to which some persons on this side of the Atlantic still tenaciously cling, while on the other side that tradition already counts among the "*ueberwundene Standpunkte*," and the effort to make soil analysis useful to practice is being zealously pursued by many hands.

The most notable recent utterance on the general subject is that of Professor Liebscher, of Göttingen, in a report of 216 pages on the results of a seven years' course of culture-plat experiments. He shows the necessity of discussing all such results on the principles of the calculus of probabilities, and by so doing comes to a number of very valuable conclusions regarding the particular soils on which the experiments were made. Further than this the results of course can not go; but Liebscher wisely accompanied his plat experiments with parallel analyses of the several soils, using the usual method of chlorhydric extraction. Regarding these he makes at the end of his report the following statement, remarkable as coming from a notable authority who has thus far never said a word in favor of chemical soil work.

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[1] Wheeler and Hartwell (Rhode Island Sta. Bul. 28) aver that I was in error in the statements made regarding the "commanding position of lime" in a paper quoted by them, in which the above proviso regarding the carbonate was not made. My meaning is, however, so plainly put in several other publications that I can not admit their claim to be well founded, and the facts shown by themselves as the results of liming but corroborate my maxim.

"While reserving detailed discussion for the future, we can not omit to mention right now that the ordinary analysis of the chlorhydric soil extract yields much more information than is mostly supposed. In fact, we can deduce the requirements as to mineral plant food of all the soils we have investigated, from their analysis, coming to the same results as from our culture tests, by adopting the following points of view in their interpretation."

These points of view agree so closely with those heretofore developed by me in my work on virgin soils that I can not but feel considerable satisfaction in seeing them verified for soils long cultivated, a point regarding which I have not expressed any opinion thus far, although convinced that such agreement would, in the nature of the case, be found to exist. Soil analysis thus becomes a most valuable guide and adjunct for culture tests, abridging the latter and eliminating their uncertainties to an extent that only long-protracted series of blind trials could otherwise achieve. Of course, the final test will always rest with culture experiments, but these can, under the lights afforded by a reasonable knowledge of the soil's peculiarities, be undertaken by the farmer on a large scale with a vastly smaller chance of costly failures. It is almost entirely upon such experience—had partly before, partly after examination—that my interpretation and conclusions as to the efficacy of this method of investigation is based.

Coming now to the second problem, numerous efforts to ascertain the condition of the soil with respect to immediately available plant food have, as is well known, been made, but have yielded very indefinite results until within the last few years. Dyer attacked the problem by the direct determination of the acidity of the root juices employed by the plant in dissolving its mineral food. When once mooted, the wonder is that this simple, direct appeal to the plant itself had not been thought of sooner, since it has long been evident that this action is much more energetic than that of carbonated water, at first thought to be the chief solvent.

Warington[1] has discussed the imperfections in Dyer's prescription of a 1 per cent solution of citric acid as a solvent for the supposed available mineral plant food. Most of these have been foreseen and admitted by Dyer himself, who is still, it is understood, engaged in the investigation of the subject. One of the most serious obstacles to the ready use of Dyer's method, especially in the West, is the presence of earth carbonates, which of course neutralize the citric acid used to an extent corresponding to the amounts present, which it is not altogether easy to neutralize without risk of increasing unduly the solvent effect, since it is inadmissible to use either heat or a stronger solution to accelerate the decomposition of the carbonates. The only really unobjectionable way seems to be the successive addition of the 1 per cent solution until neutralization ceases, then adding the required amount of the acid in addition. This is often a tedious operation, especially when the carbonate grains are somewhat large; and thus the use of the method in limestone soils is somewhat inconvenient.

I have, however, tested it on a number of soils containing only small amounts of carbonates, for the determination of the available phosphoric acid, with results agreeing exceedingly well with the cultural experience. In the absence of suitable material for such experiments in as new a State as California, where moreover nearly all soils are calcareous as a reult of climatic conditions, I have used a number of soils sent from the Hawaiian Islands for investigation as to their needs, they having ceased to produce satisfactory crops of sugar cane.

Most of the soils of the Hawaiian group are the outcome of the decomposition of black, highly ferruginous lavas, under the influence of rather copious rains. The soils so formed are usually of a deep ocherous tint, unless (as is frequently the case) they contain humus enough to obscure the iron tint, which, however, appears plainly on ignition. They would fall under the very indefinite class of "laterite" soils of German authors; but, unlike a great many of the true tropical laterites, the iron is in this case so apparent, not merely because of fine diffusion, but on account of its extraordinary amount, which sometimes exceeds 40 per cent of ferric oxid, and is usually in the thirties; while the alumina dissolved in the ordinary chlorhydric extraction is frequently only one-third as much as the ferric oxid, though sometimes equal, and frequently far exeeds the carbonate-soluble silica, proving its existence in the form of hydrate. While mostly supplied fairly with potash, many of these soils are characterized by very small lime percentages, in view of which I have long ago recommended the use of the coral sand from the beaches, with excellent results.

Nearly all these soils showed by extraction with nitric acid after ignition ample and in some cases very large percentages of phosphoric acid. As in several cases the use of phosphates had nevertheless produced good results, I suspected that the phosphoric acid might be rendered unavailable by the presence of so large an excess of ferric oxid—a relation I had previously observed in Mississippi soils, and which is readily intelligible a priori. It is strenuously reaffirmed by Liebscher, who in

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[1] Science Progress, May, 1894.

his recent publication, referred to above, mentions specially that the presence of the sesquioxids seems to depress seriously the availability of the phosphoric acid of the soil, because of the insolubility of their basic phosphates in the dilute vegetable acids of the roots.

As these Hawaiian soils seemed to offer an exceptionally good opportunity for testing this question, the determination by nitric acid in the ignited soil was supplemented by one made with chlorhydric. This treatment, as might be anticipated, gave a very much larger result in most of the samples, since crystalline vivianite will dissolve in HCl as well as the gelatinous basic ferric phosphate, for which reason I have discarded its use in the determination of phosphoric acid for the practical purposes of soil analysis. The same objection lies, of course, against the use of concentrated sulphuric acid, proposed by Goss. In either case, the results are simply obscured by the mass of inert matter brought into solution.

The table on page 92 exhibits these results, together with those obtained on some California soils. Among the latter is one (No. 1117) notably deficient in phosphoric acid, both from the analysis and from culture tests, while the rest are all from fresh, if not virgin, ground and stand in no present need of fertilization, judging from their profuse productiveness.

Keeping in mind that such figures as 6 and 8 in the third decimal place mean a deficiency of available phosphoric acid according to Dyer's results, the lesson taught by the figures in this table explains itself. In the highly productive virgin soils of California the citric-soluble phosphoric acid has ranged from 0.033 to as much as 0.063, while in the "phosphate-hungry" soil No. 1117, 0.006, or from one-fifth to one-tenth as much only appears. In the case of the Hawaiian soils the showing is equally cogent; of those from the Oahu plantation, Nos. 1 and 2 were reported as giving poor crops with the same amounts of phosphates that gave a satisfactory crop on No. 3, which contains four times as much of the easily soluble form. Nos. 1 and 3, from the Hawaii plantation, do not as yet show a very serious decrease in crop production, but it was desired to know where trouble was likely to arise. Here the phosphates are probably not concerned as yet; and I was led to investigate specially the cause of the deficient production in the case of No. 6, which bore two fair crops and then utterly refused to grow the cane to maturity.

I suspected that, notwithstanding the high humus percentage of this soil, there might be a deficiency of available nitrogen, and therefore applied to it the clew previously obtained from the investigation of the nitrogen percentages in the soils of the arid and humid regions,[1] which pointed to the much greater ease with which humus of high nitrogen percentages can be nitrified in the soil. Conversely, it was predicable that whenever that percentage falls below a certain point, nitrification will be too slow to supply the needs of a growing crop.

While I have not yet been able to verify this induction to the full extent required, all the data thus far obtained corroborate its correctness. A few such data are given in the table. Among the California soils the most striking example is that of No. 1679, one of those showing an unusually high nitrogen percentage in its humus (18.6 per cent). Alongside of it the long-cultivated soil, taken within 50 feet of the other sample, but kept in grass, unmanured, for about ten years, and lately dug up because of unsatisfactory growth of the grass, shows with a higher humus percentage a much lower proportion of nitrogen, proving strikingly the depletion caused by exhaustive cropping. A similar relation is shown between the two old soils of the Oahu plantation and the relatively fresh one (No. 3), where the ratio is as 1 to 3. Of the soils from the Hawaii plantation, the first two (4 and 5) are just a little below the Oahu soils in the nitrogen percentage of the humus, although the totals of both humus and nitrogen in the whole soil are higher. But in the case of No. 6, while the humus percentage is nearly double that of the other two, the nitrogen content of that humus is the lowest I have yet observed—1.7 only. In order to test the hypothesis in this striking case, I made the pot-culture experiment. Unfortunately, the experiment could not be carried to its conclusion, on account of the invasion of the leaves by the *Puccinia graminis*, which, despite of vigorous sulphuring finally killed the plants. It will be repeated with special precautions against the recurrence of this trouble. But even as the experiment stands, the correctness of the induction in this case can not well be called in question. I expect before long to hear of the results of the same test on the large scale, for which the same dose of Chile saltpeter (about 165 pounds per acre) was recommended.

I think, therefore, that I am justified in indulging the hope that we are on the trail of a method for the definite ascertainment of the condition of a soil as to available (nonnitric) nitrogen, which, with the method of Dyer for the corresponding determinations with respect to potash and phosphoric acid, when all are perfected, will effectually solve the problem of the manure requirements of cultivated soils that has so long resisted the efforts of chemists. There can be no doubt that differ-

[1] Agl. Sci., April, 1894.

Table of analyses of some California and Hawaiian Islands soils.

	California soils.							Hawaiian Islands soils.					
								Oahu.			Hawaii.		
	No. 110, Putah Valley, middle land, Dixon, Solano County.	No. 168, valley soil, Santa Paula, Ventura County.	No. 1167, black lands soil, 3 miles west of Tulare City, Tulare County.	No. 1117, granite soil, Fleming tract, Amador County.	No. 1281, reddish gray mesa soil, experiment station, Chino, Los Angeles County.	No. 1079, black adobe soil, University of California grounds, Berkeley, Alameda County.	Long-cultivated soil, University of California, Berkeley.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Coarse materials > 0.5mm	All.	3.50	10.60	50.00	10.00	15.00	....	2.00	2.00	2.50	4.00	3.00	5.00
Fine earth		96.50	89.40	50.00	90.00	85.00	....	98.00	98.00	97.50	96.00	97.00	95.00
Analysis of fine earth.													
Insoluble matter	67.83	85.66	62.43	77.11	67.98	54.50	....	16.60	15.84	14.49	26.99	28.66	21.07
Soluble silica	3.67	1.85	16.99	5.40	9.51	19.00	....	14.37	14.07	30.37	10.26	7.35	2.68
Potash (K_2O)	.93	.63	1.09	.35	.93	.73	....	.66	.45	.26	.40	.61	.44
Soda (Na_2O)	.12	.07	.77	.17	.42	.20	....	.09	.14	.08	.26	.17	.25
Lime (CaO)	.77	.76	1.46	.37	1.75	1.15	....	.56	.26	1.04	.52	.68	.28
Magnesia (MgO)	2.29	.59	1.44	.37	.82	1.08	....	.76	.65	.80	.96	1.04	.60
Brown oxid of manganese (Mn_3O_4)	.11	.03	.06	.09	.05	.04	....	.04	.05	.03	.21	.20	.07
Peroxid of iron (Fe_2O_3)	8.01	3.35	4.98	2.93	7.07	8.43	....	40.00	39.05	19.68	19.10	18.23	30.10
Alumina (Al_2O_3)	9.16	3.10	6.87	7.27	7.72	7.92	....	12.64	14.61	18.29	21.41	20.18	14.38
Phosphoric acid (HNO_3, sp. gr. 1.20)	.11	.20	.12	.04	.20	.19	....	.16	.19	.32	.64	.70	.97
Phosphoric acid (HCl, sp. gr. 1.115)	....	....	....	....	....	....	....	.32	.43	.35	1.60	1.28	....
Phosphoric acid (citric acid, 2 per cent solution)	.040	.062	.062	.006	.054	.033	....	.004	.004	.020	.035	.037	.025
Sulphuric acid (SO_3)	.12	.01	.02	.02	.03	.04	....	.04	.03	.09	.32	.21	.29
Water and organic matter	7.12	3.13	4.36	6.09	3.49	6.54	....	14.30	14.18	14.59	18.60	21.65	28.60
Total	99.94	99.38	100.59	100.22	99.97	99.82	....	100.22	99.52	100.04	99.67	99.61	99.73
Humus	1.71	.84	1.33	.80	.58	1.20	1.65	3.33	3.35	3.24	4.84	5.43	9.95
Humus ash	....	....	.36	.31	.26	.94	....	3.90	3.12	2.22	2.76	3.56	6.70
Containing phosphoric acid	....	....	.01	.02	.02	.04	....	.074	.11	.166	.58	.50	....
Containing silica	....	....	....	....	....	....	....	.650	.78	1.100	.76	.84	....
Humus nitrogen in 100 humus	4.250	7.990	18.190	15.270	15.500	18.580	3.40	3.55	3.30	9.800	2.80	3.100	1.71
Humus nitrogen in 100 fine earth	.072	.067	.302	.123	.090	.203	.056	.118	.110	.314	.134	.168	.170
Hygroscopic moisture absorbed at 15° C	10.32	5.49	5.38	3.27	1.98	11.98	....	19.66	18.50	21.25	23.07	23.140	23.81

ences in the other soil ingredients will influence the lower limits of each of the three primarily important substances; more especially will the presence or absence of an adequate amount of lime to keep the soil in nonacid condition, and to perform the many other important functions of that base, doubtless be found very important. I have long ago published, as the result of numerous comparisons of soil composition with agricultural practice, that in presence of much lime a smaller percentage of the several mineral ingredients will be found adequate. From the data already obtained, the same seems to hold true in respect to nitrogen. That this is likely to be so might be predicted from the well-known favorable effect of lime on nitrification, and my figures appear to indicate as probable that in soils poorly supplied with lime the limit of "nitrogen hungriness" lies rather above 2.5 per cent of nitrogen in the soil humus, while in calcareous soils it lies below that figure for grass crops on soils otherwise fairly conditioned.

It is predicable that no definite figure can be assigned that would be valid for all crops and soil conditions. The richness of the humus in nitrogen is but one of the several factors that contribute to ready nitrification; porosity and temperature as well as moisture conditions will make their influence felt, and it is thus probable that in relatively cold, close soils, and in cold climates a higher nitrogen content is required for ease of nitrifrication than where warmth and porosity concur in favoring the action of the nitrifying bacteria. Again, different crops will require a different rate of nitrogen supply. Here, as in the rest of the problem of predicting the qualities of soils, no mechanical or mere sliding scale requiring no effort of the intellect or judgment will be likely to suffice, but a number of points will have to be conjointly considered. Admitting all these difficulties, it will be no inconsiderable advantage to find in this method an approximation to the problem of a soil's requirement in nitrogen, as we have in Dyer's method an extremely useful index of the soils needs in respect to potash and phosphoric acid. While in all cases the plat or field test will have the last word, yet the simplification and directness introduced into them by the previous determination of the prominent features of the soil by chemical means is so great and palpable an advantage, and so clearly in line with the recognized methods of inductive investigation in all other lines, that its omission is hardly excusable.

After the discussion of this subject, a motion was put and carried to the effect that the section ask permission of the executive committee to hold a session at 2 p. m. the 18th, for the discussion of the subject of irrigation. The committee on nominations made the following report: For chairman, C. C. Georgeson; vice-chairman, C. F. Curtiss; secretary, H. J. Patterson.

The report was accepted and referred to the general session for confirmation.

Adjourned.

THURSDAY, *July 18, 2 p. m.*

The necessary permission having been obtained from the executive committee, the session again met pursuant to resolution for the discussion of the subject of irrigation. The subject was opened with an address by L. C. Carpenter. His address was followed by speeches from several other delegates and the discussion was continued until 4 p. m., when the section adjourned sine die.

THE SECTION ON HORTICULTURE AND BOTANY.

In the absence of the chairman, the meeting was called to order July 16, 1895, by Mr. Lazenby, secretary; and Mr. Burrill was elected chairman pro tempore.

A committee, consisting of Messrs. L. H. Pammel, P. H. Mell, and F. W. Rane, was appointed to select papers from the published programme for presentation at the general sessions. After consultation, the following papers were selected:

(1) "The Bacterial Flora of Foremilk," by H. L. Bolley.
(2) "How Shall We Teach Horticulture?" by William R. Lazenby.
(3) "Some Undefined Duties of Station Horticulturists," by F. W. Rane.
(4) "The Grass Problem of the Plains," by C. E. Bessey.

An interesting and suggestive letter from L. H. Bailey on a new method of work in horticulture was read by the secretary and elicited considerable discussion.

Section held its second meeting Wednesday afternoon, July 17.

The following resolution, offered by Mr. Pammel, was unanimously adopted:

Resolved, That the Section on Horticulture and Botany deem the organization of a new section on "irrigation" ill-advised and uncalled for.

The following papers were then presented:

"Soil Moisture as Influenced by Local Factors," by F. W. Card. "The Relation of the Systematic to the Economic Botanical Work of the Station," by Aven Nelson. "The Necessity of a Fuller Consideration of the Nonlocal Conditions in Botanical Investigation," by H. L. Bolley. "A New Spraying Apparatus," by E. S. Goff. "Bacteriological Methods and Bacteriological Work," by L. H. Pammel. "Results Reached in Crossing," by J. L. Budd.

The section held its last session Tuesday afternoon, July 18.

The first business in order was the election of officers for the ensuing year. This resulted as follows: Chairman, F. W. Card; secretary, H. L. Bolley.

A motion was made by Mr. Lazenby and duly carried, that a committee of three be appointed to report at the next meeting of this Association a carefully formulated scale of points to be used as a standard in the judging of orchard and garden fruits.

The committee appointed was: William R. Lazenby, E. S. Goff, and L. H. Bailey.

Mr. Mell offered the following, which was unanimously adopted:

Resolved, That the secretary of the Section on Horticulture and Botany be instructed to correspond with the horticulturists and botanists of the Association asking them respectively to select two horticultural and two botanical subjects of general interest to the section, for consideration at the next annual meeting. These four subjects to be selected as soon after the adjournment of the present session as practicable and that due information of the topics selected be given. The selection of the four topics to be made by the chairman and secretary of the section from the lists submitted.

The following papers were then presented:

"The Forage Problem in the West," by J. W. Toumey; and "Methods of Studying Parasitic Fungi," by G. F. Atkinson.

At the request of the members, the secretary then read the following papers, the authors being absent:

"Soil Treatment for Fungus Diseases in Connection with Crop Rotation," by B. D. Halsted. "Is Variety Testing of Sufficient Importance to Justify its Cost," by S. A. Beach. "The Value of Fruit Tests in Different Localities," by M. H. Beckwith.

The hour for the excursion tendered by the Denver Chamber of Commerce having arrived, the section adjourned.

THE SECTION ON ENTOMOLOGY.

The meeting was called to order at 2 p. m. July 16, 1895, by Chairman Gillette. In the absence of the secretary elect, Mr. Lawrence Bruner was appointed temporarily to this position.

The first paper presented was that prepared by T. A. Williams, entitled "Plant Lice of the Chrysanthemum." In his absence the secretary did the reading.

In this paper Mr. Williams described two new species of these insects, one a green and the other a brown form. As remedies he suggested the use of kerosene emulsion. In the general discussion that followed, the facts were brought out that the green species was quite readily controlled by the ordinary methods employed by florists. Not so, however, with the dark-colored species. Professor Smith had found the fumes of bisulphid of carbon to be about the only remedy for it. The method employed was to place the infected plant in some tight box or vessel in which an open dish of the bisulphid was also confined. Mr. Bruner had also noted the difference in the hardiness of the two forms, but had not made any experiments tending to their suppression. Mr. Atkinson suggested the possible use of the fungus Sporotrichum as a possible remedy, mentioning as an example of the effectiveness of this disease a case where ants in the laboratories of his college had succumbed to it. Several other references to kindred diseases were cited by those present.

A second paper by the same gentleman followed. It was entitled "A New Sawfly on Plum." The insect in question was a very common and destructive one in various parts of the Dakotas, Nebraska, and adjoining States. Its preference seemed to be the native or wild plums, but cultivated varieties did not escape. The insect is gregarious, and spins a web, draws the terminal foliage of twigs together, and feeds while protected. Paris green was suggested as a remedy. Messrs. Bruner, Gillette, and Cockerell had each seen the insect and were quite well acquainted with its mode of attack, all having had more or less experience with it or some allied species.

Mr. Waldron, at this stage of the meeting, asked the opinions of those present as to the cause for the almost total absence of the Colorado potato beetle from much of the central region of the United States. The same immunity had been noticed by Messrs. Smith, Toumey, and Gillette, but none of these gentlemen had thought much about the matter, hence could suggest no definite reasons for such a decrease in the insect's ranks.

Following this a general discussion arose concerning insecticides and insectifues.g Especial stress was laid on a certain insect lime that had been distributed to various experiment stations for trial. No very strong recommendations were given it by those who had tried it. It was thought that it might possibly be used to advantage if applied against such tree insects as cankerworms, etc. The material appeared to be some kind of petroleum refuse, similar to a crude vaseline, hence should not be expensive—a requisite for an insecticide or insectifuge for general use.

Mr. Hillman reported the appearance of *Pieris rapæ* in the vicinity of Reno, Nev. This brought up a general discussion concerning remedies that can be applied for this and other cabbage worms.

Mr. Cockerell read a paper entitled "The Entomologists' Platform," in which he urged the desirability of the entomologists writing in a more definite manner to further those reforms concerning which they were all agreed. The work of the station entomologist consisted first, of investigation, and second, of spreading the truths ascertained among the people. The latter was really missionary work, and could only be carried on successfully by united effort. Although there were entomological associations, the points of agreement among their members were too little emphasized, while the public was very ready to observe and comment on the disagreements which occurred. Yet, if the entomologists could get the agricultural and horticultural public to do only those things they could unanimously recommend, the gain would be immense.

In the discussion which followed, the matter of "technical" or strictly scientific papers arose, and it appeared to be the sense of most of those present that such papers should only be published by stations as bulletins under certain conditions, and that these papers had best be sent to scientific periodicals, transactions or proceedings of scientific societies.

Mr. Atkinson exhibited certain enlarged "Choke cherries," which resembled more or less closely the "Plum pockets," so frequently seen on various cherry and plum trees. These particular specimens were infested by a Cecidomyid larva in large numbers, and the question that arose was, "Do the Cecidomyid larvæ cause the deformity in the cherries, or is this deformity caused by some fungus, and later visited by the female fly for an egg repository?" Mr. Bruner had often seen the insects within the abnormally large and oddly formed fruits. None of the insects had been reared by him. Mr. Atkinson had found the fungus upon larva-inhabited fruits.

Adjourned till Wednesday, July 17, at 2 p. m.

Second session called to order by President Gillette.

The first paper read was one entitled, "Some Observations on the Plum Tree Gall Mite," by A. D. Hopkins. Some of the results obtained by Mr. Hopkins in his experiments with this mite were a surprise to those who heard this paper read. Sulphur did not appear to destroy the mites when used in the ordinary manner, neither did kerosene emulsion kill them when applied as strong as one part of the emulsion to two parts of water. A general discussion was then had in reference to remedies against mites.

A second paper from Mr. Hopkins was read, "On the Study of Forest Tree Insects."

A paper was then presented by Mr. Gillette, entitled "Two Leaf Rollers." These leaf rollers are two of Colorado's worst pests on fruit and box elder trees, and are specially abundant near the foothills from Fort Collins and Greeley on the north to Colorado Springs on the south. The moths which lay the eggs are abundant about the trees in the evening at this time of the year, where they congregate to lay their eggs. The moths are small, yellowish in color, and deposit their eggs on the trunks and large branches, where they lie dormant until next spring. As the worms are now through with their feeding we shall not be troubled any more with the pest this year.

Professor Gillette has been experimenting largely for the destruction of these pests, and finds that they may be destroyed either in the egg or worm state. In the egg the most successful remedies were a very strong kerosene emulsion applied during the winter, or an application of ordinary whitewash just before the eggs hatch or about the time the buds of the trees begin to open. The best remedy for the destruction of the worms was Paris green in water, applied in the proportion of 1 pound to 75 gallons of water, about 2 pounds of lime being added to prevent the burning of the leaves. The first application should be made as soon as the rolling of the leaves is noticeable, and the application should be repeated once in two weeks as long as needed. An interesting fact in connection with the destruction of these pests is that a bacterial disease has appeared at Fort Collins that has destroyed the worms in large numbers.

Mr. Cockerell then exhibited to the section a number of very interesting Coccidæ from different parts of the world, among which were typical specimens of some of the most destructive species.

The officers for the ensuing year were then elected as follows: Otto Lugger, chairman; G. C. Davis, secretary.

Adjourned sine die.

THE SECTION ON MECHANIC ARTS.

The first meeting of the Section on Mechanic Arts was called to order July 16 by Chairman Patterson. After the reading of the minutes of the 1894 convention, the section entered into a general discussion, relative to the recognition of the Section on Mechanic Arts, in the name of the Association.

The discussion brought out very forcibly that the Section on Mechanic Arts is not supported by the general Association, and in order to induce prominent educators in mechanical lines to take an active interest in the work of the section, some recognition must be given to mechanic arts in the name of the Association, inasmuch as agriculture is specifically recognized.

The regular work of the meeting was then taken up. A paper submitted by Lieut. W. H. P. Creighton was read by the secretary.

Lieutenant Creighton's paper was enthusiastically discussed, and Mr. Paul indorsed graphical methods in all educational, as well as in mathematical and technical work.

The secretary read a paper, by O. P. Hood, entitled "Engineering in an Agricultural College," which opened up a general discussion on "What courses shall we carry on in our colleges?"

The following committee on nominations was appointed: Messrs. Lawrence, Colburn, and Carpenter.

The meeting adjourned to meet July 17, 1895, at 2 p. m.

The adjourned meeting of the Section on Mechanic Arts was called to order at 2 p. m. July 17, 1895, by Chairman Patterson.

Mr. L. C. Colburn was called upon and presented a paper, full of interest and practical suggestions, on the "Theoretical *v.* Practical Work of an Engineering Course."

Mr. C. V. Kerr not being present, the subject of his paper, "Training of Negroes in Arkansas," was informally discussed by Messrs. Langford, Hill, Patterson, McCrea, Dickinson, Colburn, and J. W. Lawrence.

Hon. Frank A. Hill outlined in an interesting manner successful methods that had been employed in the education of the Indian.

The committee on nominations submitted the following report:

Your committee on nominations desires to present the following names for the officers for the ensuing year: Chairman, J. W. Lawrence; vice-chairman, S. Fortier; secretary, F. P. Anderson.

Report accepted and adopted.

The meeting then adjourned sine die.

THE SECTION ON COLLEGE WORK.

Section met pursuant to programme at 2 p. m. July 16, and was called to order by Mr. Goodell, of the executive committee, in the absence of Chairman Connell. The secretary, H. H. Wing, being absent, C. D. Smith was elected secretary pro tempore.

It was resolved that the topics, "What studies should be embraced in the four-year Bachelor of Science course" and "How can the usefulness of agricultural and mechanical colleges to the masses be increased" be presented in the general session on the morning session of July 17.

Mr. Murkland, chairman of the committee appointed in 1894 to consider the requirements for admission to agricultural and mechanical colleges, reported that the subject was being thoroughly investigated by a committee of another organization, and that they deemed it inexpedient to parallel that work.

A paper was then presented by C. D. Smith on "What Constitutes a Practical Agricultural Education."

After discussion of the subject by Mr. Clute and others as to the position of the short course in college work, the section adjourned to 10 p. m. July 16.

The section met at the appointed time, Chairman Connell presiding.

Mr. C. C. Georgeson presented the topic "Agricultural Education in Denmark" in an extemporaneous address, of which an abstract follows:

The scheme of agricultural education in Denmark presents some features, a study of which may be of value to us in America. In one essential particular it differs diametrically from ours. There the attempt is not made to give the student a liberal education. Here, any boy with a willingness to work can find an opportunity to educate himself in the arts and sciences. In Denmark such culture is not so readily obtainable. In that country attendance upon the common school is made compulsory, but the number in agricultural pursuits that take a higher or collegiate course is relatively small. The agricultural education is therefore strictly technical and goes straight to the point. The Royal Danish Agricultural Society is over a hundred years old. Its object is to disseminate a knowledge of agriculture among the farmers. It gives to young, promising farmers' sons an opportunity to acquire technical agricultural education by making arrangements with prominent farmers to take a certain number of pupils on their farms for purposes of instruction.

There are in Denmark about 20 private agricultural schools and 100 high schools in which the sciences related to agriculture are taught. Pupils may go to these schools either before or after they have taken the work on the large farms.

The Royal Agricultural College is the only institution of college grade devoted to agriculture in Denmark. There are from 300 to 400 students in attendance. No literary culture is attempted. The curriculum includes three principal branches, veterinary, medicine and anatomy; agriculture and horticulture, and forestry.

The agricultural work includes instruction in mathematics, botany, chemistry, physics, zootechnique. The instruction is thorough. The college is open for the entire year. Two and three year courses are provided, but no degree is granted. No farm is connected with the institution, but the students either have been on one of the large farms for practical work or will go to one after leaving college. The students expect to become farmers, therefore the college work is all aimed in that direction. High-school training is required to enter the Royal Agricultural College.

The section then adjourned to meet at 2 p. m. July 18.

The section met at the time mentioned.

It was moved and carried that the following gentlemen be recommended to the general session for officers of the section: Chairman. A. A. Johnson; vice-chairman, J. E. Stubbs; secretary, Eugene Davenport.

A paper was read by T. B. Comstock, of Arizona, on "How Can the Usefulness of the Agricultural and Mechanical Colleges to the Masses be Increased," and another by Mr. Myers on the same subject.

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BULLETIN No. 41

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

PROCEEDINGS

OF THE

TENTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

WASHINGTON, D. C., NOVEMBER 10–12, 1896

EDITED BY

A. C. TRUE, for the Office of Experiment Stations

AND

H. H. GOODELL, for the Executive Committee of the Association

WASHINGTON
GOVERNMENT PRINTING OFFICE
1897

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U. S. DEPARTMENT OF AGRICULTURE.

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BUREAU OF ANIMAL INDUSTRY—D. E. Salmon, *Chief.*
DIVISION OF STATISTICS—H. A. Robinson, *Statistician.*
DIVISION OF ENTOMOLOGY—L. O. Howard, *Entomologist.*
DIVISION OF CHEMISTRY—H. W. Wiley, *Chemist.*
DIVISION OF BOTANY—F. V. Coville, *Botanist.*
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DIVISION OF SOILS—M. Whitney, *Chief.*
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OFFICE OF EXPERIMENT STATIONS—A. C. True, *Director.*

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ARIZONA—*Tucson:* W. S. Devol.*
ARKANSAS—*Fayetteville:* R. L. Bennett.*
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* Director.
† President of board of direction.
‡ Assistant director in charge.
§ Chairman of council.
‖ Secretary.
¶ Acting director.

CONTENTS.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., June 9, 1897.

SIR: I have the honor to transmit herewith for publication Bulletin No. 41 of this Office, containing the proceedings of the Tenth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, held at Washington, D. C., November 10–12, 1896.

Respectfully,

A. C. TRUE,
Director.

Hon. JAMES WILSON,
Secretary of Agriculture.

OFFICERS AND COMMITTEES OF THE ASSOCIATION.

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George T. Fairchild, of Kansas.

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M. H. Buckham, of Vermont; J. M. McBryde, of Virginia;
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John H. Washburn, of Rhode Island.

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A. C. True, of Washington, D. C.

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A. C. TRUE, of Washington, D. C.; H. T. FRENCH, of Oregon;
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H. C. WHITE, of Georgia.

Military:

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A. Q. HOLLADAY, of North Carolina.

Revising Constitution of Association:

J. H. SMART, of Indiana, *Chairman;* H. H. GOODELL, of Massachusetts;
H. E. ALVORD, of Washington, D. C.

Nomenclature:

H. P. ARMSBY, of Penn., *Chairman;* S. M. TRACY, of Mississippi;
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E. H. JENKINS, of Connecticut.

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E. H. JENKINS, of Conn., *Chairman;* G. H. HICKS, of Washington, D. C.;
G. McCARTHY, of North Carolina; F. W. CARD, of Nebraska;
W. R. LAZENBY, of Ohio.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Alabama:

College: P. H. Mell, professor of botany and geology.

Station (Auburn): F. S. Earle, horticulturist and biologist.

Arkansas:

Station: R. L. Bennett, director and agriculturist; G. L. Teller, chemist; W. H. Langford, trustee.

Colorado:

College: J. W. Lawrence, professor of mechanical engineering.

Station: John J. Ryan, trustee.

Connecticut:

College (Storrs): B. F. Koons, president.

Station (New Haven): S. W. Johnson, director; A. L. Winton, chemist.

Station (Storrs): W. O. Atwater, director; C. S. Phelps, agriculturist and vice-director.

Delaware:

College: G. A. Harter, president; W. H. Bishop, professor of agriculture and biology.

Station: A. T. Neale, director; G. H. Powell, entomologist.

Florida:

College: O. Clute, president.

Georgia:

College: H. C. White, president.

Station: R. J. Redding, director.

Illinois:

College: A. S. Draper, president.

Station: E. Davenport, director.

Indiana:

College: J. H. Smart, president; W. F. M. Goss, professor of experimental engineering.

Station: C. S. Plumb, director; H. A. Huston, chemist.

Iowa:

College: J. B. Hungerford, trustee.

Station: J. Wilson, director.

Kansas:

College: G. T. Fairchild, president.

Station: C. C. Georgeson, agriculturist; S. C. Mason, horticulturist.

Kentucky:

College: J. K. Patterson, president; F. P. Anderson, professor of mechanical engineering; C. W. Mathews, professor of agriculture.

Station: M. A. Scovell, director; H. E. Curtis, chemist.

Maine:

College: A. W. Harris, president; G. H. Hamlin, professor of civil engineering; Walter Flint, professor of mechanical engineering.

Station: C. D. Woods, director.

Maryland:

College: R. W. Silvester, president; W. T. L. Taliaferro, professor of agriculture; R. H. Alvey, jr., professor of English; H. Gwinner, professor of mechanical engineering; S. S. Buckley, professor of veterinary science; H. B. McDonnell, professor of chemistry.

Station: R. H. Miller, director; H. J. Patterson, vice-director and chemist; E. H. Brinkley, assistant agriculturist; W. G. Johnson, entomologist.

Massachusetts:

College: H. H. Goodell, president; G. E. Stone, professor of botany and mycology; L. Metcalf, professor of engineering and mathematics.

Station: J. B. Lindsey, chemist.

College (Institute of Technology): H. W. Tyler, C. F. Allen.

Michigan:

College: J. L. Snyder, president.

Station: C. D. Smith, director.

Minnesota:

College: Cyrus Northrop, president; W. M. Liggett, dean.

Station: Otto Lugger, entomologist.

Mississippi:

College: B. M. Walker, professor of mathematics.

Station: W. R. Perkins, assistant chemist.

Missouri:

College: R. H. Jesse, president.

Station: H. J. Waters, director.

Nebraska:

College: G. E. MacLean, chancellor.

Station: T. L. Lyon, agriculturist; F. W. Card, horticulturist.

Nevada:

College: J. E. Stubbs, president.

New Hampshire:

College: C. S. Murkland, president; Albert Kingsbury, professor of mechanical engineering.

Station: F. W. Rane, agriculturist and horticulturist.

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College: Austin Scott, president.

Station: E. B. Voorhees, director.

New Mexico:

College: C. T. Jordan, president.

Station: Arthur Goss, chemist.

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Station (Ithaca): I. P. Roberts, director; G. C. Caldwell, chemist.

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North Carolina:

College: A. Q. Holladay, president; B. Irby, professor of agriculture.

Station: H. B. Battle, director; G. McCarthy, botanist and entomologist; B. W. Kilgore, assistant chemist.

North Dakota:

College: J. H. Worst, president.

Station: J. H. Shepperd, agriculturist.

Ohio:

College: Alexis Cope, trustee; T. F. Hunt, professor of agriculture; C. W. Burkett, assistant in agriculture.

Station: C. E. Thorne, director; S. H. Ellis, trustee; R. H. Holman.

Pennsylvania:

College: G. W. Atherton, president.

Station: H. P. Armsby, director.

Rhode Island:

College: John H. Washburn, president.

Station: Chas. O. Flagg, director; H. J. Wheeler, chemist.

South Carolina:

College: E. B. Craighead, president.

Station: M. B. Hardin, chemist.

South Dakota:

Station: J. H. Shepard, director.

Tennessee:

College: C. W. Dabney, jr., president; W. W. Carson, professor of civil engineering.

Texas:

Station: J. H. Connell, director.

Vermont:

College: M. H. Buckham, president.

Station: J. L. Hills, director.

Virginia:

College (Hampton): H. B. Frissell, principal; C. L. Goodrich, professor of agriculture.

College (Blacksburg): J. M. McBryde, president; L. S. Randolph, professor of mechanical engineering.

Station: W. B. Alwood, vice-director.

Washington:

Station: E. A. Bryan, director.

West Virginia:

College: J. L. Goodnight, president; W. S. Aldrich, professor of mechanical engineering.

Station: J. A. Myers, director; L. C. Corbett, horticulturist.

Wisconsin:

College: J. Q. Emery, regent.

Station: W. A. Henry, director; H. L. Russell, bacteriologist.

U. S. Dept. Agriculture:

C. W. Dabney, jr., Assistant Secretary.

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Division of Forestry: B. E. Fernow, chief; C. A. Keffer, assistant chief.

Division of Soils: Milton Whitney, chief; C. C. Moore, F. D. Gardner.

Road Inquiry: Roy Stone.

Division of Chemistry: W. D. Bigelow.

Department of the Interior:

Bureau of Education: W. T. Harris, Commissioner; Wellford Addis.

Treasury Department:

Geological Survey: F. H. Newell.

Canada:

Canada Experimental Farms: Frank T. Shutt.

Visitors:

David Siebert, J. W. Hoffman, John Hamilton, W. J. Quick, G. G. Groff.

PROCEEDINGS.

Morning Session, Tuesday, November 10, 1896.

The convention was called to order at 9 a. m. in the Grand Army Hall by the president of the Association, S. W. Johnson, director of the Connecticut State Experiment Station.

Prayer was offered by President R. H. Jesse, of the College of Agriculture and Mechanic Arts of the University of Missouri.

Mr. Goodell. For the executive committee I ask leave to read two paragraphs of the constitution relating to membership:

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner any person engaged or directly interested in agriculture or mechanic arts who shall attend any convention of this Association may be admitted to similar privileges.

I am instructed to move that the chiefs of the several divisions and bureaus of the Department of Agriculture, and Bureau of Education of the Department of the Interior and representatives of State departments of agriculture be admitted to the floor of this convention with all privileges under this provision of the constitution, and that all visitors who have registered and come under the fourth provision of membership be also admitted to the floor of this convention during its proceedings.

Carried.

President Johnson. The report of the executive committee is now in order.

Report of the Executive Committee.

Immediately following adjournment of the convention of the Association held in Denver, 1895, a meeting of the executive committee was called and H. H. Goodell was elected chairman and J. H. Washburn secretary.

Very early in the year the committee was called upon to fill the vacancy caused by the temporary transference of Dr. Dabney to another position in a special committee appointed at the meeting of the Association held in Champaign, Ill., in support of a measure then pending in the Senate, entitled "A bill to regulate the number of officers in the Engineer Corps of the Navy." Henry C. White, of Georgia, was elected and has served on the committee ever since.

The numerous questions arising have involved a wide correspondence, and 383 letters have been written on Association matters. The following circulars have been issued from the office of the executive committee since the last convention:

(1) A circular letter embodying such extracts from the address of our late president, Henry E. Alvord, as set forth succinctly the objects and utility of the Association, and urging all colleges and stations not members of the Association to join at once and enter into active membership. What results have followed from this appeal the report of the treasurer will show.

(2) A circular of information, designating the new officers, with memoranda of business referred to the next convention.

(3) The resolution of the Association adopting a factor for expressing butter-fat records in approximate equivalent of butter.

(4) Preliminary notice of time and place of holding convention.

(5) The formal call for convention.

(6) A circular in support of the recommendation of the Secretary of Agriculture to create an office of director-in-chief of scientific bureaus in the Department of Agriculture.

(7) The general programme covering the three days of convention.

The year has been one of unusual activity, and the demands made upon the executive committee have been proportionally great. At one and the same time there were in Congress the following bills, nine in number, all touching the interests of this Association more or less vitally:

(1) A bill reorganizing the personnel of the Navy and permitting graduates of technical schools whose course of instruction had been considered satisfactory by the director-general of naval engineering, and approved by the Secretary of the Navy, to be appointed engineer cadets.

(2) A bill drawn on the lines of the so-called Hatch experiment station bill, establishing engineering experiment stations.

(3) A bill providing for the organization and maintenance of mining schools.

(4) A bill introduced by Senator Walthall to make an equitable adjustment of the grants of land to the several States of the Union for seminaries of learning.

(5) A bill introduced by Senator Tillman to equalize the several States of the Union in the grant of lands for school purposes.

(6) A clause in the appropriation bill providing for the organization of a division of land-grant colleges in the bureau of education, with a central office corresponding to that of experiment stations.

(7) A bill regulating the manner of purchase and distribution of seeds, bulbs, etc., by the Department of Agriculture.

(8) A bill of similar import placing upon the experiment stations the onus of testing and distributing seeds, etc.

(9) The recommendation of Secretary Morton to create an office of director-in-chief of scientific bureaus and investigations in the Department of Agriculture. And as if this was not enough, pursuant to instructions the executive committee made a last effort to bring about the completion of the records of the dairy tests made at the Columbian Exposit.on and to secure adequate compensation for fourth-class postmasters at experiment stations handling large amounts of franked matter of those stations.

What wonder if, amid these legislative rocks and whirlpools, our bark had foundered; or, endeavoring to steer clear of Scylla on the one hand, it had been suddenly swallowed up by Charybdis on the other. Gentlemen of the Association, unity alone can insure success, and we can not afford to be other than a unit when we come to the halls of Congress for aid.

Of these different measures, the one relating to the reorganization of the personnel of the Navy was most actively pushed during the entire session of Congress. A report of its progress and present condition will be made a little later by the chairman of the special committee appointed to advocate its provisions.

The bill establishing engineering experiment stations seemed in a fair way to be reported favorably when the unfortunate controversy arising in committee between two of its members awakened such antagonism that it was deemed unwise to ask for further consideration.

Neither one of the two bills equalizing the grants of land for purposes of instruction was reported for action. On Senator Walthall's measure several hearings were given and a favorable report secured from the Secretary of the Interior, but no further steps were taken.

A strong effort was made to secure the passage of an act organizing a division of land-grant colleges in the Bureau of Education. Each member of the subcommittee to whom the matter was referred was seen by one or more of your committee and the subject fully explained. "Retrenchment" had, however, been made the watchword of the Fifty-third Congress, and even so trifling a sum as that required for the equipment and maintenance of this office was refused.

The subject of adequate compensation to fourth-class postmasters handling large amounts of franked mail matter of the experiment stations has received due consideration, and a long correspondence has ensued with the Post-Office Department, confined mostly, on our part, to furnishing information. Definite action has not yet been taken.

The question of compiling, for permanent record, the dairy tests made at the Columbian Exposition was early called to the attention of your committee. A clause was introduced into the agricultural appropriation bill, permissive in character, allowing the completion of the work. It was favorably reported by the committee, but was ruled out on a point of order.

Briefly summing up the status of the nine measures submitted to Congress, four are still pending, three were stillborn in committee room, and two were lost.

It had been the intention to have the Lawes Trust represented at this convention, and Prof. Henry E. Armstrong, Ph. D., F. R. S., professor of chemistry in the London

Institution, had been designated as such representative. After due correspondence a place was assigned him on the general programme, but at the last moment, when too late to issue formal notice to members of the Association, a letter of regret was received from Sir John B. Lawes, stating that it would be impossible for Professor Armstrong to be present, and that there was not time to provide a substitute. It is probable that the report of the Rothamsted investigations will be made at the next convention.

In concluding this hasty review of the year's work, your committee desires to offer the following recommendations:

(1) That a committee be appointed to wait on the War Department and adjust relations between it and the colleges. A disposition has been shown to ignore expressed preferences in the detail of officers for college duty, and the Adjutant-General of the Army, in his late report, has recommended that details be made only to those institutions showing on their rolls the presence of 150 or more students.

(2) That the Association calls the attention of all concerned to the limitations of the franking privilege granted experiment stations. The law is explicit, providing only for the franking of bulletins and college reports containing the annual reports of stations. Great care should be observed by station officers not to abuse this valuable privilege so very necessary to the work of the stations.

(3) That the chairman of the section and the editors of the proceedings of the convention be constituted a committee to pass on the papers from each section, and that the Department be urged to print the papers recommended by this committee.

(4) That station directors drop from their mailing list the names of workers in other stations and depend entirely upon the list furnished at Washington, sending for a fresh copy at the time of issuing each bulletin. Changes among station workers are so frequent that the observance of this practice would result in a great economy of time and correspondence, besides securing greater accuracy. Why should directors send out notices of every change to 51 stations, and why should these 51 stations be compelled to make the necessary changes when it is done so much easier once for all at the Office of Experiment Stations?

(5) In view of the large and increasing number of measures which are introduced in Congress affecting the interests of the colleges and stations, and the frequent lack of cooperation among those interested concerning such measures whereby the influence of the Association and the interests it represents are liable to be materially weakened, the committee respectfully recommends that institutions, members of the Association, and their officers refrain from advocating measures affecting the interests of all until such measures shall have been considered and approved by the Association.

Respectfully submitted, for the executive committee.

HENRY H. GOODELL, *Chairman.*

WASHINGTON, D. C., *November 9, 1896.*

The report was accepted, with the proviso that the recommendations made be discussed and voted on separately at such time as the executive committee should appoint (see p. 30).

Mr. GOODELL. We have just received news that General Hatch is lying in a very critical condition and probably will not recover. It seems fitting that while we are here we should send him some message from the Association, and I therefore move that the secretary of this convention send him a telegram expressing our sympathy.

Carried.

Mr. Atherton moved that a committee be appointed to prepare and send proper resolutions of regret to the family of Hon. Edwin Willits.

Carried.

The CHAIRMAN. The next business in order will be the report of the Section on Agriculture and Chemistry, by C. C. Georgeson, of Kansas.

REPORT OF THE SECTION ON AGRICULTURE AND CHEMISTRY.

It will be impossible for me in the brief time allotted to do justice to the workers by detailing all the work that they have had in hand during the past year. Much of it, indeed most of it, must necessarily be passed by without any mention whatever, not because the work does not merit it, but for sheer lack of time.

I sent a circular letter of inquiry to all the colleges and stations reported in the organization lists published by the United States Department of Agriculture, and addressed it to those men in each institution whom I deemed most likely to be able to give the information I required as heads of their respective departments. I divided my questions into four classes—those bearing on college work in agriculture, on college work in agricultural chemistry, on experiment work in agriculture, and on experiment work in chemistry. Since the college work will be treated more fully in another section, I shall here merely give a few statistics in regard to instruction in the two lines mentioned.

Instructors and students in agriculture and agricultural chemistry.—Thirty-five institutions reported 117 instructors in agriculture, 48 of whom are assistants, and 36 institutions reported a total of 17,413 students. Of this number 2,963 were in agricultural courses during the past year. Of this 2,963 students 1,355 were in the long or regular courses of their respective institutions, 237 in a two years' course, 1,258 in short courses, and 113 were post-graduate students in agriculture.

Of the institutions addressed in regard to information on the subject of chemistry, only 36 replied, and only 32 of them gave information as to the teaching force. In these 32 institutions there were 61 instructors in agricultural chemistry, 23 of whom were assistants. Only 25 out of the 32 had any students in agricultural chemistry the past year, but in these 25 institutions 925 students received instruction in agricultural chemistry. This number includes only those who actually took lectures, and does not include students who were in the agricultural courses and who would eventually get this line of study. That is to say, 63 per cent of the institutions which have agricultural courses in their curricula gave instruction in agriculture and agricultural chemistry in their restricted sense to 3,888 students during the past year. Though possibly a few hundred are counted twice, these figures will aid in giving us an idea of the work that has been done in the line of agricultural instruction.

Additions to facilities of instruction in agriculture and agricultural chemistry.—Thirty of the institutions from which I received reports have made permanent additions to their equipment for instruction in agriculture and agricultural chemistry during the past year to the total value of $202,724. This includes, however, the veterinary building at Cornell, valued at $150,000. If we deduct this very large item it still leaves $52,724 which has been expended on the erection and improvement or equipment of laboratories, dairy buildings, barns, and outbuildings or in the purchase of live stock, machinery, apparatus, models, and specimens. It is not an excessive outlay, and yet, for about 52 per cent of the institutions, $52,000 annually will doubtless go a good way toward improving facilities for instruction in these two lines of work.

Subjects taught.—All of the institutions reporting teach all the leading lines of agriculture, but in some cases special emphasis is laid on one or more lines of instruction. Thus, in California fiber culture and forage plants and fruit especially adapted to the coast are given special attention. In the South general field crops and improvements of soils are emphasized more or less, and dairying is given special attention in the following States: Colorado, Connecticut (Storrs), Georgia, Idaho, Iowa, Kentucky, Michigan, Minnesota, Mississippi, Oregon, South Dakota, Texas, Vermont, Virginia, West Virginia, and Wisconsin.

Work of experiment stations.—Thirty-eight experiment stations which reported work in agriculture employ 153 workers in this one branch, 89 of whom are superintendents or directors and 64 assistants, and 100 of them have college duties to perform in connection with their work in the experiment station. In the line of agricultural chemistry 38 institutions employ 107 workers, 47 of whom are superintendents or chiefs, and 60 assistants, and 47 of them have college work in connection with the station work.

Lines of investigation.—Cultural experiments with field crops demand much of the attention and energy of the experiment stations. Common field crops, corn, wheat, oats, and to some extent barley and rye, and in the South cotton are experimented with in nearly all the stations. There are a few that do not lay much stress on this work, as, for instance, Vermont and California, but these are exceptions. The experiments are for the most part planned to meet the demands of the respective regions in which they work. The lines of experiments with field crops are very numerous, and I can only mention the leading ones here. First, variety tests with the average field crops to ascertain which varieties are most suitable for a given locality; second, rotation experiments, which have been in progress the past year and in most cases for several years in Alabama, Colorado, Indiana, Kansas, Maine, Michigan, Minnesota, Missouri, New Jersey, Pennsylvania, Rhode Island, and probably in other States.

Preparation of the soil has also been a leading feature of the experiments with field crops, as well as various cultural methods, quantity of seed, depth of plowing, etc. These experiments are beginning to bear valuable fruit. Many of the stations have results on the same lines of work for half a dozen years or more, and can now state with tolerable certainty what methods will be the most profitable for the farmers to follow under particular conditions. Subsoiling experiments are reported from Oklahoma, Wyoming, and Kansas. Doubtless this practice is tested at many other stations. It is of special interest in the States and Territories where the rainfall is insufficient.

The nonsaccharine sorghums, and especially the varieties of Kafir corn, have been experimented with at several Western stations with gratifying success, especially in Oklahoma and Kansas. Cultural methods for tobacco are reported from Alabama, California, and New York (Cornell).

Cross fertilization to develop new varieties of grain crops is reported from Minnesota and Mississippi.

Cañaigre has been grown in California and Alabama.

Sugar beets have been grown in Nevada, Nebraska, and New Mexico.

Experiments in the irrigation of field crops are reported from Wyoming, New Jersey, Alabama, Minnesota, and Mississippi.

In the effort to find forage plants well adapted to particular regions a number of stations report variety tests with grasses and forage plants of all kinds. In this connection it should be mentioned that Connecticut and California are among those making special effort to introduce new species of grasses and forage plants. In California the object is to find something that will thrive in alkali soils and semiarid regions, and in Connecticut some 1,500 species and varieties from all parts of the world are grown in experiment plats. Legumes receive special attention in Idaho, Iowa, Kansas, Wyoming, Michigan, New Hampshire, New Jersey, New Mexico, Pennsylvania, and Rhode Island, the promising forage plant known as soja bean being tested in Iowa, Kansas, New Hampshire, and New Jersey, and *Lathyrus sylvestris* in Kansas and Michigan. The culture of silage crops received special attention in Connecticut, nurse crops for grass in North Dakota, and fertilizer tests for forage plants in Connecticut and Maine. Experiments with root crops for forage are reported from Idaho and Iowa

Extensive feeding experiments have been carried on at a large number of stations, in some cases by the agriculturists alone and in other cases in cooperation with the chemists. The feeding of steers is reported from Colorado, Iowa, Kansas, Maine, Michigan, Minnesota, Mississippi, Pennsylvania, Texas, and Wyoming. The feeding of sheep has been experimented with in Colorado, Indiana, Iowa, Minnesota, Washington, and Wyoming. The feeding of dairy cows has received special attention in Alabama, Colorado, Maine, Michigan, Minnesota, Mississippi, New York (Cornell), Pennsylvania, and Washington. Pig-feeding experiments have been made at a large number of stations. Experiments in feeding horses have been carried on in North Dakota, and with poultry in New York (Cornell), West Virginia, and Rhode Island.

Digestion experiments have been under way in Connecticut, Maine, North Carolina, Oregon, and Wyoming.

Dairy work, as already indicated, occupies a prominent place in many experiment stations. The leading features of this work may be classified as follows: Tests of dairy machinery and apparatus in Colorado, Pennsylvania, Vermont, and Wisconsin; milk testing in Connecticut, Idaho, Kansas, New York (State), North Carolina, Ohio, Oregon, Vermont, and Wisconsin; pasteurization of cream and milk in Illinois, Michigan, New Hampshire, Vermont, and Wisconsin; the use of pure cultures in Connecticut (Storrs) and Wisconsin; general dairy bacteriology in Wisconsin and New Jersey; experiments in cheese making in Minnesota, Pennsylvania, and Wisconsin; and important work with tuberculosis in connection with dairy cows in Michigan, New Jersey, and Wisconsin.

Lines of investigation of a chemical nature are very numerous. They deal with every subject in relation to soil and plant food, the examination of food stuffs and manures of all kinds, and with products of the farm of every description. Soil analyses, both physical and chemical, are reported from 13 stations. Some points of much importance are under investigation. In the semiarid region of California and other States the problem of how to eliminate injurious alkali has received much attention. In Rhode Island the acidity of the soil has been a subject of special investigation. Irrigation waters have been analyzed in all the States where irrigation is practiced, and potable waters in many other States. The analysis of dairy products has received special attention in California, Delaware, Maine, Massachusetts (Hatch), Michigan, Missouri, Nevada, New Jersey, New York (State), Ohio, and Oregon. Fifteen stations have reported work on feeding stuffs of many kinds. The composition of wheat and flour has been given special attention in Michigan, and analyses have also been reported from Arkansas and North Dakota. The properties of cañaigre have been investigated in Arizona and Texas. Sugar beets have commanded a large share of the attention of chemists in 9 stations, chiefly in the Mississippi Valley and in Oregon and California. The amount of moisture in the soil under various conditions and at various depths has been investigated in Iowa, Kansas, Minnesota, Mississippi, Nebraska, New Jersey, New York (Cornell), and Wyoming. Artificial digestion experiments are reported from Colorado and Connecticut (Storrs). The availability of organic nitrogen has been studied in California and Connecticut (State), and the starch of both sweet and white potatoes in Georgia and South Carolina. Analyses of fruits have been made in Idaho and New York (Cornell). The influence of the food on butter fat has been under investigation in Pennsylvania.

Tobacco analyses have been made in Connecticut, Pennsylvania, and Wyoming. Methods of analysis of various substances have received the attention of chemists in Indiana, Massachusetts (Hatch), and New Hampshire. The composition of farm crops has been investigated in Connecticut (Storrs) and Oklahoma. The calculation of the value of fodders by the method of least squares is reported as having been under investigation in Vermont. Lastly, the chemists at a number of stations have been burdened with the analysis of commercial fertilizers, the State laws in many States requiring that the station shall analyze samples sent them, and in several of them the station exercises control over the fertilizer trade. From the amount of work that has been published, as well as the number of stations which have reported work in this line, I judge there is no one line of chemical investigation that demands so much of the time and energies of the agricultural chemists of this country as the analysis of fertilizers.

Soil physics has received a great deal of attention in many States, particularly in relation to soil moisture, this being a question of paramount importance, especially in the arid and semiarid regions. Wisconsin has done notable work in this line, and also Dr. Whitney, of the United States Department of Agriculture.

Miscellaneous investigations of interest have been in progress in several States, as, for instance, an experiment in crossing the Persian fat-tailed sheep on Merinos and Southdowns in California, the bacteriology of tobacco in Connecticut, and the development of roots in various field crops in Kansas.

Publications.—I regret to say that I have not a complete list of the publications issued by the stations during the past year, so the number I give here will fall considerably below the actual number issued. The chemists of 28 institutions report a total of 71 bulletins, covering 2,032 printed pages, and the agriculturists of 29 stations report 76 bulletins in their particular lines, covering 3,543 printed pages. This makes a total of 147 bulletins, covering 6,754 printed pages, from the workers in this section during the past year; but, as less than three-fourths of the stations gave returns on this point, it would probably be more correct to estimate the total output of publications during the past year at 225, with 9,000 printed pages. What this means as to the dissemination among the people may perhaps best be realized when I state that in Wisconsin alone the actual number of printed pages amounted to 32,824,000.

C. C. GEORGESON, *Chairman.*

The report was accepted.

The CHAIRMAN. The next report in order will be that of the Section on College Work.

In the absence of the chairman, A. A. Johnson, of Wyoming, the report of the section was submitted by the vice-chairman, J. E. Stubbs, of Nevada.

REPORT OF THE SECTION ON COLLEGE WORK.

Owing to the quite recent resignation of the chairman of the Section on College Work, I have been called upon, as vice-chairman, to perform his duties. Whatever of completeness and thoroughness may be lacking in this paper is due to the very limited time allotted to its preparation.

I invite your attention at first to a somewhat common incident. Imagine yourselves for the moment in the library car of the Union Pacific express, east-bound, on the evening of the 4th of November. For the most part, the occupants of the car are Western men of affairs, keen and practical. Conversation and discussion over the exciting news of election day have begun to grow weary, when suddenly new interest is aroused by the introduction of a fresh topic, namely, the kind of an education which should be given to farmers' sons. Two bright-minded men, one from Montana and the other from Colorado, affirm that there is too much of higher-education nonsense in the country; that one of the modern heresies is that of giving the so-called higher education to farmers and farmers' sons, who would do better for themselves and their country if they were content with a common-school education along with the practical discipline and training of the farm. This opinion is hailed with a chorus of approval, with the further observation that there is too much of football and of similar sports in the college education of to-day. The first protest against the views just set forth came from a young lawyer, I believe, of Wyoming, who charmed us by a prophetic vision of the possible Websters and Clays and Jacksons that might be lost to our country if the farmer boy should fail to realize his ambitious dreams of public life because of the repressive influences which restrict his education to the district school and his scientific training to the field and the stable.

This incident is worth noting, for the reason that it expresses the views and convictions of very many men who are thoroughly practical, able, and successful in their own respective callings.

Being an interested listener to the discussion, I tried to formulate in my mind three propositions which, by way of answer, I should be willing to maintain:

First. That the higher education, so called, has become absolutely essential to the prosperity and welfare of those who choose agriculture as a business or a life calling. This holds true, also, with respect to industrial callings, such as engineering in its various branches and the higher class of commercial activities. If it be true that "the test of national welfare is the intelligence and prosperity of the farmer," then the colleges of agriculture and mechanic arts established by the Federal Government have been wisely established, and will cement more firmly the foundation of the national prosperity and honor. Our practical-minded friends of the discussion have simply failed, like many others, to give due weignt to the remarkable changes which have taken place in the industrial training and education of youth. The technical schools and the schools of applied science in colleges and universities have taken the place of the shop and the foundry of our fathers' time, and partly, too, of the farm, in the industrial education of this country and of other countries as well. These "institutions for higher education," these "colleges of agriculture and mechanic arts," now stand at the end of the Appian Way, to eager feet the noblest gateway to the Eternal City of industrial and commercial prosperity as well as to political peace and supremacy.

On the other hand, the lawyer from Wyoming has failed to grasp the truth that there are other lines of education than the accepted type of classical education which, while giving wide range of choice to special taste and aptitude, is both broad and liberalizing, and gives development and culture to the man, while training him in the particular disciplines which fit him for the successful pursuit of industrial and commercial callings.

If, according to Dr. W. T. Harris, United States Commissioner of Education, "urban life is the life of the future, and of the highest civilization," one or the other of two effects must follow in the future life and growth of this country. Either our soil will be tilled by tenants for the benefit of the landowner who resides in town or city, giving thereby encouragement to the growth of two distinct classes—the one a poor, dependent peasantry; the other an intelligent but selfish and unpatriotic class of absentee landlords—or we must cherish and develop in our schools and colleges that kind of training and culture which shall build up an intelligent, prosperous and independent class of farmers and artisans, each of whom owns his home, tills his own fields, markets his own products, helps to regulate the affairs of his own township, sits in the councils of his own State or of the nation, in character, in intellectual and in social qualities the peer of lawyer, capitalist, or priest.

Second. That the interest in athletic field sports, such as football, baseball, and tennis in our colleges, though but incidental to the life and work of these institutions, has nevertheless an ethical, and thereby educational value, which is worthy of high regard. The college president who keeps in view the highest character development of his students knows full well that the atlethic exercises which have become, and which will remain, a striking feature of college life do, when properly guided and guarded, displace to a considerable degree the pernicious practices that spring into action when any body of young people are brought together in common association, and do further promote the cultivation and attainment of the better qualities of personal character such, for example, as courage, obedience, endurance, and regard for personal honor. The gymnasium of Germany and the public school of England offer a strong contrast in this matter of school and college field sports, but the free and vigorous activity of Eton's football or cricket field is superior from every point of view to the rigid and systematic ordering of the daily exercise of the German gymnasium boy and to the dueling practice and drinking habits of the university student. The truth is that the outdoor life and the field sports, which have grown so rapidly into favor with American colleges, not only with the colleges for young men, but also with those for young women, may be so guided as to promote a high average of scholarship, good habits, perfect health, yea, a graceful type of womanhood as well as a sturdy type of manhood.

Third. That in the correlation of the subjects of instruction and discipline according to accepted pedagogic principles in the courses of study offered by the colleges of agriculture and mechanic arts, it will be found that the particular subjects in mathematics and in pure and applied science are carefully harmonized with those general subjects in language and literature, in the social sciences, and in history and philosophy, which pertain to the college courses usually denominated *liberal*.

As bearing upon this point, I quote the views of Prof. E. W. Hilgard, of the University of California, as given to me very recently in a personal letter. He speaks of the course in agriculture given by the University of California as follows: "With the average preparation we can command in this State we find it necessary to devote the first two years of four substantially to the preparatory sciences and general culture studies, while the last two are given to the technical studies chiefly, though not exclusively. Among these elections should always be allowed, enabling the student to put special weight upon those branches that will be of chief importance to him in after life. We do not as yet in this country aim to educate all-round agricultural experts; there is too little demand for them, and when the demand arises the degree and kind of preparation is likely to have been changed by the introduction of agriculture science into the preparatory school. Then only will it be possible to establish a uniform course for the degree of bachelor of agriculture that will hold good all around. It makes a wide difference, too, whether the student comes from the farm or from the city. The latter clearly requires a different course, especially as regards practical studies, from the boy who has grown up on the farm and merely needs to give the explanation, as it were, of the practices he is already familiar with. An all-round agricultural expert can not, with our usual preparation, be turned out in four years. Agricultural science is the most complex of all, embracing as it does all the sciences from mathematics through physics, chemistry (both inorganic and organic), mineralogy and geology, botany, zoology (both theoretical and technical), vegetable and animal physiology, plus a certain amount of engineering. Unless a man specializes, the field is too wide to be covered in four years with any degree of thoroughness. For the present, then, we must leave the way open to specialization after a certain amount of general training, the time for which varies constantly with the conditions of the public and the preparatory schools."

Again, touching further upon the preparation and character of technical work in the course of agriculture leading to the degree of bachelor of science, Prof. Thomas F. Hunt, dean of the college of agriculture of the Ohio State University, writes to me as follows:

"In a general way I would say that the four years' course in agriculture leading to the degree of bachelor of science should consist of one-third technical work of applied science, one-third science, and one-third language, history, and philosophical studies. It is, of course, difficult to classify studies precisely into the three groups mentioned, but in a general way I think we all understand it. On this basis, our course at the Ohio State University, requiring 206 hours for graduation, contains the following technical work: Agriculture, 36 hours; agricultural chemistry, 20 hours; horticulture, 8 hours; veterinary medicine, 15 hours; economic entomology, 5 hours—a total of 84 hours. Of the 206 hours, it is to be noticed further that 30 hours are elective, and that these may or may not be technical. But disregarding the number of elective hours, we require 84 hours which may be fairly termed technical. This gives rather more than one-third technical work, and perhaps this is a little heavy."

It is to be observed that the 206 hours at the Ohio State University represents a fraction more than 17 hours a week for twelve terms. The proportion of technical work in the course outlined by Professor Hunt, even if we credit the 30 hours of election to technical subjects, and thus establish a course which represents the maximum number of hours to technical discipline, allows ample room for such cultural and social studies as will stamp the course with the character of giving a liberal education to its students. It may be observed further that the acquaintance with the general truths of science which these technical subjects give will be of great service in the rational interpretation of all social phenomena, and we may therefore credit the technical studies with a definite value in respect to the kind of knowledge "which is of most worth."

ENTRANCE REQUIREMENTS.

One of the most important subjects at present engaging the attention of the Association is that which pertains to the requirements in branches of study that shall be established for admission to the freshman class of the colleges of agriculture and mechanic arts, the extent and variety of the courses of study to be offered, and the academic degrees which shall be bestowed.

The deep and widespread interest in this subject is in evidence by the appointment, two years since, of a committee from this Association, by the "report of the committee of ten" on secondary school studies and the "report of the committee of fifteen" on elementary education, both to its National Educational Association, and also the report on the subjects of entrance requirements by the Society for the Promotion of Engineering Education; further, the appointment of a standing committee of five members from this Association whose duty it shall be to report annually upon the best methods used in the various colleges and universities in the United States and in Europe for the instruction of students in the practical and scientific facts relating to agriculture, with the view to bringing instruction in agriculture into pedagogic form, gives additional emphasis to the importance of the matter of entrance requirements, and also the earnest purpose of the promoters of scientific and industrial education to put their subjects and methods into scientific form and relations.

I submit herewith the results of a brief study of the facts as they bear upon the present standard of requirement for admission to the freshman class of the colleges and universities that have membership in this Association. The questions which I submitted to the colleges, bearing upon the questions of entrance requirements, were intended to be specific and easily answered. I have received no replies to my letters from Utah and North Carolina.

Out of 46 colleges reporting, 30 have preparatory departments, 16 have no subfreshman classes. In these preparatory schools 10 colleges have a one-year course, 8 have a two-years' course, 6 have a three-years' course, 1 has a four-years' course, and 5 are indefinite, merely reporting a subfreshman class.

SPECIFIC SUBJECTS.

English.—Eighteen colleges have the standard high school requirements in English language and literature for admission to the freshman year. Twenty-eight colleges require that which represents the work accomplished in the eighth or ninth grade of the public schools.

Arithmetic.—Thirty-eight colleges require this subject to be completed. Eight colleges require the subject as far as interest and proportion.

Algebra.—Thirty-four colleges require algebra to or through quadratic equations. Four require the academic algebra to be finished. Eight do not ask for algebra.

Geometry.—Five colleges ask all of plane and solid geometry. Eleven colleges require all of plane geometry. Four colleges require from two to four books of plane geometry. Twenty-six colleges do not place geometry upon the list of subjects for admission to the freshman year.

United States history.—All the colleges make history of the United States an entrance requirement. Thirteen colleges require also general history.

Physics.—Fifteen colleges require elementary physics with laboratory practice.

Chemistry.—Nine colleges require elementary chemistry with laboratory work.

Physiology.—Seventeen colleges require elementary physiology.

Botany.—Eight colleges require elementary botany with field practice.

French or German.—Eight colleges require a reading knowledge of French or German.

Latin.—Twenty colleges offer from one to three years of Latin in their preparatory schools and several offer Greek.

The institutions which have no preparatory departments are chiefly the universities in the wealthy and populous States where there are first-class high schools in all the cities and towns. In the newer and less populous States a well equipped preparatory school of high-school grade with courses of studies covering a period of three or four years is a necessity, and will continue to be a necessity for very many years to come. The preparatory department is the means of supply to the college of many students who otherwise would never think of taking a college course.

It is evident, too, that the agricultural colleges divide themselves into two classes. The one class receives the student into its freshman class from the eighth or ninth grade of the public school. The course in agriculture, then, becomes in the main a technical high-school course of study, with special reference to the farm and the farmer.

The other class of agricultural colleges requires the completion of a high-school course of study as a requisite for admission to its freshman class, and then seeks to maintain strong four-year courses in agriculture, and in the applied science courses, such as engineering, civil, electrical, mechanical, and mining. In those States where the State university maintains strong schools of applied science, and where the agricultural college is an entirely separate institution from the State university, it is evident that the college of agriculture and mechanic arts has found its field of work to be limited to giving a thoroughly practical training adapted to young men and young women who have finished such courses as are laid down in our best ungraded schools and best grammar schools.

The weight of opinion in this Association seems to be that the colleges endowed by the Federal Government under the acts of 1862 and 1890 should be colleges according to the accepted standard in the best educational circles. I quote a paragraph from President Alvord's address given at Denver last year, viz: "Institutions in affiliation with this Association should in all respects be colleges in fact as well as in name."

NUMBER OF COURSES OFFERED.

In reply to the question, "How many four-year courses do you maintain?" I note the following: Ohio State University offers 15 courses; University of Washington, 14; Pennsylvania State College, 12; Maine State College, 9; California, Purdue, Kentucky State, Minnesota, Cornell, Virginia, and Wyoming, 7; Delaware, Idaho, Tennessee, and Wisconsin, 6; five colleges give 5 courses; eight colleges give 4; three colleges give 3, and fourteen colleges give 1 and 2 courses with numerous electives.

This general outline of the number of courses shows that the colleges of this Association, even the weakest of them, are able to give a breadth and variety to their college work which is enjoyed only by the students of the oldest and best known universities of this land.

The distinguishing feature of most all these courses of study is that they belong to the department of applied science; this is what differentiates them most strikingly from the average college of liberal arts. This it is that characterizes these colleges as the great schools for the industrial life of this country. This gives to us the great opportunity for training young men and women of high character and lofty ideals to become examples as well as leaders in the world's commercial and industrial activities.

All the colleges give courses in agriculture. Twenty-five have courses in civil engineering; twenty-two in mechanical engineering; twelve in electrical engineering, and five in mining engineering. Many of the mining States have a school of mines entirely separate from any other institution, or in connection with the State university.

FEW STUDENTS IN AGRICULTURE.

But why so few students in the advanced agricultural courses? I think the answer is found in the conditions of agriculture at the present time; other departments of labor are more remunerative than that of farming. In many of the States there is not a ready market for agricultural products. In some States, at least, if not in all, the farmers themselves are not awake to the value of training in the agricultural college. In August last, eighty-five boys, *farmers' boys*, entered the University of California, but not one entered the course in agriculture. The six students who did enter the course of agriculture were from the cities. Yet it is wholesome to the thought and life of all our industries that agriculture be elevated to a worthy place in our system of college education. The comparatively few students who may complete these courses are worth to the country all their training costs, and when the time comes for the adjustment of the present unequal distribution of rewards of labor, the college-trained, scientific farmer will be in patriotic demand.

All the colleges save eight are making special efforts to attract students to courses in agriculture. Addresses before farmers' institutes, lectures upon scientific topics, newspapers, bulletins, and contributions to newspapers, are the principal means of bringing the work of the college to the notice and the esteem of the public.

MILITARY INSTRUCTION.

The department of military instruction in the colleges of this Association is a subject I can not leave unnoticed. The military authorities have given particular attention to this subject from their point of view within the past two years. The Adjutant-General of the Army, in his report for 1896 to the Secretary of War, says: "The average number of students at the several institutions during the scholastic year was 3,401 less than during the preceding one, due perhaps to prevailing monetary depression. The number of those capable of military duty was, however, 3,009 more, and the number required to be enrolled as military students has increased 2,761. The aptitude and interest of these students under military instruction is generally satisfactory." The Adjutant-General further says: "The law authorizing details should be amended. I recommend that hereafter no detail be made to any institution that can not guarantee an enrollment of at least 150 military students, and that military professors at institutions having a less number in their military department be withdrawn and returned to their regiments."

If the recommendation of the Adjutant-General should become a law the agricultural colleges of the following States would lose the detail of the military professor, according to the report of last year under the head "Required enrolled as military students," viz: Colorado, Delaware, Florida, Georgia, Idaho, Louisiana, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, North Dakota, South Dakota, Oregon, Rhode Island, Tennessee, Utah, West Virginia, Washington, Wyoming—twenty colleges in all. Now, I venture to affirm that to strike these twenty States from the benefit of the military instruction provided for under the Morrill Act would lose to the service much of the very best work that is done outside of West Point and the purely military schools. Take an illustration: I find that one of the leading Ohio colleges reports 997 students as capable of military duty. Of these, 119 received military instruction and 77 were uniformed. It is evident from the above figures that the military spirit and military training does not abound in that institution. Furthermore, every college man knows that in the larger institutions of the East and middle West it is difficult to develop and maintain good military spirit and discipline. Now, compare this example with the Nevada State University that last year had at one time nearly 142 in the cadet battalion; that had an average attendance of 114 cadets, every one in uniform; every one required to perform his military duties regularly and strictly under the instruction of the commandant; theoretical instruction in the art and science of war given as a college requirement once a week to the cadets of the junior and senior classes of the University; one hour to drill every college day in the week, save one, throughout the year, and the military department in favor with students and faculty. Now, what is true of the Nevada State University is true, I believe, of nearly all the colleges established under the Morrill Act. The number of cadets in the Military Academy at West Point last year was 331. The recommendation of the Adjutant-General would put the minimum number of students in one of the colleges of this Association to get the detail of an army officer at 150, but 15 less than the half of the total number at the United States Military Academy last year.

Again, in a recent article by Maj. Joseph E. Sanger, it is intimated that there is a decline in interest on the part of the officers of the colleges in the military department; that the instruction is not always up to the standard, and that in some faculties there is to be found positive opposition to the military department. I must say that I do not think these criticisms apply justly to many of the colleges; they ought not to apply to any. The provision for military instructions in the Morrill Act is a good provision, and should be welcomed by the administration of every college that enjoys the benefit of that act. "Whatever is worth doing at all is worth doing well" applies right here.

It will be very easy, moreover, to remove any occasion for the above criticism. To avoid any possible misunderstanding that the college faculty is not favorable to the department of military work, it should be understood that the military department is responsible through its commandant directly to the president of the college or university, and through him to the board of regents and trustees.

Again, the instruction in military science and tactics should be placed on the same footing with other subjects of instruction, and satisfactory work be required from every student who is a candidate for a degree.

A word may be said in respect to the kind of officer that should be detailed to college work. Not every officer is fitted by nature and training to become a successful college instructor. No officer who seeks an easy berth should be detailed to the college; but one who likes to work with young men, who is possessed of scholarly tastes and habits, who has a lofty ideal of the true soldier's character and life, and who, in cooperation with the president and faculty, will infuse a worthy military spirit into the young men and aid in the development of a type of strong, self-reliant, loyal manhood, which this country will ever need.

The union of military training with the development of the civic spirit in the education of our young men will dower this nation with a reserve corps of citizen-soldiers unsurpassed in excellence by any age or in any land.

J. E. STUBBS, *Vice-Chairman.*

The CHAIRMAN. If there be no objection, the report just read will be accepted.

The CHAIRMAN. I take this occasion to announce the committee appointed to draft suitable resolutions on the death of Hon. Edwin Willits: G. W. Atherton, of Pennsylvania; C. D. Smith, of Michigan, and A. Q. Holladay, of North Carolina.

The CHAIRMAN. The next business in order will be the report of the Section on Horticulture and Botany, by F. W. Card, of Nebraska.

REPORT OF THE SECTION ON HORTICULTURE AND BOTANY.

In making up a report of the work of horticulture and botany it seemed advisable, in so far as possible, to get at the policy and aims of the different institutions and workers rather than to make a definite report of the actual work done during the preceding year. Most of our experimental work is still young, and much of our teaching, particularly in the line of horticulture, crude. We have no well-beaten track to guide us, and many of us are comparatively untried. We are largely groping in the dark for something which we feel must be there, but which too often eludes our grasp, while we are at the same time trying to make the way clear and plain to the students intrusted to our guidance. Here and there one finds a path to some hidden treasure, but for the most part it remains known only to himself, and only his students get the benefit. Let it be understood that I am here speaking of horticulture. Botany is older, has long been in the educational curriculum, and has its lines of thought and teaching well mapped out. Not so with horticulture; its pedagogical structure is yet for the most part to be builded. Its literature is scattered to the four winds of the earth, and no one man can hope to gather it together. No one is likely to attain so great knowledge of the subject that he need fear to disclose it, and each needs the help of all the others. Shall we not work together for the upbuilding of the subject as a whole rather than for its upbuilding at our own institutions?

Does horticulture follow botany?—In order to get at methods and aims, circular letters were sent to all the horticulturists and botanists, with a somewhat long list of inquiries. In this circular the first question asked was, "Does horticulture, as taught in your institution, follow botany, using the latter as a foundation?" Upon this point there seems to be comparative uniformity. Nearly all reply that it does, a few say that it is not necessarily so, while one says that botany is given at the same time, but is in no sense preparatory to horticulture any more than is Latin.

Doubtless most of us feel that botanical work is a very important aid to horticultural work, and much prefer, even though we may not insist upon it, that our students should have had some botany before taking up horticulture. If so, the outlook is encouraging.

Landscape gardening, forestry, and floriculture.—The next question asked was whether landscape gardening, forestry, and floriculture are taught, and if so, by which department. The replies indicate that, of the number of institutions from which answers were received, landscape gardening is taught by the horticultural department in 25, by the two combined in 2, while in 9 it is not taught. Forestry is taught by the horticultural department in 16, by the botanical department in 6, and by the two combined in 1, while 11 report that it is not taught. Floriculture is reported taught by the horticultural department in 22 institutions, by the two combined in 2, while it is not taught in 11.

Here are three distinct lines of work, each of which is worthy the undivided attention of anyone, which are being carried by the men who are upholding the banner of horticulture and botany. I need not say that they are not carried as they should be, for that goes without saying. Yet I would that these things might be more fully appreciated in order that the reason for some of our shortcomings might be better understood.

Experimental plant physiology.—More than half of the institutions heard from report that little or no instruction is given in experimental plant physiology. Of course, in many of these there is some incidental class-room mention of it, but no course is offered in which the student makes it his especial aim to get at the functions of plants by means of experiments carried out by himself. All unite in saying that some previous preparation in botany is needed in order that such work shall be profitable. Some say one year, others say at least two years, while more say that it is taken by juniors in their course.

In the majority of cases where given, it is stated that all regular agricultural students take it. In some cases, however, it is given without any reference to the needs of students in horticulture. One botanist states that his laboratory is well equipped for this work, that he makes a great deal of the subject, and that it is taken by all botanical students who elect to work. But he says that horticultural students do not get it, that horticulture is taught as a business, not as a science. Ought this thing so to be? The student goes to college not to learn business, though in such practical subjects much of this very properly enters. He goes rather to search into the deeper principles underlying the questions and problems with which he deals. If any person on the face of the earth needs to know something of the way in which plants carry on their functions, it is the horticulturist, a fact which many of us have had abundant cause to see, and the want of which to regret. Is not this one of the subjects which should be pushed to the front and which should be so arranged that all students who expect to deal with living plants shall get as much light as possible along this line? Experience must show how much and what ought to precede it and what problems most need elucidating.

Economic botany.—Twenty institutions report courses in botany which have a distinctly economic bearing from an agricultural standpoint. Of these, courses on economic plants and on parasitic fungi head the list. One reports a course in ecology and one a course on commercial products. It is not to be inferred that those who do not report such special courses neglect the economic side of the subject, for most of them say that it receives attention in connection with the other work, by way of illustration or otherwise. One well-known professor reports that nearly all their botany is economic and agricultural. It is merely a question of method, since all recognize the need, and the method each man can best solve for himself.

Horticultural instruction offered.—To in any way summarize the courses of instruction offered in horticulture at the different institutions is a difficult matter. Fruit growing and vegetable gardening naturally form the basis of such instruction everywhere. Only two of the institutions answering fail to report both of these or to leave it implied by a general answer that they are taught. Ornamental or landscape gardening ranks next in the number of institutions at which it receives attention, followed by floriculture and forestry in turn. Nine professors report a course in plant breeding, or the variation and evolution of plants under culture. Six make special mention of greenhouse construction and management, five of propagation of plants, three of crossing, and three of plant diseases. Only three report courses in library work. Spraying, viticulture, and seed growing each receive special mention twice, while nomenclature and a course in the botany of cultivated plants are each mentioned once. Original investigation also receives but slight mention, probably owing to the little demand for it. Among these minor subjects, propagation, crossing, plant diseases, spraying, viticulture, and seed growing undoubtedly receive attention more or less fully in connection with other work at most institutions. Probably only under special conditions are separate courses needed for any of these, unless it be in the matter of propagation.

One point in this summary may be worthy of special attention, and that is the slight mention of library courses. To be sure, this report does not measure the use made of libraries, and, indeed, several mention the auxiliary in connection with the laboratory or practical work. It does seem to indicate, however, that the value of the library is not fully appreciated. In my own experience no work has proved more satisfactory for students who have sufficient foundation to work understandingly than seminary courses. With some advice in the matter of taking and arranging notes and references, so that they shall be quickly available ever afterwards, the student soon appreciates the fact that he is getting something of permanent utility and value. To my own mind the card or slip method of note taking is best. I also find myself making more and more use of the library each year in the assignment of collateral readings in connection with the regular lecture work. I believe that no part of an education is more important than acquiring a familiarity with books, in order to know where to look for information when it is needed. This work is, of course, best suited to the needs of advanced students, but even the farmer boy, who comes in for twelve weeks of practical work during the winter, may profit much by it. In most cases he will be found as ignorant of the literature that is readily within his reach as the advanced student or teacher is of the broader literature to be found only in connection with the larger libraries. In many of the younger institutions the libraries must yet be small, but time and money will remedy this, and money can scarcely be better invested. Meanwhile, it is safe to say that even the smallest library, well used, can do much for the student.

Laboratory work in horticulture.—Laboratory work in horticulture seems to be almost wholly confined to the practical operations of horticultural work and the facilities to the common implements in horticultural usage. Very few mention any microscopical work. Experimental lines, observations, and statistical work among neighboring growers and classification of cultivated plants each receive one mention. Drying ovens and instruments for measuring and weighing are once mentioned.

It is just in this matter of laboratory work that many of us are perhaps most in the dark as to what to do. Practical work very properly forms the basis of it, but during much of the college year outdoor work is not available and the common indoor work is soon exhausted or made to become a mere mechanical repetition, which is still worse. I think we all feel the need of help at this point. The library is a never-failing accompaniment, but this can be utilized at other times. There can be no doubt that an abundance of experimental work of great value to the student would be perfectly feasible if we only had the matter worked out, and we are waiting for the man who has the time and ability to do it.

One man mentions among his laboratory facilities apparatus for mechanical analysis of soils, tubes for demonstrating capillarity, osmosis apparatus, root pressure gauge, hygrometer, and an originali nvention for measuring transpiration, auxanometer, and color screens. Perhaps here is a hint as to some of the lines that might be introduced. In many cases the questions relating to soils can doubtless best be treated by the professor of agriculture and the others mentioned by the professor of botany. If so, all the better; but ought not we, as horticulturists, to see that those of our students who want real horticultural training have the chance of getting such things as these somewhere?

Horticulture as a culture study.—One of the questions asked was, "Do you attempt to make horticulture in any sense a culture study?" To this 16 replied yes, 4 say no, and 9 say that only incidentally it is so. Several did not answer or did not understand the meaning of the question. One reply, from the far Western coast, covers the ground so well that I wish to quote it. The writer says, "Yes; constant allusion is made to the relation of the art to the higher education and its services to the biological sciences and its dependence upon advanced scientific work for its own advancement." This, it seems to me, recognizes the subject in its true position. We are constantly emphasizing the need of culture and training, and many have long looked upon the classics as prime essentials to that end. Happily, we are more and more coming to see that not all culture is confined within doors that can only be unlocked with a Latin grammar or a Greek lexicon. We are finding out that science offers breadth of training as well as the humanities. Why should it not, since in it we study the supreme wisdom as revealed to man to-day rather than that same wisdom and power as revealed to and through man in past ages?

In horticulture we have a subject preeminently fitted to minister to the needs of the student, while giving him culture and breadth of training as well. It not only, in company with agriculture, deals with those functions of life by which inorganic matter is changed into organic and useful material, but it is able to throw powerful search lights upon many philosophical and biological questions which must ever be of keenest interest to humanity. Furthermore, in the study of landscape gardening we deal with one of the noblest of fine arts, since in it we induce nature herself to paint us the picture which shall interpret her deepest expressions and her highest beauties. I am fully convinced that the subject of horticulture, or at least some phases of it, may well occupy a place in any liberal education, or in any educational curriculum, regardless of its connection with the general idea of agricultural training. The broadening influences of its biological side and the æsthetic and spiritual influences of its ornamental side fully warrant such recognition. If landscape gardening found a proper place in the course of study of all the normal and teachers' training schools throughout our land it would not be many years before our country schoolhouses, and many of our country homes, would cease to be the dreary and cheerless places that they now are.

The practical value of such a subject is much more apparent and much more likely to take a tangible hold upon the minds of people, yet even this should warrant careful consideration in almost any course of study. Why should it be less desirable or less genteel for the young man or the young woman to learn some lessons from the fine art of nature herself, which will enable him or her to render the surroundings of the home continually attractive, than to spend numberless hours in learning to paint pictures which may adorn its walls, or in acquiring some ancient classic which may adorn but a dark corner of the memory, to be ILLUMINATED only by dim and infrequent flashes of recollection? We are not likely to overestimate the practical side of this work, and we should emphasize it in every way that we can, but let us not forget our opportunity in its broader field of human ken.

Number of students in horticulture.—No accurate report as to the exact number of students who received horticultural instructions during the last year can be given, since many failed to give a definite reply. Certain it is that over 1,000 were enrolled in the various horticultural classes of the United States. Naturally those agricultural colleges which offer only one or two courses, and which require all, or nearly all, of their students to take this subject, report the largest number. Kansas leads with 197, followed by Mississippi with 160, while several of the newer institutions, and indeed two or three of the older ones, report none. In several cases the numbers reported were all, or nearly all, short course or winter students, while in some they were all, or nearly all, regular college students.

It was asked what proportion of these students probably took horticulture because they were really interested in the subject. This could of course be only a matter of judgment, and was evidently in some cases much influenced by the personal equation of the professor. The answers ranged from 50 per cent to all, more saying all than anything else. I think that most of us will agree that when the greater part of the students in an institution are required to take any subject, e. g. mathematics, to say that all take it because they want it is to misunderstand student nature. Of the twenty-six different college students who took horticulture in the University of Nebraska not one was required to take it, and since they elected it all might be fairly said to have taken it because they were particularly interested in the subject. Yet all familiar with elective work know that the need of a certain number of additional hours at a convenient time often influences such choice as much as particular taste. However, the reports indicate that a goodly number of young people throughout our land are really interested in this subject.

Horticulture as required or elective.—Horticulture is required in the agricultural course of every institution but one; in that one it is elective, but in the agricultural course only. It is required of *all* students in three. Eight report it as elective to other students, while fourteen report it as not elective to students outside the agricultural course, and a few say that it is only elective to graduates, specials, or to some limited class of students. Is not this a question which should receive attention? Why should a student be deprived of the opportunity to get horticulture because he is not classed in the agricultural course? To my mind the ideal condition is that in which the course stands on the same plane and takes its chances with all other subjects, where any student is free to elect it if he will, but where no requirement and no special inducement constrains him to elect it. Among the students registered for horticultural work at the University of Nebraska at the present time there are representatives of seven different courses—the general scientific, the biological, the philosophical, the literary, the classical, the English, and the agricultural.

Possible improvements in teaching horticulture.—Suggestions were asked for as to possible improvements in methods of teaching horticulture, but to explain and enlarge upon these would manifestly be impossible within the present limits. Among the things mentioned were more apparatus, more laboratory work and better laboratories, more field work, better grounds for illustration, observation tours, more time, text books, better preparation, more required work, work placed earlier in the course (this from an institution where it is only open to seniors), deciding upon a definite basis of instruction, so that it shall be either the manual training or the philosophical basis, but not an attempt to mix the two, narrowing the field which one institution tries to cover, better teachers, and finally students to take the work.

General character of experimental work.—So far as a single question and the replies to it can indicate the greater part of experimental work in horticulture and botany is along important lines, requiring some considerable length of time for their solution. This is encouraging, for it indicates that the pressure for immediate results, so often felt by the station workers in the early history of the work, is giving place to an expectation for deeper and more substantial work. There are, to be sure, many practical questions which can be taken up in connection with the more important lines and be made to yield results of value in a short time. These may well receive attention when they do not interfere with more important work.

Variety testing.—In regard to variety testing, nineteen report that they give a good deal of attention to this work, six say a moderate amount, and twelve say that they give little or none. Eighteen say that growers demand this sort of work from the station, twelve say that it is not or only slightly demanded, five say that information about varieties is demanded, and at least six mention that seedsmen and nurserymen demand it. In general, the facts appear to be that farmers and fruit growers want information as to what they may safely and wisely plant, while the dealers and tradesmen want the real variety testing in order to aid them in their sale of novelties.

On this subject one worker very aptly says: "Variety testing is apt to run into an advertising scheme for seedsmen and nurserymen. We are often annoyed, after our work is set for the year and at a time too late in this climate for any fair test, to receive from growers and dealers samples of seeds and plants for test. Then the following fall they write for a private report as to how their plants have turned out. I have adopted the rule never to give anyone a private report in regard to any seeds or plants sent to us. Variety testing is incidental to our work and not an object. We have little call for it from our own people, but much from growers and dealers in other States, who, as I have said, want it mainly for advertising purposes, and I strive to prevent this."

I am sure that many other workers have experienced this same phase of the problem. It is apparent that in this as in many other matters practical growers merely expect the station to serve as a bureau of information. It seems to me that if this principle is fully recognized it will materially aid in solving the vexed question of the importance or need of this work, for it is not always necessary that the station test the varieties in order to get the information.

Variety testing is naturally demanded more in the newer States than in the older, and the reason oftenest given why growers demand it is that the State or horticulture in the State is new. Other reasons mentioned are that tradesmen's statements are unreliable; that the growers need the information; that they deem this the work of the station; that this is a class of work which they can understand; that they fail to see that results are local, etc. One horticulturist says: "We find this the most popular feature of our work—one that attracts the attention of the general public most readily, because it is the one that they can most readily understand. They demand variety testing as an object lesson which they are unable to indulge in themselves without considerable individual cost. We deem it the most uncertain, unreliable, and unsatisfactory feature of our work, but are compelled to indulge in it to popularize the station." Replies from several others indicate that they are discarding it as fast as feasible.

Dissemination of seeds and plants.—Twenty-two workers report that more or less has been done by their station in disseminating seeds or plants, while fifteen say that nothing, and three say that a very little in the way of their own productions has been sent out. In a majority of cases they were sent free, though some have asked the cost of transportation and packing or of propagation, while a few have sold at a fixed price. Among those who have tried it six say they think it wise and eight consider it unwise. Three consider it unwise to send them free, and several others say that it is undesirable except for cooperative experiments or with very careful handling. In fact nearly all who consider it wise make the statement with some limitations annexed. Of those who have not tried it, two say they think it would be wise and five think it would not. It is quite evident that the majority both among those who have had experience and those who have not think it an unwise practice. New Jersey reports sending out weed seeds to farmers at a fixed price and thinks the results are good.

Experimental work of the year.—To give any satisfactory mention of the different lines of experimental work carried on by the horticulturists and botanists during the year is utterly impossible within the limits of this paper. Variety testing, being the commonest and most convenient line of work, naturally receives more frequent mention than any other line. Following this come experiments with plant diseases, fertilizers, plant breeding, spraying, cultural experiments, vegetable forcing, and insect depredations, each of which receives mention several times. Other things mentioned are experiments with cañaigre, crown gall, orchard tillage, grafting of hickories, root pruning, crossing, propagation, climatic seed tests, irrigation, windbreaks, apples, potatoes, rate of timber growth, winter protection of fruit buds, potency of pollen, apple blight, methods of tree planting, study of the codlin moth, corn selection, cucurbits, thinning apple trees, greenhouse fertilizers, bulb growing, soil treatment for nematodes, peach diseases, sweet potato rot, grain and corn smut, seedling fruits, peaches, pollination of plums, preservation of fruits by alcoholic vapor, cereals, forage plants, effect of hot water on germination, greenhouse work with flowering plants, physiological effect of different chemicals on potatoes, etc. Colorado reports a careful study of the flora of the State, with especial reference to weeds and grasses; New York a horticultural survey of the State, while the Pennsylvania horticulturist has spent much time in traveling among the growers of his State to become better acquainted with their needs. These, of course, include only the more important lines, and do not begin to cover the problems taken up by the different workers. They are very encouraging, for they indicate that the stations are covering a much broader field than formerly, and that the results of their work must become more and more useful to the people interested.

Proportion of experiments which fail.—In reply to a question as to what proportion of experiments fail to yield definite results owing to climatic or other unfavorable conditions, nearly all report some such loss. A number say that the proportion is small; about as many say that the loss is considerable, perhaps one-fourth, while others report varying proportions up to one-half. At least three say that one-half their results are lost from one cause or another. Only two say that they meet no such loss. Several say that they now try to avoid lines in which losses are most frequent.

Station workers are sometimes criticised because they do not show more results of their effort, but it should be remembered that in general they are just as much dependent upon natural conditions and phenomena as the farmer himself, even more so in many cases, and are just as likely to meet with failure in their work from these causes as he is in his.

Time demanded by outside work.—The station worker is not allowed to pursue his work uninterruptedly. There are many outside demands upon his time. Only five of all the horticulturists and botanists replying to the questions say that none of their time is occupied with work at farmers' institutes, though fifteen say that this demand is but slight. At least twenty-four report varying amounts of time which show that this work demands a good deal of attention. As many as eleven report from three to four weeks thus spent, while five say that from one to two months are required at institutes, fairs, and horticultural meetings. None of our members appear to be suffering for lack of something to do.

Appreciation of the work.—Nearly all workers feel that their work is generally appreciated by the people of their State, or at least by those who know it, and that it is growing in appreciation. Only two say that it is not well appreciated, and two that it is not very highly valued, but in all these cases they report that the conditions are improving. One worker in a new State says that the people rely too much on the station.

Bulletins issued.—As a matter of statistics it may be said that some seventy-five or eighty horticultural bulletins and over thirty botanical bulletins were issued between July 1, 1895, and July 1, 1896. Aside from this, much matter is published in annual reports and other places. In one or two States everything appears in the annual report.

Two replies from across the border indicate that the Canadian workers are in harmony with us in methods and in the general scope of the work which they are trying to cover.

In closing, I feel that I should apologize to the botanists for the fact that in this report greater attention is given to horticulture than to botany. This is partly due to my own greater familiarity with the horticultural work, and partly to the fact that horticulture, being educationally the younger subject, has greater need of attention.

FRED W. CARD, *Chairman.*

The CHAIRMAN. Unless there be objection, we will consider this very interesting report accepted, and I will now call upon J. W. Lawrence, of Colorado, to present his report on mechanic arts.

REPORT OF THE SECTION ON MECHANIC ARTS.

In making out this report I have endeavored to present such matter as might be regarded as evidence that the work in the mechanic arts side of the agricultural colleges is moving forward to better and more substantial work, or at least is not slipping behind.

Some time ago I sent out a circular letter making practically only two inquiries, one as to what advance, if any, had been made in the studies and work of the departments operating along the line of the mechanic arts; requesting also that the general condition of the work be stated.

Knowing that many were interested in the two bills lately presented in Congress, known as the "State engineering and experiment stations bill" and the "Wilson-Squire engineering and education bill," I made inquiry as to how they are regarded by the different colleges, and what had been done by each toward the advancement of the bills.

The replies were prompt and courteous. Upon inspecting the answers received and looking over the courses of study offered, I find that there seems to be a wide difference in the constitution of the curricula. At one end of the list are colleges having a course of study scarcely better than that of a high school, while at the other are found those whose requirements for admission would demand the completion of a first-class high-school course.

One college reports having endeavored to establish, by a great and radical change, a course that should be, in fact as well as in name, a college course. The experiment was tried, and the consequence was that they found themselves with depleted ranks and were forced to retreat to their former position. They found that the students coming to them had not the necessary preparation, and that the stand taken for a higher grade of work failed to bring about any noticeable improvement in the class of students coming to them for admission. I have received this complaint from more than one source; and those who have answered the query as to why this is so agree that it is on account of the schools of lower grades not furnishing students with the required amount of preparation.

Acting on the assumption that "the colleges are made for the people," a number of the institutions report that, in order to afford such students an opportunity to acquire the needed preparation, they have introduced preparatory and subfreshman courses, which give a thorough preparation about on a level with a good high-school course. It is noticeable that these complaints of lack of preparation come from colleges situated in a new or sparsely settled part of the United States, although an exception is noted in one of the older Middle States, where the professor reporting declares that the poor scholarship shown by those applying for admission is due to the poor public-school system in that State.

Therefore it will appear that we shall have to return to the proposition that "the schools were made for the people and not the people for the schools."

This is one of the points that seems to have been brought out by my inquiries, and while this Association has done much to improve the college courses of study there is still much to be accomplished through its instrumentality. I am firmly convinced that, no matter how good a technical education a man may have, if he is lacking in sound, broad culture and an adequate knowledge of the English language he will be outclassed by the technical man possessing the latter qualifications, especially if he is to teach in the colleges of the country.

I am impelled to dwell somewhat upon the foregoing because there is an evident desire in the mechanical departments of the colleges, and more especially in the younger ones, to raise the standard of scholarship, and to be fair to the students in so doing.

Judging from the letters received, there appears to be a commendable interest taken in the matter of courses of study, and I am sure great good must result from these efforts.

With regard to attendance upon courses lying along mechanical lines, there appears to be no lack of students who desire to take up the work, especially where the course is a separate and distinct one.

There is a growing desire to make a plainer line of demarkation between the agricultural and mechanical courses, and have each stand on its own merits, and not have one used to support the other. There are some distinct exceptions to this, however, and some institutions are using the mechanic-arts feature simply as a supplement to the agricultural work, while there are others which have the two courses closely woven together. Time will doubtless develop which is the best method to pursue.

Then, again, the question seems to present itself whether it is better to make a simple mechanic-arts course out of it or to develop the work into the highest kind of engineering.

Some of these questions are such as might, perhaps, come under the caption of "A course of study;" but I am bringing them to your attention because they are points which have developed in this inquiry as being those upon which much activity is manifested by the mechanical sections, and much progress is being made toward the strengthening of the work.

As an example, one of the younger colleges reports, "We do not now admit any students to the mechanical-engineering course except college students. No academy students are given work of any kind in the department.

"No shop work is given to students other than mechanical-engineering matriculates.

"Every graduate from this department (thirteen) has a position directly along the line of mechanical engineering. We graduate nine more this year."

As to numbers in attendance, there is a universal response that the numbers are increasing, and that, too, at a most gratifying rate. Some report that the increase of numbers is in excess of the facilities for instruction. One example will illustrate:

One college says: "So far as the work in the mechanic-arts department at this institution for the last year is concerned, the attendance was only limited by the capacity of the shops. One hundred and seventy students took work in the shops, besides a senior class of eighteen who did a large amount of advanced laboratory work in the way of testing engines, boilers, etc., calibrating various engineering instruments, and testing the strength of the common materials of engineering.

"The interest in this line of work is growing rapidly at this institution. If our attendance increases as rapidly in the next three years as it has in the last three years we will be entirely unable to handle our classes with the present facilities, even if we should entirely revise our schedule of recitations, and carry on the shop work all the time."

The increase of the material equipment of many of the institutions during the past year is also in evidence as being a direction in which much progress has been made. Some institutions report the addition of new benches and tools; some the building of additions to plants already existing; others that they have put up entirely new buildings for the accommodation of the department.

One college reports the erection of a fine mechanical building, and the fitting up of the same, at a cost of $198,000—the most costly one mentioned as having been completed during the past year.

The amount of time devoted to shop work in the various colleges formed another interesting feature of the replies, but that may more properly come before the Section on Mechanic Arts, and I will not occupy the time by discussing it now.

The kind of work given is also of importance; it varies considerably, and might at some time properly come before some section of this Association for discussion. My inquiries developed the fact that many of the institutions are gradually introducing experimental laboratories for work in both mechanical and electrical engineering.

Some have already had them in successful operation for many years, and among the newer institutions there seems to be a growing desire to have them. Those lately established are started in two different ways; some are fitted out in one or more existing rooms that have been remodeled for the purpose, while the others consist of buildings built especially to receive appliances designed to be used for purposes of experimenting along mechanical and electrical lines.

This brings me naturally to the last feature of my report, the "Wilson-Squire engineering and education bill," and the "State engineering experiment stations bill." In presenting some points regarding these bills at this time, it is not my purpose to usurp the functions of any existing committee, or in any way to trespass upon the territory of anyone who may have something to say upon the subject.

I was somewhat surprised and much gratified when I received replies to my inquiries to find how hearty the responses were, and to know that so much lively interest was manifested in regard to the bills. College presidents and department professors nearly all most heartily indorse the measures. A good many wanted the bills modified somewhat, but the latest revision of the bills will remove the cause of most of the objections. By far the greater number are in favor of the "State engineering experiment stations bill" in preference to the "Wilson-Squire engineering and education bill." I have been urged by many to bring this matter of the "engineering experiment stations bill" prominently before the convention at this time, as a matter affecting all the land-grant colleges. I am constrained to believe, however, that a great deal of earnest work has already been done by the trustees, presidents, and professors of the various colleges, and that, as a rule, they are already fairly well informed regarding the purport of the bill; therefore, as it would take some time to get the matter in proper shape for discussion, I will refrain from presenting much matter that is explanatory, except to say that I think that the bill is the logical sequence of previous legislation. It is similar to the Hatch Act. It provides for experiment stations for engineering, in the same manner as agricultural experiment stations are provided. I also believe that it would not be in accordance with the rule of the Association requiring this report to inject a large amount of matter relating to this subject.

Many of the professors in the mechanical departments have expressed themselves as being very desirous of attending these meetings and exchanging ideas with their fellow-workers. Why are they not present the same as the professors from the other college departments? Could not this be brought about? Can not the college presidents and trustees present see to it that more of the mechanical men are present at these meetings? I am sure much good would come of it, and it could be made mutually beneficial. The discussion of technical papers in the section, the comparison of methods, and the discussion of topics arising incidentally would be features which would accrue to the benefit of all.

J. W. LAWRENCE, *Chairman.*

The CHAIRMAN. If there be no objection, the report will be considered as approved, and I will call next for the report of the treasurer, J. H. Washburn, of Rhode Island.

REPORT OF THE TREASURER OF THE ASSOCIATION.

John H. Washburn, treasurer, in account with the Association of American Agricultural Colleges and Experiment Stations.

Balance on hand from last year	$565.88
Dues for 1895–96	930.00
	1,495.88
Total expenditure	1,020.43
Balance on hand November 10, 1896	475.45

ITEMIZED STATEMENT.

Receipts.

Experiment stations in Alabama, Arizona, Arkansas, California, Colorado, Connecticut (State and Storrs), Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York (State and Cornell University), North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, Washington, Wisconsin, and Wyoming, $10 each	$490.00
Colleges in Alabama, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia (A. and M. College and Hampton Normal Agl. Inst.), West Virginia, Wisconsin, and Wyoming, $10 each	440.00
Total	930.00

Expenditures.

1895.

Voucher 1.	Paid C. P. Gillette, expense of entomological committee	$4.00
2.	Paid E. L. Wepf, for 300 lists of members	5.00
3.	Paid Forden, Pratt & Co., expense of lecture	15.00
4.	Paid J. H. Washburn, incidental expenses of executive committee	4.25
5.	Paid J. E. Thomas, official stenographer	11.28
6.	Paid Judd & Detweiler, for printing	10.70
7.	Paid C. Gregerson, for printing	5.50
8.	Paid Carpenter & Morehouse, printing	3.00
9.	Paid H. H. Goodell, committee expense	13.43
10.	Paid H. H. Goodell, committee expense	27.30
11.	Paid H. S. Gardner, printing	11.68
12.	Paid L. M. Brown, typewriting	1.75
13.	Paid S. H. Gardner, typewriting	1.86
14.	Paid H. C. White, committee expense	53.00
15.	Paid Ebbitt House, committee expense	17.50
16.	Paid Carpenter & Morehouse, printing	11.25
17.	Paid J. C. Hall Co., printing	3.25
18.	Paid Ebbitt House, committee expense	59.75
19.	Paid H. C. White, committee on examination	67.55
20.	Paid Spring-Emerson Co., printing	4.75
21.	Paid H. H. Goodell, committee expense	31.37
22.	Paid H. P. Armsby, committee expense	19.44
23.	Paid M. A. Scovell, committee expense	40.65
24.	Paid L. M. Brown, duplicating and typewriting	11.40
25.	Paid H. H. Goodell, committee expense	43.68
26.	Paid H. C. White, committee expense	65.10

Voucher 27.	Paid A. W. Harris, committee expense	$61.74
28.	Paid Thomas J. Hunt, committee expense	37.85
29.	Paid H. C. Murkland, committee expense	33.48
30.	Paid A. W. Harris, committee expense	16.45
31.	Paid G. E. Stratton, convention notices	2.25
32.	Paid J. M. McBryde, committee expense	30.05
33.	Paid Carpenter & Morehouse, printing	1.25
34.	Paid H. H. Goodell, committee expense	35.71
35.	Paid H. H. Goodell, committee expense	34.85
36.	Paid W. M. Hays, committee expense	41.00
37.	Paid D. Gillis, printing	10.00
38.	Paid J. H. Washburn, incidental expenses at Denver for printing and postage	39.95
39.	Paid Carpenter & Morehouse, printing	8.00
40.	Paid L. M. Brown, typewriting	1.75
41.	Paid M. E. Eldred, typewriting	5.00
42.	Paid H. H. Goodell, committee expense	12.66
43.	Paid Carpenter & Morehouse, printing	10.00
44.	Paid H. C. Burch, Grand Army Hall	75.00
45.	Paid J. H. Washburn, correction	20.00
Total		1,020.43

The CHAIRMAN. It is generally customary to appoint an auditing committee to examine the report of the treasurer. For that duty I will appoint C. D. Woods, C. F. Allen, and J. E Stubbs. (For report, see p. 68).

Reports of committees are now in order.

Mr. MURKLAND (chairman of the committee on entrance requirements, courses of study, and degrees). Mr. Chairman, inasmuch as there is a possibility that there may be differences of opinion on some of these matters, and as the time now is short for a full discussion, I move that this report be specially considered at some future time, and printed, in order that it may be laid directly before the members of the convention.

The motion was adopted.

The CHAIRMAN. There not being time this morning to listen to further reports of committees, it is proper now to take up the consideration of the organization of a permanent Section on Irrigation, for which petition has been duly made, signed by seventeen members.

Mr. PATTERSON. I move that the permanent organization of a Section on Irrigation be made.

Mr. ATHERTON. I move that the whole matter be laid upon the table for one year.

After a short debate the motion of Mr. Atherton prevailed by a rising vote of 29 to 16, and at 11.45 a. m. the session adjourned.

EVENING SESSION, TUESDAY, NOVEMBER 10, 1896.

The general session convened in the Grand Army Hall at 7.30 p. m., Vice-President R. H. Jesse, presiding.

The CHAIRMAN. The first thing before the convention is the unfinished business. At the morning session we decided that the recommendations of the executive committee should be taken up one by one. The chairman of the executive commiteee will read them.

Mr. GOODELL. The first recommendation is as follows;

That a committee be appointed to wait on the War Department and adjust relations between it and the colleges. A disposition has been shown to ignore expressed preferences in the detail of officers for college duty, and the Adjutant-General of the Army, in his late report, has recommended that details be made only to those institutions showing on their rolls the presence of one hundred and fifty, or more, students.

Mr. STUBBS. I move that a committee of three be appointed by the chair in accordance with the recommendation of the executive committee.

Carried. (For committee, see p. 47).

Mr. GOODELL. The second recommendation is:

That the Association calls the attention of all concerned to the limitations of the franking privilege granted experiment stations. The law is explicit, providing only for the franking of bulletins, and college reports containing the annual reports of stations. Great care should be observed by station officers not to abuse this valuable privilege so very necessary to the work of the stations.

Adopted.

Mr. GOODELL. The third recommendation is:

That the chairman of the section and the editors of the proceedings of the convention be constituted a committee to pass on the papers from each section, and that the Department be urged to print the papers recommended by this committee.

Adopted.

Mr. GOODELL. The fourth recommendation is:

That station directors drop from their mailing list the names of workers in other stations and depend entirely upon the list furnished at Washington, sending for a fresh copy at the time of issuing each bulletin. Changes among station workers are so frequent that the observance of this practice would result in a great economy of time and correspondence, besides securing greater accuracy. Why should directors send out notices of every change to 51 stations, and why should these 51 stations be compelled to make the necessary changes when it is done so much easier once for all at the Office of Experiment Stations?

Adopted.

Mr. GOODELL. The fifth and last recommendation is:

In view of the large and increasing number of measures which are introduced in Congress affecting the interests of the colleges and stations, and the frequent lack of cooperation among those interested concerning such measures, whereby the influence of the Association and the interests it represents are liable to be materially weakened, the committee respectfully recommends that institutions, members of the Association, and their officers, refrain from advocating measures affecting the interests of all until such measures shall have been considered and approved by the Association.

Adopted.

The CHAIRMAN. New miscellaneous business is now in order.

Mr. GOODELL. I move that a committee of five, one of whom shall be the Librarian of the Department of Agriculture, be appointed to consider the subject of indexing agricultural literature and report upon the feasibility of the same.

Carried. (For committee see p. 56.)

Mr. ATHERTON. I move the adoption of the following resolution:

Resolved, That a committee of four, of whom the chairman of the executive committee shall be one, be appointed by the executive committee to await upon President-elect McKinley and present to him the importance of such an organization and administration of the Department of Agriculture as will give unity and permanence to all its scientific work and keep that work free from political influence.

Adopted. (For committee see p. 68.)

Mr. ATHERTON. I move that the officers of this Association communicate with the President of the United States, to see whether it will be agreeable for him to receive this Association in a body.

Carried.

Mr. WHEELER. I desire to introduce the following resolution:

Whereas some experiment station workers have failed in certain of the station publications to cite authorities for statements made and to give proper credit for work done by others, and in consideration of the unfavorable light in which the work of the stations must be viewed by scientists in consequence: Therefore be it

Resolved, That this Association considers such a course unscientific and not conducive to the best interests of the experiment stations of this country.

Referred to executive committee (see p. 47).

Mr. ALVORD. As subcommittee in charge of the matter of procuring busts of Hon. Justin S. Morrill for several colleges ordering the same, under action taken by the

Association at its Washington convention of 1894, I now respectfully submit the following report:

After the subscriptions verbally made at the convention mentioned by representatives of several colleges had been confirmed in writing, arrangements were concluded with Mr. Preston Powers, of Florence, for making a marble bust of Senator Morrill to be owned by the Association, and from this twenty-five casts in plaster. Every cast was to be finished by the sculptor and personally attested by him, and the casts and marble to be packed separately, one in a case, and delivered in New York City, transportation charges paid.

Great delay occurred in executing the work, more than twice as much time being occupied as at first agreed. But it appears from explanations made by Mr. Powers that the delay was entirely unexpected and due to unavoidable causes, for which the contracting sculptor should not be held responsible.

The marble and the casts ordered were finally received at New York during the month of October last and eighteen casts were at once forwarded to the subscribing colleges which had paid for the same as called upon, and were shipped in accordance with instructions respectively received.

Of the institutions making verbal subscriptions in November, 1894, three failed to confirm the same in writing and were dropped from the order list. In response to a circular of inquiry sent to all colleges acting with the Association, a few additional orders were received for casts. Some of the institutions which ordered casts have not yet responded to the requests made to them by letter for payment upon the consignment of the casts from Italy, as originally agreed with the sculptor.

As a result, there are now at New York, stored and insured, subject to the order of the Association, seven plaster casts and the marble bust.

It is recommended that one of the casts be presented to Mrs. Justin S. Morrill in the name of the Association, to replace the plaster bust of Senator Morrill borrowed from her for the collective college exhibit made by the Association at the Columbian Exposition and which was broken while in the hands of the transportation companies for return to its owner. Also, that of the six casts remaining, the colleges ordering them in writing be given thirty days' notice, during which they may be paid for and claimed at the original rate of $45 each, with proper charges added for storage and insurance, and that after the expiration of this limit other colleges which may apply be furnished the same in the order of their applications upon payment of $50 for each cast, delivered packed and "f. o. b." at New York City.

Mr. Powers, the sculptor, has retained in his studio at Florence the original mold and the first cast made from the marble. From these other plaster casts can be made, and, as he states, equal to those now supplied. It is recommended that the executive committee be authorized to contract with Mr. Powers for the making of casts of this bust hereafter only upon orders given for and in the name of this Association, and that they be supplied to colleges at not less than $50 each, delivered in New York, any margin of profit to be covered into the treasury of the Association. This will reimburse the Association for expenses now incurred in this connection, which will somewhat exceed the amount received for the casts already ordered.

The fine marble bust of Senator Morrill by Powers is the property of the Association, and this convention should provide for its proper disposition. It is suggested that the executive committee be authorized to temporarily deposit the marble in the Corcoran Art Gallery at Washington, and also to provide for presenting it at a suitable time to the Congress of the United States, to be permanently placed in the Senate Chamber, with an appropriate inscription on behalf of the Association.

An account of the receipts and disbursements made by the undersigned as subcommittee for this purpose will be made as soon as a letter now due is received from the sculptor. It is requested that the new executive committee be authorized to receive and audit this account, and if found correct, to direct the treasurer of the Association to adjust the same. And I also request to be relieved from duty as committee in charge of this matter, after the settlement of the account.

Respectfully submitted.

HENRY E. ALVORD.

The report was accepted and its recommendations adopted.

Mr. WASHBURN. I have here a letter from the secretary of the Cosmos Club, extending to the members of this Association while here in the city, the privileges of the club. The secretary of the Association was directed to write a letter of thanks accepting the invitation.

Mr. ALVORD. I move that the Association send a letter of respect to Senator Morrill, and ask him to attend the meetings of the Association.

Carried.

Mr. HARRIS. I wish to offer the following resolution:

Resolved, That a committee of three college presidents be appointed by the executive committee to cooperate with the secretary of the Association in revising and publishing a table of the college statistics similar to a table published some years ago.

That the committee be directed to publish the table not later than December 7, 1896, if possible, and if not, to publish at that time such statistics as may be available, and the perfected table as soon thereafter as may be found practicable.

Referred to the executive committee (see p. 47).

Mr. ATHERTON. I desire to present the report from the committee on House bill 3618 (Senate 735) to establish and maintain courses of instruction in naval engineering in the scientific and technological schools of the United States and for other purposes. Your committee trusts that the report will meet the approval of the Association.

REPORT OF THE COMMITTEE ON A BILL TO ESTABLISH AND MAINTAIN COURSES OF INSTRUCTION IN NAVAL ENGINEERING.

History of the measure.—This bill is based upon Senate bill No. 2779, introduced in the Fifty-first Congress, first session, by Senator Butler, of South Carolina, and Senate bill No. 1289, introduced in the Fifty-second Congress, first session, by the same Senator.

At the convention of this Association, held at Champaign, Ill., in November, 1890, after a careful and prolonged consideration of the measure by the college section, with special reference to its bearing on the interests of the colleges represented in the Association, followed by a full discussion of the report of the section on the floor of the convention, a committee was appointed, consisting of Messrs. Atherton, Smart, and Dabney, to present to the proper committee of each House of Congress the judgment of this Association in support of the measure. This was the first movement of an organized body in behalf of the bill, though many institutions and individuals had already given it a most cordial and emphatic indorsement, such as the State universities of Tennessee, Michigan, Wisconsin, Illinois, South Carolina, and Ohio; Madison (now Colgate) University, Hamilton, N. Y.; Purdue University, Indiana; the Worcester Polytechnic Institute, Massachusetts; St. John's College, Annapolis, Md.; the Pennsylvania State College, the University of Pennsylvania, and others.

Your committee received a most courteous and cordial invitation to appear before the Senate Naval Committee. Their presentation of the matter was listened to with great attention and called forth an extended colloquial discussion, which appeared to enlist the hearty favor and support of the entire committee.

The Naval Committee returned the bill to the Senate with a strong report (No. 576, Fifty-second Congress, first session) in favor of its passage, but the pressure of other matters prevented it from being reached during that Congress. For that reason your committee failed to make a report at the next convention of the Association, as it seemed hardly worth while to do so at that stage of proceedings.

In the Fifty-third Congress the bill was not introduced, but at the opening of the Fifty-fourth Congress it was again brought forward, with such additions and modifications as subsequent experience and reflection had suggested.

Your committee then resumed its efforts to carry out the instructions of the Association, the vacancy caused by the appointment of Dr. Dabney in the Department of Agriculture being filled by the executive committee by the appointment of President H. C. White, of Georgia. Owing to the absence of the chairman the burden of the work fell on Messrs. Smart and White, and the credit for whatever was accomplished belongs to them.

As the provisions of the Wilson-Squire bill include all that was important in the earlier bills, and as the arguments in support of each measure are substantially the same, the present report deals only with the bill now pending.

Essential features of the bill.—The prime purpose of the bill is to increase the number of engineering officers in the Navy to such an extent as is required by the recent large increase in the number of ships of war, and the total change occasioned by the substitution of steam for sails as a motive power.

To those who have not given attention to the subject it must seem well nigh incredible that a great and powerful Government should undertake to reconstruct and enlarge its Navy so as to make it commensurate in extent and quality with the requirements of its position among modern nations; should institute a careful and prolonged series of experiments and expend many millions of money for the purpose of providing its new vessels with an armament representing the highest achievements of scientific construction; should fully and unequivocally recognize the fact

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As the provisions of the Wilson-Squire bill include all that was important in the earlier bills, and as the arguments in support of each measure are substantially the same, the present report deals only with the bill now pending.

Essential features of the bill.—The prime purpose of the bill is to increase the number of engineering officers in the Navy to such an extent as is required by the recent large increase in the number of ships of war, and the total change occasioned by the substitution of steam for sails as a motive power.

To those who have not given attention to the subject it must seem well nigh incredible that a great and powerful Government should undertake to reconstruct and enlarge its Navy so as to make it commensurate in extent and quality with the requirements of its position among modern nations; should institute a careful and prolonged series of experiments and expend many millions of money for the purpose of providing its new vessels with an armament representing the highest achievements of scientific construction; should fully and unequivocally recognize the fact that sailing vessels have been absolutely superseded in modern warfare, and should, accordingly, spend other millions in fitting up its new vessels with engines and machinery fit to be models of their kind; should thus recognize the fact that the engineer has come to take, in great part, the place of the sailor in the Navy, even more than in the merchant marine; should continue under the changed conditions to train the same number of officers of the line as when such officers constituted the sole, or almost the sole, official complement of a ship of war. But while thus clearly recognizing a total change of conditions, should yet take no single step to increase the number of that branch of the official force upon whose intelligence and skill and courage and training the efficiency and even the safety of the war vessels absolutely depends. Yet such is the fact, as it has been annually presented to Congress for several years past in successive and urgent reports of the Secretary of the Navy, the Chief of the Bureau of Navigation, and the Chief of the Bureau of Steam Engineering.

Extract—Report of Secretary of Navy, 1890, urging an increase in the Corps of Naval Engineers.—The Secretary of the Navy, in his annual report for the year 1890, said:

"Of equal importance with the above changes is the demand for an increase in the number of the Engineer Corps. At present there are not enough engineer officers in the Navy for ordinary working purposes, and if no additional ships were building, an enlargement of the Corps would be necessary. The important additions that are now being made to the fleet emphasize still further the urgent necessity of immediate action. The engines of the new ships, with their great complexity and delicate adjustment, require the highest kind of expert treatment, and unless a sufficient force is provided the safety of the ships will be seriously endangered. A bill for this purpose has been introduced in Congress, which provides, also, for the selection of a certain number of graduates of technical schools for appointment in the Engineer Corps. With the general principles underlying this bill the Department heartily concurs, and it earnestly asks that action may be taken upon it at the coming session."

Extract—Report of Secretary of Navy, 1891.—In 1891 the Secretary of the Navy, recurring to the same subject, referring to and reaffirming his previous report, said:

"It was then stated that there were not at the time 'enough engineer officers in the Navy for ordinary working purposes, and if no additional ships were built an enlargement of the Corps would be necessary.' A modern man-of-war is a vast and complex machine, needing intelligent and trained minds to insure a perfect working of the parts, failure in any one of which may be fatal at a vital moment; and the sense of responsibility, the physical and nervous strain upon the engineer officer charged with the care and supervision of this network of machinery is very great. His duties are not only of the highest importance, for upon him mainly depends the efficiency of the motive power, but they are at the same time arduous and dangerous. Manual labor and subordinates are at his service, but he can not be everywhere, and he should have the assistance of men like himself to bear their share of his load.

"It is false economy to put in our new vessels all that is most advanced in high-pressure machinery and the multitude of engines and devices by which steam and mechanical appliances are made to do the work of man, and then to provide an insufficient number of officers to contol them."

Extract—Report of Commodore George W. Melville, Engineer in Chief, 1889.—The distinguished Chief of the Bureau of Steam Engineering, speaking of the same subject in his report for 1889, said:

"The statements made in my report of last year as to the necessity of increasing the number of officers in the Engineer Corps hold good with even greater force at the present time, owing to the steady decrease of the number of officers in the Corps and the increase in the number of modern high-powered ships soon to be in service, each new one with more auxiliary machinery scattered about in different compartments than its predecessor, and all of which requires intelligent and constant care. The Bureau is constantly embarrassed in finding officers for necessary duty on account of the insufficient numbers in the Corps. The numbers allowed to ships have been reduced as low as prudence will permit, and in some cases even lower than circumstances would seem to justify, owing to the inadequate training and insufficient number of the petty officers, which throws much of the work that should properly be done by them on commissioned officers.

"On shore the officers have to be taken from their regular duty for steam trials and other purposes, with attendant delay in that duty in all cases, and requiring them, on their return, to work long after office hours and on Sundays to keep the current business from falling behind.

"When all the new vessels now appropriated for are in commission it will be impossible to properly officer them in the Engineer Department and carry on the other work of the Corps with the number allowed by law. I therefore renew my recommendation of last year that the number of engineer officers be increased to not less than 300; and even this number will be found to be insufficient to give the proper care and supervision to the machinery of ships completed and building unless assisted by a sufficient number of intelligent and skilled artificers and well-trained firemen.

"Attention is called to the comparison made in my report of last year between the number of engineers in our Navy and that of Great Britain, and to many recommendations in the report by the Board of Admirals on the British naval maneuvers for 1888 for an increase in the number of engineer officers. If imitations of some of the conditions of war made the insufficiency of numbers apparent, it does not seem wise to wait till war comes to profit by the lesson."

Extract—Report of Engineer in Chief, 1890.—In his report for 1890 that officer recurs to the same subject as follows:

"In my former reports this subject has been dwelt on at some length, as it was deemed one of the most important with which we have to deal. It is with regret that I have now to report that matters are now in still worse condition than they were a year ago, and that troubles mentioned as likely to occur are already apparent, for the number of engineer officers now in the service is not sufficient for the proper performance of the duties required of them. All that I have heretofore said can be repeated with emphasis, but in this report I shall only call attention to a few of my former recommendations in connection with what will now be presented. . . .

"When my last report was published, but one ship (the *Yorktown*) with modern machinery had been commissioned; since then three others (*Baltimore, Charleston,* and *Philadelphia*) have been placed in regular service, each with one to two less engineer officers than they should have for safety and efficiency, and less than they would have if the Corps was sufficiently large to permit the proper detail, but still more than will be possible when the number in the Corps has been reduced to the legal limit of 170. As had been foreseen, the worry and anxiety undergone by these officers in their endeavors to keep things going and in order, with the insufficient number of trained men at their disposal, has proved too much for some of them, and they are breaking down. A policy which leads to such results can only be productive of disaster to the service. It requires a very simple calculation to show that the present legal numbers in the Engineer Corps will not be sufficient to properly officer the ships now in commission and those for whose construction appropriations have already been made, and this without taking into account the number required for shore duty and to provide for sickness and an occasional leave, etc. Something must be done, and done promptly, or we shall not only have some serious breakdown to repair which might have been avoided, but also an accident more than likely to be attended with loss of life. . . .

"In the naval battle of the future the engineer staff will have a difficult and important part to perform, and if there is failure in the engine room no amount of skill and bravery on the bridge may suffice to avert disaster. Celerity of movement has decided many a naval battle and will decide many more, and the celerity of movement of a modern ship depends directly on the skill of her engineer officers."

Extract—Report of Engineer in Chief, 1891.—In his report for 1891 the same officer still further emphasizes the subject. Among other things he says:

"It is with regret that I am again compelled to report that the number of engineer officers is insufficient for the proper performance of the duties belonging to them and to emphasize the fact that unless measures are taken at once to remedy this condition and to stop the steady decrease in numbers, we shall before long have a painful awakening by a serious breakdown or accident on some of our vessels. There is a limit to even a naval engineer's endurance; and while the officers of the Engineer Corps will do their best to make all needed repairs and keep in efficient condition the magnificent machinery of the new vessels, from which the country justly expects so much and in which it takes a proper pride, they can go no further than the limit of their physical strength; when this has been reached the machinery must take care of itself.

"The necessity for an increase of the Engineer Corps is recognized throughout the service, and it was gratifying to find in the annual report of the Navy Department for last year that both the Honorable the Secretary and the Chief of the Bureau of Navigation recommended it. . . .

"Inasmuch as the bill introduced in the last Congress has failed with the close of its sessions, I give herewith the features which I believe should be embodied in any measure for an increase of numbers.

"The number of engineer officers should be at least 300, and even this number will be inadequate unless supplemented by a sufficient number of intelligent and skilled artificers and well-trained firemen. The division into grades should be in accordance with the duty to be performed, and as far as practicable arranged so as to give reasonable promotion in order to keep the ablest young men in the Corps. At present we are constantly losing bright and promising young men by reason of slow promotion and overwork. . . .

"I have given the matter of the necessary number of engineer officers most careful study and consideration, and am prepared to submit, at the proper time, details in regard to the number needed and a scheme for recruiting the Corps. I need not go into this here, as the important point is to secure action by Congress; when this is assured, I can submit a memorandum to the Department for transmission. I may say here, however, that the number of officers asked for is neither a guess nor an approximation, but is a careful estimate based on the actual duty to be performed at sea and on shore; it was made by considering the needs of every ship and every shore station, making allowance for the fact that all our ships will not be in commission at once, and that some provision must be made for sickness and leave. In other words, it is the minimum number which, in my opinion, will be adequate for ordinary circumstances in time of peace; it will be altogether too small in time of war.

"It should be added that the proposed increase should be made gradually, in order to secure thoroughly good men. Twenty each year till the full number is reached would provide for this gradual increase, and still allow for the reduction due to retirements and resignations of some of the younger men, who can not resist the tempting and lucrative positions offered them in various mechanical and electrical engineering establishments and technical schools. Much as we need the full number asked for now, I would regard it a misfortune to have the entire increase occur in one or two years, as it would be impossible to secure the required number of competent men in that time."

For ten successive years these and similar statements have been urged upon the attention of Congress. They have been strikingly reinforced by the number of prostrations of naval engineers, due to overwork, the progressive increase in the cost of repairs to machinery, due to an insufficient number of naval engineers to maintain the necessary supervision, and the lack of a reserve of trained officers.

The undermanning of the Naval Engineer Corps.—The November number of the American Engineer and Railroad Journal, in the course of an able and extended review of the present condition of the Navy, presents figures which throw a striking light upon this point.

At the beginning of the war, in 1861, the Government had 89 ships, of which 37 were propelled by steam. For the entire 89 there were 671 line officers, and for the 37 steamers 174 engineers. In 1864, at the height of the conflict, when the Navy had been placed upon a war footing, there were 2,846 line officers and 1,728 engineers. In 1865 the numbers had been changed to 2,463 line officers and 2,279 engineers. In the following year, 1866, the Navy had been reduced to a peace footing, and there were 395 line officers and 379 engineers. During the next twenty years the number of line officers was steadily increased and the number of engineers as steadily diminished, so that on the 1st of January, 1886, with only 85 vessels on the Navy Register, as against 320 in 1866, there were 733 line officers and only 221 engineers. Ten years later, January 1, 1896, when the new navy had come in with its great steel ships, enormous engines, high-power guns, and complicated machinery, there were 108 vessels on the Navy list with an aggregate of 317,275 horsepower, but the number of engineers had been reduced to 173—one less than just before the war, when there were only 37 steam vessels in commission, not one of which had an engine of more than 1,000 horsepower. As matters now stand, the ratio of engineers to line officers in our Navy is 1 to 4.13, while in the British navy the ratio is 1 to 2.18, and active efforts are there under way to increase the number of engineers on the ground of the inadequacy of the present force.

The consequence of this astonishing condition of things in our Navy is what might be expected. The engineering force on shore is too small to perform the duties properly belonging to it, and the force on shipboard is breaking down under the stress of overwork and anxiety. Chief Engineer Tower, of the *Indiana*, whose case recently attracted public attention, had been on duty continuously for thirty-six hours when he succumbed to the strain. We might cite numerous other special cases, but prefer to quote the statements of two eminent authorities.

Our overworked naval engineers.—A letter published in the Philadelphia Ledger by Dr. Robert H. Thurston, director of the Schools of Mechanical Engineering and of the Mechanic Arts of Cornell University, suggested by a dispatch to that paper on the fatality attending the Engineer Corps of the Navy, in consequence of overwork, calls attention to this condition of things in the most impressive manner. We quote portions of the letter:

"SIBLEY COLLEGE, CORNELL UNIVERSITY,
"*Ithaca, N. Y., November 22, 1895.*

"SIR: I was intensely interested in and greatly distressed by the communication of November 19, in your Washington correspondence, relating to the condition of the Engineer Corps of the Navy. I was myself a member of that corps during the civil war, and for a half dozen years or more after its close, and many of the men whose suffering and death you describe were acquaintances, some of them personal friends, and among these were some of the ablest and noblest men that the United States Navy ever knew, and the proportion of noble and able men in the Engineer Corps was always great. I know that the tale is not overdrawn and that much more might be said with full justification. The list of officers thus needlessly destroyed might be greatly extended; for it is not since the new navy has been under construction only that the Engineer Corps has been thus overworked and overstrained. This latter period has only intensified a strain which has existed in a milder form for many years, and the present crisis is but the culmination of a gradually and steadily increasing pressure, which dates from the earliest days of the steam navy.

"During the war men were ready to meet any and all kinds of danger, hardship, and imposition, and resignations were rare, but an exodus began immediately afterwards from the ranks of this corps, which has never wholly ceased. Men have, in many instances, clung to their old employment, and still remain in service, able men, helpful and efficient men, men of talent and culture, who might have done much better in civil life, sometimes through pure sentiment; oftener, I am inclined to think, because sentiment was reenforced by the sanguine expectation—never yet justified by the facts—that justice and wise expediency would in time rescue them from the obviously impending day of unbearable trial. But the service has for a generation past lost continually by resignation, and its losses have included many of its most valuable officers, most of whom might probably have been retained had wisdom and justice and good feeling marked the legislation of Congress and the policy of the executive department of the service. Of those who have thus resigned I have known many, and I do not now recall a single case in which the officer thus returning to civil life was not greatly advantaged, from a business point of view, by the change. If the existing crisis is not promptly and wisely dealt with every other member of the Engineer Corps who can find his opportunity will resign, and hard service and the weight of responsibility now thrown upon everyone on duty, and in rapidly increasing intensity, will pass the rest either over to the retired list or into the other world. The present condition in this department of the United States Navy, at least, is discreditable to the Naval Committees of Congress and to Congress itself, a reflection—less deserved, perhaps no less real, however—upon successive administrations, and especially the latter ones, and upon the responsible heads of the Navy Department of the last generation.

"I have personally known the Engineers in Chief of every Administration, from 1861 to the present time, and I know that every one of them has faithfully represented the condition of the Engineer Corps to the Navy Department and to Congress, so far as they were permitted. . . . The present Engineer in Chief has been more outspoken than many of his predecessors; but even his reports, so far as published, give no adequate idea of the nature or magnitude of the existing crisis. As I write his report lies on my desk, and I observe that he simply states that 'the number of cadets in the Engineer Division now being graduated by the Academy is not sufficient to supply the vacancies in the corps caused by deaths, resignations, and retirements. If some means can not be devised whereby the Engineer Division at the Academy can be increased, recourse must be had to the technical schools and colleges of the country to fill the vacancies, as the number of engineer officers is now less than allowed by law and very much less than the needs of the service require.'

"This statement reads very mildly, coming from Engineer in Chief Melville, and my interpretation of it is that either he has given up in despair of securing a proper and efficient service in the Engineering Department and a creditable Engineer Corps, or his usually outspoken and honest statements and protests against this long-progressing deliberation of the Engineer Corps have been themselves dehabilitated by official pressure. But in any case the responsibility for this fearful injury to the Navy and to the country must lie with the Navy Department and Congress. The possible consequences, aside from the destruction of the corps itself and of so many brave and able men in case of the outbreak of war which so many of our 'statesmen' are predicting, are tremendous—a fine navy ruined and probable failure in every naval contest.

"That responsibility does not, I am sure, lie with the Engineer Corps itself. It is composed of the best men that were ever gotten together in any service, and the most convincing testimony of the bravery, patriotism, and ability of these officers is found in the fact that they still remain in the service and on duty. The fault does not come of neglect on their part to report the necessity of action on the part of the Department and on Congress. The trouble arises from the fact that their recommendations have been entirely unheeded. . . . This matter affects the lives of every engineer officer in the service, of all officers and all men, in fact, for no one can say when a ship may be lost, or a battle fail of success through disability of the engineer department of some heavy iron-clad. It affects the honor and efficiency of the whole Navy, it touches the honor of the nation.

"R. H. THURSTON."

An inadequate Naval Engineer Corps a naval weakness.—The editor of Cassier's Magazine for October, 1896, speaks as follows on the same subject:

"The overwork to which naval engineers are subjected was again evidenced in the eight-day maneuvers, a short time ago, of the North Atlantic squadron of the United States Navy. On the battle ship *Indiana* Chief Engineer Tower and one of his assistants, A. McAllister, collapsed. This represents 50 per cent of her complement of engineer officers. That is to say, the 'endurance' of the battle ship *Indiana*, under easy maneuvers in time of peace, is practically just eight days, as far as her absurdly insufficient engineering complement is concerned. There seems no doubt that, in the event of war, there would be naval collapse under present circumstances. In addition to the officers mentioned, several machinists and a number of firemen were brought up from below prostrated. Within the past few weeks also Chief Engineer Borthwick was recommended for retirement, by reason of injuries incident to active service. This is a pretty sorry record—one that any naval power worthy of the name should be ashamed to have known. The only consolation that the United States has in the matter is the poor one that the British navy is in a similar, but not so hazardous, a plight. One would think that both Governments would promptly take sensible measures, tending to a proper valuation of naval engineers' services, and a decent recognition of the fact that they are all-important to the value of their men-of-war as fighting machines."

Immediate need of increase in Corps of Naval Engineers.—We have dwelt at length on this phase of the subject, partly because the existing situation is of such grave import that the public mind ought to be thoroughly aroused to its dangers, but more especially because the facts stated form the foundation of the whole argument. If the conviction is once established that the engineering force of the Navy is totally insufficient in numbers, the people of the country will demand from Congress prompt and energetic action. The question will then become one of means and methods only.

The bill under consideration, recognizing these acknowledged and threatening evils, proposes an adequate and entirely practical remedy. It proposes to enlarge the Engineer Corps of the Navy by making use of facilities already provided, and provided for the most part at public expense by existing technical institutions throughout the country. It does not in the slightest degree interfere with the course of engineering instruction already given at the Annapolis Naval Academy; but it proposes, after all Annapolis graduates have been assigned, to call upon the civilian institutions named to furnish from among their graduates a sufficient number of trained men to make the required increase—extending this increase progressively over a series of years.

The bill provides for increasing the active list of the Engineer Corps of the Navy from the present number, 191, to 303. Until this number has been reached, 30 engineer cadets are to be appointed each year, in addition to the number of vacancies occurring in the Engineer Corps during the preceding year, and after the full number has been reached the number of cadet appointments each year is to be double the number of vacancies occurring in the lowest grade of commissioned engineer officers during the preceding year.

Educational feature of the bill.—Graduates of technical schools whose course of instruction in mechanical engineering is considered satisfactory by the head of the naval engineering service and the Secretary of the Navy are eligible for appointment as engineer cadets. Candidates must not be less than 19 nor more than 24 years of age, and before appointment must undergo a physical examination before a board of medical officers of the Navy. Those who receive appointments are to be given one year of practical naval engineering instruction on board a vessel of war, and a second year of practical and theoretical instruction in a navy-yard or at some advanced professional Government school for graduate work. At the conclusion of this two years' service they are to undergo another physical examination and a professional examination at the Naval Academy, and the order of merit shown by the latter examination determines the order of appointment to vacancies in the corps of engineer officers.

Those who fail to secure commissions in the naval service, but who have satisfactorily passed the required examination during the two years of probationary service and instruction, are each to receive an honorable discharge, and the sea pay ($1,200) of an ensign in the Navy. The Government recognizes the fact that those who fail to receive commissions are entitled to consideration. These young men will have received a training which will make them valuable members of the naval reserve; and to compensate them for giving two years of their life to the acquisition of naval instruction, they are to be given the pay which is now received by the Naval Academy graduates who fail to enter the service.

It will be seen that the provisions of the bill thus far mentioned aim on the one hand to provide the needed increase of naval engineer officers, and, on the other hand, as regards the technical institutions concerned, to open an additional career for their graduates. Other provisions affect the actual work of the institutions more directly, and contain the promise of benefits which the great majority of them could not secure in any other way. For example:

Benefits accruing to educational institutions and to naval service.—(1) Facilities for instruction in naval and marine engineering and naval architecture are to be furnished by the loan of such models, plans and machinery as can be spared without detriment to the naval service, many of which would be of great value either as working equipment or as illustrative material in shops and laboratories and museums.

(2) Professional naval engineering literature, in the form of monographs and similar publications of the Department of the Navy, is to be furnished free of cost to such students as pursue the prescribed course of engineering studies.

(3) It is proposed to detail officers of the Corps of Naval Engineers as professors of engineering at such institutions as maintain these courses of instruction. These officers will give practical and theoretical instruction in the technical subjects relating to their profession, in cooperation with the regular teaching staff, and with a view to supplementing their work in the engineering courses.

(4) Provision is made for an efficient and thorough inspection of the instruction in naval engineering given in the institutions to which commissioned officers are detailed. It is not probable that such inspection could extend to the minute details of the work, and it is doubtful whether it would be desirable that it should; but the steadying and stimulating influence of a competent official inspection at suitable intervals could not fail to be constantly felt by instructors and students alike, as is now the case with the somewhat similar inspection exercised by the War Department over the work of the military officers detailed to the several institutions.

(5) The advantage to the naval service of having able officers detailed to colleges throughout the country can not be overestimated. Their influence and example would be a powerful stimulus to the department in which they were employed; while in turn they would receive the broadening inspiration which comes from contact with scholarly men engaged in different departments of knowledge.

National scope of the measure.—The far-reaching importance of this measure, the educational features of which have been thus briefly outlined, can hardly be overestimated. It touches alike great questions of public policy and special questions of technical training. The indispensable necessity of providing a greatly increased force of thoroughly trained engineers to meet the requirements of an enlarged Navy must, in view of the evidence presented, be fully and promptly recognized. It is a simple matter of fact, which no one disputes, that the existing courses of instruction at the Naval Academy do not meet this imperative demand, nor can the Academy be made to do so without such important changes in legislation and administration as are not likely to be undertaken until some Secretary of the Navy, informed with the spirit of the new era and opening his eyes to a vision of the twentieth century, shall grasp the changed condition and the new needs of the modern navy with the same comprehensive intelligence which George Bancroft in 1846 brought to bear upon the conditions and needs of the old navy when, as Secretary, he established the Naval Academy and thus radically reorganized the entire system of training naval officers. The time for a like reconstruction has now come. New terms demand new measures as well as new men. The new navy has become an engineering service and its organization must accordingly make distinct recognition of that fact.

Excessive cost of educating cadets at Naval Academy.—Even if it were practicable to modify the courses of instruction at the Naval Academy so as to provide in due time the requisite number of engineer officers, such a policy would, in the opinion of your committee, be neither desirable nor economical.

Under the present system it costs the Government of the United States from $12,000 to $15,000 to graduate a cadet at Annapolis, while the entire increase contemplated by the bill under consideration could be provided by existing technical institutions without the expenditure by the Government of a single dollar beyond what must in any case be expended in order to maintain the Engineer Corps at the point of average efficiency on a peace footing. Stated in another form, at the present rate of educating naval officers, it would cost the Government a large amount to graduate at the Naval Academy the 30 cadets which it is estimated should be annually added to the corps until the full number is reached. If half of this number should be taken from other institutions, as proposed in this bill, the saving to the Government would be very great. The same rate of saving to the Government would afterwards continue, the aggregate amount each year depending upon the number of cadets needed to fill vacancies.

The study of the mechanic arts and sciences would be encouraged.—But the argument on the ground of economy, however convincing it may be, is far less weighty than the considerations of public policy involved. The Government of the United States, on its own initiative, in cooperation with the several State governments, has established and is maintaining a great group of institutions of higher learning, which have already done and are still doing a work of inestimable importance and magnitude in advancing the spirit and improving the methods of scientific research and instruction throughout the country. These institutions possess property amounting in the aggregate to nearly or quite $20,000,000, with an annual income of $6,000,000, a teaching force of more than 1,600, and a body of students numbering about 18,000, who largely represent that great middle class which forms the bone and sinew and brain of the Commonwealths to which they belong.

The leading object of these institutions, according to the terms of the Congressional charter, is "without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts." The Government has made generous and special provision for extending and strengthening the agricultural side of the work of these institutions, and has supplemented the requirement that they shall teach military tactics by providing arms and equipment and detailing officers from the Regular Army for the purpose of military instruction. But thus far nothing has been done to provide special facilities for instruction or incentives to advancement in the other great department contemplated by the law of 1862, viz, "the branches of learning related to the mechanic arts." The tendencies of modern industrial development have, however, compelled attention in that direction, and it is probable that during the last twenty-five years more of the thought of the educational and industrial world has been turned to that branch of subjects, and more money expended in promoting them, than in any other single direction. Under this powerful impulse every important institution of higher learning in the United States has been forced to extend its work in the mathematical and physical, even more than in the natural sciences, while many new institutions have been established, either as technical schools or manual training schools, devoted wholly or very largely to this field of work. Thus, by enlarging the curriculum of the old institutions, and by the establishment of new ones, the sciences which lie at the foundation of engineering (a word which may be taken to sum up and express the whole matter) have received an enormous impulse. Nowhere is this fact more conspicuous than in the case of the land-grant colleges. When provision was first made for these institutions, the caprice or indolence of an indexing clerk labeled them as "agricultural." Common convenience and a tacit response to popular sentiment for a time perpetuated the label and well-nigh obscured the fact that the original law of Congress contemplated a much broader purpose.

Scope and purpose of land-grant colleges.—But events have proved weightier than words. A growing public need has compelled these institutions, with one or two apparent exceptions, to increase the range and improve the quality of their engineering work, and State legislatures, acting in close touch with the same popular demand, have, as a rule, been more willing to make liberal appropriations for that purpose than for any other. The result is that a vast amount of instruction in all the leading branches of engineering is now being given in all parts of the United States, much of it being of an extent and quality not surpassed anywhere in the world. These land-grant colleges and universities are, in the fullest sense, public institutions, endowed and maintained at public expense, on grounds of a wise and far-reaching public policy. The Wilson-Squire bill proposes to make use of the facilities thus already provided at public expense as a means of recruiting one arm of the public service. It proposes for the first time in the history of the country to place the graduates of these institutions upon an equal footing with the graduates of the Naval Academy, and the reaction of such a policy upon the institutions and upon the Naval Academy, as well as upon the entire naval service, could not fail to be powerful and beneficial.

Advantages to be derived by the Naval Academy and the naval service.—We do not propose in this report to pass the slightest criticism upon the system of instruction pursued at the Naval Academy, though the single year devoted to marine engineering is obviously and even ridiculously inadequate. But to any educational institution nothing is more fatal than isolation from the life of other institutions. However strong in its faculty, its equipment, and its financial support, it can not do its best educational work or keep pace with the progress of its own time without the stimulus of competition with others engaged in the same field of activity. Fixed methods tend to become routine, routine hardens into rigid mechanism, and mechanism would become petrifaction unless it were saved by the perennial vitality of knowledge itself. At present the Naval Academy stands alone. Its graduates compare themselves with one another. Its standards are their standards, its methods their methods, its range of work their range. But the passage of this bill would promptly change all that. The graduates of the Academy would at once be brought into competition with the choicest men from other institutions, and the competition would test not merely the capacity to stand a fixed theoretical examination, but the habit of mind, the grasp of principles, the breadth of view, the adaptability, the readiness of resources, the staying quality of the men who had been trained under the different systems. This test of the men would be even more surely a test of the institutions themselves, and thus the existence of a high standard, of absolutely uniform application in all parts of the country, would have an immense uplifting and vitalizing potency. The civilian institutions would learn from the Academy and the Academy from them. If either failed to stand the test successfully, both public opinion and the necessities of the public service would compel the finding of a remedy.

Duty of the nation to these institutions.—These and like considerations would apply, if the only question were how to secure the needed increase of naval engineers at the least expense and of the highest efficiency. But it should not be forgotten that as to a large number of the technical institutions of the country (the land-grant colleges and universities represented in this Association) the National Government is in a peculiar sense responsible, and that any measure calculated to widen their field of usefulness not only serves the better to fulfill the original intent of Congress but closely touches the honorable repute of the Government itself. Having established these institutions, it should adopt such a policy toward them as will maintain them at the highest point of efficiency and secure from them to the public service the largest possible return. No one can doubt, for example, that the cause of good order is promoted and the national defense strengthened by the fact that they are, year by year, sending out into the community a very considerable number of young men trained in a knowledge of the elements of military science and practice, better informed as to the place the military service occupies under our system of institutions, and prepared in case of need to render intelligent and effective service to the Government. In the same way these colleges, without a cent of additional expense to the Government, but by the simple adoption of some such measure as the bill referred to, may be made to contribute to the naval establishment a body of technical skill and training which could not otherwise be secured, except by an immense annual expenditure. It is even doubtful whether it could be so effectively secured by any expenditure, however great, applied to other institutions or agencies, as it can through institutions distributed throughout the country as these are, and holding their peculiar relation to the life of the people.

The naval service strengthened by bringing the Naval Academy into competition with other scientific institutions.—It is a matter of common remark that the training to which our present naval officers are subjected and the course of life which they necessarily pursue tend to separate them in occupation and in habit of mind, more than any other branch of the public service, from the thoughts and feelings and interests of the great mass of the people. Under our system of institutions no class of public officials, no branch of the public service, no body of men whatsoever, ought to be thus comparatively shut out from contact and sympathy with the common life. In this respect it would be of incalculable service to the Navy if its professional ranks were constantly being recruited from among the graduates of civilian institutions who, at their age, would necessarily carry into the naval service more of the civilian habit of mind and manner of viewing things, and would compel the members of the regular naval corps to compete, not among themselves exclusively, but with picked men representing the best training of the country at large. The fact of the naval service being thus recruited would also create a much more general and intelligent interest in it throughout the country at large, and would help to educate the people to look upon it more directly as one of their own agencies. It seems unquestionable that this mutual reaction of the nation upon the service and the service upon the nation would result in great advantage to both.

A naval engineering reserve secured by passage of this bill.—Nor would the advantage be measured exclusively by the number of students from civilian institutions who should actually enter the naval service. But a large number still, who would probably for various reasons never enter the service except in case of an emergency, would yet carry with them into their civilian employments a knowledge of and interest in the technical requirements of the Navy, which would furnish a body of trained, sympathetic, and intelligent criticism that would serve as a wholesome tonic to the service; and, more than all, they would furnish an invaluable naval reserve which the country might summon to its defense in time of war.

The national need of a naval engineering experiment station.—At the risk of extending this report beyond convenient length, we must briefly notice two other features of the Wilson-Squire bill—that providing for an engineering experiment station and that relating to the organization of the Engineer Corps. Of the former little need be said before such a body as this. The quickening impulse that has been given to every branch of agricultural science and practice by the establishment of experiment stations in the United States and in Europe clearly indicates what may be done by such agencies. The station carries on systematically and continuously, on a scale of broad cooperation, what the individual in most cases can do only in a fragmentary and isolated way. A similar means of research and experiment in relation to the numerous and difficult engineering problems that are constantly arising could not fail, as it seems to us, to be of great and lasting benefit to the naval service itself and to every branch of the limitless field of physical research. It is wise, doubtless, to confine the work of the station, at the outset, to the special needs of the Navy; but the results obtained there must very soon become common property, to the benefit of the entire industrial system of the country. The proved utility of the work would almost of necessity lead to its extension in many new directions, and, if the spirit and purpose of this bill prevail, the whole system would most naturally become correlated to and cooperative with the same branches of work in the approved technical institutions of the country.

The graduates of technological schools will demand an unqualified military status.—As to the legal organization of the Engineer Corps of the Navy this committee has not felt that it could wisely undertake to form an opinion respecting a question so much outside of the range of its immediate concern. It has preferred to devote attention to those educational features of the bill upon which the members of this Association have a right to form and express an opinion, and the committee believed that, in so doing, it would best subserve the interests of the naval service and of the institutions here represented. There are, however, one or two points involved in the pending bill which are quite pertinent to the considerations presented in the preceding part of this report. It strikes the uninstructed layman as a very peculiar condition of things which not only diminishes the necessary expert force of skilled engineers far below the point of actual safety, but so far fails to recognize changed conditions as to relegate that force to a position of military inferiority. A recent editorial in the London Engineer, discussing this general subject with reference to the needs of the British Navy, says: "The truth will have to be recognized that without the engineer, the admiral, the captain, the blue-jacket, the whole executive branch of the service are useless. The naval supremacy of Great Britain rests in the hands of the engineers."

Value of the machines of naval vessels.—Since the year 1889 the United States Government has made contracts for the construction of hulls and engines of naval vessels which, including premiums paid, amount to more than forty-five millions of dollars. This is in addition to the amount expended in the construction of vessels in the Government navy-yards, as well as for armor and armament of all the vessels. The machinery of the new battleships is estimated to cost at least 40 per cent of the entire cost of hull and motive power, that of the fast protected cruiser over 50 per cent, and that of the torpedo-boat destroyer 66 per cent. This is exclusive of the armor and armament.

Importance of giving an unqualified official status to the engineer officer.—The modern war ship is, in fact, a great fighting machine, the construction, maintenance, and handling of which demand the highest skill and training. The graduates of our technical institutions who are fit for the performance of such duties are everywhere in demand in the higher walks of all the engineering professions, where they are accustomed to receive the consideration and pay to which their attainments entitle them. It need hardly be said that such men will not be attracted to the engineering service of the Government unless they find in that service the same conditions prevailing. It is accordingly an essential part of the scheme for inviting the graduates of technical institutions to enter that service that they shall there receive the rank which is required by the nature of their duties. We can not better state the nature of these duties, as illustrating the real status of the engineer in the modern navy, than in the words of Professor Hollis, of Harvard University, who was formerly an officer in the service:

"The duties performed on shore by the engineer consist of the design and inspection of the propelling machinery and boilers, and of certain auxiliary machines for all our ships; of the care of navy-yard machinery under the control of the Bureau of Steam Engineering, and the inspection of boilers; of the superintendence and inspection of all repairs to machinery; of all the routine duties incident to examination of men for employment or enlistment in the engine departments; and to the examination of officers for promotion, and of the inspection of certain materials for use in the naval service.

"The duties of the engineer at sea consist of the care of propelling machinery and of most of the auxiliary machinery; of the repairs to all machinery; of keeping watches in all except the smaller vessels, and superintending the running of machinery; of looking after the storage and expenditure of coal and stores; of keeping that part of the double bottom and inner skin of the ship beneath the machinery and boilers properly cleaned and painted; of looking after the efficiency of all pumps; of keeping in good condition all water-tight doors in the machinery and boiler compartments; of making all official reports and requisitions under the cognizance of the Bureau of Steam Engineering; of maintaining a division of from 20 to 196 men in a state of organization and efficiency, the number of men depending upon the size of the ship; also of requiring and inspecting the clothing for these men; and of other duties, such as court-martial, official inspections, ship visiting, and examination of provisions and stores which all officers, line and staff alike, have to share."

It is obvious that the engineer's service is the vital point of safety both for the ship and for the lives of its crew. A failure here might easily involve appalling disaster in time of peace and national humiliation in time of war.

Work accomplished by the Association.—In furtherance of the duty intrusted to it, the committee has labored to present and urge these views as fully and widely as possible. An extensive correspondence was carried on within and beyond the membership of this Association, and the response was in nearly every instance most cordial and helpful. The committee desires in this public manner to express its hearty appreciation of the intelligent and earnest efforts put forth in so many quarters. Some institutions enlisted not only their faculties, but their boards of trustees, their alumni, and their students. Engineering societies, newspapers, and magazines have given a vigorous and effective support to the measure, and we have good reason to believe that a continuance of the same activity will result, at no distant day, in the enactment of a law embracing all the important features of the present bill.

GEO. W. ATHERTON,
JAMES H. SMART,
HENRY C. WHITE,
Committee.

Mr. HARRIS. I move that the report be accepted and that the committee be continued under the original instructions.

Carried.

The CHAIRMAN. We will now take up the amendment to the constitution, relating to membership, proposed by H. P. Armsby, of Pennsylvania, as follows: "No delegate shall vote in more than one section and each delegate shall, when presenting his credentials, designate the section in which he desires to vote."

It was voted that this question be indefinitely postponed.

The CHAIRMAN. The president's annual address is now in order, and President S. W. Johnson will address the Association.

ANNUAL ADDRESS BY THE PRESIDENT.

GENTLEMEN: I shall occupy your valuable time for but a few moments on this occasion. You are specially concerned in two great branches of worthy endeavor, viz, the promotion of agriculture and experiment and the education of those who are or are to be engaged in the practice of agriculture, mechanic arts, commerce, and domestic affairs.

You represent 54 agricultural experiment stations to which are attached 33 substations wherein 586 persons are working with head and hand in the business of discovery. You also represent 57 agricultural colleges that employ over 1,300 teachers and officers in giving instruction to 14,000 pupils, young or old, in industrial science and practice. In support of these grand enterprises you have the good will and substantial aid of our United States in their legislative and executive capacities, and in most cases liberal appropriations from the governments of the several States.

You have the intelligent appreciation and hearty cooperation of all good citizens who have been able to thoroughly inform themselves as to the objects and methods of your work.

Our country has become noted for the endowment of many schools, colleges, and even universities by men whose thrift, enterprise, and good fortune have enabled them to amass wealth. Some of the colleges represented in this association have been thus essentially aided by private munificence.

We have also evidence that the agricultural experiment stations are finding similar appreciation. A citizen of Connecticut, who during his lifetime manifested a lively interest in the work of the station with which I am identified, has bequeathed a very considerable estate to the board of control of that station, providing that presently one-half of the income and ultimately the entire income therefrom shall be applied to carrying on the work of that station in accordance with the legislative enactments under which that work has been prosecuted hitherto.

The forty years that have elapsed since I began to teach agricultural science have witnessed a most wonderful development in general and technical education. The school in which I commenced my life work in the year 1855—one of the first to establish and I believe one of the very few to maintain courses of agricultural instruction without a break for forty years—had when I took a place in its faculty but two working professors and the same number of assistants. It had but 25 or 30 students; its total yearly income was about $3,000; its entire endowment yielded but $300 annually, and that source of income was cut off after a few years.

Now that school has a corps of teachers larger than our greatest universities had when it began its career, its annual pay roll exceeds $100,000, and some 550 or more students are in daily attendance. Forty-five years ago, when I was in that school as a student, no examinations were required on entrance, and no honors were awarded on departure. Now, with very few exceptions, its students are candidates for degrees, and sustain an entrance examination which of itself is almost a liberal education.

The last twenty years have seen a no less remarkable development of the agricultural experiment station. Here Connecticut was again among the pioneers, and she then harbored within her borders some dreamers of a good time coming when industrial practice and science should voluntarily yoke themselves together and harmoniously pull together for the common good. But that in so short a space as twenty years every State and every Territory that was and that was to be within that time should have one or more effective experiment stations in full operation, entered not into the heart of any man to conceive.

In 1853 I had the good fortune, as a student, to matriculate in the University of Leipsic. I soon found my way to Möckern, a neighboring village, where had been very recently established the earliest agricultural experiment station, founded on a farm, by an association of farmers for the exclusive purpose of applying the methods of scientific research to elucidating urgent questions of farm practice. Since that time I have had occasion to become somewhat familiar with the work of most of the European agricultural experiment stations, and I am proud to be able to say, I believe truthfully, that the experiment stations of these United States are, on the whole, not less efficient and not less useful than those of the Old World. We have not made such brilliant discoveries or carried out such extensive fundamental investigations as are associated with the names of Wolff, Julius Kühn, Gustav Kühn, Henneberg, Stohmann, Hellriegel, Nobbe, and Wollny, but we have made a good beginning, and have laid some foundations, broad, deep, and permanent, on which fair superstructures are surely building, which it is admissible to hope will favorably compare with the results of the efforts of our European colleagues, who were earlier in the field and have had twice or thrice the time, or even more, for bringing their work to fruition that any of us have enjoyed.

In both college work and station work we have to adapt our efforts to the needs of those who are to be immediately benefited. Neither college nor station can secure the support of citizens who are unable to appreciate what we are doing. Our duty is to aim as high as possible without overshooting the mark. We can not succeed with instruction that is too purely disciplinary, because our constituents will not relish it; neither will success be attained by the cramming process. The young pupil and the parent must both be brought to see that profitable education demands first of all enlargement of mental capacity as an essential prerequisite to extensive acquisitions of knowledge, and that if a man is well exercised and developed in all-round intellectual athletics his appetite, his digestive and assimilatory powers may be fully trusted to find abundant nourishment and to make rapid and healthy growth.

Unfortunately, we have too many rather bright but small, smoothbore citizens, who can not perceive that they are not great guns, and who are ready on the briefest notice to undertake the world's work, which they hasten to do by disparaging, undermining, and leveling down whatever is above their power to surmount or to understand. The pernicious activity of these undisciplined superficial people tends to bring it to pass that schools, colleges, and, if possible, experiment stations are organized and operated on a low plane by men who impose on the public with large talk about little things, to the disgust and humiliation of the true friend of progress.

But such drawbacks will not permanently block the wheels. You can not get together twenty or thirty young men or young women and begin to educate them on ever so narrow and elementary a basis that they, or the best of them, will not sooner or later acquire that unquenchable thirst for knowledge and that activity of mind which surely impel to wider and higher culture.

In my own State the Sheffield School of Yale University has been definitely pronounced unsuited for agricultural and mechanic-art education, because it requires an elementary knowledge of Latin for admission to its regular courses. But now we are told that the students of the Storrs Agricultural College who have entered that institution without further preparation than the common school can furnish, and who may have a preliminary year in the college itself to make up deficiencies in preliminary studies—we are told, I say, that these young men and young women desire to study Latin, having found that there is great use for some acquaintance with this immortal dead language, and having come to perceive that those who know Latin are far better judges of its utility than those who do not.

In agricultural and industrial education much good use may easily be made of both Latin and Greek, because they are so universally taught in our preparatory schools and academies, because they furnish excellent mental discipline, and for the important reason that some knowledge of them vastly facilitates the handling of the English tongue, the mastery of science, nomenclature, and the acquisition of a working use of French and German scientific literatures, those vast storehouses of things new and old, inability to employ which is a heavy handicap to the investigator in every department of inquiry.

But for the tens who can devote the time needful for a really liberal education there are thousands that must be content with a smaller intellectual equipment, and to them it is a great boon that we have in every State and Territory of the Union a school, college, or university where they can obtain cheaply the means of self-development in many noble directions, and of instruction in many useful sciences and arts; and if but few can make present avail of the full three or four years' curriculum, yet in some of the shorter, more technical courses which are now so generally and generously offered the earnest inquirer may find opportunity to enter on the highway of science. And here I may perhaps be pardoned for expessing my personal satisfaction in the recent successes of the shorter course. The vain efforts of my teaching colleagues and myself thirty years ago to secure attendance of more than a very few young farmers on our longer courses of agricultural instruction led us to plan and announce a shorter course to fully occupy and to be completed in six weeks of the winter time, and for years Professor Brewer and I held ourselves ready to do extra work in behalf of any who might enter for such a course. But we were up before the daybreak, and the generation then on the stage had to pass and make room for another before either the longer or the shorter course was to be in demand in the State of Connecticut.

It is something, however, to have been forerunners, even though seemingly we were but as "a voice in the wilderness," for the wilderness is breaking into bloom.

The skillful teacher will know how to make the study of any subject and the practice of any art wholesome as a discipline, as well as satisfying and inspiring to the awakened intellect. For this purpose the teacher should evermore remain an earnest student, keeping as far as possible abreast with the advance of knowledge in the subjects he teaches, and if he can also take active part in research his influence will be the more powerful and pervading.

Just as in our colleges of agriculture and mechanic arts, we should be careful at the outset to fit discipline and instruction to the actual needs of the students. So in the experiment station we ought at first to give prominence to those lines of work which our constituencies can most plainly see are to them directly useful—are, in fact, to them indispensable. The first and firmest hold which the station has had on the people of the Eastern and Southern States has been its demonstrated ability to make the farmer safe in the purchase and intelligent in the use of commercial fertilizers. Another stout link between practice and science has been that series of developments which are vividly called to mind by mention of the "Babcock test."

When the men of practice find that they can safely confide in and rely on the men of science in respect both to what the latter claim they can do and admit they can not do, then the men of science are warranted in entering upon the wide field of abstract research; then they are indeed blameworthy if they fail to give a share of their best endeavor to winning for the domain of science some portion of the vast outlying realm of darkness unexplored. For some of us that duty is already knocking at our doors; for all of us the time is short during which we can justifiably neglect to kindle and to tend and direct the search lights of truth.

An immense advantage enjoyed by the German investigator consists in the fact that he has a clientele of landed proprietors who have themselves passed the strenuous discipline of the gymnasium and the university, and have also, so to speak, inherited liberal culture from ancestors highly educated both in the theory and the practice of field and crop culture, and in all branches of husbandry and rural technology.

Thus it was that the Saxon Society of Landholders, which founded the station at Möckern, secured at the outset a brilliant young scientist, Dr. Wolff, and an experienced farm manager, Mr. Behr, to initiate the work of that station. These men were supplied with competent assistants, and they at once began investigations of plant nutrition and of animal nutrition, without any special reference to immediate results, and the work thus laid out on broad lines has been almost steadily prosecuted in that station to this day, and will doubtless go on for years to come, or until a satisfactory conclusion has been reached.

Let us hope that ere long in this country, as in the Old World, the stations will be empowered to put the capable investigators into positions where they can give their powers unreservedly and exclusively to discovery. I have found great satisfaction in following from day to day during the last six or seven years the steady progress which Dr. Osborne's often baffled but always renewed efforts have accomplished in bringing order and illumination into the chaos of plant proteids.

A clear knowledge of the various individual proteids—their composition, properties, physical and chemical, and the means of distinguishing and identifying them—is evidently of the most fundamental importance. Osborne's work has demonstrated that scarce a single one of this class of bodies had been obtained by earlier investigators in a state of purity or had been analyzed with correct results. He has shown that various names long current in proteid literature were applied to indefinite mixtures or to supposed substances that do not exist. He has also made evident that under the names "conglutin" and "vitellin" no less than six distinct proteid substances have been confounded together. So soon as the proteid of our important feeding stuffs have been chemically differentiated and defined, it will be in order to attack the problems of their chemical constitution by the methods of research that have been applied with such brilliant success in the modern study of organic chemistry.

Until the work thus outlined has been carried far toward a satisfactory finish, the precise nutritive value of the proteids will remain an irresolvable problem.

In respect to the carbohydrates, including the pentosans and pentoses, recent developments of the most signal importance have been attained, mainly through the genius and persistence of Emil Fischer. Here, too, much remains to be learned. What do we know of the nature of the various vegetables used and valued as food for man and beast? The cabbage, the pumpkin, the onion, the apple, pear, orange, grape, all invite the beginning of investigation, while wood, straw, hay, and all common forms of forage, together with the sugar beet and the turnip, are subjects whose study has gone just far enough to display the meagerness of our knowledge of them. It is to be hoped that those chemists among us who have worked with Tollens in this field may find opportunity to cultivate it further.

And here I would urge the younger scientists of our colleges and stations to place themselves, if for but a few months only, under the influence of the great European teachers, and I hold it to be a most worthy use of any funds that may be available to send college teachers and station workers abroad to gather inspiration and finish at the Old World shrines of science. Considered as mere tools, our chemists, botanists, and all who adopt college and station duty as life work are worth sending to be sharpened, adjusted, and polished where that business has been transacted longest and most efficiently.

In closing I will briefly call attention to some matters connected with the publications of our stations which, to my mind, admit of betterment.

As a station director, I hold it to be extremely important that the library of my station and my own private library, which is necessarily distant from the station, should contain complete files of all the publications of all the stations, so arranged that any of them may be instantly referred to.

For this purpose it is essential that a uniform system of publication be adopted and strictly followed by all the stations. The plan most in use is to issue the two kinds of printed matter that are named in the acts establishing the stations, viz, bulletins and annual reports. I am of the opinion that it is a mistake to put forth other styles of publications for two reasons—(1) the annual report and the bulletins are sufficient in number and in kind to include everything that it is desirable to print, and (2) to issue circulars, extras, or what not is to make an unnecessary complication, which has no terrors for the one director who prepares and prints them, but which may be the last back-breaking straws on the shoulders of the other directors, who have to spend many weary hours in trying to keep the run of the hundreds of station documents that are yearly issued.

I would respectfully suggest that simplicity is much easier and much more satisfactory than complexity, which, in case of station documents, always tends to perplexity.

Another matter of importance tending to the longevity of station directors and librarians is that bulletins should be perfectly distinguished and identified by two simple earmarks, viz, the name, in the first place, of the station from which they proceed, and, second, by consecutive numbering, using whole numbers only.

If I have in hand Bulletin 45, then I ought to be able to know that 44, 43, and all the lesser numbers have been not only planned or written, but have been printed and distributed. If after receiving 45 I get 45*a* and 45*d*, I can infer that 45*b* and 45*c* have been issued, but I have no basis on which I can estimate how many of the letters of the alphabet are likely to stand for separate bulletins, and I must write a letter in order to get my bearings, or else the publishing station must take the trouble to print and send out a key to its cipher.

Again, a technical bulletin, or a second or a new series, or Bulletin A, B, C, now and then appears to break the continuity of an otherwise orderly sequence. These sports and freaks are out of the line of natural evolution and their survival should be frowned upon as not of the fittest, but as unmistakable misfits.

I desire to express the earnest wish that each station shall, if possible, maintain a small reserve of publications, the first demand upon which shall be to make good the wants of the sister stations.

Gentlemen of the Association, I thank you most heartily for the honor of presiding over your deliberations at this meeting, and for your appreciative attention on this occasion.

Adjourned to meet at 9 o'clock Wednesday morning.

MORNING SESSION, WEDNESDAY, NOVEMBER 11, 1896.

The convention was called to order by President S. W. Johnson at 9 o'clock a. m.

The CHAIRMAN. I have to announce that the members of the committee on military will be G. W. Atherton, A. Q. Holladay, and H. H. Goodell. General business is now in order.

Mr. GOODELL. I am instructed by the executive committee to report back the resolution of Mr. Wheeler (see p. 31) in following modified form, and move its adoption:

Resolved, That it is the sense of this Association that station workers in quoting others should give them credit therefor and make such citations as will facilitate ready reference.

Adopted.

Mr. GOODELL. I am instructed to report back the following resolution of Mr. Wheeler, with the recommendation that it is inexpedient to take action at the present time:

Whereas owing to a lack of indexing, or to any uniform system of indexing the station publications, much difficulty is encountered on the part of those who wish to consult them, especially where the card index of the Office of Experiment Stations is not available, and to encourage farmers and others in the several States to preserve, bind, and keep them for reference: Therefore be it

Resolved, That this Association recommends that the publications of each station for the year be paged consecutively, and that there be appended to the annual report, or final publication for the year, a title page and an alphabetical index of subjects similar to that in the Experiment Station Record.

The executive committee have considered this matter and have found such obstacles in the way that they think it inexpedient to take action at the present time. It was found that in a number of States the bulletins were published by the stations, while the annual report was published by the State printer, and therefore it was difficult to page them consecutively. In addition to this, it was found that an index to the bulletins would not be allowed with the annual report if published by the State printer. For these reasons the executive committee report that it is inexpedient to take action at this time.

Mr. ATHERTON. I move that the executive committee be instructed, either directly or indirectly, by reference to the proper standing committee to give the subject as full consideration as possible during the present year, to the end that some convenient system may be adopted, and that report may be made at the next annual convention.

Carried.

Mr. GOODELL. I am instructed by the executive committee to report back the resolution of Mr. Harris, in a modified form, and move its adoption:

Resolved, That a committee of three college presidents be appointed by the chair to wait on the Commissioner of Education and request the compilation of a table of statistics, similar to the one prepared by President Atherton several years since, and that if it prove impossible to obtain prompt publication of the statistics by the Bureau of Education, the committee be authorized to prepare and publish statistics at the earliest date practicable.

Adopted. (For committee, see p. 52.)

Mr. GOODELL. I am instructed by the executive committee to move the adoption of the following resolution:

Resolved, That hereafter committees shall not incur any expense whatsoever without the specific authority of the executive committee first previously obtained.

Adopted.

Mr. GOODELL. There was referred to the executive committee a recommendation that a standing committe of five be appointed on nomenclature. The executive committee recommend the adoption of this recommendation.

Adopted. (For committee, see p. 63.)

Mr. GOODELL. The following memorial presented by Mr. G. McCarthy was referred to the executive committee, and inasmuch as it was not read last night I will read it now. It is signed by thirty-seven directors of experiment stations, and is as follows:

The undersigned directors of American experiment stations, recognizing the benefit to be derived to agriculture from an improvement in the quality of seed merchandise and by enabling seedsmen to offer a guaranty of specified quality, request the Association to appoint a committee of experts in seed testing to devise and adopt a standard form of seed-testing apparatus and method of procedure for use in all American stations who shall hereafter publish seed tests, to the end that all such work shall be strictly comparable and that seedsmen may guarantee the quality of their seeds according to the official method.

We suggest that the committee so appointed shall meet in Washington as soon as possible after the adjournment of the Association, and shall adopt a standard method and form of apparatus, and, further, shall report the same to the Director of the Office of Experiment Stations of the United States Department of Agriculture, who shall be requested to officially publish the same. After such publication, no change in method or apparatus shall be permissible until the same has been approved and adopted at a regular meeting of the Association or by a committee newly appointed, and so on from year to year.

That the Director of the Office of Experiment Stations shall be requested to contract with some responsible instrument maker to furnish, at a reasonable price, the official form of apparatus and accessories to all who may desire the same at their own cost.

We suggest, further, that the Secretary of Agriculture be requested to defray the actual and necessary expenses of the members of the committee while so engaged, out of any funds of the Department available for the purpose. If this is impracticable, the expenses of each member of the committee will be met by the institution which he represents.

The executive committee report back the memorial of Professor McCarthy in the following modified form, and recommend its adoption:

The undersigned directors of American experiment stations, recognizing the benefit to be derived to agriculture from an improvement in the quality of seed merchandise and by enabling seedsmen to offer a guaranty of specified quality, request the Association to appoint a committee of experts in seed testing to devise and adopt a standard form of seed-testing apparatus and methods of procedure for use in all American stations which shall hereafter publish seed tests, to the end that all such work shall be strictly comparable, and that seedsmen may guarantee the quality of their seeds according to the official methods, said committee to report at the next annual convention.

Carried. (For committee see p. 63.)

Mr. SMART. I move that the president of the Association appoint a nominating committee of nine to report to the Association a list of candidates for the offices to be filled.

Carried. (For committee see p. 56.)

Mr. ATHERTON. I move that the Association give unanimous consent that Professor Hamilton, deputy secretary of agriculture of Pennsylvania, be allowed to address the Association at this time.

The CHAIRMAN. There being no objection Professor Hamilton has the floor.

ADDRESS BY PROF. JOHN HAMILTON OF PENNSYLVANIA, ON AGRICULTURAL EDUCATION.

I have asked for the privilege of the floor this morning that I may have the opportunity of calling your attention to a feature of the work of education, in the direction of practical and scientific agriculture in the United States, which needs immediate attention, and which, in my judgment, promises more for the increased usefulness of the institutions which you represent than any other single line of work that these land-grant colleges and experiment stations have heretofore performed.

In order that I may make clear the thought that I wish to convey, permit me to remind you of two or three facts in the history of the new education, which are preliminary and in some degree explanatory of the situation in which we find ourselves to-day.

The agricultural colleges came into existence in response to a demand upon the part of a large number of our citizens who are deeply interested in the future of the agriculture of this country and who hoped, by the establishment of these institutions, to provide a population for the rural districts which would not only be highly developed as educated men, but which would also have that special training and knowledge which would fit them more completely for the scientific and rational pursuit of agriculture than was possible under the old methods of education provided in the classical schools.

It was believed that large numbers of young men would avail themselves of the education in agriculture which these new colleges undertook to give, and that in the near future the country districts would be well supplied with scientific farmers, who would make agriculture a life pursuit, and be an example and stimulus to others not so fortunate in educational advantages as themselves. The disappointment that followed when it was found that, instead of appreciation, a strong prejudice against this new education was developed on the part of those whom these colleges were intended to benefit was not the only painful experience that these public-spirited citizens had to endure. They found, as well, that there was comparatively little desire on the part of young men for the education that had been provided, and that the courses of study which had been prepared with so much care were despised by the great body of students themselves.

It was very soon seen that the work of education in this new direction would be of slow progress, and that many years must elapse before the hopes of the founders of these colleges could be realized.

Although there was this indifference on the part of young men toward this branch of learning, there was, on the other hand, a strong desire on the part of those who were engaged in the business of farming for agricultural information. To supply this demand the experiment station was brought into operation, and through investigation and experimentation it endeavored to assist agricultural people, by solving questions that they had been unable to determine for themselves through the aid of bulletins published from time to time, and embodying the substance of truths that had been ascertained. Much valuable information was soon collected and distributed throughout the country. It was then found that many of the country people, by reason of their lack of scientific training, were unable to understand the full force and application of the teachings of these scientific investigators, and there arose the necessity for some persons, familiar with science and its relation to practice, to go out through the country districts and explain the meaning of these experiments, and show the farmers how they could use the facts collected and apply them in the conduct of their calling.

Out of this grew the Farmers' Institute, and now, in almost all of the States, this form of instruction is doing much to spread a knowledge of science and her methods, and to familiarize farmers with scientific facts and terms, and to secure the respect of agricultural people for the truths thus presented.

The result of all these agencies is that a great advance has been made, and scientific training and scientific truth have been rapidly gaining in favor among rural people, until it is now quite common to find men conducting their business as farmers upon the best and latest teachings of science, as made known by colleges of agriculture, experiment stations, and institute lectures, that are at work all over the land. Whatever measure of success has been secured in the improvement of agriculture during these late years has been chiefly due to the information and education in science as it applies to rural pursuits that these institutions which I have enumerated have brought to the farming people of this country; and it is now perfectly clear to all thoughtful men that the future prosperity and advancement of agriculture in America must come through the still more general spread of scientific knowledge of their art among rural people, and through new discoveries of science as it affects agricultural methods and practice, brought into use by those engaged in the actual business of farming.

Owing to the influences of which I have spoken and to the low prices of farm products and the consequent small profits of agriculture, there has never been a time in the history of this country when agricultural people were in greater need of knowledge or were more anxious for information in regard to their calling than they are to-day. How shall this urgent and increased demand most speedily and effectively be met? This brings me to the particular point to which I wish to direct your attention this morning.

If improvement of condition has been effected during past years through increased knowledge of better methods in agricultural practice and its dissemination among the farming people, may not this indicate to us the method which ought to be pursued to bring about improved conditions in the future? If these people are suffering from lack of knowledge, is not the remedy very clear and our duty plain?

In Pennsylvania we are trying to supply this necessity in a way that promises success. A single difficulty, however, bars our progress, and it is to the removal of this obstacle that your assistance is invoked.

The State College and Experiment Station have undertaken to carry the latest and best information in regard to the various branches of modern agriculture into every country home in the State. They have several sets of men out over the State to-day, endeavoring to establish reading circles among the farmers, and are offering books at wholesale prices on the various subjects in which these people are most interested and are endeavoring to aid each reader by such assistance as a corps of more than forty expert professors can render, answering questions, explaining difficulties that arise, and giving all of this free of charge. For more than two years this work has been going on, and now we find that the great obstacle in the way of its complete success is in the unsuitable character of the books that it is possible to obtain and in the great expense that a set sufficiently complete involves.

The remedy for this serious difficulty which confronts us, and provision for supplying this, the essential part of the Agricultural Chautauqua plan, a plan capable of the widest application and which promises to be highly beneficial to millions of agricultural people in the United States and other lands, are suggested in a statement that I shall presently submit for your judgment and action.

The great need just now is for suitable books upon agriculture. Until these are provided the work of the colleges and stations, the institutes, and the Chautauqua course must be seriously retarded, valuable time be wasted, and a great opportunity be endangered, if not entirely lost. The introduction of the study of agriculture into the public schools is also sure to be demanded inside of the next twenty-five years, and will be the next phase in the development of the new education, begun forty years ago. We need to get ready for these new features of the agricultural educational work, and we need to get ready *now*. Books costing from $1 to $2 or $3 each ought to be had for from 15 to 30 cents apiece, and discussions of subjects that occupy 100 pages ought to be condensed, and can be condensed, into 10. Station bulletins, containing much valuable information, and costing many thousands of dollars and years of careful and patient labor to secure, are lying all around in fragmentary form, of little value to the great mass of men, solely because of the lack of some central and competent authority to collect the truths which they have secured, and arrange their teachings in some logical and readable form, for use by those who so much need the information which they contain.

To ask you to constitute such an authority, and set to work at once a corps of competent scientific men arranging this and like information, and providing for its distribution among the agricultural people of this country, is the request that I have come to present, and the method for the accomplishment of this extremely desirable end is suggested in the following statements, which I shall now read, and in the resolution which follows:

"Recognizing that the future development and success of agriculture in the United States is directly dependent upon a more complete knowledge by rural people of improved methods of farming;

"And realizing that the discovery of these improved methods, and the showing of the adaptability of practical and scientific truth to agricultural operations, is the specific duty of the colleges of agriculture and of the experiment stations of the United States:

"And appreciating the fact that their work is comparatively futile, unless the information thus obtained is disseminated among the agricultural people, and is put in useful form;

"And realizing, also, that the bulletins published by the stations and departments of agriculture of the several States and of the nation, although containing much of the latest and best information, do not form a complete and systematic course of instruction in agriculture, but, on the contrary, are quite fragmentary and disconnected;

"And believing that a systematic and complete course of instruction adapted to the use of farmers and embracing the latest and best information known with regard to their occupation is highly desirable, if not an immediate necessity;

"And that in order to secure attention and study on the part of the farming people as a class, the books containing the information should be of attractive form, well illustrated, printed in clear type, on good paper, and be furnished free from copyright and royalty, and that each volume should treat of but one or two subjects, and not be larger than from 75 to 100 pages, so as to enable the purchaser to get what he wants as cheaply as possible and without having to pay for other matter not desirable;

"And being of the conviction that the chief obstacle now in the way of establishing an agricultural Chautauqua course of reading and study for farmers is in the lack of suitable literature and in the expense involved in the purchasing of books;

"And feeling that the need for such a course of reading and instruction is national, and not confined to sectional or State boundaries:

"Therefore, we respectfully request the honorable Secretary of Agriculture of the United States to consider the advisability and propriety of arranging for the editing, under the direction of the national Department of Agriculture, of such a series of books as the necessities of our farming interests seem to require; engaging in their preparation the best scientific assistance that the country affords; purchasing the copyright, and having the books published for distribution at cost of paper, presswork, binding, and postage; making up a series of works that shall include all of the topics relating to practical agriculture.

"*Resolved*, That a committee of three be appointed to present these suggestions to the honorable Secretary of Agriculture of the United States, and also to render such assistance as may be necessary in securing for the Department of Agriculture such appropriations as will be sufficient to carry out the purpose herein expressed."

In considering this proposition several important questions naturally arise:

(1) Has the Department of Agriculture the legal right to undertake the work?

(2) If it has, is it its duty to organize a force necessary to carry the proposition into effect, or is there another and better method of securing the desired result?

(3) What, in all probability, would be the effect if such a system were inaugurated?

With regard to the first question raised, permit me to call your attention to some of the declarations of the Secretaries who have defined the scope and powers of this Department.

Secretary Rusk, in his report for the year ending June 30, 1890, pages 46 and 47, makes the following statements:

"The measure of the efficiency of the Department of Agriculture is largely its ability to supply practical, useful information to the public. * * * We have found it desirable to cause the publication from time to time of short practical tracts, inexpensive in form, devoted to some special feature of agricultural work, calling for clear, concise instruction, within the comprehension of any person able to read them."

In his report for 1892, page 20, the same Secretary states that—

"In order to fulfill its mission this Department must be prepared to do with reference to agriculture all that our individual farmers are unable to do for themselves. * * * The commission of this Department, as I may call the law under which it was originally established, is broad enough to cover any work which in the judgment of its chief may have a bearing upon agriculture in this country."

A division of records and editing has been in operation in the Department for several years, and during the year ending June 30, 1894, out of 205 different publications issued by the Department 149 were by this division, and the total number of copies of all publications for that year amounted to 3,169,310. The present Secretary, in commenting upon the "Yearbook" for 1894, page 50, states:

"It ought to contain the results of researches made in the various bureaus and laboratories during the year, and should be so plainly written and popular in its character as to adapt itself to the practical farmer and be held in esteem by him as a work of reference on agricultural science, practice, and statistics."

During that year 254 different publications were issued by the Department, aggregating over 4,000,000 copies, or 420,000,000 printed pages, and these were distributed free.

It has been the uniform practice of all the Secretaries to issue such publication of facts relating to agriculture as they deem advisable, and no one can call in question their right so to do. If any doubt should arise, it would be set at rest by the act of Congress approved May 15, 1862. The act creates

"A Department of Agriculture, the general design and duties of which shall be to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word."

It being, therefore, clearly within the powers of the Department to collect and publish such information as is proposed in the statement and request submitted in this paper, the way is clear for the consideration of the second question:

Is it its duty to organize a force competent and sufficient to carry the plan into operation, or is there another and better method of securing the desired result?

At present there is not in this country, outside of the Department of Agriculture, any authority or central board of editors authorized or competent to undertake this work. If there were, they would be unwilling to undertake it under the conditions, which contemplate no royalty or copyright, but provide that the publications shall be had at cost. Cheapness is an essential feature of the plan, and to secure this the cost of preparation of the copy would have to be borne by the Department, making the series of books available at the price of paper, presswork, binding, and postage.

If, therefore, this work is to be accomplished in the near future, it will be necessary for the Department of Agriculture to organize a corps of men to outline its scope, and it would also need to secure the assistance of experts in the preparation and compilation of the text.

What would be the effect if such a system were inaugurated?

It might be objected that the publication of such a series of books by the Department would be an infringement upon the rights of private publishing houses, appropriating work that these publishers have a right to expect would be committed to them.

As has been shown, no private publisher can do the work under the conditions prescribed. There is no profit in it. The books are to be furnished at cost. But it does not follow, because this work is done by the Department of Agriculture and at cost, that private publishers will thereby suffer loss. The introduction of a popular course of reading in agriculture will create a desire for agricultural literature, and perhaps no better method for advertising the class of books that publishers issue on agricultural subjects can be devised than this.

Each of these elementary books ought to contain references to larger works, treating of similar subjects, giving the publisher's name and address, together with the price of the book. Farmers, therefore, who are making a specialty of some particular branch of agriculture, will have at hand a convenient means of discovering where full information can be had in regard to that subject, and would purchase books that they otherwise might not know were in existence. Instead, therefore, of being a disadvantage to the publishers of agricultural books, this course of instruction would prove the best possible advertisement for their trade.

There would also be created a demand for new books upon agricultural topics. This would give remunerative employment to many scientific men who are now deterred from entering this field of labor because of the limited demand. Professors in the colleges and experiment stations would be put in position to thereby greatly enlarge their field of usefulness, and at the same time supplement their usually quite meager salaries.

In addition to what has been stated, the farmers of the country, through the influence of this course of reading, would be brought to appreciate more fully the work of the higher institutions of learning and of the experiment stations, and be more likely to send their sons and daughters to these colleges, to secure the training and knowledge which the parents had found to be beneficial to themselves.

Its influence would also be felt by the primary schools in the country. An awakened and informed community would insist that so much of science as could be taught should be introduced into the public schools, and being themselves in control, they would be able to see that their wishes were carried into effect.

Therefore, on every account, it would seem to be the duty of the Department of Agriculture to undertake this work, and thus aid the great body of agricultural people in what is now their most pressing need.

After some discussion the suggestions of this paper were referred to a committee of three for consideration and report at the next convention (see p. 63).

Mr. TRUE. I would like to present the report of the bibliographer of the Association. (This was a list[1] of 1,450 books and pamphlets on agriculture and the associated sciences, which had appeared within the last four years.)

The CHAIRMAN. If there is no objection, the report is considered adopted.

Mr. GOODELL. Since we are on the subject of books, I wish to say that the committee to which was referred the subject of indexing agricultural literature, consisting of Dr. True, Professor Hays, and myself, have carefully considered that subject during the year, and have prepared a provisional list of works on agricultural subjects. We find that list already amounts to two thousand titles, and we have not commenced to cover the ground. After consultation and receiving a letter from Professor Hays, who, I am sorry to say, is not here, I move that a committee of five, one of whom shall be the librarian of the Department of Agriculture, be appointed to consider this matter of indexing agricultural literature.

Carried.

The CHAIRMAN. The Chair announces as members of the committee to wait on the Commissioner of Education and urge the preparation of a statistical table, A. W. Harris, of Maine; J. L. Goodnight, of West Virginia, and J. E. Stubbs, of Nevada.

The CHAIRMAN. We will now have the report of President Murkland on entrance requirements, courses of study, and degrees.

REPORT OF COMMITTEE ON ENTRANCE REQUIREMENTS, COURSES OF STUDY, AND DEGREES.

Your committee, appointed November, 1894, and continued with further instructions at the last annual meeting of this Association, presents the following report:

ARTICLE I.

SECTION 1. Congress, in establishing and endowing the institutions known as the land-grant colleges, evidently intended that their work for the classes they were

[1] U. S. Dept. Agr., Office of Experiment Stations Circ. 31.

designed to benefit should be, as far as practicable, uniform in scope and character in the different States and Territories. It is inevitable, however, that this uniformity, desirable as it is, should be somewhat limited or conditioned by the environment of each college.

SEC. 2. The act of 1890, further endowing these colleges, points to their development along certain specified lines. In conformity with the spirit of this act these institutions are constantly tending to become schools or institutes of technology. That they must be collegiate in scope is required by the law itself.

SEC. 3. The steadily increasing tendency to ignore and obliterate all State lines in scientific and educational work; the free intercourse in social and industrial life among the people of the several States, and, in consequence, the steadily broadening field of usefulness and activity open to the graduates of educational institutions; the association of the land-grant colleges into a national organization for the protection and promotion of their common interests; the increasing recognition by the National Government of the importance and promise of the work of these colleges—all these considerations make it desirable that the degree or degrees awarded by these colleges should represent work approximately uniform in character and scope; should be, in other words, degrees of such recognized value as to pass current, each the equivalent of the others, in any State or Territory.

SEC. 4. It is clearly recognized that the social and educational conditions prevailing in the several States make it impossible, for the present, to prescribe uniform requirements for admission into the colleges of this class. In some States, for some time to come, concession must be made to the defective condition of the public-school system. But it by no means follows that in making such concessions the colleges are prohibited from protecting their standards of work and graduation. These, by proper effort, may be maintained and made to conform in educational value to those of the colleges which are more happily situated. Moreover, a certain community of interest makes it the duty of each college to protect at the same time its own reputation for thorough educational work and the reputation of its sister institutions.

SEC. 5. The educational conditions prevailing in the United States make it impossible to require of students in schools of applied science or technology that their liberal training should be acquired in preparatory schools. These institutions, therefore, can not exclusively confine their attention to technical subjects. They must include in their courses for graduation certain elements of a liberal (or general) education.

SEC. 6. These considerations, thus briefly outlined, make it desirable that all colleges in membership with this Association should unite in requiring for the bachelor's degree, or degrees, at least the following general studies:

Mathematics—At least through algebra, geometry, and trigonometry.
Physics and chemistry, with laboratory work in each.
English language and literature—At least two years' work.
Other languages (one, at least, modern)—Four years.[1]
Mental science and logic or moral science—One year.
Constitutional law.
Social, political, or economic science—One year.

SEC. 7. It is desirable, also, that the bachelor's degree, or degrees, should represent an approximate uniformity in the amount of work done in the several colleges. The conditions generally affecting these colleges are such that a greater amount of work is demanded of their students than is required in the colleges of longer standing and other traditions. In the judgment of your committee it is not too much to require the equivalent of fifteen hours per week of recitations and lectures, together with ten hours per week of laboratory work or practicums, including the time devoted to military science and drill. Upon this basis, the above-mentioned general studies should be assigned a relative importance approximately as follows:

	Hours.		Hours.
Algebra	75	Modern languages	340
Geometry	40	Psychology	60
Trigonometry	40	Ethics or logic	40
Physics (class-room work)	75	Political economy	60
Physics (laboratory work)	75	General history	80
Chemistry (class-room work)	75	Constitutional law	50
Chemistry (laboratory work)	75		
English	200	Total	1.285

The total number of hours included in a four years' course, allowing fifteen hours per week for thirty-six weeks, would be 2,160; with ten hours' laboratory work or

[1] The statement "four years" means 340 hours. These may be distributed over four, three, or two years, or confined to one year.

practicums added, 3,600. In general terms, therefore, the foregoing general studies should comprise about two-fifths of the work required for a bachelor's degree.

SEC. 8. It is recommended that in the establishment and nomenclature of degrees the colleges should strictly observe the doctrine of parsimony, and that only the baccalaureate degree of bachelor of science be conferred for a technical course of four years. Statement, in the diploma, that the degree is conferred for the accomplishment of the course in agriculture, engineering, chemistry, etc., would afford differentiation enough to distinguish the several varieties of the degree.

ARTICLE II.—ENTRANCE REQUIREMENTS.

SECTION 1. The difference in the character of the school systems, both public and private, of the several States is too great, in the opinion of the committee, to permit the formulation of rigid entrance requirements applicable to all the colleges having membership in this Association.

SEC. 2. But the committee holds that it is advisable, as a beginning, to determine the requirements in a few subjects upon which it is possible for all the colleges to agree, and to recommend others which, although too high at present for adoption by some of these institutions, may yet serve as a standard or goal toward which effort may be directed.

SEC. 3. As a standard series of entrance requirements, to be adopted as soon as possible, we recommend the following:

(1) Physical geography.
(2) United States history.
(3) Arithmetic, including the metric system.
(4) Algebra, to quadratics.
(5) English grammar and composition, together with the English requirements of the New England Association of Colleges and Preparatory Schools.
(6) Plane geometry.
(7) One foreign language.
(8) One of the natural sciences.
(9) Ancient, general, or English history.

SEC. 4. From a careful examination of the catalogues we believe it to be practicable, either now or in the near future, for these institutions to unite in requiring as a minimum for admission to their lowest collegiate class:

(1) Physical geography.
(2) United States history.
(3) Arithmetic, including the metric system.
(4) Algebra, to quadratics.
(5) English grammar and composition, together with the English requirements of the New England Association of Colleges and Preparatory Schools.

ARTICLE III.

We recommend that the conclusions embodied in this report be adopted as indicating essentially the position of this Association, with the express declaration, however, that the Association in adopting this report does not attempt to exercise any function other than an advisory one, and that any attempt to enforce an arbitrary uniformity would result in unmixed evil. These conclusions may be summed up as follows:

(1) That two series of entrance requirements, a standard series and a minimum series, be approved by the Association, and that the two series herein given be so approved.

(2) That approximately fifteen hours be devoted to recitations or lectures each week for thirty-six weeks each year; that ten hours laboratory work or practicums be added.

(3) That the list of studies given in section 7 of this report be included in every course leading to a bachelor's degree.

(4) That the degree of bachelor of science be recognized as the standard degree conferred by the colleges of this Association.

Respectfully submitted.

CHAS. S. MURKLAND,
ABRAM W. HARRIS,
GEO. W. ATHERTON,
J. M. MCBRYDE,
THOS. F. HUNT,
Committee.

The report was referred to the executive committee with directions to place it in the order of business on the following morning. (See p. 59.)

The CHAIRMAN. The time has passed for receiving the reports of the committees, and we have barely time enough left for regular business. The next item is a consideration of the amendment to the constitution changing the name of the Association.

Mr. SILVESTER. President Patterson informed me yesterday that, as I was the author of the resolution, he desired that I should present to-day the resolution offered in this hall two years ago. As then offered it was:

Resolved, That the name of this Association be changed to "An Association of American Colleges for the Advancement of Agriculture and Mechanic Arts."

After some discussion it was voted to refer the question to a committee of five to be appointed by the President. (See p. 56.)

The CHAIRMAN. President Holladay asks unanimous consent to introduce a resolution of congratulation to Senator Morrill.

RESOLUTION OF CONGRATULATION TO SENATOR MORRILL.

Whereas the Association of American Agricultural College and Experiment Stations learns with pleasure that the Hon. Justin S. Morrill, now more than fourscore years of age, the patriarch and nestor of the Senate of the United States, has lately been reelected for the sixth time to a seat in that body by a majority approaching unanimity: Therefore, be it

Resolved, That the congratulations of this Association be, and are hereby, tendered to the Hon. Justin S. Morrill, on his receiving so impressive and well merited a tribute to his character, talents, and distinguished public services.

That this Association wishes for Senator Morrill many years to come of life, happiness, and usefulness as an inspiring example to the youth of our country.

That the secretary of this Association is requested to place this resolution on record with the proceedings of this convention and to forward an engrossed copy of the same to Senator Morrill.

The resolution was referred to the executive committee and reported back with recommendation for its adoption.

Adopted.

Adjourned to meet at 7.30 p. m.

EVENING SESSION, WEDNESDAY, NOVEMBER 11, 1896.

The convention was called to order by President Johnson at 7.30 p. m.

Mr. Battle offered the following resolution:

Resolved, That in furtherance of the resolution in regard to seed examinations as recommended by the executive committee and adopted by the Association (see p. 48), a committee of five be appointed by the president to carry on the work as outlined by the resolution.

Adopted.

The CHAIRMAN. We will now listen to an address by C. W. Dabney, jr., the Assistant Secretary of Agriculture, on civil service in the Department of Agriculture.

Dr. Dabney's paper, which has been published elsewhere,[1] discussed in detail the growth in recent years and the present condition of civil service in this Department. All employees above the grade of unskilled laborer or worker, except the Secretary, Assistant Secretary, and Chief of the Weather Bureau, are now in the classified service. A plan of examinations for establishing lists of eligibles suited to the requirements of the Department was outlined. The main object of this plan is to afford opportunities for graduates of agricultural colleges and technical schools to enter, through competitive examinations, not only the higher positions, but also to receive "temporary employment in the minor positions of the Department where they would have opportunities for observation and study which would fit them for better work," and ultimately for promotion to the higher grades.

The need of an administrative officer who could give continuity to the scientific work of the Department was pointed out. The Secretary of Agriculture has recommended to Congress the appointment of an additional officer in the Department "to be known as director-in-chief of scientific bureaus and investigations, who shall continue in office during good behavior, and perform such duties as the Secretary may assign him."

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[1] U. S. Dept. Agr., Office of Experiment Stations Circ. 33.

The CHAIRMAN. The Chair will announce the following committees:

Committee on nominations: J. H. Smart, of Indiana; A. T. Neale, of Delaware; P. H. Mell, of Alabama; G. E. MacLean, of Nebraska; B. F. Koons, of Connecticut; W. A. Henry, of Wisconsin; A. Q. Holladay, of North Carolina; H. E. Alvord, of Washington, D. C., and J. H. Connell, of Texas.

Committee on changing the name of the Association: G. E. MacLean, of Nebraska; R. W. Silvester, of Maryland; W. M. Liggett, of Minnesota; W. A. Henry, of Wisconsin, and J. H. Washburn, of Rhode Island.

Committee on indexing agricultural literature: A. C. True, of Washington, D. C.; W. M. Hays, of Minnesota; the Librarian of the Department of Agriculture (W. P. Cutter); H. P. Armsby, of Pennsylvania, and E. Davenport, of Illinois.

Mr. SMITH. I desire to introduce a resolution in support of a bill now pending in Congress providing for a director-in-chief of scientific bureaus and investigations in the Department of Agriculture.

Whereas the Committee on Agriculture and Forestry of the United States Senate has reported a bill to provide for a director-in-chief of scientific bureaus and investigations in the Department of Agriculture, with the recommendation that the same do pass; and

Whereas the work of the various agricultural colleges and experiment stations has brought those institutions into relations with the Department of Agriculture of such a character that any important change in the administration of the affairs of that Department must necessarily affect the success and welfare of the colleges and stations: Therefore, be it

Resolved, By the Association of American Agricultural Colleges and Experiment Stations that the creation of the proposed office and the appointment thereto of a broadly educated scientific man, who shall hold office during good behavior, would be of the highest value to the cause of scientific agriculture in the continuity of purpose and harmonization of operations that should result from the labors and influence of such an officer.

Referred to the executive committee. (See p. 58.)

Mr. SMART. When the Morrill bill was pending in Congress the committee in charge felt the need of a little more help than they had in Washington so they invited the master of the National Grange to assist them, and I am sure I am telling no secret when I say that he rendered extraordinary services in passing that bill. Colonel Brigham is sitting here now, and I move that we give him the floor and recognize the importance of the service he rendered on that occasion.

Carried.

Mr. BRIGHAM. Mr. President and gentlemen, I appreciate the fact that you are full of business and that your time is limited, but I am pleased to have the opportunity to say that we are all deeply interested in the work in which you are engaged. At the time to which the gentleman refers, I came with two other gentlemen, representing organizations with which I am connected, to help pass the first measure relating to agricultural experiment stations and to provide for their establishment. I introduced in the Ohio legislature and asked the passage of the measure establishing the station in Ohio. I have always been greatly interested in your work and I believe every citizen of our country is interested in its success. I have never felt we were asking for anything specially for the farmer when we were asking legislation to help on the work in which you are engaged. We are all dependent upon agriculture. And if we can learn how to cheapen the cost and protect the layman, every individual in every country is benefited thereby.

Now, there are several organizations and associations that are laboring to do that for the purpose of developing and building up agriculture. You are doing a very great work. You have, however, only just commenced. There are some farmers who do not appreciate it, but they are beginning to do so, and will more and more.

I can assure you that the organization that I represent, and which is represented by several others here, is in thorough sympathy with the objects which you have in view and in the work in which you are engaged; we cooperate in every way possible to promote the interests of agriculture and of our people generally.

I have no suggestion to make with regard to the details of your work, but I want to assure you, in conclusion, that all of us work heartily for the purpose of benefiting agriculture, some of us on different lines from those on which you are working; but it is a mistake, a great mistake, for us to get in one another's way or to throw any obstacle in one another's way. We can criticise if we criticise justly, and good will come of it.

I can assure you from my visits throughout the country, from my association with the representatives here to-day, that you may look to the Patrons of Husbandry for help in every effort you are making for the good of the farmer and for agriculture. We need your help and we appreciate the good you are doing, and may God speed you in your important work.

Mr. True presented the report of the committee on methods of teaching agriculture, as follows:

Report of Committee on Methods of Teaching Agriculture.[1]

Need of uniformity in the study of agriculture.—The committee on methods of teaching agriculture submit a report of progress. From the outset of its work the committee has recognized the fact that a thorough investigation of the subject intrusted to it would require a long time. It has therefore endeavored during the past year simply to lay the foundation for future work. The first thing was to find out what was done in this country in the teaching of agriculture. A circular of inquiry sent out for the committee by the Office of Experiment Stations has elicited responses from about fifty colleges. These replies, grouped under thirteen general heads, have been tabulated and brief summaries have been prepared which will be submitted as a part of this report. A large amount of data has been collated in this way which will be useful in further studies in this line.

The general conclusion thus far drawn from an examination of the data, though a negative one, is well worthy of the serious consideration of the association. It is plainly shown that there exists at present in this country no standard for instruction in agriculture. There is a bewildering variety as regards the topics taught, the time devoted to each topic, the order in which the different topics occur in the course, the relative amounts of class-room work and laboratory or practical exercises, etc. Granting all that ought to be conceded because of local conditions, it is nevertheless obvious that general progress in the teaching of agriculture in college courses can hardly be expected until there is greater uniformity in planning and conducting the course of study in this subject. Toward securing reasonable uniformity in this matter it behooves this Association, as well as the individual teachers of agriculture, to give earnest heed.

The committee is not prepared at this time to go much beyond this simple declaration of the great need of studying this subject thoroughly and deeply. More time must be spent in digesting the data collected and in discussing the evidence adduced before detailed conclusions can be drawn. On one point, however, the committee wishes to present to the Association some further considerations.

Necessity of definite nomenclature.—One great obstacle to the intelligent discussion of the scheme of agricultural instruction and the methods of agricultural teaching is the lack of a definite nomenclature of the subject. This confusion of terms is evident in the data collected by the committee, as well as in much of the current discussion of this subject which appears in the public prints. It is obviously not an easy matter to bring order out of confusion in such a case. The committee has not been able to give time enough to this phase of the subject to definitely settle anything even in the minds of its own members. It proposes, however, to suggest for the consideration of the Association a tentative scheme for the division of what is commonly designated agriculture in courses of study into several distinct branches or subdivisions, and for giving each of these branches a definite name, as follows:

Agriculture..	1. Agronomy, or agriculture (technical).	Climate, soils, fertilizers, and crops—plant production.
	2. Zootechny, or animal industry.	Animal physiology and animal production.
	3. Agrotechny, or agricultural technology.	Agricultural industries, e. g., dairying, sugar making.
	4. Rural engineering, farm mechanics, or farm equipment.	Roads, drains, irrigation systems, farm buildings, etc.
	5. Rural economy, or farm management.	General policy of farm management, rural law, agricultural bookkeeping, etc.

[1] This report, with accompanying papers on Some features of European institutions for agricultural education, by A. C. True, and Notes on agricultural education in the Scandinavian countries, by F. W. Woll, has been published as Circular 32 of the Office of Experiment Stations of the U. S. Department of Agriculture.

If we can reach a point where the term *agriculture*, as applied to what is taught on agricultural subjects in a college course, shall generally be understood to include at its widest the five subordinate subjects indicated in the above scheme, and in its restricted sense only what applies to plant production, an important step will have been taken in settling the proper boundaries of agricultural instruction and in fixing the proper subdivisions of the general subject. It is probable that the substitution of a more definite and technical term for agriculture in its restricted sense would simplify matters. The term agronomy is tentatively suggested as such a term, and the opinion of members of the Association on this, as well as on the other terms suggested, is invited.

Courses in agriculture in foreign schools.—Before presenting the summary of data collected by the committee it may be well to add that examination of the courses in agriculture in foreign schools was made, as far as practicable. One member of the committee had the privilege of visiting representative agricultural schools in Germany, France, Belgium, and Holland during the past summer, and holding personal conferences with leading agricultural educators in these countries. The general results of his observations will be given in a brief paper appended to this report. At the suggestion of the Director of the Office of Experiment Stations, Prof. F. W. Woll, of Wisconsin, made a special investigation of agricultural institutions in Denmark, Norway, and Sweden during a vacation trip last summer. A brief statement of the results of his observations is also appended to this report, and it is hoped that he will present a longer account in the Experiment Station Record.

J. H. CONNELL,
A. C. TRUE,
T. F. HUNT,
H. T. FRENCH,
H. H. WING,
Committee.

NOVEMBER 10, 1896.

Mr GOODELL. It will be remembered that in one of the early sessions of this convention an invitation was extended to the members of the National Grange, in session in this city, to attend the meetings of this convention. In acceptance of that invitation a number of the officers of the National Grange and a number of the masters of State Granges have been with us to-night. During a recess of this convention to-day a committee from the National Grange, acting upon its order, waited upon the officers of this Association and extended to the delegates of the Association an invitation to meet with them in their general session to-morrow forenoon.

I move, therefore, that the general session of this convention to-morrow morning adjourn at 11 o'clock for the purpose of proceeding in a body to the National Hotel and remaining a few moments in assembly with the Patrons of Husbandry

Carried.

The convention then adjourned to 9.30 o'clock the following morning.

MORNING SESSION, THURSDAY, NOVEMBER 12, 1896.

The convention was called to order at 9.30 a. m. by President Johnson.

Mr. GOODELL. I am directed by the executive committee to make report on the resolution offered by Director C. D. Smith in regard to a director-in-chief of scientific bureaus in the Department of Agriculture (see p. 56), with a recommendation that it be adopted.

After some discussion the resolution was adopted.

Mr. GOODELL. I will now read a resolution introduced by Chancellor MacLean:

Whereas the present system of weights and measures in use in the United States militates seriously against our trade with foreign countries, and in order to better facilitate comparisons of experimental data obtained at home and abroad, as well as to effect an important saving of time in the education of our youth; and furthermore in view of the rapid growth of the country, which increases continually the difficulties involved in a change: Therefore, be it

Resolved, That this Association, through its executive committee, transmit a communication to Congress urging the importance of the early adoption of the metric system of weights and measures as the only legal standard for the United States.

The executive committee recommend the adoption of this resolution.

Adopted.

Mr. GOODELL. I will now read a resolution introduced by the Section on Entomology and referred to the executive committee for report:

Whereas recent serious outbreaks in several States of the Union of insect pests of such pernicious and destructive character as the San José scale, the Mexican cotton-boll weevil, migratory locusts, the chinch bug, the army worm, the gypsy moth, the leopard moth, and other species calls for the exercise, on the part of official entomologists, of extraordinary police powers, the adoption of extreme methods of treatment, and the expenditure of considerable sums of money in work which is more strictly economic than scientific; and

Whereas the past history of the introduction of insect pests is such as to give sure ground for the belief that further serious pests to fruit and farm crops will be continually introduced into this country: Therefore, be it

Resolved, first, that it is the sense of this Association that the institutions herein represented should take steps to secure carefully considered legislation in all States which possess no insect-pest laws and to secure revision of such unsatisfactory laws as already exist, with the object that this legislation should give to the directors of the several experiment stations such powers as may be necessary, under their various circumstances, to properly deal with this subject; and

Resolved, second, that in the opinion of this Association it is imperative that immediate steps be taken to control the dissemination of the San José scale upon nursery stock by means of properly authorized inspectors in every State.

The executive committee reports back the preamble and resolution, deeming it inexpedient as a matter of general policy for this Association to attempt to influence legislation in the various States (see p. 110).

The CHAIRMAN. There being no objection, the report of the executive committee is approved.

Mr. GOODELL. I have here the report of the committee on entrance requirements, courses of studies, and degrees (see p. 54), which was referred to the executive committee. The executive committee recommend the adoption of the report of the committee on entrance requirements, courses of studies, and degrees, as presented by the committee, with this prefatory declaration, to wit:

That the schemes of studies presented for admission to the colleges and for graduation therefrom are suggestive and tentative, not to be considered as of necessity or binding upon the colleges which may assent to the adoption of said report, and subject, without prejudice as to equal efficiency, to such substitutions of other studies of equal and similar educative value for those named in the schemes as the peculiar conditions of the several colleges may make necessary.

Mr. WILSON. Before the question of adoption of the report is put I would like to have a discussion of this subject.

Mr. FAIRCHILD. While I should be very much pleased to have the four years of languages put in as elective with an equal quantity of exact or applied sciences, I am willing that the report should be adopted with the amendments which the executive committee have prefixed, provided that it be explicitly stated that the course is four years in length.

Mr. SMITH. It seems to me that if the report means anything, it is ill advised to introduce it now. If it means nothing, then there is no necessity for its introduction. Both our theory and our practice are not in accordance with the suggestions of the report.

Mr. WILSON. I desire to call attention to the fact that the report specifies a course of four years.

Mr. HARRIS. It means three hundred and forty hours, which may be distributed over two or three or four years. The recommendation of the committee was that it should be distributed over two years, but I see that it is printed here *four* years.

Mr. WILSON. Then it should be corrected.

Mr. WASHBURN. It has been suggested by a gentleman here that his trustees would not be in favor of putting in two years in the study of modern languages. Then do not do it. Nobody has asked it. He says it is not of any advantage to the farmers of his State. That may be true. The question is, What shall we give for a degree of bachelor of science, and only that? The only point the committee, as I understand, wants to make, is the minimum amount of work which should be given to the students who receive the degree of bachelor of science. The same colleges that are giving that degree can take in men who do not know how to read and write. If they can do some of the practical and laboratory work, the colleges can take them in and educate them, but they do not want to put themselves on record as colleges giving charlatan degrees. That is the only point. If the agricultural colleges are going to give a degree, let them give a degree that is good for something, and educate any kind of a man as far as he can go.

Mr. SNYDER. I notice that according to this schedule 150 hours are given to physics and chemistry with 150 more for laboratory work. That is, this scheme proposes to give 300 hours to physics and chemistry (botany is not mentioned at all), and to give 340 hours to modern languages, for the degree of bachelor of science.

Mr. WASHBURN. The report is not a course of study. It is only a framework, and represents only about two fifths of the work.

Mr. SNYDER. Then the other three-fifths ought to be indicated.

Mr. WASHBURN. You can fill that out as you please.

Mr. SNYDER. If this report means anything, it means that more time should be given to modern languages than to science.

Mr. FAIRCHILD. Bachelor of science does not mean languages. It does not in any sense of the word mean that there must be a certain amount of foreign or ancient languages, and among the scientific men of our country to-day there are many who have mastered the tools of science outside of such a course of study, and only because they had the training in science and because they found their way to these tools through science.

Now this report emphasizes the foreign languages in a way which to my mind is unnecessary. I have been connected for thirty-two years with colleges which have not taught the languages as necessary to the degree of bachelor of science, and yet out of those colleges have come some of the best men whom you can recognize here to-day. Is it right and proper to insist that modern languages are necessary for the degree of bachelor of science when it may not be required for the degree of bachelor of arts? Why emphasize language in such a proposition?

Mr. MYERS. There is so much division in regard to this matter that I move the report be referred back to the committee.

Mr. WILSON. This motion permits some discussion and I want to say but a word. I came here almost entirely for the purpose of getting some light to assist me in building up a four-year agricultural course. We have been stumbling six years to do that, and recognizing your great ability in other directions I supposed there would be no trouble in getting some light on how to teach agriculture. It is not a question of arranging curricula of the ordinary studies, but what are we going to do with the farmer's boy whom we take from the farm and send back to help educate the neighborhood? That is what brought me over the Mississippi and across the Alleghany Mountains.

Now, the only place where you would interfere with us would be in the requirements of algebra. We have boys who live about 20 miles from where algebra is taught, and if they come without a knowledge of algebra we must send them home or take them as we find them. At our own solicitation our trustees permitted us to take such boys in and begin with algebra, and when graduation came they were not behind the others. These husky farm boys always account for themselves. It is not a question about entrance. You can leave that to our judgment. It is a question of graduation. What the people want to know is what we are doing as educators. It is not a question whether we are going to measure ourselves up along side of the classical colleges and see how near we come to them. The question is, What are we doing for the farmer's boy and the mechanic's boy? I regret that this question has been raised here at all at this time.

Mr. MYERS. I move to refer this matter back to the committee for further consideration and report.

Mr. WHITE. Let me suggest that if the convention should be pleased to adopt the report of the executive committee, it would be a reference of the entire matter to the committee of the whole, which would be a recommittal to the small committee that originally had it in charge. If the members of the convention will bear in mind the exact phraseology of that preamble it will be observed that the whole scheme is accepted tentatively. I think we should study it carefully and come back next year with suggestions looking to its improvement. If you refer it back to the committee it will disappear from the sight of the convention and all of us who have not charge of its consideration. I think it would be better to adopt the report of the executive committee and let it be printed in the proceedings of this Association.

I therefore move the previous question on the adoption of the report of the executive committee.

Mr. MYERS. The motion before the house is to refer that matter back to the original committee.

Mr. MURKLAND. A pretty full view of every objection which has been urged was taken by the committee, and it was because of such objections and because the committee viewed them in every light in which they could see the objections, that the report was presented in its present form. To refer it back to this committee would attain no worthy end, and it seems to me that the question really is whether or not we wish to have these colleges stand for anything before the people of the country. It is a question, as the gentleman from Iowa has suggested, as to the manner in which we are administering the trust referred to us by the land-grant acts, acts by which we are absolutely compelled to maintain our institutions upon a collegiate basis; and with a desire to emphasize the determination of these colleges to carry out the provisions of these acts in strict loyalty and in perfect honor these resolutions have been presented. To refer them back to the committee would seem to imply—I do not say it would—but it would seem to imply that we are unable to meet the absolute requirements that Congress has imposed upon us. As to the question of detail, much has been said and ably stated by other members of this committee.

It was my great pleasure for a few moments yesterday evening to meet the honorable gentleman who so thoroughly represents the cause of education in the national administration, and to leave with him a copy of this report with the hope that he might be with us this morning. I am delighted to see that he has just entered the hall, and I will gladly surrender any time which may belong to me to the Hon. William T. Harris, Commissioner of Education.

The CHAIRMAN. I speak the sentiment of this convention when I request that Dr. Harris give us his views on this or any subject which is before us.

Commissioner HARRIS. I know very little about the instruction in agriculture in the colleges, although I confess to a great deal of interest in it. I have looked over the report of your committee and must say that it seems to me to be a very wise report. It gives mathematics to the student of agriculture. It takes up the principles of numbers and the philosophy of space in geometry and the application of that knowledge in actual practice, in surveying, mechanics, etc. The fundamental principles of time and space have been wisely placed by your committee first in the list of studies recommended as requirements for the bachelor degree. They furnish the great basis for dealing with the world of matter or world of motion. Physics and chemistry are properly placed after mathematics by this committee because they are an application of mathematics.

We find next, English language and literature, to which the committee assigns 200 hours. Now the farmer's boy wants to know the great literary productions of the human race, because this knowledge will aid him in judging human nature. The person who knows human nature is of course armed at all points against imposition.

Mental science is put in the course. A citizen as well as a farmer should have some knowledge of that. This represents only 40 per cent of the programme. Sixty per cent of the programme is left for other things.

It is the intention, I suppose, to fill up the 60 per cent of the programme not named with studies that will develop and make practical this directive power. The study of algebra, chemistry, physics, foreign languages, logic, and the like, would seem to fit him for some other industry or for a profession, but 60 per cent of his time is used in gaining directive power. In general, I believe that the object of the agricultural colleges should be to take the boy from the farm, make him a man of directive power, and put him back on the farm.

Now, I wish to say a word in closing of the relation of the farmer to the other kinds of industry, and call attention to an obvious fact, which is that these colleges tend more toward mechanical industry than they do toward farming. I suppose everyone admits that. The instruction in agriculture has not been reduced to a pedagogical form. The agricultural colleges, therefore, have had to begin with raw material, as it were, and work it into shape, and have thus been at a disadvantage. I want to say, however, that it is a good thing that mechanical industries are so intimately connected with agriculture in these colleges.

The report of the committee was adopted by a rising vote of 34 ayes to 11 noes.

Mr. GOODELL. I have here a resolution introduced by Mr. Hamilton, of Pennsylvania, having reference to the publication of books connected with agriculture. (This resolution is given in Professor Hamilton's address, on page 50.)

The executive committee report back this preamble and resolution and recommend that a special committee of three, to be known as the committee on farmers' institutes, be appointed by the president to consider all matters pertaining to farmers' institutes and report at the next convention, and that Professor Hamilton's paper be referred to it for consideration.

Carried.

Mr. GOODELL. I am instructed by the executive committee to give an opportunity at this time for anyone desiring to present an invitation for the meeting of the convention next year.

Mr. LIGGETT. On behalf of the board of regents and the faculty of the Agricultural College of Minnesota, I extend to you a most cordial invitation to meet with us next year, and in doing so I would suggest that a summer meeting be held, because I think it would be very much more enjoyable.

Invitations were also extended from the experiment station at Geneva, N. Y., by W. H Jordan, and from the station at Wooster, Ohio, by C. E. Thorne.

(At this point Senator Morrill appeared in the hall and met with an enthusiastic reception.)

Mr. MACLEAN. I wish to say that the committee on name of the Association has agreed unanimously on a report, and if the convention is in the same frame of mind as the committee, it might be well to let that committee report at once and have a long rest upon the subject of name.

We agreed to have a name which would describe just what we have in the most direct English possible, and we all agreed in that these colleges, without being limited in their liberty, are primarily for agriculture and the mechanic arts; and that the experiment stations should retain a place in the name of the Association. We believe there will never be peace in this Association so long as we have a descriptive name that ignored the mechanic arts.

After prolonged discussion, which was carried into the evening session, the resolution to change the name of the Association was lost by a vote of 37 to 16.

The CHAIRMAN. It will give us great pleasure to hear from our old friend and father, Senator Morrill.

Senator MORRILL. Mr. President and gentlemen, I am sure that I did not come here for the purpose of making a speech when all the new members who are present are loaded with one and anxious to get it off. I am not present for the purpose of making any observations. I know not what topic is under consideration. I do not wish to interfere with it, but my own impression is that the agricultural colleges and experiment stations are all in a tolerably prosperous condition, and therefore I am here for the purpose of seeing some of my old friends that I used to see thirty odd years ago when I was laboring to get the institutions established. As these institutions seem to be established permanently, I do not think that I have now any further observations to make.

Mr. SMART. I desire to make a report from the committee on nominations, which I will ask the secretary to read for me:

Your committee appointed to nominate officers of the Association for the ensuing year and to name the committee on nomenclature have the honor to present the following recommendations:

For President.—G. T. Fairchild, of Kansas.

For Vice-Presidents.—(1) M. H. Buckham, of Vermont; (2) James Wilson, of Iowa; (3) J. M. McBryde, of Virginia; (4) A. Kingsbury, of New Hampshire; (5) J. E. Stubbs, of Nevada.

For Secretary and Treasurer.—J. H. Washburn, of Rhode Island.

For Executive Committee.—H. H. Goodell, of Massachusetts; H. C. White, of Georgia; A. Cope, of Ohio; T. J. Burrill, of Illinois; and the ex officio members provided for by the constitution, the president, the junior ex-president (S. W. Johnson, of Connecticut), and the secretary and treasurer.

For Bibliographer.—A. C. True, of Washington, D. C.

For Committee on Nomenclature.—H. P. Armsby, of Pennsylvania; E. H. Jenkins, of Connecticut; S. M. Tracy, of Mississippi; C. P. Gillette, of Colorado; and A. C. True, of Washington, D. C.

On motion of G. W. Atherton the secretary was instructed to cast the vote of the Association for the officers named by the committee.

Mr. ATHERTON. The Association here assembled represents institutions which are all the legislative children of our honored friend who has already addressed us. We all feel in this Association something of the inspiration that comes from contact on the one side with the Government of the United States and on the other with the great propelling life of the people of this great democracy moving forward to a destiny which we all believe in, so magnificent and unparalleled; and as the act of 1862 was the first to put into definite form the germ of that conception which is so vitalizing and revolutionizing the educational ideas and methods of the United States, and as Senator Morrill will always remain connected with that great act as the first interpretation of that great impulse and inspiration, I am sure that all of us would like to have an opportunity to take him by the hand, if the burden to him would not be too great, as we pass out in adjourning.

I move that we now adjourn, in order that we may have an opportunity to pass in review and express to Senator Morrill our warm and affectionate regard and reverence.

Mr. GOODELL. I will second that motion. Permit me to give a notice before it is put. Immediately after adjournment the Association will proceed to the National Hotel, where the Patrons of Husbandry are now in session, and exchange fraternal greeting. Returning from lunch at precisely 1 o'clock the members will assemble in the East Room of the White House for the purpose of calling on President Cleveland.

Thereupon the motion of Mr. Atherton was carried, and the convention adjourned.

EVENING SESSION, THURSDAY, NOVEMBER 12, 1896.

The general session convened in Grand Army Hall at 7:30 p. m., President S. W. Johnson presiding.

The CHAIRMAN. The chair will announce as members of the committee on farmers' institutes, C. W. Dabney, jr., of Washington, D. C.; W. H. Jordan, of New York, and W. A. Henry, of Wisconsin. As the members of the committee on seed testing, E. H. Jenkins, of Connecticut; G. H. Hicks, of the U. S. Department of Agriculture; G. McCarthy, of North Carolina; F. W. Card, of Nebraska, and W. R. Lazenby, of Ohio.

Mr. GOODELL. There is a large amount of business to be transacted this evening, and I move that the evening be devoted simply to business and not to the consideration of other matters on the programme.

Carried.

Mr. ALVORD. A special committee was appointed at the ninth annual convention of the Association at Denver, with instructions "to codify the resolutions and declarations of previous meetings of this Association concerning uniformity in action on the part of colleges and stations in matters of common interest," which committee now respectfully reports:

The printed proceedings of eight annual conventions, and such records of the Washington convention of 1887 as exist, have been carefully examined. From these all resolutions and declarations which may be included by the language defining the duties of this committee and a few other declarations of the Association regarding its own affairs which it seems desirable to bring together and present for review have been copied. These abstracts have been arranged according to their character and bearing, with notes showing when and where adopted and where printed. In a few instances phraseology has been changed to preserve uniformity, without altering the meaning; and in two cases two separate resolutions have been consolidated and rewritten, preserving the original intention. Thus prepared, the result is herewith submitted for the action of the Association.

Instead of reading this report in full, which, as you can very well understand, is somewhat voluminous and could not well be followed, I take the liberty of submitting the following motion: I move that the report of the special committee upon codifying the resolutions and declarations of previous meetings of this Association be accepted and referred to the new executive committee, with instructions to edit the same, including the resolutions and declarations of this convention, and that the whole be printed and submitted to the next annual convention of the Association, with such recommendation as the committee sees fit to make in connection therewith.

Carried.

Mr. GOODELL. At the request of the Section on Entomology, I present the names of officers elected to serve during the ensuing year: A. D. Hopkins, of West Virginia, chairman, and M. V. Slingerland, of New York, secretary. I move their confirmation.

Carried.

Mr. GOODELL. I am instructed by the executive committee to offer the following resolution: "*Resolved*, That the dues for each college and each experiment station in this Association be fixed at $10 for the year 1897." I move its adoption.

Carried.

Mr. GOODELL. I also offer the following resolution, recommended for adoption by the executive committee:

(1) Inasmuch as a large amount of experiment station work has been reported since the Handbook of Experiment Station Work was issued, this Association would respectfully urge the Honorable Secretary of Agriculture to arrange for the preparation of a revised edition of this useful publication by the Office of Experiment Stations at an early day.

(2) Inasmuch as a large part of the work of the United States Department of Agriculture is along lines kindred to those of the experiment stations, it is deemed by this Association highly desirable that the revised edition of the handbook should include summaries of the work of the Department as well as of the stations.

(3) There is, in the judgment of this Association, great need of a general index of the publications of the Department, and as the preparation of such an index would almost necessarily precede the making of summaries of Department publications for the handbook, it is hoped it will be practicable for the Department to undertake at once the preparation of this index.

Adopted.

Mr. GEORGESON. I present the names of officers of the Section on Agriculture and Chemistry, as follows: Chairman, W. H. Jordan, of New York; vice-chairman, C. D. Woods, of Maine; secretary, H. J. Waters, of Missouri.

Confirmed.

Mr. EARLE. I present the names of officers of the Section on Horticulture and Botany, as follows: Chairman, P. H. Mell, of Alabama; secretary, L. C. Corbett, of West Virginia.

Confirmed.

Mr. DAVENPORT. I present the names of officers of the Section on College Work, as follows: Chairman, H. C. White, of Georgia; vice-chairman, A. W. Harris, of Maine; secretary, E. Davenport, of Illinois.

Confirmed.

Mr. STUBBS. I present the following resolution:

Resolved, That the executive committee be charged with the editing and publication of the proceedings of this convention, in cooperation with the United States Department of Agriculture.

Carried.

Mr. ATHERTON. Without going very much into an explanation and taking up the time of the Association, I move the appointment of a committee of three to revise the constitution of the Association and report at the next annual convention. There are various reasons for doing this which I have not the time to go into now, and some of which are not quite definitely formed in my own mind.

When the Association was first formed we were entering upon new and untried ground. The pendency of the Hatch Act was the first inspiration to the formation of an Association, and after the act had been passed it was deemed that this Association might do valuable work in connection with the stations established under it, and also in connection with the colleges of which the stations were branches.

The time has come, I think, for us to review the ground over which we have passed, and I move the appointment of a special committee of three to report upon the provision of the constitution, and, if possible, submit a draft of a revision at the next convention of the Association.

Carried.

The CHAIRMAN. I now announce the committee on revision of the constitution, as follows: J. H. Smart, H. E. Alvord, and the chairman of the executive committee.

Mr. EARLE. The Section on Horticulture and Botany wishes to report.

The attention of the Section on Horticulture and Botany was called to that portion of the report of the committee on uniformity in station nomenclature relating to horticultural terms; and, after some discussion, it was moved and carried to amend the last sentence in the definition of the term "acclimatization" by placing it in parenthesis and making it read "(the distinction between this term and acclimation is not generally carefully drawn, but acclimatization is preferred for scientific uses)."

As thus amended, the adoption of this portion of the report was recommended. The amended report of the committee on nomenclature is as follows:

RECOMMENDATIONS OF THE COMMITTEE ON UNIFORMITY IN STATION NOMENCLATURE.

The committee recommends:

(1) The adoption of the following by-law:

PROPOSED BY-LAW.

There shall be a standing committee of five on nomenclature. The director of the Office of Experiment Stations shall be ex officio a member of this committee, and the remaining four members shall be elected at the same time and in the same manner as other officers of the Association, and shall hold office for the same term. The committee shall elect its own chairman.

It shall be the duty of this committee to recommend to the Association such action as, in its judgment, will tend to promote uniformity and simplicity in the nomenclature used in station publications. Such recommendations shall be transmitted to the executive committee, and by it communicated to the director of each station at least thirty days before the annual convention.

In making such recommendations it shall be the duty of the committee to take into consideration any action by other organizations bearing on this subject, and to cooperate with such organizations, so far as practicable, in securing uniformity of usage between station workers and others in the same field.

(2) That the Association recommend to the several stations the uniform use of the following terms, with the significations appended:

A.—FIELD CROPS.

Maize (*Zea mais*).—Used when speaking of the plant in general.
Indian corn.—The grain of maize.
Corn forage.—The maize plant when fed without the removal of the ear.

Corn stover.—The maize plant after the ear has been removed.
Silo.—A structure in which green forage is preserved.
Silage.—Green forage preserved in a silo.
Siloing.—The process of preserving green forage in a silo.
Cultivation.—Stirring the soil by means of a cultivator.
Culture.—Refers to all methods by which a crop is improved or produced.
Tillage.—Stirring the soil by means of any implement for the purpose of growing a crop.

B.—BREEDS AND BREEDING.

Pure-bred.—(Not thoroughbred or full-blood.) Refers to the progeny of the members of a class of animals having like characteristics which are uniformly transmitted.
Grade.—An animal descending from common stock, but having more or less of the blood of some pure breed.
Cross, or cross-bred animal.—The direct cross of two pure-bred animals of different breeds.
Reversion.—(Not atavism, throwing back, or breeding back.) The process by which qualities are inherited from grandparents or more remote ancestors.

C.—FEEDING STUFFS.

[1] *Protein.*—(Not crude protein.) Total nitrogenous matter. Analytically, total nitrogen multiplied by 6.25 or other conventional factor.
[1] *Albuminoids.*—Coagulable nitrogenous matter. Analytically, albuminoid nitrogen multiplied by 6.25 or other conventional factor.
[1] *Nonalbuminoids.*—Noncoagulable nitrogenous matter. Analytically nonalbuminoid nitrogen multiplied by 6.25 or other conventional factor. (Should not be used to designate nonnitrogenous matters.)
Terms like "flesh formers," "tissue builders," and the like should only be used as explanatory terms.
Ether extract.—(Not fat or crude fat.) The material extracted from the dry feeding stuff by dry sulphuric ether.
Digestible fat.—The digestible portion of the ether extract.
Carbohydrates.—(Not carbhydrates.)
Fiber.—(Not "woody fiber" or cellulose.) The residue from the Weende method or its modifications.
Nitrogen-free extract.—(Not carbohydrates nor soluble carbohydrates.) Total dry matter minus ash, protein, fiber, and ether extract.
Digestible carbohydrates.—The sum of the digestible fiber and digestible nitrogen-free extract.
Pentosans.—(Not pentoses.) Total material yielding furfurol.
Individual substances in any of these groups should be designated by their scientific names.
The digestible portion of any of these groups should be designated by prefixing the word digestible to the proper name, as "digestible protein," "digestible albuminoids," "digestible fiber."
It is suggested that in tables for popular use the digestible fat be multiplied by 2.25, the digestible carbohydrates added, and the sum entered as "digestible carbohydrates and fat," the fact of the multiplication being explained in the text.

D.—ANIMAL CHEMISTRY AND PHYSIOLOGY.

[1] *Protein.*—Total nitrogenous matter.
[1] *Albuminoids.*—A collective term for albumen, globulin, fibrin, acid and alkali albuminates and other coagulable nitrogenous substances.
[1] *Collagens.*—A collective term for mucin, collagen, elastin, keratin and related bodies.
[1] *Proteid.*—Use only as an adjective; thus, proteid metabolism = the metabolism of protein.

E.—DAIRYING.

[1] *Protein.*—Total nitrogenous matter of dairy products.
[1] *Casein.*—The nitrogenous matter of milk coagulable by acids or rennet.
[1] *Albumen.*—The nitrogenous matter of milk coagulable by heat.
Curd.—The total precipitate produced in milk by the addition of acids or rennet.
Other nitrogenous matter should be designated by their scientific names.
Lactose.—(Not lactin.) The sugar of milk.

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[1] Recommitted for further consideration.

Fat.—(Not fats nor butter fat.) The glycerids of dairy products. When a distinction is to be made, as in case of oleomargarine or filled cheese, the term "butter fat" may be used.

[1] *Sterile.*—Free from all germs.

[1] *Sterilized.*—Sterilized products are those which have been heated to 100° C.; they are not necessarily germ free, although they may be.

[1] *Pasteurized.*—Pasteurized products are those which have been heated above the thermal death point of the vegetative organisms, but below the coagulating point of the albumen (60°-70° C.).

Pure culture.—A culture containing but a single organism.

Starter.—A culture of any nature used to start a fermentation.

Natural starter.—A starter prepared by the spontaneous fermentation of milk products.

Culture starter.—A starter made by introducing a pure culture into a pasteurized or sterilized milk product.

Acidity.—The acidity of dairy products should be expressed by the per cent of acid calculated as lactic acid.

F.—HORTICULTURE.

Acclimation.—The spontaneous or natural process of becoming, or the state or condition of being, inured or accustomed to a climate at first injurious.

Acclimatization.—Generally used in a more active sense than acclimation, as denoting the positive means or acts (as of man) in causing an organism to become inured to a climate. (The distinction between this term and acclimation is not generally carefully drawn, but acclimatization is preferred for scientific uses.)

Development.—The growth or life history of the individual.

Evolution.—The doctrine which supposes that one form of life may give rise to another form. The life history of the race.

G.—ENTOMOLOGY.

The committee recommends that the following general rules as to the adoption and use of common names for insects be adopted, but that action on specific cases be deferred to the next convention.

(1) No common name shall be applied to more than one species of insect.

(2) A single species of insect in any one stage of development shall have but one authoritative common name. It may have different common names for the different stages, e. g., apple worm and codling moth.

(3) When other than the authoritative name is used it should be made secondary in importance, e. g., the bollworm, also called "corn worm."

(4) Priority should be given due consideration, but should never be allowed to fix an inappropriate name on any species.

(5) As a rule, it is better to use a common name that will associate an insect with its food plant or host or with some well known habit or peculiar appearance of the insect. Twig girdler, bagworm, and saddle-back caterpillar are good examples of such names.

(6) The scientific name of an insect treated should always be given whether the common name is mentioned or not.

H. P. ARMSBY,
S. M. TRACY,
E. H. JENKINS,
THOS. F. HUNT,
C. P. GILLETTE,
Committee.

Mr. ARMSBY. I move that all definitions of the terms relating to the nitrogenous constituents of feeding stuffs, animals (and dairy products), be referred to the standing committee on nomenclature for further consideration, and that the remainder of this report, with the amendment proposed by the Section on Horticulture and Botany, be adopted.

Mr. PLUMB. A distinction is made between the terms "sterile" and "sterilized." I would like to have a statement made on that point.

Mr. ARMSBY. So far as the chairman of the committee is concerned, he can only state that these definitions were prepared by Dr. Babcock and were adopted by the committee exactly as he prepared them. As I understand it, the logical discrepancy

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[1] Recommitted for further consideration.

was thought not to be so important as might appear on the *face* of it. If gentlemen think it desirable, I am perfectly willing to include this also.

Mr. PLUMB. Sterilized milk is not sterile milk.

Mr. SMITH. We use the word sterilized exactly in the sense adopted by this committee; but the word sterile, if used in the same way, will have to be applied to milk and sterilized milk will have to be called sterile milk if we are logical in our etymology. Sterilized milk means milk that has been heated to 100°

Mr. EARLE. Will everybody else use that word in the same sense? I think not. I therefore ask that the report be referred back to the committee. I think the word sterilize has been in scientific use too long to be tampered with and that a dairyman should manufacture a new name in order to meet the requirements.

Mr. PLUMB. I move that these terms be referred back to the committee.

Carried.

Mr. WASHBURN. The Section on Mechanic Arts nominates the following officers: Chairman, C. S. Murkland, of New Hampshire; Vice-chairman, W. F. M. Goss, of Indiana; Secretary, F. Paul Anderson, of Kentucky.

Confirmed.

Mr. WOODS. The committee on auditing has examined the accounts of the treasurer and reports as follows:

Your committee, appointed to audit the treasurer's accounts, begs leave to report that it has examined the same and finds them correct, with properly approved vouchers for each item of expenditure, and finds that there is a balance on hand of $475.45.

CHAS. D. WOODS,
C. FRANK ALLEN,
J. E. STUBBS,
Committee.

Accepted.

The CHAIRMAN. I appoint upon the committee to wait upon President-elect McKinley (see p. 31) G. W. Atherton, J. E. Stubbs, J. H. Smart, and H. H. Goodell.

Mr. ATHERTON. I am instructed by the committee to report the following resolution on the death of Hon. Edwin Willits:

Resolved, That this Association desires to place on record its deep sense of irreparable loss in the recent death of the Hon. Edwin Willits.

As one of the early and efficient promoters of the legislation out of which this Association grew, as one of its original members, and always the devoted advocate of the interests which it represents, as a public official of pure and stainless record, as an educator inspired with the highest ideals, as a citizen constantly engaged in efforts for the benefit of his fellow-men and striving to elevate the standard of civic life, as a gentleman of fine intelligence and unfailing courtesy, as a loyal and faithful friend, in fine, as a typical representative of complete and well-rounded American manhood he will always be enshrined in our loving remembrance.

Resolved, That this resolution be entered on the minutes of the Association and a copy sent to his surviving family.

By the committee.

GEO. W. ATHERTON.
ALEX. Q. HOLLADAY.
CLINTON D. SMITH.

Adopted.

The convention then adjourned sine die.

MINUTES OF THE SECTIONS.

SECTION ON COLLEGE WORK.

Two sessions of the Section on College Work were held in the parlors of the Ebbitt House November 10 and 11, the vice-chairman of the section, President J. E. Stubbs, of Nevada, presiding. The sessions were devoted entirely to papers and addresses on the question, "What should be taught in our colleges of agriculture?" and on "The exodus from the farm." The first address was delivered by G. T. Fairchild, of Kansas, as follows:

What Should be Taught in our Colleges of Agriculture?

In treating the subject "What should be taught in our agricultural colleges?" I shall make certain assumptions, without taking your time in argument to prove them. To me they seem fundamentally grounded in the object of these colleges, as stated in the organic act of 1862.

First. I assume that we are to aim directly at the inspiration and cultivation of scientific modes of thought in agriculture among the multitude. No mere expert training of the few can open to the industrial classes the liberal education promised and provided for by Congress. These colleges must attract the multitudes to their halls.

Second. It is safe to assume that the results of genuine research and experiment by highly trained experts must be accepted and utilized by a body of educated farmers sufficiently alive to the interests involved to appreciate principles and apply them with such modifications as sound understanding may require. The uneducated farmer asks for a rule of thumb, an explicit direction in detail; the educated farmer finds his rule for varying circumstances in the general principles established by research and experience. Unless the colleges of agriculture reach a considerable body of farmers with their liberalizing education there is little hope for a scientific agriculture.

Third. It is quite as evident that the moral and material support for scientific investigation of all phases of agriculture must come from such influences among the people, inspiring genuine desire for information. These fifty or more experiment stations will need the backing of a wide-awake, well-educated body of farmers in every State, or fail of support.

Fourth. I assume that the genuine experts for maintaining the rigid inquisition of nature must be found by the sifting process of a strong college course in line with agriculture. I see no other way of developing genuine talent and distributing it to the best effect than to draw into colleges a strong body of quickened minds, and eliminate the weak and uncertain by consistent training in the very lines of thought to be followed later. The experience of the past few years emphasizes the importance of the sifting process.

Fifth. It is safe to assume that any course which fulfills these requirements must be truly educational as well as instructive, and introductory rather than exhaustive. The training of human faculties to expert use requires a touch that recognizes all the phases of nature. Especially is this true in agriculture, where all of nature's laws must be obeyed to rule in any. To pour facts into memory will serve little purpose until the relations of facts are mastered by exacting scientific study in more than one direction.

To meet the conditions thus assumed, I propose plans that have already met a large measure of success in offering to the farmers' sons and daughters, fresh from their country schools, a general course of study in line with the industries of this life. It is absolutely essential that the way from the farm to the college shall not be interrupted. The city high schools do not and can not furnish the true line of training for the farm boy whose every sympathy is in the field and forest and farmyard. The trend of secondary schools is almost universally toward the need of the city in merchandise, manufactures, and professions. The inquisitive farm boy needs place for his natural development among the trees, grasses, crops, and herds, and machinery where all the great questions of his life are to be answered. The traditional curriculum has been the natural means of training in the use of books and the handling of men. The needed course must train in the handling of things and the use of nature, with books as mere tools.

To accomplish these ends of such a course of study, I would have a symmetrical development of body, mind, and sentiment along the most feasible lines of growth in my ideal farmer of liberal education. As fundamental in all study, a thorough training in the English language must stand first. If this is given through a comparison with other tongues I shall not complain, but the result must be English rather than linguistic information, or grammatical expertness.

For a good second in this liberal training I place an exacting study of mathematical principles and distinct applications of these in quantitive sciences like chemistry and physics. Form and quantity in all fundamental relations must be grasped as the basis of the universe.

The third essential is a symmetrical development of the descriptive sciences and the philosophies of organic life, as illustrated in all phases of plant and animal economy upon the farm. Soil culture in farm, orchard, and garden, the economy of farm machines, economic entomology, and vegetable and animal pathology must be so presented as to quicken the ingenuity of the student. Museum, class room, and library must display the riches of information open to inquisitive thinkers along these lines.

A fourth line of training should be in the arts of expression. To think and to express thought are essentially coincident and mutually dependent. Completeness of expression alone insures completeness of ideas. Hence all the definiteness that training in drawing—geometrical and free-hand—can give, should be coupled with good laboratory practice in all the sciences, and explicit training in composition and public address. I believe no better aid to exact thinking can be given than by training the voice to express by precise modulations the multitudinous phases of thought concealed in words.

Last, but not least, I put a training in manual dexterity, with the shop, the farm, the garden, and the greenhouse as the means. Nothing develops ingenuity and gives confidence equal to some form of manual training. The more general this is in developing dexterity rather than limited skill, the better education it gives for scientific agriculture for either profit or investigation. The more continuous it is, the more perfect the habit of devising and doing becomes.

Such a course I can give in outline without departing far from the tested curriculum of the Kansas State Agricultural College. I will try to present it in such form as to show progress along the five lines of training:

A course of instruction in agriculture.

FIRST YEAR.

English, etc.	Mathematics, etc.	Sciences.	Expression.	Dexterity.
The sentence.	Algebra.	Botany.	Free-hand drawing.	Woodwork.
Composition.	Algebra.	Bookkeeping.	Geometrical drawing.	Woodwork.
Etymology.	Algebra.	Elementary physics.	Physical laboratory.	Garden or farm.
			Rhetoricals and drill.	

SECOND YEAR.

Principles of horticulture.	Geometry, plane.	Inorganic chemistry.	Chemical laboratory.	Garden or farm.
Descriptive agriculture.	Geometry, solid.	Organic chemistry; Mineralogy.	Blowpiping.	Iron forging.
Dairy farming.	Geometry, descriptive.	Entomology.	Chemical analysis.	Farm and garden.
			Rhetoricals and drill.	

THIRD YEAR.

General history.	Trigonometry.	Physiology.	Surveying.	Farm and garden.
Civics.	Mechanics.	Zoology.	Topography.	Iron foundry.
Rhetoric.	Economics.	Agricultural chemistry.	Perspective.	Farm or garden.
			Rhetoricals.	

FOURTH YEAR.

English literature.	Advanced physics.	Agriculture.	Sketching.	Farm or garden.
Psychology.	Advanced physics.	Feeding and breeding.	Botanical laboratory.	Machine shop.
Logic.	Engineering.	Animal economy.	Thesis.	Specialty.
		Geology.	Rhetoricals.	

This course of four strong years rightly leads to the degree of bachelor of science, and is worthy the name for subject-matter as well as manner of training. From the numbers thus trained there will be a few whose bent of mind and love of research direct into definite lines of investigation. For these a variety of strong post-graduate courses of two or three years should be provided with the master's degree at the end conferred for original work carefully presented in a thesis. My preference is that such a course, in our colleges of agriculture, should couple the science pursued with one of the arts illustrating its economic applications. It thus gains a technical character most conducive to energy of purpose and action. The Kansas college in this way couples botany or entomology with horticulture. and chemistry or zoology with agriculture. The interest and the meaning of both are thus enhanced.

These students, in technical courses, should have every encouragement and aid in the use of literature of their science, through whatever language it comes. Comparatively little time is needed to gather the elements of a foreign grammar needed to read with understanding any book in a science already familiar, and with this object directly in view a student learns with surprising ease.

In conclusion, I emphasize again the importance of so adjusting the studies in an agricultural college as to give a liberal education of body, mind, and sentiment in tune with the end to be served—a genuinely scientific agriculture and a body of agricultural science.

The next paper on the same subject was presented by H. H. Goodell, of Massachusetts, as follows:

In an old book containing the wisdom of an age two thousand years older than the present I find this quotation: "How can he get wisdom that holdeth the plow and that glorieth in the goad, that driveth oxen and is occupied in their labors, and whose talk is of bullocks?"

Apparently the same need of instruction was as urgent then as now, and the tiller of the soil in the fertile plains of the eastern world felt there was something more to be desired than simply following day in, day out, the dreary routine his fathers had left him. That there were sources of information even then is evident from the fact that the wise Solomon could discourse of trees, from the cedar of Lebanon even to the hyssop springing out of the wall; and it is added that he spake also of beasts, of fowls, of creeping things, and of fishes. The same questions that stirred the heart of the agricultural seer so many centuries ago are pressing with renewed force now, and more light is sought on all the difficult problems that present themselves to the farmer of to-day. It is the mission of the agricultural colleges to furnish this light and lead the way.

I am asked to present this afternoon a brief paper on what should be taught in our agricultural colleges. Perhaps I can express myself in no way more clearly than by outlining to you the course at the Massachusetts Agricultural College. That has stood ever since its foundation, in 1867, for agriculture alone, instruction in the mechanic arts being supplied by the Institute of Technology, which has shared with it the proceeds of the grant of 1862 and the later one of 1890.

While it has been the purpose of the faculty to give the best possible instruction upon every subject taught, there has been no effort to expand the course beyond the proper limits of a simple professional school or to compete in any manner with other existing institutions. On the other hand, the college has from the outset been intended to be something very different from a mere manual-labor or farm school for training apprentices in the various operations of husbandry. Since the first few years manual labor has been entirely discarded, except in so far as it has an educational value—not how to plow and hoe, but when and where to do it to the best advantage. The hours of student life can be much more profitably employed than in mere manual labor, opportunities for which are everywhere presented, while the facilities for education are offered only at the college and for a limited period. More mind and less muscle is the watchword of to-day. In preparing the soil, in planting, in cultivating, in haying, in harvesting, in threshing, in the management of the dairy, in fact almost everywhere, intelligence is the principal thing, and mere brute force comparatively worthless. The old prejudice against thoughtful, studious, and progressive men as book farmers and fancy farmers has at length been overcome by the mass of printed matter which is flooding with light every household and by the numberless improvements which have been demonstrated to be not merely expensive luxuries for the rich, but of priceless value to every tiller of the soil. But to turn more directly to the curriculum itself.

This naturally divides itself into seven departments—the English, the agricultural, the chemical, the botanical, the mathematical, the zoological, and that of languages and social science.

(1) English has a place in the curriculum of the Massachusetts Agricultural College because of its practical value and its educational value.

By its practical value we mean its value in enabling the student to express his thought by oral and written language. Looking at the study from this point of view, we may name it the study of oral and written expression. The specific subjects and exercises set for securing this practical advantage from the study are these: Rhetoric, during the freshman year; declamations, during freshman and sophomore years; essays, in the freshman, sophomore, and senior years; orations in the junior year; logic and debates, in the senior year. The principal object in these exercises is to secure accuracy and facility in the use of the English language as an instrument by which thought is expressed.

In addition to these studies, American literature is studied in the sophomore year and English literature in the junior and senior years. While, as an incidental advantage, the student's style in writing and speaking may be improved and perfected by reading and studying the best works of the best authors, literature is studied chiefly for its educational value. As literature is one means by which the thoughts and aspirations of men are expressed, one can learn the history and progress of the thought of the American and English people from the study of American and English literature. The student's mind being thus brought in contact with the great minds that have adorned the pages of English and American history, his powers are quickened and developed thereby, his mental horizon is enlarged, and thus a most important educational advantage is secured.

(2) The agricultural course covers a field of such wide and varied extent that it is hard to compass it in a four-years' course. The graduates must know the origin and nature of soils and subsoils, and the proper treatment of each; the methods and advantages of the various kinds of tillage, and the modes of drainage and irrigation, with their cost and value. They must understand the worth and peculiar effect of every variety of mineral and organic fertilizers; the construction and use of all the implements and machines of improved husbandry; the best modes of planting, cultivating, and harvesting all sorts of crops, and the varieties of each which are most valuable for different localities and objects. They must be familiar with the characteristics of the different breeds of domestic animals and their various adaptations; with the proper modes of feeding for particular purposes, and of treatment in health and sickness, and with the principles of breeding. They must be acquainted with the keeping of farm accounts, the ordinary rules of business, and the legal rights and obligations of landholders; with the renovation of worn-out lands and the improvement of those which are new and rough; with the most desirable location and construction of farm buildings, the correct division of an estate into arable, pasture, meadow, and woodland, according to circumstances, and the building of roads, bridges, and fences. They must understand the use of rotation in crops; the management of the dairy; the cultivation of vegetables in the market garden and under glass; the raising of small fruits and their transportation and sale; the planting and culture of vineyards, orchards, and forest trees, and the theory and practice of landscape gardening, with the proper selection and treatment of ornamental plants. The strictly agricultural part of this course is carried on for eight terms, mostly by lecture, embracing the following topics: The history of agriculture, soils, drainage, irrigation, disposal of sewage, fertilizers, field crops, implements, breeds and breeding, dairy farming, cattle feeding, laboratory, and experimental work. The horticultural work covers six terms under the following heads: Horticulture, market gardening, landscape gardening, floriculture, sylviculture, care of greenhouses, and construction.

(3) The course in chemistry extends over nine terms, the last three of which are almost entirely laboratory work, eight hours per week. Commencing with lectures and practice in elementary chemistry, there follow in succession dry and humid qualitative analysis, lectures and practice in organic chemistry, chemical physics, and quantitative analysis. In connection with this is a series of lectures on the application of chemistry to the industries of life.

(4) Botany covers seven terms, embracing structural, analytical, economic with laboratory work, cryptogamic, and physiological. The course aims to treat of all the more important features connected with the study of plants which have a close bearing upon agriculture without at the same time deviating from a systematic and logical plan. Throughout the entire course the objective methods of teaching are followed, and the student is constantly furnished with an abundance of plant material for practical study, together with an elaborate series of preserved specimens for illustration and comparison. In the freshman year the study of structural and systematic botany is pursued, with some observation on insect fertilization. This is followed in the first term of the sophomore year by the systematic study of grasses, trees, and shrubs, and this during the winter term by an investigation into the microscopic structure of the plant. The senior year is given up entirely to cryptogamic and physiological botany.

(5) The mathematical course. In this day of scientific experiment, observation, and research on the farm, the advantages of a thorough knowledge of the more elementary branches of mathematics, general physics, and engineering must be more than ever apparent; and it is to meet the needs of the agricultural college student in these lines that the work in the mathematical department has been planned.

The mathematics of the freshman, sophomore, and junior years are required; those of the senior year elective. The sequence of subjects is as follows: Bookkeeping, algebra, geometry, and mechanical drawing in the freshman year; trigonometry, mechanical drawing, and plane surveying—the latter embracing lectures and field work in elementary engineering, the use of instruments, computation of areas, leveling, etc.—in the sophomore year; general physics—including mechanics, electricity, sound, light, and heat—and descriptive geometry or advanced mechanical drawing in the junior year; and, finally, two electives in the senior year, mathematics and engineering, respectively.

The mathematical option includes the following subjects: Fall term, plane analytic geometry, embracing a study of the equations and properties of the point, line, and circle and of the parabola, ellipse, and hyperbola; winter term, differential calculus, and summer term, integral calculus.

The senior engineering option is designed to give to the student the necessary engineering training to enable him to take up and apply, on the lines of landscape engineering and the development of property, his knowledge of agriculture, forestry, botany, and horticulture. It embraces a course of lectures, recitations, and field work on the following subjects: Topography, railroad curves, earthwork, construction and maintenance of roads, waterworks and sewerage systems, etc.

The engineering elective is intended to equip the student to enter a comparatively new field—that of landscape engineering, which is coming more and more prominently before the public attention; for with the increasing consideration which is being paid to the public health and the development and beautifying of our towns and cities come fresh needs and opportunities.

(6) The zoological course commences with one term of anatomy and physiology, followed by a term of laboratory work eight hours per week, in which each student is required to make dissections, use the microscope, and make drawings of his work. This is followed by one term of zoology, three of veterinary science, and four of entomology, the last three being optional, consisting largely of microscopic work and drawing eight hours per week.

(7) The seventh and last course embraces the modern languages, French and German, political economy, constitutional history, and a course of lectures on rural law, including the rights and obligations of landholders, and other subjects of practical importance to every citizen, whatsoever his profession.

I have now sketched more or less in detail the seven divisions of our agricultural courses. It is for three years rigid and defined, with liberty to select and specialize in the fourth. The structure is reared somewhat after this fashion: Agriculture the foundation; botany, chemistry, zoology, and mathematics the four corner stones, while the walls are solidly built up with English, horticulture, floriculture, and forestry on the one side; English, physiology, entomology, comparative anatomy of the domestic animals and veterinary on the other; English, mechanics, physics, and civil engineering on the third, and English, French, German, political economy, and constitutional history on the fourth. The study of the English is made the basis of all study. It is interwoven with every course. It is, in fact, the very warp and woof of every branch pursued. These seven courses, each distinct in itself, yet each aiding in the interpretation or solution of the difficult problems met with, require a four years' course. They proceed hand in hand, and the completion of a study in one department is coincident with that in another. Mutual help is the watchword. Each for all, but all for each, in laying broad and deep the foundation and building up the solid structure. Thus when the relations of the weather—of heat, air, moisture—to farming are considered, on the botanical side are being studied the structure of the plant—its organs, the relation of its root system to soil and moisture; on the chemical, the elements important in an agricultural point of view and their properties; and in the mathematical, such algebra and geometry as will lead on to practical work in surveying and drainage. So, too, when soils and tillage are under consideration, in like manner are studied plants beneficial or injurious to man, general geology, and those insects hurtful or otherwise to the crops. In short, the effort is made to have each course supplement and be in harmony with the other, and the different studies so fit into each other as to make one rounded whole.

H. J. Waters, of Missouri, read the following paper on the first subject:

It is perhaps one of the most fortunate circumstances connected with the creation of the agricultural colleges of the nation that the act of Congress bringing them into existence was broad and comprehensive enough with respect to their purposes and objects to admit of the teaching of a wide range of subjects. This was especially fortunate when it is considered that a large number of these institutions were to be brought into existence within a very short time, to be officered by men without special training and experience in teaching the branches of science directly relating to the industrial pursuits, and brought into existence at a time when industrial or technical education in America had scarcely begun.

The comprehensive charter with which each institution was vested at its birth permitted a reasonable amount of experimentation in the arrangement of courses of study, in methods of instruction, etc. This experimentation has proven invaluable in many ways. Then, too, this broad plane has given the greatest liberty of adaptation of courses of study to the peculiar needs of the different States of the Union. For example, a State having large mining interests would naturally find it most profitable to develop her system of technical education along the lines of mining engineering more rapidly and fully, relative to the other lines of work, than would be justifiable of a State whose agricultural interests largely predominated and whose mining interests were comparatively unimportant.

It is clear, therefore, that no definite scheme of studies equally applicable to the needs and requirements of all States and to the peculiarities of the public and high school system of the different States can be laid down. Nor is it, in my judgment, possible, except within very wide and general limits, to say what shall be and what shall not be taught in our agricultural colleges.

By the terms of the act we are compelled to admit that the leading object of these institutions is to teach such branches of learning as are related to agriculture and mechanic arts. And while express permission is given for the teaching of the classics, it is clear that they are not to constitute the leading object. In other words, the teaching of principles and the applications of the sciences to the useful arts is mandatory, while teaching the general culture studies embraced in the classics is entirely optional.

In the first place, it is held that the intention of the act was to establish and maintain colleges, and that the instruction should be of college grade. Within this limit it is further held that any subject directly relating to and promotive of any important industrial interest of any State may be properly taught by the land-grant college of the State, provided that in addition to its being useful it shall at the same time be in the highest degree educational. (The major proposition is intended to be inclusive, but not entirely exclusive.) Its converse, viz, that no subject not directly fulfilling these requirements is eligible to a place in the curriculum of any agricultural college is not necessarily true.

It appears to me to be a matter for each college to determine for itself whether it will attempt to take cognizance of all the important industrial interests or concentrate its efforts and funds upon a few of the more prominent ones. As to whether a given college shall offer courses in agriculture, mechanical, mining, civil, or electrical engineering, and domestic economy, or require all its students to pursue one course embracing the leading educational and industrial features contemplated in the law, should be left to the properly constituted authorities of that college to determine.

The general policy of the institutions with reference to the proportion of cultural and technical subjects offered in a course designed to cover a given industry is a proper subject for discussion by this body. By the letter of the law there is no restriction as to what these cultural subjects shall embrace—whether the classics, modern languages, psychology, or what not. While it is agreed upon every hand that in all cases provisions should be made in all courses for a reasonable amount of instruction that tends toward liberal culture, it is equally clear that the technical, the industrial, the useful instruction (those sciences relating to the several industrial pursuits) shall constitute the majors, in order that the training there imparted may be directed to some practical end. But it is insisted that our colleges of agriculture shall be broadened, that the training shall be more liberal. Let this broadening be in the direction of an increased number of distinctively technical courses of study, rather than in the introduction of a wider range of subjects in the courses themselves. Let each course be as severely technical as possible. Let agriculture constitute the chief and important subject in the course in agriculture, just as is law the essential element in a course in law, just as is medicine in the course in medicine. Let it be a professional course to fit the student to become a successful farmer, or a teacher or investigator of some branch of agriculture. Not in the teaching of agriculture alone should this rule apply, but to all courses maintained by the funds derived from the land-grant act and the acts supplementary thereto.

That such courses will not have a high educational value is denied. Until these colleges are able to turn out young men who can and will conduct the ordinary operations of a farm or garden, dairy or orchard more successfully than young men of similar ability who have not had the advantage of such training, the advisability, profitableness, and economy of an agricultural education will be problematical in the minds of the farmers. So long as the colleges are unable to demonstrate their usefulness to the farmer beyond a shadow of a doubt, so long will the general public rightfully question their value. So also the graduates from the engineering courses should be able to demonstrate by their lives and by their successes along the lines of their training that the expenditure of time and money in acquiring that education was a profitable investment. These results can not be secured with any degree of certainty so long as the courses of study are designed with reference alone to the discipline of the mind, and the acquisition of useful facts is overlooked entirely or made a mere incident.

The arrangement of the courses in engineering with reference to the character of the instruction and the methods of imparting it, with reference to the proportion of nontechnical or cultural instruction to technical, has been quite generally agreed upon. A glance at the schemes of studies of the engineering courses will reveal a general similarity, indicating an approximately unanimous judgment of the teachers in these courses and of the framers of them.

An examination of the courses in agriculture, however, convinces us that a large amount of experimenting in this line is yet being indulged in by our colleges. There is not that similarity in composition, in arrangement of studies, already noted in the engineering courses. Contrasting two courses in agriculture representing the extremes in these regards, we have required for graduation in the four years' course in College A, 49.9 per cent general culture, 24.6 per cent nontechnical scientific, and 25.4 per cent technical; College B, 8.1 per cent general culture, 39.3 per cent nontechnical scientific, and 52.6 per cent technical. That is to say, that in College A 49.9 per cent of the student's time is devoted to general culture subjects, such as English, mathematics, history, political economy, etc., 24.6 per cent of the total hours required for graduation is given to the study of sciences more or less related to agriculture, and but 25.4 per cent of his time is given to the study of the application of these sciences, to the successful pursuit of agriculture, and to a study of the art and practice of agriculture.

In College B these percentages are, as stated above, 8.1 per cent general culture, 39.3 per cent nontechnical scientific, and 52.6 per cent technical. These two colleges represent two important agricultural States in the Union; their requirements for admission are not essentially different; the public and high school systems of the two States are quite similar, and presumably about equally developed, and, finally, the agriculture of these two States does not differ materially. Yet the policies of these colleges are as strongly opposed one to the other as they could well be when attempting to accomplish the same purpose. Each college claims a prominent place in the front ranks of agricultural educators, and points to its courses of study as evidence of the correctness of the claim.

A majority of the colleges of the country have made their courses a happy medium between these extremes, approximately as follows: General culture, 24; nontechnical scientific, 46; and technical, 30.

Although one prominent college included in the average requires but 18 per cent of technical work, the proportion of technical work required in their courses in agriculture by these more conservative colleges does not compare with the amount insisted upon in the engineering, medical, law, and other professional courses. It is insisted from the outset that the course in agriculture is a professional course, and as such this profession for which it purposes to fit men is of prime importance.

But what of the training for citizenship in this course is instantly demanded? I answer, what of the citizen engineer, what of the citizen physician, what of the citizen minister? Is the farmer as a citizen expected to play a more important part than the engineers educated by our land-grant colleges? Is he less likely to have acquired under the parental roof, in the public schools, the same amount of patriotism, the same amount of knowledge of the proper administration of governmental affairs, than is the student who goes into any other of the professional courses? Is the student in agriculture less likely to acquire that knowledge necessary for the highest duties of citizenship upon his own motive and in his experience in college and in after life than are other professional men? It is believed that all of these questions carry their own negative answers.

The following paper on the subject was read by H. C. White, of Georgia:

I am asked to discuss, in a short paper, the subject "What should be taught in our colleges of agriculture?" The use of the possessive pronoun in the title somewhat limits or at least gives definiteness to the range of the discussion. The question, I take it, is not "What should be taught in a college of agriculture?" but rather "What should be taught in the colleges whose representatives are brought together in this Association?" The distinction is important in its bearing upon the discussion in hand. In order to determine what should be taught therein it is proper to inquire what a college of agriculture is or should be. Assuming agriculture to be a distinct profession or pursuit in which men are to engage who are specifically and technically trained to that end, I can very well understand that there might be a college or school of agriculture as there are colleges or schools of medicine, law, theology, engineering, music, art, and other so-called professions. In such event the college of agriculture, in determining what and how it should teach, could probably do no better than to follow closely the example set by these other professional schools in the character and scope of the teaching which they offer and upon which they have determined after long years of experience and historic development. I think it is true that the primary function of these schools is the teaching of the great body of rules of practice or procedure in the several professions, with incidental exposition of the scientific or dogmatic principles upon which the rules are based. It is acquiescence in these rules, indeed, which is professed; the recognition of their reasonableness and soundness which give character to and uniformity in the tenets of the profession. Now, in order that such teaching may not be the mere inculcation of blind empiricism, these institutions take for granted (at least the best of them do and all of them should) that their matriculates have already been educated—have had their store of general information, their powers of observation, and their faculties of reasoning already developed by the educative processes of the school, the academy, and the college. Law, medicine, theology, etc., are "learned professions," not so much because the pursuit of them necessarily develops learning, but because, properly, only those should engage in them who are already "learned," in the sense that they are truly educated and so equipped that they are properly prepared to acquire increasing learning with increasing years.

The schools which teach these professions are, in fact (or should be), technical training schools in specific lines. They are not truly, except incidentally, educational institutions at all. So, perhaps, should be a true "college of agriculture." Now I do not say that the practice of "agriculture" may not eventually be (or, indeed, is not now, for that matter) competent of exposition in a code of general rules of procedure such as those which are accepted as at the basis of the practice of law, medicine, or theology. But I think we must all admit, at least, that as yet these rules have not been framed to what our distinguished friend, Dr. Harris, so aptly characterizes as a "pedagogic form." As yet they have not been so systematized as to come within the province of the teacher. So long as this is true, therefore, in the sense which I have endeavored to convey, a genuine "college of agriculture" is, perhaps, without existence or the possibility thereof.

Undoubtedly it is extremely desirable that this great industrial art, the practice of which in these latter days has become indeed worthy to rank as a learned profession by reason of the manifold applications possible therein of the great stores of learning achieved in many of the branches of human investigation and research—particularly in the physical sciences—should speedily have its rules of procedure reduced to such form as will bring them within the legitimate domain of the "pedagogue"—he who "leads the children" to think and act aright in all the works of their heads and hands. We who form this Association are perhaps of all men those most interested to that end. One object of this immediate discussion, no doubt, is to elicit an exchange of opinion upon that subject.

Waiving this point for the moment, however, and turning to consideration of "our" colleges, what is it that should be taught in them?

As most clearly setting forth the objects and character of these institutions, I will be pardoned for quoting the familiar text of the laws establishing them, which I do, not merely to state their provisions, but also to approve heartily thereof. Each of them is a college—not an academy or a school; its function "to promote the liberal and practical education of the industrial classes;" its "leading object · · · to teach such branches of learning as are related to agriculture and the mechanic arts · · · without excluding other scientific and classical studies;" and each is under obligation to devote a portion of its revenues to giving "instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life." The quotation of the law in this discussion concerning what we should teach in our colleges is pertinent because where its requirements are specific we are bound, as honest men, to observe them. Were they all specific and explicit there would be no need of this discussion. What we desire to arrive at is an interpretation of the general requirements of the law and a course of procedure which shall best fulfill its spirit and intent.

Dealing first, then, with the injunctions which are specific, our institutions are to be educational establishments, not professional schools. They are to contribute to the drawing out and direction of the intellectual powers of the youth of the land—particularly of the "industrial classes"—so that they may be properly fitted by "liberal and practical" culture to engage in the "several pursuits and professions in life."

They are colleges, and this designation helps us to determination of the stage in the educational process where our work should properly and profitably begin. With the differing conditions surrounding the institutions in different localities it is obvious that no fixed and uniform regulation can be laid down upon this point. The subject of entrance requirements to colleges generally—in what topics and to what degree—is engaging the earnest and systematic attention of educators in other associations similar to our own. Excellent ideals are set, to which it is sincerely hoped we may all be ultimately enabled to attain, uniformly, in all parts of our common country. As yet, however, this is manifestly not practicable. Time may make it possible. So far as "our" institutions are concerned, I think we might properly and safely demand of applicants for admission thereto that they should exhibit the same or equivalent measure of acquirement (in "liberal" culture, at least) and intellectual development as is required by other collegiate institutions in the same or similar localities. Our teaching should begin at a corresponding stage.

While upon this point permit me to indulge in a few reflections of a general nature which are yet pertinent to this discussion:

(1) Obviously, there is no warrant, in law or reason, for the distinctive designation of our colleges as "agricultural" or "mechanical." I think it is a pity that the habit has grown among us. "Land-grant," or "State," or "science," would be more fitting appellations if distinctiveness is desired. "Agricultural experiment station" is an eminently proper name for our stations; it indicates just what they are; "agricultural" or "mechanical" prefixed to our colleges is unwarranted, to say the least, and is likely to be misleading.

(2) I think it unfortunate that the word "classes" occurs in the Federal act of endowment. There should be no "classes" known to the law in this Republic; surely we should recognize none in the construction of our schemes of education.

(3) If, as we believe (otherwise our professions are a deceit and our occupation a fraud), the proper, acceptable, and successful prosecution of the great industrial pursuits—agriculture, the mechanic arts, and other—demand an education and a degree of culture (both "liberal" and "practical") no whit less thorough and no lower in order than is required for engagement in other pursuits, we should take care that nothing which we set forth in the curricula of our colleges shall be a confession of the weakness of our faith or be capable of construction into an admission that our education develops less able thinkers, less worthy men, less competent leaders of their fellows, or leads to less honorable or dignified pursuits than that which is furnished by other collegiate institutions. We should never forget that our colleges are one important fruit of the memorable conflict, actively begun a half century ago and waged and won within our generation, between science and dogma for the recognition of the study of the physical sciences as a legitimate and necessary factor in genuine education. They were born of this conflict, the victory in which was a triumph of modern enlightenment over ancient narrowness, a decision that new elements should be introduced into our educative processes, not to supplant but to reenforce the old, that the two together might contribute to the formation of a completer man. The successors of the victors would woefully misapply the fruits of the victory if the institutions which they set up should deliberately embrace the very errors which were combated to give them life and exhibit a narrowness and one-sidedness in their curricula which, although of opposite tendency, would be no less fatal to the development of the perfect man than that which in the older institutions was condemned.

The laws creating our colleges not only permit us to guard against this danger; they enjoin us so to do. The provisions of the law are in accordance with the wise and reasonable views on the subject of education which guided the conflict referred to to its successful termination. Efficient hewers of wood and drawers of water and skillful artisans there were in abundance before the blessed enactment of 1862. This was not designed to add to their numbers or perpetuate their guilds. It was intended to increase the learning of the youth of the land, to furnish them with intellectual powers and stores of knowledge especially applicable in the industrial pursuits by providing liberally for education to that end, in order that those who might engage in such pursuits should no longer be mere slaves of a craft, but freemen in the intelligent prosecution of their chosen handiwork.

The specific subjects enjoined by the law to be taught are:

(1) Military tactics. As a lover of peace and of all agencies in the body politic which conduce thereto, I should be inclined, individually, to say "more's the pity;" but as we have it to do, let us do it thoroughly and well; not necessarily to the extent of placing our students under military discipline, which, personally, I deprecate for many cogent reasons, but as efficiently, consonant with its peculiar character, as we propose to instruct in other branches embraced in the curriculum.

(2) Agriculture and the mechanic arts. Let me waive discussion of these for the moment.

The nonspecific injunctions of the law are certainly general enough to weigh upon the conscience of no man who is a wise educator. They should be so, for obviously differing conditions in revenue, locality, character of students, and other circumstances will make necessary differences in the curricula of the colleges, both in the number of branches taught and in the relative importance assigned them. "Branches of learning related to agriculture and the mechanic arts;" "without excluding other scientific and classical studies;" "the various branches of mathematical, physical, natural, and economic science." Surely, so far as the letter of the law is concerned, the strictest constructionist could not assert that anything having the faintest shadow of a claim to be considered a branch of education might not be taught in our colleges.

The great purpose of our colleges may be gathered from both the letter and the spirit of the law. It is to furnish a "liberal and practical education," suitable for those who may be expected to engage in industrial pursuits. Without entering into discussion (which would be interminable) of what is or may be meant by the "liberal" and the "practical" in education, I think we all recognize that there are certain great groups of studies which differ somewhat in their educative purposes and methods, although their ultimate aim is the same, and it is not always easy to determine for a given study to which group it more particularly belongs—the one devoted mainly to redecraft, the other to handcraft; the one dealing mainly with the mind, the other with the sense; the one characterized sometimes as "literary," the other as "scientific." Both are necessary in judicious education. Our colleges are called upon to furnish both, but this does not mean that they are to exhaust the field in either direction or to be uniform in the branches which they adopt or in the relative importance they may assign to them. I venture to say that, personally, I should consider certain branches as universally essential, each to be pursued to the extent commonly covered by a college course. These are, in redecraft, the English language and literature, mathematics, psychology; in handcraft, the physical sciences, physics, chemistry, biology; with regular and ample laboratory work in each. To these fundamentals it is possible and may be desirable to make many additions on either hand. In rede-culture, the classical and foreign languages, history, economics, moral science; in handcraft, subdivisions of the physical sciences to any extent which may be practicable or desirable—mineralogy, geology, workshop mechanics, and the elements of technology in various lines. The pedagogic value of these differ with differing circumstances, and each college should carefully determine for itself those best suited to its special conditions. One thing, however, I think should constantly be borne in mind in the conduct of this, the truly educational work of the colleges. In teaching the "branches of learning related to agriculture and the mechanic arts," we should make it clearly appear that they are so related. In the liberal culture given by study of the masterpieces of our English tongue, for example, selections might readily and preferably be made to show that correct speaking and writing, a pleasing style in composition and expression, adherence to the rules of rhetoric, and even, perhaps, a touch of the breath of poetic inspiration, are as becoming and necessary in one who speaks and writes of the industrial occupations of the people as of him who declaims of their rights and liberties upon the stump or discusses their political problems in the columns of the press. The evolution of civilization presented by the study of history may be as well, if not better, shown by emphasizing the part played therein by peaceful industries as by recountal of battles and sieges and the lineage of kings. Patriotism may be inculcated no less through proper pride excited by the industrial achievements of our country in its times of peace than by panegyric of its glories won in times of war. Illustrations necessary to demonstrate natural laws in science may be taken from the myriad examples furnished upon the farm, in the field, and in the workshop, which will serve at least equally as well the purposes of pure science as those arranged artificially in the laboratories or on the lecture table. Where differentiation is found possible, moreover, in the physical sciences, those branches should be selected which relate most directly to industrial pursuits; provided, always, that a proper pedagogic method is afforded and a genuine scientific spirit be maintained. Soil physics, agricultural chemistry, botany, entomology, animal nutrition, economic geology, may serve for truly educative purposes as furnishing illustrations of principles in the study of the pure sciences, physics, chemistry, and biology.

In fine, while it is not necessary, nor is it proper, that we should erect our colleges into unreasoning partisans of the industrial arts as in antagonism with other pursuits, yet we should make manifest to our students, by illustrations drawn therefrom in our educative processes, by the teachings of history, and by exhibition of their proper and legitimate fruits, that through them lies a path to usefulness and happiness at least equal in stability and dignity to those offered by other occupations or professions.

So much for the educational work of our colleges. What shall we say to the injunction to teach agriculture and the mechanic arts? How far may we go and in what manner to make our colleges, in part, training schools in distinct pursuits? This, I take it, is the point of most interest in the present discussion.

First, then, as to agriculture. While my opinions are merely tentative, and I can not be said to have reached positive convictions on the subject, notwithstanding a fair acquaintance with what is being done in this particular at home and abroad, I am inclined to think, at present, that the school of agriculture should be a school of demonstration, not of attempted education. The professor of agriculture (if there be one) should teach neither physics nor chemistry, nor biology, nor engineering, nor any parts thereof, under the titles of soil physics, agricultural chemistry, stock breeding, farm surveying, and the like. He should rather demonstrate the applications of the previously taught principles of pure science in the operations of the farm. The school of agriculture should be provided with a suitable farm, including orchards, garden, and dairy, each equipped in the best manner possible with proper buildings, stock, cattle, and machinery, and each should be conducted regularly and systematically as a model of its kind in illustration of the proper and best methods of actual practice in the several branches of agricultural industry. The students of the college should be admitted to witness, and, if need be, to take part in the operations, and the demonstrator in each should be competent and required to give explanation of the processes and the reasoning underlying them. It can readily be seen that the number of these processes may be very great, including preparation and tillage of land, drainage, irrigation, feeding and care of stock, breeding of cattle, vegetable and fruit culture, butter and cheese making, the housing, preparation, and marketing of farm products, and a great number of others. The point I particularly make is that these operations should be illustrative, and in every case performed in the very best manner that science and experience direct. The school of agriculture should be the clinic of the college. In a manner it should bear the same relation to the college that the hospital bears to the college of medicine. It should be primarily designed for those who have already received, or are at the same time receiving, the educative culture of the college proper, and it should not undertake to dupl cate or infringe upon the pedagogic work of the college. This may seem unnecessary to say, but perhaps it is not so so long as it not infrequently happens that a "professor of agriculture" conceives it his duty to give lecture-room instruction to his classes in smatterings of botany, agricultural chemistry, vegetable and animal physiology, and other such topics which properly belong to the departments of the several special physical sciences, where they can be taught much better and with a proper regard to the period in the student's education where they should be introduced, and since the most of our text-books on so-called "agriculture" follow the same general plan in their treatment of the subject. So far as these text-books are concerned, perhaps it is not possible to follow any other plan, since the practice of agriculture can only be taught by actual demonstration. When what they do is well done, as is the case in the admirable little manual of our friend Professor Voorhees, these books serve a most useful purpose, but should not be taken as exemplifying the course to be given by the professors of agriculture in our colleges. Although certain of the topics which I have mentioned may in strictness be considered of the nature of applied rather than of pure science, they are in the main such as should enter into the education of any man of liberal culture, and should not be estimated as the peculiar possession of those only who propose entering the industrial pursuits.

Again, this illustrative work and training of the college farm and its attachments should be distinct from the research work, in its several lines, of the experiment station. It is, unquestionably, eminently advantageous and desirable that the station should be intimately associated with the college, particularly for the sake of the station, but for sake of the college as well. For that matter, an investigator in one might very well be (and preferably) a teacher in the other, and advanced or graduate students of the college might be admitted to participation in the researches of the station; but the work in each should be distinct, and while they should cooperate and aid each other whenever possible, the distinctive purposes and functions of each should be carefully discriminated. In connection with this technical training in handcraft, instruction might properly be given in the school of agriculture, in farm management and economics, in the history of agriculture in all its branches, and in the systematic and critical study of agricultural literature.

Instruction in the mechanic arts, I take it, should follow the same general lines, the workshops taking the place of the farm.

Now, I am aware that I have mapped out an amount of work for our colleges which is stupendous. Either the educative work or the illustrative work is alone very great; the entirety—to us of small means, especially—is simply appalling It will rarely, perhaps never happen, that any of our colleges can do it all; but I submit that it might be wise to follow the general policy which is herein outlined. Let each college do what it can, and make its selections among the lines of work offered according to its means and the conditions surrounding it. Upon certain points I should be inclined in all cases to insist:

(1) That our colleges should be colleges in fact as well as in name. They should be educational institutions in higher learning, in which the physical sciences particularly should fill their proper and important place as educative branches. They should be true colleges, requiring, on the one hand, of those admitted to them a certain proper degree of previous education, and on the other stopping short of the specialization in distinct branches which constitutes, in the pure sciences, the proper work of the university, and in certain of the applied sciences of the experiment stations.

(2) That they should provide the necessary and proper amount of this educational work first of all and should never permit themselves to become the nurseries of unlettered craftsmen in the industrial arts, however skillful. This need not, necessarily, exclude from certain of the technical courses those who are seeking information rather than education, but care should be taken that the chief function of the college is educational, not informational.

Where the land-grant college subsists exclusively upon its Federal revenues it must, perforce, be modest in its aspirations. Should other collegiate institutions exist in the community with which it may cooperate, so that it may require of those admitted to it a previous reasonable degree of college education, then its work may legitimately be chiefly given over to the demonstrative teaching which I have indicated. Best of all, perhaps, is the arrangement, when it is feasible, of such intimate and local association with other collegiate institutions as will provide for the educative and leave the bulk of the revenues of the college available for the technical demonstrative work. Such an arrangement as—my friend Professor Bailey will permit me to say—is so ably administered at Cornell University, in the State of New York, for example, certainly leaves nothing to be desired. I am quite well aware that "many men, many minds," and that an arrangement of a given character which might be admirable in one locality and under one set of conditions might not work well in another locality and under different circumstances. I am discussing the question purely from an ideal standpoint.

In any event, whatever may be the conditions, rede-craft (in its best and thorough signification) should precede, or at least accompany, hand-craft, however thorough this may be. Our colleges must give such good, genuine, broad education to their students as will equip them with the mentality requisite to cope successfully with their fellows in the intellectual struggles of life, or else they fail of their purpose, become a laughingstock of scholars, and a hurt rather than a blessing to the community. In no other way, in my judgment, can our colleges serve the great purpose for which they were founded—to make of the industrial pursuits intellectual occupations to be engaged in by educated men.

The first paper on the exodus from the farm was presented by I. P. Roberts, of New York, as follows:

The Exodus from the Farm: What are its Causes and what can the Colleges of Agriculture do to Nourish a Hearty Sentiment for Rural Life?

During the last quarter of a century farm machinery, inventive genius, and new discoveries of various kinds have made it possible for one man to produce four times as much of many farm products as formerly. If a greater per cent of the farm boys did not find some other occupation than that of their fathers, it is evident that there would not be employment for all unless some new and extended market was found for surplus products.

We live in an age of specialties. Work has been divided and subdivided until occupations are so numerous that almost anyone can find a calling well suited to his tastes and training. Formerly many farmers' sons remained on the farm because there was no appropriate calling for them outside of farm life. The result has been that a large per cent of those who now occupy land are not adapted to their calling.

The law of "the survival of the fittest" up to the present time has not been operative among agriculturists. It has been truthfully said that anybody could farm; that was, but is no longer true. When the soil was fresh and soft and rich, and required the minimum of skill and effort to secure crops, those most unfitted for rural occupations could easily secure a competence and even a surplus. But all this is changed.

Competition in agriculture, as in other things, has become severe, and he who does not have a liking for and understand his profession must, sooner or later, find employment with and be directed by those who either naturally or by training are better fitted to battle with the more difficult conditions which surround us. From this time on, the law of "the survival of the fittest" will prevail in agriculture.

The whole course of our Federal policy toward public lands has tended to produce a race of soil robbers, not farmers, and sooner or later in all civilized countries the robber pays the penalty of the broken law. From 1861 to 1865 vast numbers of men changed from producers to consumers, and prices of farm products became abnormally high when measured by inflated currency. These conditions could not fail to mislead and disappoint many when population and currency were restored to normal conditions.

Soon after 1865 there were added to the farming community, in addition to a vast influx of foreigners, many soldiers who saw in the high prices then prevailing quick and large returns from the rich lands which had been opened to settlers by the construction of extended systems of railways.

From 1870 to 1880 the percentage of increase of new farms was 50.71 per cent, while the increase percentage of population was but 30.8 per cent. During the decade 1880 to 1890 the increase of new farms was 13.86 per cent and the increase in population was 24.86 per cent.

During the war times inventive genius not only so improved the appliances of agriculture as to quadruple the productive power of each farm, but it also, through improved steam transportation, brought the products of several foreign countries into sharp competition with our own exportable farm products. This could have but one result—overproduction, which invariably ends in prices so low as to preclude the possibility of profit.

The farm boy was not less able to feel the forces that modified his life than other boys, although he was not able to analyze them. He saw railroads being constructed, shops of every kind going up, buildings increasing at an unheard-of rate, and he also saw that the men engaged in these lines of activity received a much larger remuneration than did the tillers of the soil. He was not to blame for these conditions. Neither he nor his father perceived that in certain lines of industry there was unusual activity or a great demand, while in other lines there was overproduction and hence small remuneration. Instead of blaming the country lad for seeking these more remunerative positions, I have the highest respect for his shrewdness and good judgment in availing himself of them.

He saw, or should have seen, that three-fourths of the labor formerly required for harvesting the millions of acres of crops annually raised was being performed in the cities. The construction of binders, mowers, harvesting machines, steam thrashers, improved harrows, and sulky plows gave full and remunerative employment to men who formerly worked in the field, while the labor of many a farm boy was no longer required in the field to raise or glean the harvest of the United States.

The exodus from the farm was inevitable and justified, and the result eventually will be a race of farmers who not only like rural life, but who are well fitted to pursue it profitably. There are now many who occupy the land who must, of necessity, leave it, since neither by nature nor by training are they adapted to their vocation, and the sooner they leave their unprofitable occupation and enter into something that is more remunerative, and the sooner trained and cultivated farmers own and till the land, the better it will be for all concerned.

In order to discover the boys who are naturally fitted for rural affairs and train them for their life work, more "sifting" must be done at an early period of their lives. This naturally begins in the rural school districts. Here must be taught the simpler principles of the natural sciences. Here must be discovered the likes and dislikes of the farmers' children. No one would think of trying to educate a child for an expert musician who had neither ear nor taste for music If we can determine the natural trend of a child of 10 to 15 years of age, while yet in school, in the direction of sound and tune, may we not also discover it in other directions at this early age? If, then, agriculture in its broadest sense is to be taught in the district schools, there must be teachers—living teachers, for books are worth little in the hands of children without a trained mind present to explain, interpret, and apply the thing taught.

While something can be done by traveling teachers and by institutes if the work is well and thoroughly done, trained teachers must be provided, and here is a legitimate work of the colleges. We should not lay less stress upon training the farmers, but far more upon training teachers for the district, the village, and the high schools.

To nourish a healthy sentiment for rural life, some of the mysteries of rural life must be known. To know a flower, how it grows and how it feeds, is to love it. By teaching the elementary sciences as applied to agriculture in the secondary schools throughout the country pupils may be "sifted" much earlier than at present. The tastes of each may be determined. One must go to the city, because if retained on the farm he would be a failure, while another will naturally develop the tastes and abilities which go to make the successful farmer.

We have fallen upon strange times, unusual conditions—such conditions as have never been before in all the history of civilized nations. Formerly most of the national and individual effort was to secure food and clothing. In our day we have more food than all the people can eat, we have more clothing than the people can wear, and we are forced, from these peculiar circumstances, to let our fields lie idle, abandon them to the growth of weed and briers, and to pull the fires from the boilers and stop the wheels of manufacturers.

It seems to me that the problem reaches far back of what appears on the face. It is difficult to solve, and I hesitate even to make a recommendation as to what would be wise to do, yet I fully believe that a supply slightly less than is needed is far better than an oversupply of products which can not be stored or saved without loss for future generations. If the working classes—and by this I mean nine hundred and ninety-nine out of every thousand able-bodied American citizens—could be content to work six, or at most eight, hours per day and devote the balance of their time to acquiring knowledge and to recreation, we should then not have a glutted market, intermittent labor, and the ills which immediately follow when a large number of men are overworked, or, still worse, when a large number find employment for only a portion of the year at high wages, and are left unemployed, either mentally or physically, for longer or shorter periods.

If, somehow, we could get clear of the grasping, sordid, money-getting spirit which is so prevalent in all America, and learn to prize highly leisure, wisdom, and knowledge, the problem of low prices, overproduction, and exodus from a healthy rural life would be measurably solved,

The following paper on the second subject was read by E. Davenport of Illinois:

Thoughtful men have become alarmed in recent years at a seeming disposition to abandon the land and move to town, and so general and pronounced has this migratory movement seemed, that it has been called the "modern exodus."

Because of the economic questions involved, every effort should be put forth to understand this exodus; and because the colleges of agriculture are institutions particularly charged with the interests of rural people, it is eminently fitting that these matters receive careful attention here.

The following paper does not pretend to completeness, nor was it written from the larger views of the economist. It simply recites some personal observations and the convictions that have been forced upon me by intimate contact with farmers and a somewhat careful study of their needs.

We may well ask ourselves some questions: Has the exodus been overestimated? What are the causes that draw men from their farms? What classes of people are involved? Is the principle of selection affecting the quality of country residents, and how? Will a man leave the land as soon as he is educated? Are the conditions of life improving in the country as rapidly as in the city? Is land becoming relatively less remunerative? Are farms becoming larger? Who owns them? If they are rented, where are the owners? What are they doing? And why are they not living upon their possessions? Is the tenant system extending and what are its effects?

Space forbids an attempt to answer all these questions, if indeed an answer is possible. Questions connected with the impulses and movements of a great people are often too complex and subtle to yield to analysis or to be explained by reasoning. However, certain considerations stand out clearly in the perspective.

First of all, let us not be deceived by its seeming magnitude. That our population is increasing more rapidly in the city than in the country, is not to be taken as conclusive evidence of a growing desire for city life, because agrarian population appears first in order of development. Manufactures, commerce, and cities await the accumulation of wealth from the products of the soil. Again, there are natural limits to country population, while no bounds are set to the multiplication of towns, the extension of city limits, or the density of urban population; so that at any time after the pioneer period each succeeding census will likely show an increased proportion of city population indicating a movement from the country. Considering the wealth of our people, the activity of her business interests, and the rapidity with which her history is making, we are to expect an extensive and pronounced migration to the city, which might seem like an exodus and still be normal.

It should stand out clearly in the mind at the outset that though the movement is pronounced, this is not so much a question of numbers as of quality. There is small danger of our lands being deserted and rendered unproductive, as witness the wild rush at the opening of each of the few remaining reservations, when men, women, and little children stand for days in rain and slush awaiting the signal to cross the border—the last hope to own land. Land has not so generally decreased in price when measured by a true standard of value as is commonly believed, and yet remains practically out of reach of poor people. The query is not so much how many, but who are going to town? Is the principle of selection one that is operating to elevate or to degrade the country people? This is the question upon which will turn the future condition of the American farmer, and possibly the fate of a government by the people. This question is not to be solved by statistics showing mere magnitude of movement, but rather by a minute study of the real and the alleged causes that contribute to the results, together with their inevitable consequences. Without a doubt this exodus has been considered quantitatively and vastly overestimated. It has not been much, considered qualitatively, and has therefore been underestimated.

Through a long and intimate acquaintance with farmers I have sought diligently for the reasons that draw them from their farms, and these are the ones given me by the people themselves:

The family goes to town to educate the children; because of the difficulty of securing competent help; on account of the excessive burdens upon the housewife; to retire from business, or to establish a son upon the farm. All but the last lead to renting, so that in point of fact the land changes hands and loses in the transaction the benefit of careful oversight. The last is no part of the exodus, because a natural successor is installed, but all go to swell the city census and to contribute to the numerical effect. The young man's separation from the farm comes about, according to his own statement, from a desire for an education, an impulse to see the world, a belief that the city offers more and better opportunities for advancement, or, as he may frankly admit, because he does not "like" the farm.

Now, these are the reasons by which the individual supposes himself to be actuated: That they are not always the real causes I have abundant reason to believe. For example, I have often heard farmers insist that the business does not "pay," but I do not remember ever to have heard one give that as his reason for leaving the farm. Farm life in certain families is so meager as to fall upon a really noble nature like a blighting curse, yet I never heard a young man put that fact into words as fitting his own case.

Again, many of the alleged reasons are the fruit of impulse, not the settled convictions of judgment. They are often at variance with fact, and commonly the individual acts in face of the utmost ignorance of the new conditions among which he proposes to place himself. From this we must conclude that the exciting cause is often unsuspected by the farmer himself, and that the subtle forces that actuate should be sought beneath the reasons given. They must be sought in the conditions that surround the farm, and the effect of these conditions upon its revenue and upon the hearts and the minds of its people.

It seems a paradox to say that profitable farming has contributed to this movement, but such is the undoubted fact. In certain favored sections farming has been exceedingly profitable on lands secured at a nominal figure, and many a family has retired and is living in comfort on the rental of landed property accumulated in less than half a lifetime. This fact is largely responsible for introducing the tenant system into America and ingrafting a species of serfdom upon our free institutions. So has prosperous agriculture contributed to her own degradation.

It must not be overlooked that rural life and affairs have been influenced by exceedingly peculiar circumstances during the last two or three decades. This period, which has been one of general prosperity, has borne heavily upon the farm, because of the opening of the boundless West. Here was half a continent peopled from the rural population of the other half, rendering labor scarce and costly and at the same time flooding the markets with grain and animals cheaply produced at the expense of virgin fertility. This has rendered farming on older, more valuable, and often better lands, for the time unprofitable, and few realize what this withering competition has really been, and none but a careful student or the sufferer himself appreciates the unequal fight against virgin fertility.

Besides all this, the same period has witnessed the greatest activity in business enterprise and inventive genius along mechanical lines that the world has ever known. So vast have been the undertakings and so rapid the changes as to create an imperative demand for a high degree of technical skill. Even mediocrity, if coupled with faithfulness, has been well, even extravagantly, recompensed. The countinghouse, the shops, and the great lines of transportation have demanded and received the best attainable ability, and it has all drawn heavily upon the farm.

In all this period of general prosperity the farmer and his farm have suffered the severest competition in two directions at the same time, the one aimed at himself and the other at his business—a draft upon the most ambitious young men for skilled service in new and fascinating lines, and a subtraction from the people to develop the great West, throwing back upon Eastern agriculture a burden of cheap products to cancel her efforts and eat up her substance like the self-digestion of the stomach after death. We have overdone the matter of development, and the wonder is that American agriculture has endured so well. The production of a million miles of the best land on earth suddenly thrown upon the world contemporaneously with the opening of the Suez Canal and the development of India! Nothing like it was ever done before, and it came near paralyzing the agriculture of the w rld.

But this combined competition from within and from without is passing. We have witnessed the practical exhaustion of the public domain. Population has pushed too far into the "Great American Desert" and is retreating, and the best energy of the virgin fertility of half a continent has spent itself. The skilled mechanical occupations that have been so attractive are establishing among their people a competition that is most pitiless. Schools have been organized to fit young men to win positions, and already an applicant must show previous training and render the most faithful service. Not only that, an age limit is being set. A locomotive engineer will find difficulty in securing a new position after he is 35 years old, and one of our great lines has set the age limit for firemen at 26. None of the skilled professions are merciful to their employees, nor can they be, for if a new device comes in requiring fewer men or skill of a different kind, the old operatives are retired. The worst of this competition is over, and I personally know of young men having taken technical courses and afterwards coming to the conclusion that landed property is in the end most valuable.

The growth of our free-school system has been phenomenal. We would not have it otherwise. It was organized upon a geographical basis, but it is rapidly becoming organized upon a municipal plan, and farmers may well mourn in sackcloth and ashes at the passing of the district school, and with it the possibility of the township high school.

Of all the factors involved in the present discussion, the most widespread and the most pernicious in its consequences is the "moving to town to educate the children." Such a condition of things is anomalous. The people are neither farmers nor citizens. Upon the change of residence family idleness succeeds habits of industry and thrift, and the children by inference establish a conviction that there is some natural connection between an easy life and living in town. They do not know, or if they know do not realize, that the family has ceased acquiring; that it is in a business sense "marking time" for their benefit. They learn to look upon this new existence as the normal condition of city life, and they love it as all children prefer indolence to industry. They have lost their touch with nature and have but a few conjugations to show for it.

These inferential sentiments upon the part of the child are encouraged by his studies. During all his school years he is removed from contact with rural affairs and for the most part with all nature. His mental activities are directed along abstract lines. His training is extremely intellectual and devoid of the industrial idea, or else it is technical, as fitting him for a "position." In either case he is unfitted rather than equipped for rural life. Coming as he has from intimate contact with nature and with material things, it is not strange that he suffers a kind of mental atrophy as he passes from the natural to the artificial; from the great school of observation and experience to the narrow field of what he with his small wisdom is able to draw from books.

Many a naturally broad minded, deep thinker has been spoiled in educating, and while erudition is to be respected above most things, the best educators have detected this inherent weakness in a system of education that does not educate, and under various names and by various methods are getting back to nature. When the newer school of pedagogy shall have impressed itself upon our schools, the whole trend of education will not be so strongly away from rural life.

No subject is of more importance here than the growth of the tenant system. It is at first a consequence, but once established, it becomes a prolific cause of evil that is insidious and far-reaching. It robs the land of that careful oversight that is its due; it tends to impoverishment of soil, lessened productiveness, and a failing revenue. It discourages improvement and removes the impulse and the occasion for rural adornment and landscape beauty. It is incompatible with the home instinct which is the chief excellence of rural surroundings. Renting divides with another the results of effort. Carried ahead a few generations this may only mean that one man pays rent to another because his grandfather was less shrewd.

A further evil attends the tenant system, and that is its effect upon country schools. After the landowner moves to town, he is forced by taxation or by tuition to contribute to the support of the schools that he proposes now to patronize. He meets many unexpected expenses incident to city life to which he has hitherto been a stranger, and he acquires habits of parsimony. He is no longer interested in the district school; on the contrary he will, from motives of economy, oppose it, for he can not see why he should support a school in which he has now no interest. The renter can not stand for good schools because he pays but little tax and his activity in this direction is considered an unfriendly act toward the landlord. This condition of affairs carried to its limits simply defeats the primary object of the free-school system and provides the worst possible education for the children of the tenant. Instances are not wanting in which the tenant has not been able to renew his contract because of his influence in the matter of school expense.

In so far as the social instinct accounts for this exodus, it is largely outside of the better class. We shall always have those who need the stimulus of numbers or of excitement to induce activity. These will drift naturally to the city. As light substances float where the eddies are strongest, so this lighter element of humanity will always constitute the flotsam and the jetsam of city life. It is not the highest, but the lowest or the weakest type of man that needs this stimulus to effort. The farmer's is not a solitary life unless he makes it so. The social instinct in man is no explanation of the drifting of the better class into the cities, and if it is true that our best young men and women are demanding the city life because of the excitement and the entertainment, then something is wrong with our system of perpetuating the American race.

I come now to what in my judgment is the most potent influence in draining the best young people from the farm. I refer to that caricature of humanity that passes for a farmer in the pages of current literature. Simple minded, and incidentally honest, uncouth in language and coarse in manner, destitute of everything but good intentions, he is depicted more unfavorably than is positive villainy. A creature of the imagination, a composite of everything comical, is made to represent one-half of a great people. His very name is fixed, and his horse's name is Dobbin. As his biographer warms to his task he rises to the supreme of ridicule and his very words are systematically misspelled. Then, when all other means are exhausted, as a last and telling effort, this typical farmer is contrasted, not with the average, but with the most favored citizen. The two extremes of man, the farmer and the dude, have been so definitely and so unfavorably portrayed as to be well on the road to extinction. The fruit of all this is that country towns put on city airs; that clerks and small tradesmen rank themselves above the farmer and affect airs with his family.

So it has come about that odium has attached to the land and its occupants. Why, no man knoweth. Like other occupations, farming has its disagreeable features; but sensible people of all callings understand the significance of agriculture, respect the people engaged in it. Certain gentlemen of leisure, thoughtlessly forgetting that there is any connection between the food that keeps them alive and this same calling and people they caricature are doing a great wrong to the American farmer. True it is that farming was once the occupation of slaves; but as the English people and their language were more impressed by the Saxon serf than by his Norman conqueror, so is the natural advantage with the soil and her people. If we drive the American citizen from the farm he will rent it to the foreigner; but if Americans are to control America they must keep possession of the land. If I have spent much time upon this point it is because I regard it as an insidious evil which, being laughed at, goes unpunished and unrebuked, and because I firmly believe it is doing more to permanently depopulate our lands of good people than all other causes combined.

What can our colleges do? From their name and nature they owe a definite duty to the community, to the soil, and to the individuals that own it.

Economists would prevent the overdevelopment of a dependent class and preserve an homogeneous population. City societies for relieving distress among the poor would return the surplus to the soil. We shall side with the economists. We can not endure the loss of the best and the return of the worst. We want a cultured rural class, not a peasantry. The colleges must take high ground in the matter and reestablish a standard of refinement and culture so nobly typified in the old-fashioned country gentleman.

Our people are undergoing a trial in this transition period of our great country. The situation is many sided. Hitherto the colleges have contented themselves with technical instruction. They have a broader work. They must attack the whole problem, or they will come short of their duty and forfeit their prerogative.

The business side of farming needs attention. The calling must be fairly profitable or a cultured people will not develop on the land or remain if they do develop. The fertility of our lands, which is our capital, is gradually but surely disappearing. We are selling our birthright piece by piece. Methods looking to the economizing of fertility and to the increase of the productive capacity of the soil are almost unknown or unheeded by the general farmer. We persist in pioneer methods after pioneer conditions are passed, and the individual grows discouraged when old-time practices yield a constantly decreasing revenue.

The remedy for all this is more knowledge of the right sort. George T. Powell, speaking before the New York Society for Improving the Condition of the Poor concerning the question of the causes of agricultural depression in the State of New York, said that a noticeably higher degree of prosperity and contentment was found in the vicinity of Cornell University, and that it was by the people themselves attributed to the influence of the Experiment Station. He further observed that graduates of the college of agriculture over the State were so many centers of better methods and better feeling. The cumulative influence of forty colleges and experiment stations will tell ere another decade has passed, for the people are beginning to have confidence in these institutions

Our farmers need to know how to pass from the extensive agriculture of pioneer conditions to the more protective and intensive methods necessary to sustain production on older lands. They need to know that this change should be made gradually, not suddenly; and that it should be most active in periods of prosperity, because high farming is no remedy for low prices. The ten-hour day should be introduced upon the farm as securing better habits of labor and greater results, together with more comfort to the laborer. Labor should be employed throughout the year. Even if for a month or two it is unprofitable it will pay in the end, for the best labor will seek constant employment. When discharged at the beginning of the most trying season, the winter, it is but natural to look for employment in the city where seasonal influences are supposed not to operate.

The waste on most farms from loss of fertility, from labor ill bestowed, from abuse of machinery, and from unprofitable animals in debt to their owner and their food would constitute a fair profit. Our colleges and stations are learning the drift of general principles. They must discover methods and practices that are ultimately safe: and learning these they must teach them in season and out of season to student and practitioner, to the end that waste of fertility, of goods, or of energy be prevented, and that the rural class remain prosperous, cultured, and happy.

There is a domestic side. In the city the home life and the business life are entirely divided. It is not so in the country. It is fortunate for the children that they are thrown in daily contact with the business side of life. To that is due the superior stability of the country boy. But the business should not invade the home. There should be times and seasons in the farm home when business topics are tabooed. No day should pass but that the home life as a thing of happiness should be directly stimulated. The library, the periodicals, the games and amusements must each receive attention from the standpoint of rural life, and the colleges ought to lead in the matter.

Now that architects have turned their attention to the designing of moderate-priced cottages, those home comforts, known under the name of modern conveniences, are to come into our country homes. A bathroom costs less than a new carriage, but a crown awaits that architect who will design a really convenient kitchen.

There is an esthetic side. Home adornment and landscape beauty are the cheapest sources of that placid contentment that conspires to morality and strength of character. The first steps in this direction would generally be the firing of a wilderness of rubbish or the destruction of a forest of weeds. I passed, the other day, a house in a natural paradise, but horribly disfigured by the accumulation of the various accidents of human occupancy. Swinging from a post was a new patent gate. It subserved no evident purpose, for it was the only visible "sufficient barrier," yet it cost more money than would have sufficed to restore the reign of nature and to transform the insufferably ugly spot into a veritable Eden—a home. Why, then, was it not done? It was not from want of money, but want of artistic instinct. A few trees, a little fresh, clean sod, a few curved lines, and the thing is done. An individuality is attached to that spot, and there is home. The colleges must labor for this directly.

There is an economic side. The natural advantages of ownership of land are not appreciated. The family living is seldom entered to the credit of the farm. "I raised that" is considered sufficient, and not until the farmer comes to pay city bills for table expenses does the sometime farmer realize what he eats. The country boy is deceived by the sound of city salaries. He has not known money in large amounts. The results with which he is most familiar are expressed in bushels or in pounds. What is in excess of family needs makes its way into dollars from time to time, but unless he keeps accounts he does not realize the yearly footing. The salary is expressed in gross yearly totals, and the supposed difference amazes him. He does not know that most city positions win a living and nothing more. He does not know that as the country grows older salaries will grow smaller instead of larger. He does not know that even a skilled occupation may be suddenly destroyed by some new invention, and the employee "relieved" in middle life, but at an age too advanced to permit the learning of a new trade equally remunerative. He does not know that when he is too old or too feeble to sit at his table daily, his land will still labor for him, because he has established in company with it a business. He does not realize that a man on a salary is simply hired out; that he does not establish a business, but must retire when he can no longer render regular personal service. He does not know the cumulative value of land when held in a family for a few generations, nor the advantage it gives. The young man and the young woman must be taught these things, and the colleges of agriculture must do it. It has been taken for granted that these courses are to train dependent young men for valuable service in landed enterprise. There could not be a more fatal error. Somebody owns the soils of these United States, and these courses are to train their sons and daughters to a proper appreciation of the natural advantages they possess.

There is a sentimental side; and it needs a further word. The ridiculous foolishness that caricatures this calling and this people will pass. But our young men and women have no proper standard of what is genuine success. In the books written for their edification, all the characters achieve phenomenal success. This is intended to encourage and stimulate effort. It succeeds in setting up before them a standard ordinarily impossible of achievement. All that they read is cast in the superlative. What they see is nearer normal, but in the halo of their enthusiasm common things and ordinary people and their successes look insignificant and mean. The true value of the success that ordinary people may attain by the severest exertion needs magnifying mightily, and our colleges must do it. This is vital to the success of rural life. Not many will be Presidents, not many will startle the world, and our young men need to know better than they do that no intellectual pearls will be buried even in the wild solitude of the farm.

There is an educational side. Would that some genius arise and prepare a series of common-school text-books, in which the spirit of nature should breathe through every sentence and every word. Would that our normal schools were fitting in greater numbers teachers that could see in the surroundings of the schoolhouse a great laboratory of living things and that would begin to build an education upon a knowledge of these things as a foundation. Of how many trees or plants does the child learn the names, uses, or relationships? Of how many of the animals about him does the child in school learn the habits? What use is made of the fauna, the flora, or the geography of the neighborhood? When will the teacher lead the little child into the activity of the great living world about him? The colleges can hasten the day if they will.

Last of all we need a new definition for an agricultural course. Let it be this: A broad and liberal education from the standpoint of rural life and its affairs. Let its object be the fitting of the children of American farmers for the duties of life in a free republic. Let it be in part intensely technical, but let it include also the sciences, history, economics, the humanities, if you will, but only let it be stimulating.

The colleges of agriculture must consider these questions. They have no choice in the matter. On them is the burden of the education of that great middle class the rural people, without whose independence, stability, and character a free government may not hope to succeed. On these economic considerations must courses of study be arranged and educational policies established.

If I have had a purpose in preparing this paper, it is to bespeak a higher standing for the American farmer and a more liberal and a more fitting education for his children.

SECTION ON AGRICULTURE AND CHEMISTRY.

The sessions of the Section on Agriculture and Chemistry were held in Grand Army Hall during the afternoons of November 10, 11, and 12, C. C. Georgeson, presiding.

The first paper was presented by H. A. Huston, as follows:

CHEMISTRY FOR TECHNICAL AND PRACTICAL STUDENTS.

In the suggestions that follow it is assumed that the student is one who intends to make chemistry his life work. The field is large and the subject is constantly becoming more divided into specialties. With this comes the temptation to begin the differentiation process at too early a stage in the student's development.

Foundations for technical work.—The first essential for the technical student is the ability to really read English. This statement may seem so simple as to be uncalled for here, but it is a fact that many students enter our technical institutions who can say the words before them, but who do not really grasp the full meaning of any but the very simplest statements, and frequently do not get the full relations of even these.

It is all very well to say that these defects are to be attended to by the much-abused instructors in English; yet, if you expect your students to get the most from reading or lectures, it is your duty to find out whether the students have a good working knowledge of the means of communication; and if they do not, put them in the way of getting it. The desirability of a working knowledge of German and French will be admitted.

Paradoxical as it may perhaps appear, the foundation of technical chemistry is a good working knowledge of the principles of physics. No inconsiderable part of the chemist's work consists of purely physical operations and measurements. The chemical student who can determine the working conditions of his balance, check up his weights, his graduated ware, and his thermometers, determine a specific heat, generate and control an electric current, reduce gas volumes, and who has a working knowledge of optical instruments, has a tremendous advantage over one who must do these things by rule of thumb or take them on trust, and who must one day stop in the midst of professional work to train himself in some or all of them.

The student must know the principles of chemistry—the fundamental laws—and at least enough chemical facts to illustrate and fix these laws in his mind. This knowledge is derived from the book, the laboratory, and the lecture. The three sources are given different degrees of prominence by different institutions. Even at the risk of appearing at variance with most teachers, I am of the opinion that the so-called lecture is given too much prominence and the good old hard grind on the book too little. I am now speaking of elementary instruction. The young instructor, fresh from his European studies, is especially liable to overdue the lecture. What is the nature of the work? The instructor makes an abstract from several standard works, combining fundamental laws, illustrative facts, attractive novelties, and perhaps startling paradoxes, and presents the medley to the best of his ability, while performing before his class experiments too elaborate to be performed by the student at the laboratory desk. This lecture is in turn abstracted by the student to the best of his ability while watching a series of complicated experiments, rewritten, read, and blue penciled by the instructor, and perhaps again written over by the student.

All this requires a great outlay of time and I expect you are familiar with the value of the final product—the student's note book. For it is generally in his book, not in his head. I believe the time could have been better spent by a careful study and discussion of a good text book and enough laboratory work of simple character to give the student an opportunity to test the statements of the text book and to acquire some skill in manipulation.

At this stage it seems to me that lecture work should be confined to experimental demonstration of the fundamental facts, and its purpose should be to supplement the text-book and laboratory work by such experiments as can not be well performed by the student, and by such as the instructor may think necessary to add to direct especial attention to the more important principles.

The student can not learn too soon that his text-book does not contain all there is of the science. Standard works of reference and journals should be accessible, and he should at least be made familiar with the general character of these works in order that he may know where to look for fuller statements of facts when occasion may require.

The quantitative relations of the science should be early insisted upon, and enough of the student's laboratory work should be made quantitative to give him confidence that his equations and the numerical results of them have a substantial basis in facts. It is not uncommon to find students, after several years study, really deficient in chemical arithmetic.

Training analysts.—When the more important principles of the science are learned we turn to the analytical side of the subject. There is no danger that anyone will become too good a qualitative analyst. The probability is very much in the other direction, and I think that one reason for it is that too little attention is paid to the principles at the base of all analytical operations. And right here again is the place for the good solid grind with the book. Not one of the multitude of covers with more or less intelligible tables between them, but a good solid study of the real facts, physical and chemical, on which chemical separations are based. Here we want both the how and the why; the method and the reason for it. In the quantitative work seek accuracy first, speed will come in time. In quantitative work there are a good number of determinations that every analyst is very likely to need, and these are very properly made the basis of the quantitative course. The number of subjects must depend largely upon the available time. But one purpose should be kept steadily in view—to give the student confidence in this work. To this end, substances of known composition, not necessarily chemically pure salts, should alone be used until this confidence is established.

From this on the quantitative work should be directed to giving training in subjects most likely to be useful and to promote the student's ability to adapt himself to varying work. For this last nothing is more valuable than to acquire the habit of carefully studying and rigidly following working directions of a few new methods. When the student comes to take his place in a technical laboratory he must of necessity use many special forms of apparatus and methods peculiar to that particular business, and here his adaptability will count.

Development of technical sense.—As soon as the student is qualified to begin work on technical products of variable composition the necessity for training his technical sense arises. He must be taught to use his head, to bring common sense to bear on the operations associated with the purely chemical work. Here belong the subjects of methods of securing representative samples from materials in all sorts of condition, the question of what substances are important enough to require quantitative determination, the choice of the analytical method best suited to the purpose, the question of what refinements in analysis the method of sampling and the requirements of the work will justify, the question of allowable differences between duplicates, the significance of a given variation in percentage, the allowable working error, which is a very variable quantity with different materials, and, finally, the ability to interpret properly and present clearly the results of his work.

In the development of this technical sense visits of inspection to industrial plants are valuable. Lectures by specialists in given fields are most profitable as sources of information not otherwise obtainable, broadening the view and stimulating the student to make some field of work his own. Thrice fortunate is he who is under an instructor who is a specialist and who combines relations with an industrial plant with his teaching. There is no better way for the student to get in touch with the commercial relations of his training than association with such instructors.

Capacity to conduct investigations.—When the student has his analytical tools well in hand and his technical sense somewhat developed he may undertake original investigation. There is a tendency among young instructors to put students at work on what is sometimes called "organic manufacturing" long before they are competent analysts. Older instructors are not blameless if their own zeal in original work leads them to use student aid as soon as the student can do furnace work, and at a period of the student's development when he ought to continue systematic analytical work.

I fully appreciate the great scientific and technical advancement due to the development of organic research. But too many young men, after leaving the organic laboratory, have spent years in hitching a molecule of something to the outermost fragment of the wreck of a benzol ring—work interesting to the former instructor, perhaps, adding a new fact to our knowledge, but narrowing the horizon of the worker at the very time he ought to be expending it.

It is better to put a student on a very simple investigation of his own than to associate him with the instructor in a difficult investigation where the instructor does the thinking and the student most of the work.

There is a good field in connection with analytical methods; perhaps none better for a start than an investigation of the student's ability to duplicate work requiring complex manipulation.

Considering the length of time available for work in the undergraduate courses of most technical institutions, but little research work can be done by the undergraduate unless at a sacrifice of time needed for systematic analytical training. Thesis work has many sins of omission to answer for and some of the other kind.

Statement of results.—Last, but by no means least, is the ability and necessity to put the results of work in clear and intelligible form. This must include both a statement of the facts and the relations and meaning of the results of the work, whether these relations be scientific or commercial. The ability to do this distinguishes the chemist from the analytical machine.

Discussion of the question, "What should be an implement test?" was opened with a paper by E. Davenport, of Illinois. He stated the three considerations affecting the value of an implement to be (1) efficiency, (2) draft, and (3) durability. That machine should be considered the best which does the best work under average conditions. In determining the efficiency the quality as well as the quantity of the work should be taken into account, and the durability of the whole machine is to be measured by that of its weakest part. The dynamometer test is the one most frequently applied, but "it can teach us nothing more than the expense of operating, or give indication whether the demand for power will be steady or unsteady, whether it will be easy or hard upon the team. Of all the tests it is the easiest applied, and while valuable it seems that every other consideration is even more valuable." A sharp distinction is drawn between a machine test proper and a field trial. The latter is more valuable because it tests the machine in a great variety of conditions and takes into consideration its natural life. The speaker strongly recommended "the examination of old machines that have been under fair management to discover the parts that are first suffering. This, with a field trial for quality of work and ease of draft, is about all that can be done, and will in most cases constitute a fairly satisfactory test, though greatly inferior to what the companies themselves are doing, for commercial reasons."

The discussion was continued by R. J. Redding, of Georgia, who stated that "(1) it should be an inflexible rule that no machinery or implement or appliance be tested primarily in the interest or for the benefit of competitive manufacturers or dealers; (2) in general, the expediency of a suggested test, with reference to its bearing upon agriculture, should be affirmatively determined upon by the director or other officer in charge of the station, and (3) with few exceptions machinery to be tested should be such as the station is prepared to use regularly, or at least occasionally, in conducting the experiments and investigations in the usual course."

The form in which the results of these and similar tests should be published was discussed by C. S. Plumb, H. J. Wheeler, H. J. Patterson, E. B. Voorhees, R. J. Redding, and James Wilson. The consensus of opinion seemed to be that the essential results of these tests should be given to the public, whether they were of such a nature that they could be used for advertising purposes or not, although great caution should be exercised in the matter.

A paper on "Influence of width of tire on draft of wagons," was read by H. J. Waters, of Missouri.

H. J. Wheeler, of Rhode Island, read a paper on, "The recognition of the acidity of upland soils as an indication of their need of calcium carbonate."[1]

D. E. Salmon, of the Department of Agriculture, discussed the "Effect of the tuberculin test upon the dairy." He stated that tuberculin has been found to be a successful diagnostic in the hands of experienced persons when it has not been used at too frequent intervals on the same animal. He discouraged its promiscuous use by buyers of stock. He maintained that it was useless to kill diseased animals and not to disinfect the stables. The work of inspection and disinfection should be done by experienced officials of the State. Methods of disinfection were briefly

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[1] The essential features of this article have appeared in Rhode Island Sta. Rpt. 1895, p. 232 (E. S. R., 8, p. 571).

described. The free use of hot water or steam for this purpose was recommended, although bichlorid of mercury (1 to 1,000), carbolic acid, and sulphuric acid are effective, but must be used with caution.

The following paper was presented by E. B. Voorhees, of New Jersey:

SHOULD MILK BE SOLD ON THE BASIS OF QUALITY?[1]

The very great progress in the dairy industry in this country in recent years has been due in large measure to the investigations conducted by the various experiment stations. These investigations have, however, been largely along lines connected with the production of milk and the manufacture of butter and cheese. Aside from the work of the bacteriologist, but little attention has been given to that enormous and constantly increasing branch of the industry, the retail milk trade, particularly the study of methods by which differences which occur in the cost of nutrients, due to inequalities in composition, may be so adjusted as to encourage the producer of milk of good quality and to protect the consumer against what may be termed "indirect adulteration." An investigation along this line, for the purpose of learning something of the variations that occur in the composition of milk as delivered to consumers, was begun in New Jersey the past year, the results of which indicated very strongly that variations in the cost of nutrients are much greater than legitimate business interests can maintain.

The samples represented as nearly as possible the actual supply of the four cities from which they were secured, viz, New Brunswick, Newark, Trenton, and Camden; that is, while samples were not taken from every dealer, the number taken represent a fair proportion of both small and large producers and dealers. The samples were in all cases taken in the morning from the delivery wagons on their route and from the stores of retailers, and, therefore, represent milk as delivered to consumers. They were taken in some cases from full cans, in other cases from cans partially full, in others from cans almost empty, and still others from bottles. In the latter case the entire contents of the bottle represented the sample.

The analyses of the samples were made immediately upon their receipt in the laboratory by the chemical methods adopted by the Association of Official Agricultural Chemists.

The cost as delivered to consumers was practically the same everywhere, namely, 8 cents per quart.

In the samples obtained from New Brunswick the variation in total solids ranges from 11.82 per cent to 14.03 per cent, or a difference between highest and lowest of 2.21 pounds per hundred, or 18 per cent dry matter. The variation in fat ranges from 2.99 per cent to 4.57 per cent, a difference of 1.58 pounds per hundred, or 50 per cent. The average composition of the milk, however, is higher than the average composition given as representing normal milk, and in but one case is the variation in the proportion of the different constituents so marked as to indicate that the samples were not fairly representative of whole milk.

In the samples from Newark the total solids range from 10.81 per cent to 14.86 per cent, a difference of 4.05 pounds per hundred, or 37 per cent, while the fat ranges from 2.56 per cent to 6.92 per cent, a difference of 4.36 pounds per hundred, or 130 per cent. The average composition is, so far as total solids are concerned, practically identical with the New Brunswick average, though showing a slightly higher percentage of fat. In one sample the content of total solids and fat is so low as to create a suspicion of adulteration, and another contains an undue proportion of fat.

In the samples from Trenton the percentage of total solids ranges from 10.61 per cent to 13.96 per cent, a difference of 3.32 pounds per hundred, or 31 per cent. The fat ranges from 2.97 per cent to 4.80 per cent, a difference of 1.83 pounds per hundred, or 61 per cent and in one sample only does there appear to be an abnormally low content of total solids and fat.

In the samples from Camden the range in total solids is from 12.06 per cent to 16.55 per cent, or a difference of 4.49 pounds per hundred, or 37 per cent. The range in fat is from 3.28 per cent to 7.76 per cent, a difference of 4.48 pounds per hundred, or 138 per cent. The average composition of the milks from Camden is very much higher than that from the other cities, both in total solids and in fat. Two samples only show an abnormal percentage of fat.

On the whole, however, the milk supplies of those cities may be regarded as extremely good, showing an average of: Total solids, 12.97; fat, 4.13; casein and albumen, 3.37; sugar, 4.75; and ash, 0.72 per cent.

A further study of the results shows that the samples fall into eight distinct classes according to their composition, the first, containing those showing less than 3 per cent of fat; the second, those containing from 3 to 3.50 per cent of fat; the third,

[1] See, also, U. S. Dept. Agr., Office of Experiment Stations Bul. 35.

those from 3.50 to 4 per cent; the fourth, those from 4 to 4.50 per cent; the fifth, those from 4.50 to 5 per cent; the sixth, those from 5 to 5.50 per cent; the seventh, those from 5.50 to 6 per cent; and the eighth those containing over 6 per cent of fat.

In the first class but four samples are recorded in which the total solids average less than 12 per cent and the fat 2.84 per cent, an average composition so low as to lead to the belief that the samples included do not represent the whole milk of well-fed, healthy animals, but since these milks were sold at the same price per quart as others of higher quality, they are not excluded from this discussion.

In the second class 16 samples are included, showing an average of 12.15 per cent total solids, and 3.34 per cent of fat.

The third class includes 34 samples, one-third of the whole number, the average composition of which exceeds the average assumed for good milk. The remaining samples, 48 in number, or nearly half, exceed 13 per cent of total solids and 4 per cent of fat.

The fact that milk falls into the various classes already indicated in respect to composition shows at once that at a uniform price per quart there is a wide variation in the cost of nutrients to the consumer. Assuming, for the present, that the quality of the nutrients, as represented by the total solids, is quite as good in one class of samples as in another, the cost per pound of total solids in class one, at the rate of 8 cents per quart, or 2 cents per pound,[1] is 35 cents, while in the eighth class it is 26 cents, or 38.5 per cent greater in class one than in class eight. In other words, $100 spent for milk of the quality represented by the eighth class would purchase nutriment that would cost $138.50 if purchased in the form of milk of the quality represented by class one.

These extremes exhibit the range of cost; the average cost would be 31 cents, which is fairly representative of class four, which includes about one-fourth of the total number of samples; more than one-half of the total number, however, show a lower quality than the average.

The fact that the constituent fat in milk varies more than the remainder of the constituents, or solids-not-fat, shows that the more expensive nutrients contained in the poorer milks are also less valuable as food than the less expensive nutrients contained in richer milks.

The fat contains about two and one-fourth times as many heat units or calories per pound as protein or carbohydrates; hence, so far as supplying the needs of the body for heat is concerned, a pound of fat is two and one-fourth times as valuable as a pound of protein or carbohydrates.

A study of the average composition of the milks in the preceding classification shows that as the total solids in the milk increases for the various classes the percentage of fat is increased in greater proportion than the solids-not-fat. For instance, in class one but 25.9 per cent of the total solids is fat; in class two, with slightly over 12 per cent total solids, it is increased to 27.5 per cent; in class three, with over 12.50 per cent total solids, the fat constitutes 30.2 per cent of the total nutrients; in class four, with over 13 per cent total solids, the fat is increased to 32.2 per cent; with 13.70 per cent total solids in class five, the fat is 34.2 per cent; in class six it is 37.20 per cent; in class seven it is 38.2 per cent, and in class eight the fat constitutes 45.8 per cent of the total solids contained in the milk.

In other words, the total solids as represented by class six, for instance, contains 20 pounds per hundred more of fat than is contained in 100 pounds of total solids represented by class one. The consumer not only secures his total solids in the richer milk at a lower cost per pound, but also obtains a product which is very much richer in nutritive matter.

The facts brought out by this investigation in regard to the variation in the cost and quality of the nutrients contained in milk show very clearly that the standard now in use as the basis of sale, viz, the quart, is illogical, and is unfair both to the consumer and to the producer of good milk.

That is, the method results in indirect adulteration and affects both the consumer and the producer of good milk. Because of the wide variations that occur the consumer is really affected more than by the actual adulteration that is practiced, if we assume that the four samples of very low quality, which constituted but 4 per cent of the whole number examined, were adulterated. The chief fear on the part of the consumer seems, however, to be on that score, as is evidenced by the fact that in many States large annual appropriations are made the express purpose of which is to exercise a control or to pay the expenses of a milk inspection which has for its sole object the detection of adulteration. In our State it costs over $12,000 annually for this purpose.

Assuming that the percentage of fat is a safe guide as to the nutritive value of milk—which assumption is practically borne out by this study—the content of this constituent would better serve as a standard than the quart. For instance, on the

[1] On the average, a quart of milk will weigh 2.15 pounds.

average the milks examined, and for which at the average price of 8 cents per quart $4 per hundred were paid, contained in round numbers 4 per cent, or 4 pounds per hundred of fat. If milk containing 4 per cent of fat is worth 8 cents per quart, milk containing 3.50 per cent would, on the same basis, be worth 7 cents per quart, and 3 per cent milk only 6 cents per quart, while milk containing 4.50 per cent fat would be worth 9 cents per quart, and 5 per cent milk, 10 cents per quart. If the fat content standard were adopted, the consumer would be protected in the sense that he would receive just what he paid for, and the producer of a high quality product the advantage of a higher price, which fairly belongs to him, because of the greater cost of producing milk of a better quality.

This method of purchasing milk is now used in many creameries with entire satisfaction to both the seller and the buyer, and the facts brought out in this investigation indicate that its adoption is quite as important in the purchase of supplies for the home where the entire product is used as food.

Investigations now in progress at our station indicate, too, that this method is entirely practicable; it only requires that the producer shall understand the chief causes of the variations in the quality of milk, as far as now known, and that he adapt himself to those conditions, and make frequent tests of the fat content of his product, which may now be readily accomplished by the use of inexpensive apparatus, and which can be operated by any intelligent person. It would seem that this subject is well worthy the attention of our experiment stations, to determine whether the sums now expended for milk inspection, as now conducted, may not be directed toward an inspection which will afford a better protection of both producer and consumer, and that a careful study should be made of the further and allied question as to the methods by which sales on the basis of quality may be accomplished in the retail trade.

C. C. Georgeson, of Kansas, read the following paper:

How Shall Selling Milk on the Basis of Quality be Accomplished in the Retail Trade.

The subject is not of my own choosing, but I have consented to say something in the hope that it will set the ball rolling and perhaps others can bring out points of value. I recognize the fact that it is a question of vast importance to consumers of milk, especially in our cities. The means for determining the quality of milk which have been invented as yet, are not of a nature that the ordinary consumer, the householder, can make use of. He is at the mercy of the dealer, and it would be highly desirable if some plan could be evolved by which he could always be assured that the milk he bought was of a desirable quality. To protect the consumer against impositions, several States have laws which fix the quality of the milk that is allowed to be sold within their borders, and all large cities, and every considerable town and village, have regulations which require dealers to furnish milk of a certain quality to their denizens.

But before we discuss plans it is essential that we should have a clear understanding of what is meant by the word "quality." Does it simply mean that the milk must contain a certain per cent of fat and solids not fat? It is possible for milk to be of a good standard in this respect and yet be a very objectionable article of food. It must also mean that it shall be pure milk, neither diluted with water nor adulterated by the additions of preservatives or other substances intended to deceive the consumer. It means that it must be clean, free from dust and dirt, and it means that it must be palatable, free from any taint offensive to taste or smell. It means it must be healthful, free from disease germs of every description, and that it must be the product of healthy cows. In short, if a proper standard of quality is established, it must cover not the composition merely, but all of these other points by which milk can be deteriorated. It means pure, sweet, normal, wholesome milk.

Now the question is, What means can be devised to provide such milk, and such milk only, for the retail trade? Only experts can determine whether a given sample of milk is of the quality here designated. The chemist and the bacteriologist must both be consulted. This at once excludes all possibility that the average consumer can determine the quality. If it were simply a question of the per cent of fat and solids-not-fat in the milk, the difficulty might perhaps be met without great trouble, but the estimate of nutritive matter does not determine the healthfulness of the milk, which is still more important. Even though a test should be devised so simple that by stirring a chemical into a sample of milk, the several constituents of that sample would proceed to arrange themselves in strata, and the per cent of each could be read off on the side of the glass, still the consumer would be unable to determine from this whether it was a fit sample of milk to give his children; it might still swarm with germs of diphtheria, typhoid fever, or tuberculosis, for the detection of which I have so far failed to hear of any short-cut process.

To be assured of an acceptable quality of milk, the average consumer is, therefore, necessarily dependent on the regulations established by law and on the officers entrusted with the enforcement of the law. Does not the question therefore resolve itself into this, "What is the most effective and least cumbersome system of regulations which can be adopted for the retail milk trade?" On this subject there are necessarily many and various opinions, and it would be a difficult matter to draft a law which would cover all cases equally well. But it is easy enough to point out some of the essential features. The law should not merely deal with the milk as it finds it in the market; it should reach out to the cow in the barn of the producer, to the feed, cleanliness, and the sanitary conditions which surround her; it should also reach out to the health and cleanliness, not only to the man who milks and feeds the cow, but to his family and the persons with whom he is in daily contact; it should reach to the water the cow drinks, and to the water which is used in cleaning the milk vessels, and it should protect the milk from contamination in transit from the time it leaves the cow till it is poured in the pitcher of the consumer. Anything short of this is imperfect and can not insure a healthful quality of milk to the consumer. Do you say that this is too much, that it would be impossible to enforce regulations which would be so far reaching. I say it is already done in several places with entire success, and what is done successfully on a comparatively small scale can certainly be done with equal, or even greater success, on a large scale with properly adjusted machinery. To be sure this supervision and the care needed on the part of the producer would cost something, and at present it is only the well-to-do who can afford milk of the quality here aimed at; but why should not a city guarantee such milk to all its denizens, both rich and poor. It is to the interest of every city to preserve the public health and it is because of a lack of supervision that serious diseases are sometimes spread broadcast among dense populations by the most perfect of all means of dissemination, the milk used in the family.

I know of no more perfect system for the supply of absolutely pure, sweet, healthful milk to city consumers than that adopted by a private company in the city of Copenhagen. It was primarily a philanthropic measure designed to bring milk of the quality here designated within the reach of the poor as well as of the rich; and they do it there with only a small charge per quart more than that of ordinary milk. This company buys the milk from a large number of producers, and it is shipped in to a central distributing point by rail and wagon. The producers of milk for this company must subscribe to a very strict code of regulations, which prescribes the kind and quality of feed the cows must have and proscribes a list of feeds they must not have. It describes how and when the cow must be milked and the measures that must be taken to insure cleanliness, both as regards the cleanliness of the animal, the milker, the stable, and the air in the stable. They must agree to handle the milk in a certain way and to deliver it promptly at the transportation depots. The cans are sealed when they leave the farm. The dairy farmer must submit to the inspection of his herd at any and all times by veterinarians in the service of the company, and, besides these, traveling inspectors are constantly on the road and drop in unexpectedly to ascertain if the feeding, milking, and cleanliness agreed upon is lived up to. Great care is taken to prevent the spread of disease. If a laborer on the farm, or any member of his family, is taken down with a contagious disease, the producer must notify the company and stop the milk until the case is investigated. These and many other points are strictly enforced. When the milk arrives at the station and as each can is opened, an expert is at hand who tastes and smells of the milk, and if a can is tainted in the least it is set aside and the cause investigated. Samples for analysis are likewise taken daily. After the milk is filtered in specially constructed filters it is again put in sealed cans and loaded on delivery wagons, which distribute it through the city. The milk is not accessible to the driver except through the faucet at the bottom of the can, and it is delivered directly to the house of the consumer. They furnish a special quality, which they call "children's milk," to supply which only the milk of particular cows, set aside by the company's veterinarians, is used. The company finds it possible to sell such milk at 5.5 cents a quart for children's milk and 4.5 cents for ordinary sweet milk, while milk from other sources without guaranty is sold at 4 cents.

Milk producers may be divided into three classes: (1) Those who furnish a specially high-class article to private customers at an advanced price; (2) those who furnish milk to city dealers who retail to the public; and, (3) a miscellaneous class of producers, who peddle their own milk through the streets. In the first case the character of the trade requires the milk to be of high-class quality, or the producer will lose his customers, and yet without supervision it is possible to introduce disease even here. In the second case, the milk dealer can, if he will, exercise some degree of supervision over the source of his supply; but it is to him simply a question of profit, and where the law does not require supervision he is apt to buy the milk wherever he can get it the cheapest if it only is sufficiently good not to contaminate all his milk with a taint of offensive taste or smell. The supervision as to the per cent of solids and fats which the city might require is no guaranty that it is a wholesome article of diet. And there is still less protection to the consumer against deleterious milk peddled by the third class of producers from the miscellaneous character of the supply.

These being the conditions, how is it possible to guarantee the quality of the milk in the retail trade? I confess that I see no other course but for each State to enact stringent laws, which shall prescribe detailed regulations of such a nature that if they are lived up to they will insure that none but good milk is ever offered for sale within its borders, and enforce them, appoint a dairy and food commissioner with a competent and numerous corps of assistants, whose business it shall be to visit every farm from which milk is sold, keep a constant supervision over the health of the cattle, the manner of their feeding and treatment, and the handling of the milk until it reaches the consumer, and with adequate penalties for infractions of the law.

The next paper was read by J. L. Hills, of Vermont.

WHAT IS THE MOST PROFITABLE WAY TO DISPOSE OF SKIM MILK?

This paper is made up of ideas regarding relative profits accruing from the use of skim milk in various ways, based largely upon facts brought out by American experiment-station investigation work.

Skim milk is used (1) as a food, human and animal, (2) as a fertilizer, and (3) in the arts.

Waiving, for the time being, the first and most important use in order to get the minor ones out of the way, skim milk, and indeed dairy by-products in general, are occasionally used directly as fertilizers. Such use is obviously wasteful, and should only be made a last resort, in the absence of animals to which it may be advantageously fed. Its analysis indicates that at current Eastern prices for similar ingredients in commercial fertilizers it is worth about 10 cents per hundred as plant food, a price at which too many dairymen are willing to sell. It is needless to remark that the nitrogen, phosphoric acid, and potash are in readily available forms.

The use of skim milk in the arts is, I believe, comparatively limited as yet. The precipitated casein has entered into the composition of certain forms of cement or glue and of artificial ivory.

Turning now to what must and will ever constitute the main use of dairy by-products, the feeding of animal creation, we find skim milk to be well adapted to and relished by every domestic animal, as well as by mankind.

The subject under discussion here naturally divides into the feeding of (1) animals and (2) of men.

Animal feeding.—There are five reasons which thus far have served to reduce the use of skim milk by city people and, indeed, in part by the dairymen themselves:

(1) Skim milk is a farm product, and especially in dairy districts is made in excess of the human requirements of the immediate vicinity.

(2) It is bulky, dilute, and transportation rates per unit of food are relatively high.

(3) There is a strong prejudice against its use among those who do not appreciate its true dietetic value and its relative economy which is difficult to overcome.

(4) It has as yet not been so manipulated as to be put up in attractive and appetizing form.

(5) Its sale for human consumption is prohibited in many States.

For these reasons, therefore, almost all skim milk is fed upon the farm. It is usually fed to pigs or calves, but sometimes to cows, horses, colts, sheep, lambs, and poultry, and even to squashes and pumpkins designed to beat the record for mammoth growth at the next county fair.

Many American stations—notably Iowa, Maine, Massachusetts, Michigan, New York, Pennsylvania, Vermont, and Wisconsin—have made feeding experiments on various classes of farm animals, with the view of comparing the relative values of skim milk and other foods from the economic standpoint. These have usually resulted to the advantage of the dairy by-product. So far as the writer is aware, no experiments have as yet been reported by any American station showing that skim milk is more profitable when fed to one than to another class of domestic animals. From the nature of the case, this must always be indeterminate and variable, because changes in the market prices of pork, veal, beef, milk, etc., and in the most profitable means for the disposal of skim milk when animal feeding alone can be depended upon, must ever be a local problem to be solved by the individual. It may not be amiss to say, however, that the results of experiments, as well as the general experience of well-informed and practical dairymen, seem to indicate that under the dairying conditions and market prices of farm produce in the Eastern States skim milk is more profitable when fed to swine than when fed to cows, calves, or sheep, provided the animal is forced to rapid growth and sold at not to exceed 250 pounds live weight. Several investigators have tried to improve skim milk for animal feeding, with the view of making it more palatable or nutritious. Morfit proposes to add to and blend into skim milk white sugar and cotton seed oil, the whole being boiled in a vacuum pan to one-third bulk; Dierking emulsifies with it a mixture of rape-seed oil and some mucilaginous material, making a sort of artificial cream, while Rhenstrom manufactures feeding cakes of varying composition, made by precipitating, drying, and grinding the casein of the skim milk, mixing the same with more or less nitrogenous or carbohydrate feeding stuffs, according to the nature of the cake desired, and finally strongly compressing the mass.

While primarily intended for animal consumption, there is no reason why such substances, if palatable and agreeable, should not enter into human dietaries, a consideration which brings us naturally to the subject of skim milk in human feeding.

Human feeding.—It will be remembered that the fundamental principles of feeding, human and animal (abridged from Dr. Atwater's statements), are:

(1) Food builds up body tissues, keeps them in repair, or is consumed to yield energy in the form of heat to keep the body warm and create strength for its work.

(2) The most healthful food is that best fitted to the wants of the user. It must supply the different nutrients in digestible and palatable (agreeable) forms, in the kinds and amounts needed by the body to build up its several parts, to repair them, and to yield energy in the form of heat and muscular power.

(3) The cheapest food is that which furnishes the most nutriment at the least cost.

(4) The most economic food is that which is both most healthful and cheapest.

It should also be borne in mind that the four cardinal sins of American food economy are (1) extravagance in the purchase of food; (2) ill-balanced nutrients, digestible carbohydrates being in excess and digestible protein relatively lacking; (3) overeating, and (4) poor cooking.

Does skim milk fulfill the conditions of the fundamentals already given? Does it tend to save us from our dietary sins? It may be safely said, barring exceptional cases and presupposing healthy animals, that it is well balanced, healthful, digestible, agreeable, cheap, economical; and that in the highest, truest sense of the words, in the light of the general food of the human race, the most profitable means of disposing of skim milk is as human food. Further than this, it is safe to say that once the obstacles now in the way of the more general use of skim milk in the cities are removed larger sums than are now received by way of the pork barrel will be returned to farmers for skim milk used.

Skim milk is particularly valuable in human dietaries for two reasons: (1) Its dry matter consists largely of digestible protein; (2) it forms one of the cheapest forms of digestible protein.

In other words, it serves to narrow and to cheapen our naturally too wide and too costly rations.

By reference to Dr. Atwater's tables, published in the Yearbook of the Department of Agriculture, and in his several valuable monographs, we find that a pound of separator skim milk contains 0.034 pound protein and 170 calories.

"A pound of lean beef contains about 0.180 pound of flesh formers and has a fuel value of 870 calories. Two quarts and a half, or 5 pounds, of skim milk will furnish the same amount of flesh formers, and have nearly the same fuel value as a pound of round steak. Two quarts of skim milk have a greater nutritive value than a quart of oysters; the skim milk has 0.14 pound of flesh formers and fuel value of 680 calories, while the oysters contain only 0.12 pound of flesh formers and have a value of 470 calories. The nutriment in the form of oysters would cost from 30 to 40 cents, while 2 quarts of skim milk would have a market value of not more than 2 or 3 cents. An oyster stew made of one part oysters and two parts skim milk would owe its value for nutriment more to the milk than to the oysters. Bread made with skim milk would have much more of the flesh formers than when made with water."

The following table, taken from the report of the twenty-sixth annual meeting of the Vermont Dairymen's Association gives—

A comparison of skim milk with other foods.

	One pound contains—		
	Refuse.	Flesh formers.	Fuel Value.
	Pound.	*Pound.*	*Calories.*
Whole milk	....	0.033	325
Skim milk	....	.034	170
Oysters, solid (equal to 1.5 pounds skim milk)	....	.061	235
Bluefish (equal to 1.5 pounds skim milk)	0.486	.098	205
Chicken (equal to 2 pounds skim milk)	.348	.148	325
Beets (equal to 1 pound skim milk)	.200	.013	170
Potatoes (equal to 2 pounds skim milk)	.150	.018	325
Bananas (equal to 1.5 pounds skim milk)	.400	.007	290
Beef:			
Round (equal to 4.5 pounds skim milk)	.077	.181	870
Sirloin (equal to 6 pounds skim milk)	.130	.159	1,040
Shoulder (equal to 4 pounds skim milk)	.164	.161	716
Shoulder, clod (equal to 5 pounds skim milk)	....	.193	835

From the standpoint of economy, skim milk is a cheaper source of protein at 50 cents a hundred than is any other food. It is cheaper at $1 per hundred than is any food except wheat flour, corn meal, and bran, but one of which is adapted to narrow a ration. Most dairymen consider themselves well paid to receive the equivalent of 25 cents per hundred pounds for skim milk when turned into pork, and many are willing to sell it at the creamery at 15 or even 10 cents per hundred.

It will be recollected that earlier in this paper dilution, prejudice, lack of attractiveness, and legal enactment were stated to be barriers between producer and consumer. Are they insurmountable?

(1) Dilution may be avoided by (*a*) casein precipitation, filtration, the dried curd being marketed, (*b*) by concentration and sterilization (or pasteurization). It is safe to say that details for the successful management of this portion of the work would follow popular demand for the article.

(2) Prejudice can be best overcome by education, which may extend to legislative halls as well as to the haunts of poverty. I look for great good to come from the dissemination of the results of the food investigations of the Department of Agriculture.

(3) Lack of attractiveness in the method of its presentation to the public may be solved, perhaps, by the making of cottage cheese, condensed skim milk, or in other ways, which will quite surely be worked out by dairymen if they are aroused to the opportunities open to them.

Legal enactments forbidding the sale of skim milk might now be far better replaced by acts permitting the sale of any healthful milk, skimmed or whole, upon its guaranty of solids and fat and by acts looking to the health of the animals and the sanitary condition of the stables.

I have made no reference to the manufacture of filled cheese as a profitable means of utilizing skim milk, since under laws now existing the wrongful profits accruing therefrom have been shut off.

The discussion of the question, "Can station farms be conducted so as to not unfit them for experimental purposes?" was opened by R. H. Miller, of Maryland, in a brief paper, and was participated in by R. J. Redding and H. J. Wheeler.

The question, "How nearly can physical conditions of soil be controlled and methods for the same?" was discussed by M. Whitney, of the United States Department of Agriculture, who described electrical apparatus of his own invention for determining, by means of electrical resistance of the soil, the amount of moisture in the soil, the temperature at different depths, and the quantity of soluble salts it contains. The apparatus is also adapted to the determination of the progress of leaching in the soil and of the depth to which rainfall penetrates. He stated that several of these instruments are in successful use by farmers.[1]

I. P. Roberts, of New York, described a new dynamometer for use in determining the draft of agricultural machinery.

W. H. Jordan, of New York, briefly discussed, "Reforms which should be inaugurated in the methods of making feeding experiments." He classed feeding experiments under two heads—those which are undertaken for the purpose of discovering the fundamental principles of animal nutrition, and those which may more properly be styled tests of theory or experiments as object lessons. The first class is of the greater importance, but a large proportion of the experiments which the stations have heretofore made belongs to the second class. In the speaker's opinion, reform in feeding experiments should come along the line of a closer study of the materials fed and the product obtained and the lengthening of the feeding periods until we are sure that we have established and maintained certain effects from certain rations. The discussion of this subject was participated in by I. P. Roberts, W. A. Henry, J. B. Lindsey, James Wilson, and C. C. Georgeson. The principal point brought out was that while the value of scientific experiments is unquestioned, many practical experiments which do not lend themselves to scientific accuracy may be conducted with advantage by the stations.

Two papers—(1) "A brief statement concerning our present knowledge of the com-

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[1] See U. S. Dept. Agr., Division of Soils Bul. 6.

position of crude fiber and extract matter," and (2) "The distribution of galactan in agricultural plants and seeds"—were presented by J. B. Lindsey,[1] of Massachusetts.

Other papers presented were "Irrigation for the Eastern agriculturist," by F. W. Rane, of New Hampshire; "Improvements in laboratory methods of teaching agriculture," by T. F. Hunt, of Ohio, and "Improvements in and further tests of the laboratory methods for teaching agriculture," by C. S. Plumb, of Indiana.

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[1] See Massachusetts Hatch Sta. Rpt. 1896, p. 92.

SECTION ON HORTICULTURE AND BOTANY.

Three sessions of this section were held in the lecture room of the Cosmos Club, F. W. Card, of Nebraska, presiding.

G. E. Stone, of Massachusetts, read the following paper:

VEGETABLE PHYSIOLOGY IN AGRICULTURAL COLLEGES.

The subject of teaching plant physiology in agricultural colleges, as well as other scientific colleges, is one of great importance. It is no exaggeration to state that there has been no branch of botany so neglected in our country as the physiology of plants. It is in fact the last branch of botany to be taken up, and it is only within the last few years that any serious attention has been given to it whatever. This fact, too, is rather singular when we take into consideration that agricultural practices are based upon the laws of vegetable physiology. Many years ago Dr. Lindley, when editor of the Gardeners' Chronicle, emphasized this very point in the statement that "good agriculture and horticulture are founded upon the laws of vegetable physiology," and no less an authority than Marshall Ward has recently expressed himself in a similar manner. At the same time we have been content to teach agriculture and agricultural botany in our colleges for years without considering it necessary to give the student anything more than an elementary course in morphology, followed by flower analysis and the gathering of a herbarium, with a little histology thrown in. The history of botany in our colleges shows that it has followed this sequence in its development. At first many of our institutions gave attention only to morphology and systematic botany. This knowledge enabled the student to know a rhizome from a root, the different parts of a flower, and how to determine the name of a plant as well as the family to which it belongs. Then came a course in histology and cryptogamic botany, which has been followed in later years by one in vegetable pathology. To be sure, certain physiological facts have been mentioned in our courses of botany and agriculture, but so far as I am aware the majority of our colleges have touched upon physiology only in an incidental manner. I know of graduates of agricultural colleges who could not define the functions of a leaf or tell anything about the known metabolic processes which take place in it, although they might be able to tell something about its structure, simply because they never had an opportunity in their course of study to learn anything about such facts. Now, I ask, should not such facts be well understood by our students in agricultural colleges? Is not a knowledge of the function of the leaf fully as important as that of its structure?

There are many reasons why more attention has not been paid to vegetable physiology in America, and I shall endeavor to point out some of them. The first botanical activities in a new country are always devoted to systematic work, and this is quite logical. The systematic botany of America has required many botanical workers, and will require the life work of some others before it is completed and before botanists will be compelled to turn their attention to other fields, such as the morphology, physiology, and biology of plants. This fact has already impressed itself upon the mind of our younger generation of botanists, and within the last six years not a few of them have endeavored to take advantage of the superior courses in morphology and physiology offered in Germany by such masters as Strassberger, Pfeffer, and Goebel. Indeed, if we reflect upon the history of botanical science in Europe, we will note that a similar development has taken place there. First came the systematic workers who were represented by Linnæus, Jussieu, and the De Candolles, and they were followed by the morphologists and physiologists, like Hofmeister, Strassberger, Sachs, Naegeli, and De Bary. But the systematic work of Europe having been practically completed years ago, morphological and physiological questions received attention there much earlier than we could expect here, and practically these are the only questions which receive much attention in Europe to-day.

America, however, has not been entirely without physiological workers in the past, and it would be an injustice if I did not call attention to some of them. We have only to recollect the able experiments of Professor Draper on the chemistry of assimilation, carried on as far back as 1844, and those of William S. Clark, president of the agricultural college at Amherst, who was as much chemist as botanist, on plant growth. Both of these men did excellent work, although it is but justice to state that undoubtedly it is not what it would have been had their environment been different.

Again, the facilities for teaching physiological botany in America have not been what they ought, nor have the opportunities offered by some of our larger universities been taken advantage of. It can not be said, however, that this is due to the lack of interested students, but rather to the lack of interest on the part of the gentlemen who have had such courses in charge. The truth of the matter is that if one wished to take a course in experimental physiology a few years ago he could not do it in this country, because no institutions offered a course in that branch which would be satisfactory, and furthermore because there were no laboratories equipped for that purpose.

Previous to 1890 there were only three or four American botanists who ever took a genuine course in physiology in a foreign university, but since that time there has been something like a dozen who have availed themselves of this opportunity, and as a result vegetable physiology has received an impetus not only in our colleges, where already one or two laboratories, as at Purdue, the University of Minnesota, etc., have been established, but also in our secondary schools and high schools, where the text-books now in use contain some physiology.

Another factor which is responsible for the nondevelopment of vegetable physiology, and we may justly say of botany in general, is the position which some of our principal higher universities have taken in regard to introducing pure botanical courses. The course termed biology, which they offer mainly through zoologists, has made the development of higher botany impossible. Most of the zoologists having these biological courses in charge have apparently looked upon botany as a subject worthy of being taught merely to women and children. In regard to such conceptions of botany I have no objections to urge, for, judging from the way in which this subject has been studied in many of our colleges, I do not see how it could be considered worthy of any more serious consideration. This so-called biology as understood here and in England (though not in Germany), which endeavors to convey to the student at least a fairly good conception of both the physiological and anatomical characteristics of a few plants and animals, is in my estimation far superior to that botany which leaves the student with merely the knowledge of the Latin names of a few hundred plants. As far as my own observation goes, the botanists have been much more backward in this country than the zoologists, and they are consequently responsible for the inferior position which botany has taken in our institutions of learning.

In Germany, however, this is by no means the case. No names can be found among the contemporary zoologists which excel those of Naegeli, Sachs, and De Bary.

Before taking into consideration, however, the details connected with plant physiology in its relationship to agricultural colleges, let us have a clearer understanding of just what it is. The necessity of defining a branch like physiology is in itself a reflection on our botanical development, especially when there are so many excellent text-books treating of physiology in a distinctly characteristic manner. Nevertheless such misconceptions exist, and I feel justified in calling attention to them. There has never been any question as to what physiology implied among the animal physiologists; neither has there been any among European vegetable physiologists. But right here in our American agricultural institutions we have had professors of botany who did not, and do not to-day, seem to know exactly what ground this subject covers. One institution that I have in mind has advertised for years a thorough and complete equipment for work in vegetable physiology, and yet this very same institution has scarcely had a single piece of purely physiological apparatus in its outfit during the whole time. The institution I refer to by no means stands alone in this matter. There are others holding the same conception of physiology. The fact in regard to the matter is this—that there are still some botanists who insist on calling the study of the structure of a stem or leaf, or the mounting of a slide, etc., physiology. The origin of at least part of this erroneous conception is not far to seek, neither is it easy to eradicate, so long as our institutions will employ such abominably antiquated text-books as Wood's Class-book of Botany, a work which pretends to devote a few pages to physiology, though scarcely touching the subject, except in the most primitive manner. Physiology as treated by such eminent animal physiologists as Foster, Bowditch, Ludwig, Du Bois Reymond, and others, implies function, and I can not understand how a botanist can even have looked into the text-books of Vines, Sachs, Pfeffer, Frank, and others without obtaining a similar conception. In the treatment of this subject we shall therefore follow the European conception rather than the provincial American, and we shall now pass on to a consideration of the advantages to be derived from a study of physiology.

Why should physiology be taught in agricultural colleges? Because it is that branch of botany which has the closest relationship with all horticultural and agricultural knowledge and practice. It is, in fact, the very foundation of these branches. It concerns itself with the functions of plants rather than with their structure—factors in plant life which present the most puzzling phenomena. It concerns itself with all the questions connected with plant food, whether taken from the soil or air, with symbiosis, co-relation, vegetable pathology, and all of those intricate processes which manifest themselves through the action of such external stimuli as heat, light, moisture, etc.

It requires no extensive reasoning to show that of all the factors which practical gardeners, floriculturists, horticulturists, and agriculturists have to contend with, that of the relation of the plant to external stimuli is by far the most important.

Physiology should, therefore, occupy a prominent place in the curriculum of every agricultural college. I do not wish, however, to imply that we should dispense with any of our other branches of botany, for a good grounding in the elementary branches, such as systematic botany, morphology, and histology, is absolutely essential. For example, physiology should never be taken up as a study by itself until the student has had a laboratory course in histology. Such a course would be illogical and absurd. It would be just as ridiculous for the student to do this as it would be for an untrained engineer to attempt to run a machine of which he knew absolutely nothing. A training in physiology has, furthermore, a great bearing on station work, especially in the investigation of plant disease, fertilizer experiment, spraying of plants, and in fact in every kind of agricultural and horticultural work. As our experiment station workers are largely trained in our agricultural colleges, they should therefore have the advantages of a physiological training. A large number of our plant diseases have their origin in physiological disorders, and here, too, we have neglected physiology as a preliminary training to the study of the abnormal condition of plants. The subordination of physiology in this respect finds its parallel only in the neglect of the study of the mechanical condition of the soil. I deem it no exaggeration when I state that a man is not capable of doing his best work in vegetable pathology until he pays some attention to the normal functions of plants. This matter is now, I believe, becoming well understood. If there is any one class of experiments, however, which shows a defect in physiological knowledge more than any other, it is that large class pertaining to various kinds of treatment with fertilizers and fungicides, or in other words, where deductions are drawn from the behavior of plants under different kinds of treatment. In such experiments we frequently find that the number of plants employed is too small from which to draw conclusions, that the conditions are not always similar, and that such factors as individual variation are entirely ignored. It is only after years of physiological experimentation that the effect of the manifold external factors on the vegetable organism can be thoroughly appreciated, and this is especially true in regard to individual variation, which always manifests itself, even when the external factors are eliminated as far as possible. Only those botanists who have worked for days or months at a time, measuring the minute changes which take place in a large series of plants, are in a position to understand the significance of these factors.

It remains for us to call attention to the place of physiology in the curriculum. Inasmuch as physiological botany concerns itself with function, it is essential that any extensive course in this branch must be preceded by a fairly good course in anatomy and histology, just exactly as morphology should precede systematic botany, or normal histology that of vegetable pathology. I believe, however, that in every elementary branch of botany the function of the plant should be taken into consideration. Many of the sound ideas contained in the report of the committee of ten on the teaching of botany in our secondary schools might be profitably employed by our colleges. They recommend always bearing in mind the following questions: What, Why, and How? Indeed, these questions concern themselves with every branch of botany from the mere name of the plant to its biological features. As in the study of morphology and physiology we can pay some attention to the biological features of the plant, so when we take up histology we can sprinkle into advantage some elementary physiology.

The time given to physiology at Amherst is eight hours a week for one term. The term[1] is the last one in the senior year, in an elective course, and is preceded by four terms of elementary botany, which includes morphology, systematic botany, economic botany, histology, and cryptogamic botany, in the order named. The cryptogamic botany requires two terms of eight hours per week each, and special attention is given to pathogenic fungi. The histological botany requires one and one-half terms, while two and one-half terms are given up to the study of morphology, systematic and economic botany. This gives the student a fair basis for physiological study, although it leaves him slightly weak in histology, there being at present only

[1] The year is divided into three terms.

about seventy-two hours of laboratory work devoted to this subject. We would prefer to put the student through some such practical work as Strassberger's text-book, but the time at our disposal is not quite sufficient. It is in the line of histology that we should expect our students to be weak compared with those of other scientific colleges, because in our agricultural colleges there is no practical need of histology being taken up so extensively, since it has less about it of a practical nature and consequently it has to make room for other branches of more importance. The two branches of botany that our agricultural colleges can develop to a considerable extent are vegetable physiology and pathology, and the advanced systematic, histological, and embryological work can be left to other scientific institutions. By doing this we specialize along a line in which we are expected to excel, and are not compelled to work along lines which other institutions have a chance to develop better.

Bearing in mind what has been said in regard to teaching elementary physiology in connection with other branches of botany, I believe that in addition to this one term of eight hours per week will be found sufficient to cover the ground fairly well in the college course. This should also include about twenty lectures on the subject. We consider the matter of lectures an important one, because the subject can be treated better than by the use of text-books.

Many writers treat physiology from the standpoint of irritability. This is an excellent method, because year by year we are tracing pheuomena back to some form of irritability, and consequently this subject should be fairly well understood. The physiology of Vines treats the subject in this manner; so does also his later text-book (vol. 2, 1896). The former work, however, is too comprehensive for a college student, although the latter is not. The smaller volume has also the advantage of being up to date, and on the whole it constitutes the best text-book in English that could be substituted for a course of lectures. There is one other book possessing great merit, and that is Sorauer's text-book, entitled Popular Treatise on the Physiology of Plants. Professor Sorauer is well known as an authority on the diseases of plants, and his position for many years as professor in the Horticultural Institute at Proskau has given him an opportunity to write a text-book on physiology particularly adapted to agricultural and horticultural students. While the method of treatment is perhaps not quite so comprehensive as some, the exceedingly practical way in which the subject is handled makes it an excellent supplementary work for the student to read. In regard to laboratory manuals, the best work for the student is undoubtedly Darwin and Acton's Physiology of Plants. On account of the lack of explanatory details connected with the experiments, this work should be used only in connection with a teacher. We have used it for two years and have been able to utilize a large number of the experiments described therein. It is not necessary that each student should perform the same experiment, and the ground can be covered more extensively by dividing the work up into sections, and touching upon the various experiments from time to time in the lectures. Rigid adherence to any text-book is hardly essential or desirable, and in Darwin and Acton's the experiments can be improved upon and frequently simplified. In fact, for an agricultural course there are other experiments which are much better than those described, and should be supplemented.

Much more attention can be given to plant foods. For example, many pot experiments can be made with various kinds of commercial fertilizers and house-plant foods; on the effects of the various potash compounds on the growth of clover, or nitrate of soda on grass; and on the effects of preceding cultures of mustard, buckwheat, lupine, clover, etc., on the growth of forage plants. In short, in an agricultural course the same principle should be borne in mind in physiological experiments as in other branches of botany—namely, to substitute an experiment which possesses some agricultural feature for one which has little agricultural significance, provided this feature does not interfere with the logical and general treatment of the subject. For a practical course in physiology considerable apparatus is needed. This is generally expensive and, when imported, not always satisfactory from the American idea of machinery. Much of the apparatus can be constructed in the laboratory, providing a good set of tools is at hand. Some students possess the natural Yankee technique, and such students are likely to take a genuine interest in physiology on this account. Much time is saved by having the apparatus all ready to put together at short notice, and for this purpose it is necessary to have a good stock of glassware on hand, which should be fitted up for the various experiments.

The discussion following the reading of this paper brought out the fact that while less physiological botany is taught than was considered desirable, yet the importance of the study is fully appreciated.

A paper on the "Place of botany in the curriculum, and time, phase, or phases of work in each period and relation to other subjects in the course," by L. H. Pammel, of Iowa, was read by the temporary secretary, F. S. Earle. The author outlined the botanical course of the Iowa Agricultural College. No botany is required for admission, but it is provided for in required and elective courses, covering a considerable period of the college course. The use of text-books for teaching elementary botany was advised. Laboratory work should be kept under the guidance of assistants or those in charge, and the economic features should be kept in the foreground, while not neglecting the training value of the subject.

"Industrial teaching of horticulture in agricultural colleges" was outlined by S. C. Mason, of Kansas. The author thought that industrial horticulture offers great advantages in that it gives manual training and presents unusual opportunities for teaching by advanced students. Such a course should be preceded by some botanical work. The horticultural course in the Kansas Agricultural College was outlined.

The following paper by E. S. Goff, of Wisconsin, was read by the temporary secretary:

Laboratory Work in Horticulture.

In the University of Wisconsin all of the students in horticulture have either had two or three terms of work in structural and physiological botany, or else have had one term of work in "plant culture," which gives them the elements of these sciences. The laboratory work which I have been accustomed to give our students in horticulture, with two lessons which I shall introduce this season for the first time, is substantially as follows: I include in the catalogue work in the greenhouse as well as in the horticultural laboratory proper.

(1) One lesson in making cuttings from dormant wood. The students are given wood of the grape, currant, and sometimes of other plants, as Marianna plum. They are taught how to make the cuttings, and are expected to explain the reasons for making them in the particular ways. They perform this work in the laboratory with the approved tools which we furnish.

(2) Two lessons in making grafting wax and grafting paper. The first lesson is in making grafting wax. The materials and utensils are provided, and the students make the wax according to a printed formula. The second lesson is making grafting paper, which is performed under the supervision of the instructor.

(3) One lesson in cleft grafting. This work is done either out of doors in the orchard, or, if in the winter time, in our garden greenhouse. In the latter case trees sufficiently large for cleft grafting are brought in and temporarily planted.

(4) Two or three lessons in whip grafting. This operation is performed with apple scions upon apple seedlings, after the manner practiced by nurserymen. The students have the benefit of three large wall pictures, showing the position of the hands and tools in the different steps of the process.

(5) One lesson in budding. In winter this is performed in the garden greenhouse with materials prepared during the preceding summer and autumn.

(6) One lesson in planting, cuttings, and root grafts. The students are given the approved tools and taught to perform the work in the manner that best economizes time and strength.

(7) Two lessons in pruning and covering grapevines. The first lesson includes the pruning and the second the covering. This work is usually done in the garden greenhouse with vines taken up in autumn and stored in the cellar.

(8) Two lessons in spraying and the use of spraying tools. The students are first given instruction in different kinds of spraying tools, and are required to take at least one of the pumps apart, pack it, and put it together. Next they are given instructions in spraying, either out of doors or upon the trees in the garden greenhouse. Our students in horticulture have previously had instructions in compounding insecticides and fungicides.

(9) One lesson in the use of the stapling machine in making berry boxes. The students are taught how to use the machine, and they are expected to use it one at a time as opportunity occurs.

(10) One lesson in packing apples. A model apple barrel is filled with apples and pressed with the approved appliances.

(11) Two lessons in outdoor pruning. These lessons are put in at times when the weather is favorable for outdoor work.

(12) Two lessons in describing apples. The descriptions of the leading pomologists are studied and the points for description are noted, after which written descriptions are made of certain varieties.

(13) One or two lessons in judging apples. This lesson necessarily depends somewhat on the stock of apples available. Sometimes apples are so high priced in our markets that we feel obliged to omit it.

(14) One lesson in packing plants for shipment by the most approved methods and appliances.

In addition to the above, our students in horticulture are given work in the greenhouse as follows:

(1) One lesson in making a propagating bed. Each student makes a small propagating bed, in which he afterwards carries on the operations of propagation.

(2) One lesson in making and planting soft-wood cuttings.

(3) One lesson in preparing earth beds for vegetable culture in winter.

(4) One lesson in sowing seeds.

(5) Two lessons in pricking out plants.

(6) Two lessons in transplanting plants. This work is generally performed in our garden house, and includes planting out small plants, as cabbages, strawberries, etc., with the most approved tools by the most approved method.

(7) One or two lessons in preparing vegetables for market.

(8) Two lessons in potting plants.

(9) One lesson in shifting plants.

(10) One lesson in treating greenhouse plants for insects and fungi.

The work in the greenhouse is interspersed with the laboratory work as convenience dictates. Our students in horticulture are almost all in attendance during the winter season; hence most of our work is necessarily performed indoors, but we find our garden greenhouse, which is simply a greenhouse inclosure, without floor, benches, or center roof supports, a most convenient and practical addition to our equipment for instruction.

L. C. Corbett, of West Virginia, read the following paper:

SYSTEMS OF RECORD KEEPING IN EXPERIMENTAL HORTICULTURE.

A uniform system of note filing, simple yet complete, for station use, is each year becoming more and more of a necessity. As the work takes new divisions and becomes more continuous in its character, a very different problem is presented than that of the annual experiment. In extended work covering a series of years, the exact or even approximate requirements of any division of the work can not be foretold. Hence the necessity of a flexible or expansible note file. The first thing to suggest itself along this line is the card system, or something of a like nature, in which the cards are replaced by slips of convenient size. This is certainly a decided advance over the common ruled notebook and ledger system, in which several entries must be made in various parts of the same book, if it be of any considerable size. Then these large ledgers or journals are unwieldy, they can not be carried into the field, and are therefore merely interpretations from the actual field notes. In the work of transcribing, error is almost a certainty, for no matter how careful or accurate the workman, the change of an adjective or the omission of a punctuation mark may be sufficient to alter or even absolutely reverse the meaning of a sentence.

One of the prime objects, then, is to avoid the necessity of copying from one book to another. If there were no other advantages to be gained, the lessened cost of record keeping would in itself be sufficient to claim careful attention.

Another aim in view is a system of note filing which shall be without limit, and which shall not have that objectionable feature of the slip system—the loss or misplacement of slips.

In order to overcome the necessity of rewriting notes, the books or pads used must be made of a size convenient for the pocket and, therefore for use as a field notebook. This requires the use of a somewhat smaller sheet than would otherwise have been adopted. The slip used, which is 4¼ by 7¼, is convenient for holding in the hand in making entries and for carrying in the ordinary sized coat pocket, and it is yet large enough to contain all the necessary data relating to the (behavior) and yield of farm or garden plants during a single season, and as a new book is used for each year's work the size of the book never becomes unwieldy. Each experiment, if it be one of considerable extent, is given a separate book, or if there be a number of coordinate lines of work under one general head, these are all brought together in a single book.

This is, in reality, a combination of the loose slip and book form of note filing. The advantages of this scheme are almost without limit, as compared with any other plan now in use.

It possesses all the best points of a slip system, in that a special ruling may be had for any line of work in hand. The number required will determine whether they are to be printed on the ordinary job press or whether a mimeograph copy is to be made. The use of the mimeograph I have found to be a most convenient and labor-saving aid in ruling slips for special experiments. For general variety tests, either with farm, garden, or fruit crops, a set of printed blanks can be easily devised which, used in combination with blank slips as interleaves, furnishes one of the most convenient forms conceivable.

Another point possessed by this form is its flexibility. By that I mean not only its power of expansion, but that of contraction as well.

To illustrate: If in the course of an experiment a page becomes torn or soiled and it is desirable to replace it, the clips can be loosened and a reproduction of the slip be placed in its stead; second, if the book was not made with sufficient space for the work in hand, new forms or blank pages can as easily be added, or transferred from one book to another.

As a pad for field use it is convenient for writing upon, as it is of a width easily grasped by one hand while writing with the other; the back cover is made of heavy board, to give a firm writing support, and the flexible cloth stub allows of almost unlimited freedom for folding back leaves not in use, as well as overcoming the annoyance of wearing and tearing out, experienced in the use of the heavy, manila, detail paper without cloth stubs.

The front cover is made of a lighter piece of cardboard, and provided, like the back cover, with a flexible cloth stub.

For binding thin books, the staple used in binding pamphlets of all descriptions is found to be most convenient, but for thick books the brass binding staples or tacks are found to work best.

If it were known at the time of making a book, that no changes would be made, it might be sewed together, but the use of the clips and staples allows of loosening the covers and bringing together in a single book the observations upon any variety or subject, during any series of years, so that the work of collating data for reproduction in bulletin or tabular form is a simple matter.

To illustrate, suppose we have an orchard of forty varieties of pears. This year I have a single book with one or two leaves devoted to each variety, and so on, in succeeding years, for fifteen or twenty years. Then I desire to bring all the notes upon each variety together. The books have all been uniform in size and in style of blank used. I have only to loosen the clips of my fifteen or twenty books and bring together in separate books, or in a slip file, the loosened leaves, and I have the thirty pages relating to Nos. 1, 2, 3, etc., either arranged in series, by years, in a slip file, or rebound in books, using a book for each variety, and by way of suggestion I should say that at the end of each period of years, be it two, five or ten, as the case may be, books should be made containing all the slips bearing data upon any particular subject or variety.

All books of whatever character should be carefully and plainly indexed upon the outside cover, so that when filed, those bearing upon related subjects can be placed together.

I would further suggest the use of this, or a like form, for constant use as a pocket scratch book, so that any note taken in the course of travel or of inspection may fall into its proper file, and when the general book-making period comes around, they then find a permanent home.

A temporary file is necessary for miscellaneous notes, and for all slips before they are prepared for binding. As has been suggested, all outlines and all preliminary data, such as the name of experiment, variety name and number, where plants and seeds were obtained, etc., is written upon the slips while in this temporary file and before they are bound into books, but all are made into books before they are required for use in the field, to prevent loss, misplacement, and duplication.

The temporary file used consists of a drawer or box of convenient depth and width for holding the strips when standing on edge. The slips relating to various subjects are placed in folders made of heavy, manila, detail paper, and folded so that one cover is about three-fourths of an inch shorter than the other, to allow of ready inspection of the title written upon the contained slips.

Recapitulation.—In this system we have—

(1) All the advantages of the loose-slip system.

(2) When bound we have the convenience of a flexible-backed pocket notebook.

(3) At no time does the plan prevent additions, deductions, or combinations.

(4) No duplication or copying is necessary, if full field notes are taken.

(5) The blank and printed or mimeograph slips allow of endless modifications and combinations, so that although the slip, per se, is small, ample space can be provided even for the most extended observations. If necessary, slips that are a multiple of the type size may be used as folders where maps or charts too large for a single sheet are necessary. In this way the scheme may be accommodated to nearly all requirements of private or experiment-station work.

The form of blank to use.—The form of blank to be used must be determined by the use to which it is to be put and the peculiar conditions under which it is to be used, and so designed as to accommodate the greatest variety of plants and experiments. The printed matter must therefore be limited to general heads, rather than extended to detail. The detailed form for any particular plat or test must be provided by special ruling. I advocate the limited use of type or printed slips, and prefer special rulings. The printed forms are suitable for variety tests and a few cultural tests only. Other detailed matter is much better if not made to conform to a set plan, except in the case of notes on the influence of climate upon the behavior and growth of plants.

Until some general and uniform plan is provided for studies of such character we can never arrive at any satisfactory conclusions regarding the general effect of exposures, varying degrees of temperature, and humidity upon our common plants. Yet this appeals to me as one of the most interesting lines along which cooperative experiments can be conducted, and it is my purpose here and now to ask all horticulturists present who are willing to cooperate along this line to give me their names, and before another season opens up I will provide them with the necessary blanks, in order to insure uniform and concerted efforts along the lines that seem to suggest themselves as most important.

In a few far-reaching cooperative lines of work, like the one suggested in variety tests, I am inclined to favor the adoption of a uniform system of note taking by the several stations, but when the problem is that of cultural methods, or other original lines, no set plan, except it be designed for the particular work in hand, will ever suffice.

The discussion following the paper disclosed about as many systems of note taking as there were persons taking part in the discussion.

A paper by E. G. Lodeman, of New York, on the "Position of botany in horticultural education," was read by L. C. Corbett.

Upon motion of L. C. Corbett, a committee was appointed to consider the question of providing a bureau of plant registration. The committee appointed consisted of L. C. Corbett, of West Virginia; W. A. Taylor, of the United States Department of Agriculture; L. H. Bailey, of New York; F. S. Earle, of Alabama, and C. H. Shinn, of California. The objects of such a bureau were stated to be (1) to prevent duplication of names and the renaming of old sorts; (2) to form a national herbarium of economic plants; (3) to simplify nomenclature; (4) to aid the student of varieties and variation under cultivation; and (5) to secure to the originator his discovery as is now done for the inventor. It was generally considered that such a bureau should be attached to the Division of Pomology of the United States Department of Agriculture.

The section appointed a committee on seed testing, consisting of G. McCarthy, of North Carolina; F. W. Rane, of New Hampshire; and G. H. Hicks, of the United States Department of Agriculture, which was made a subcommittee to the one appointed in general session of the convention (see p. 63).

SECTION ON ENTOMOLOGY.

Three meetings of the section were held November 10, 11, and 12, 1896, in the office of L. O. Howard, Chief of the Division of Entomology, United States Department of Agriculture, O. Lugger, of Minnesota, presiding. In the absence of the secretary elect, W. G. Johnson, of Maryland, was appointed temporarily to this position.

After a discussion of the need of better legislation against noxious insects, on motion of W. B. Alwood, of Virginia, a committee of three was appointed by the chair to further consider this matter and report at the next session. The committee appointed was: W. B. Alwood, L. O. Howard, and W. G. Johnson.

The chair called the attention of the section to the sale and manufacture of various bogus insecticides. It was the general expression of the members present that some action should be taken to suppress these frauds.

In the absence of the author, L. O. Howard read a paper entitled, "Notes from Auburn, Alabama," by Carl F. Baker, of which the secretary has made the following abstract:

Cotton and corn have been very free from insect injury the present season, the greater part of the damage to these plants being done by fungi. The scarcity of the bollworm in corn was very conspicuous. *Protoparce celeus* and a species of *Dicyphus* var. *vestitus* reported common on tomatoes. The larvæ of a Plusia, probably identical with *P. brassicæ*, was found abundant in the college greenhouse. It was parasitized by a Copidosoma. The Southern army worm (*Laphygma*) was reported as having done much damage to Bermuda grass lawns. The cucumber moth (*Margaronia hyalinata*) and the ailanthus worm (*Oeta compta*) were quite common. *Gelechia cerealella* and *Plodia interpunctella* were numerous in granaries. *Agraulis vanillæ* was reared on *Passiflora incarnata*, and *Terias nicippe* on *Cassia occidentalis*. A Scolytid was bred from dead twigs of fig. A Sesiid was reported as boring the twigs of the black locust, doing much injury. A geometer was bred from larvæ on pokeberry which had defoliated this plant. An Anthribid beetle was reared from peaches killed by *Monilia fructigena*. A small moth, resembling the one becoming injurious to peach and some varieties of apple in Colorado, was also bred from these peaches. The author was of the opinion that this moth would appear elsewhere soon, as infested fruit was being shipped out of Colorado in considerable quantities. *Copris gopheri* was reported to have been taken at lights.

In the discussion which followed this paper, E. A. Schwarz, of the United States Department of Agriculture, furnished the secretary with the following: The occurrence of *Copris gopheri* in Alabama was of considerable interest, since gopher insects were hitherto recorded only from Florida, but before accepting this fact Mr. Schwarz said he would like to see specimens from Alabama, since the smooth forms of our common Copris were likely to be mistaken for *C. gopheri*. Dr. Hamilton's recently published statement that *C. gopheri* had been attracted to lights in a house at Sanford, Fla., was also alluded to.

F. A. Sirrine, of New York, read a paper on "Termites (*T. flavipes*) as a forcing-house pest," and has furnished the following abstract: These insects were found injuring chrysanthemum plants in forcing houses at Floral Park, N. Y., during the month of August, 1896. The injury consisted in the gnawing of the bark from the plants just below the surface of the ground, and mining the center of the stems. Bisulphid of carbon was successfully used for their destruction, but the writer said more plants were injured by it than by the Termites. The same author referred to some experiments he had performed during the winter of 1894-95 and 1895-96 with cocoons of *Melittia ceto*. He said moths from cocoons buried in a sandy loam to a depth of four inches were unable to reach the surface. Checks were conducted at the same time each year by placing cocoons on the surface of the ground and covering them with cheese-cloth-covered lantern globes.

Mr. Sirrine stated also that in 1894 the potato growers of Long Island became alarmed about what they called "pimply" potatoes. In 1895 buyers reduced the price 5 cents per bushel on account of this pimply condition of the tubers. During the same year F. C. Stewart gave the subject careful study and decided that the trouble was due to some insect injury. The present season, 1896, Mr. Stewart continued his observations, and in July found minute white grubs boring into the tubers. He also found pupæ in the soil about the potatoes. Both the larvæ and pupæ were sent to Mr. Sirrine, who bred the potato flea-beetle, *Epitrix cucumeris*.

The next paper was by W. G. Johnson, entitled "Experiences with white muscardine and the chinch bug." The author gave a careful review of some of his observations in the field and laboratory with the so-called chinch-bug disease while he was connected with the Illinois State Laboratory of Natural History. Reference was also made to some work of B. M. Duggar, who had charge of the insect disease investigations in Illinois from June, 1895, to June, 1896. It was shown that the action of this disease upon chinch bugs in close confinement, under the most favorable conditions, was very slight, and that the death rate after inoculation was scarcely over 10 per cent. The writer stated that the same fungus was almost universally present on a large variety of species of insects, and that it does not seem to increase to any appreciable extent by artificial distribution. It was also shown that it will grow more profusely on insects immediately after death, when killed in hot water or otherwise, than on the living. In view of these facts, the author recognized the fungus as a facultative parasite and a slight natural reducing agent of insects, but, beyond this, experience did not lead him to claim for it any economic value whatever.

In discussing this paper W. B. Alwood said the chinch bug had been quite bad in Virginia, and that he had attempted to propagate this same fungus for distribution, but failed. He said that not over 10 per cent of the chinch bugs in his infection cages showed any fungus growth. O. Lugger said about 45,000 boxes of this fungus were sent out from his office the present season, but that the reports of success and failure were very confusing.

The report of the committee on the need of better legislation against noxious insects was unanimously adopted and referred to the executive committee of the Association (see p. 59).

That portion of the report of the committee on nomenclature relating to entomology was read, unanimously adopted, and referred back to the executive committee.

Mr. Alwood then read a paper on the "Dissemination of the San José scale in Virginia," of which he furnishes the following abstract:

The San José scale was first discovered in Virginia in 1893, at Charlottesville, where it had been introduced on nursery stock from New Jersey. This for some months was thought to be the only center of infection in the East, but a little investigation soon showed the source of the infested plants, and then the scale was rapidly located at different points throughout the entire Atlantic coast region. Diligent inquiry through ordinary methods only succeeded in locating the scale at one other point in the State during the next two years, viz, at City Point, where several thousand infested trees from New Jersey had been planted and an orchard of 18,000 trees become involved. But after the passage of the Virginia scale law giving ample police powers, systematic inspection was begun, with the result of locating ten different infested premises in the first two days' work. The inspection work was continued during the summer of 1896, and it is now thought that most of the infested places are known.

A map was exhibited showing that there are now known to be thirteen points of infection in the State, including some nurseries, not counting the infested premises of each individual. Of these, three are in the great Valley, six in the Piedmont, and six in Tidewater. Most of these are widely separated from each other and only two or three can now be considered serious. The history of each case has been carefully looked up, and in every instance the insect was introduced on nursery stock from without the State. New Jersey was said to have been the chief offender, but it was intimated that Maryland, Georgia, and Louisiana had each sent infested stock into the State.

The powers given the inspector by the Virginia law are found to be ample and the people, quite generally, cooperate readily with the officers; but the lack of specific funds for carrying on the work is an almost total defect and will prevent accomplishment of much necessary work in the way of clearing up a few seriously infested premises where the owners do not seem to realize the danger which threatens the fruit industry.

W. G. Johnson then reviewed the present status of the San José scale in Maryland, stating that every infested locality and nursery in the State had been personally inspected by himself since the 1st of August in accordance with the tree and nursery-stock law. It was stated that the scale had been definitely located in 12 counties, including three nurseries, and in no case had been completely exterminated, except where its attack was confined to one or two trees. The speaker further stated that he was of the opinion that the pest never could be completely suppressed on account of its wide distribution and firm foothold in Maryland, but could be kept in check by persistent and energetic fighting by a thorough and harmonious State organization on the part of the nurserymen and fruit growers. Speaking of the potash-lye whale-oil soap for its extermination, he said this wash was very much more satisfactory than the old soda-soap wash, but that it was too expensive, and a cheaper wash must be found that would answer the same purpose. Trees treated last fall with whale-oil soap at the rate of 2½ to 3 pounds to a gallon of water were this season literally covered with the scale. Mr. Johnson said he had now under way a series of experiments with various combinations of kerosene emulsion and whale-oil soap, the cost of washes varying from 4 to 8 cents a gallon. He also stated that R. S. Emory, one of Maryland's most successful fruit growers, had purchased 5,600 pounds of the potash-lye whale-oil soap this season, and had already used about half of it on his scale-infested trees. He said Mr. Emory was very much more pleased with this soap than he was with that made with soda. It is easier to apply and more effective. The speaker said Mr. Emory was not thoroughly satisfied, however, with the soaps, and was of the opinion that some entomologists placed too much confidence in them for the destruction and suppression of the San José scale. The author said he agreed with Mr. Emory on this point.

A paper entitled "Economic entomology in North Carolina," by Gerald McCarthy, was read by L. O. Howard, in the absence of the author. [Abstracted by the secretary.] From the botanical standpoint, the author said, the State had been pretty well covered; while the entomological side, in a large part, still remained unexplored. Briefly outlining the entomological work of the year, he said *Phorbia brassicæ* was very destructive to young cabbage along the coast region early this season. Tobacco decoction and crude carbolic acid applied to the soil around the plants gave the best results. The cotton caterpillars Heliothis and Aletia were present. The Northern army worm was reported this spring. The chinch bug was also seen in isolated spots. The imported elm-leaf beetle was also found on elms in one town. *Lina scripta*, the Western cottonwood beetle, was also found on Carolina poplar and cottonwood. *Gelechia piscipellis* was found mining the leaves of tobacco. The bull or horse thistle, *Solanum carolinense*, seems to be its normal host. This same leaf miner is also reported from Florida as injuring tobacco. No satisfactory remedy has yet been found. The following scale insects were reported: New York plum scale, convex scale, gloomy scale, San José scale, oyster-shell bark louse, scurfy scale, euonymus scale, and privet scale. The euonymus scale was found a difficult one to combat. The gloomy scale was confined to silver maple, and very destructive. The writer stated that the State Horticultural Society had instructed him to draft a law against fruit pests, to be presented to their next legislature.

In the absence of the authors, L. O. Howard read a paper on "Some results of recent studies of grass-feeding Jassidæ," by Herbert Osborn and E. D. Ball, and has made the following abstract:

In this paper the authors refer to the previous publications of the senior author on the subject of the damage done to pastures and lawns by the leaf-hoppers of the family Jassidae, and show that while it has been indicated that the loss must be enormous, the insects appear to a great extent to be destroyed by the use of a tar pan or "hopper-dozer." Up to the present time, however, our knowledge of the life histories of the species involved has been too meager to furnish a certain basis for remedial measures. The present paper determines the life history of a number of species, the range of their food plants, especially in the larval stages, and a study of the specific limits of a large number of species.

More or less detailed consideration is given to the following species: *Tettigonia bifida, Diedrocephala mollipes, D. noveboracensis, Gypona octo-lineata* Say=*flavilineata* Fitch, *G. bipunctulata, Xestocephalus pulicarius, Xestocephalus* n. sp., *Neocoelidia tumidifrons, Dorycephalus platyrhynchus, Hecalus lineatus* Uhl., male=*H. fenestratus* Uhl, *Parabalocratus viridis, Platymetopius cinereus* n. sp., *Deltocephalus debilis, D. inimicus, D. melsheimeri, D. sayi, D. configuratus, D. albidus* n. sp., *D. inflatus* n. sp., *D. reflexus* n. sp., *D. pectinatus* n. sp., *D. abbreviatus* n. sp., *D. compactus* n. sp., *D. signatifrons, D. weedi, D. sylvestris* n. sp., *D. oculatus*, n. sp., *D. minimus* n. sp., *Athysanus curtisii, A. bicolor, A. obtutus, A. comma.*

The second paper, "On the use of steam apparatus for spraying," was read by the author, Dr. L. O. Howard, who also furnished the following abstract:

The speaker, after a brief historical account of the development of hand apparatus for spraying insecticides, considered in detail some twenty machines which have been constructed since 1882, which spray by steam power, showing that a thoroughly efficient apparatus of this kind can be constructed for from $250 to $300. Not only were the especially constructed machines described, but also several makeshift apparatus which utilized the services of ordinary watering carts and road engines and steam fire engines. In conclusion, he expressed the opinion that such apparatus will seldom be constructed by the owners of even large orchards for their own individual use, but that for community orchard work they are valuable and will come more and more into use, while the professional sprayer, an individual who is bound to come to the front, will use steam-power machines. Perhaps the greatest value which they possess, however, is for work on shade-tree insects in cities and larger towns. The time is coming when every city which takes a pride in its shade trees will possess one or more of these machines.

Mr. Alwood offered the following resolution, which was unanimously adopted:

Whereas in consideration of the recent alarming spread of the San José scale in the Atlantic and Middle States, and the further fact that we believe its suppression can only be accomplished by carefully framed laws, which should be enacted in the several States: Therefore be it

Resolved, First, That the Section of Entomology of the American Association of Agricultural Colleges and Experiment Stations indorses the principle of special legislation for the suppression of this pest;

Second. That a committee of ten be created, with L. O. Howard, Chief of the Division of Entomology, United States Department of Agriculture, as chairman, which shall carefully prepare such memoranda as they deem best in relation to legislation dealing with the pest, and when so prepared this matter shall be submitted to the authorities of the several States concerned for such action as the legislatures thereof may choose to take.

Third. That it is the sense of this section that State inspection for the control and prevention of the dissemination of this pest upon nursery stock is imperative.

The chair appointed the following committee: L. O. Howard, W. B. Alwood, W. G. Johnson, F. A. Sirrine, J. B. Smith, J. A. Lintner, F. M. Webster, G. G. Groff, A. D. Hopkins, and G. H. Powell.

SECTION ON MECHANIC ARTS.

Two sessions of this section were held in the parlors of the Ebbitt House, November 10 and 11, the chairman, J. W. Lawrence, of Colorado, presiding.

The first paper read was one by E. Kidwell, of Michigan, entitled, "Requirements for the proper government of an educational institution." This paper provoked sharp discussion, the criticisms of governing boards of these institutions being vigorously combated.

A paper on "Experiments with an air-lubricated journal"[1] was read by A. Kingsbury, of New Hampshire.

The following paper was presented by R. H. Thurston, of New York:

EDUCATION IN MECHANICAL ENGINEERING AND THE MECHANIC ARTS.

Education in mechanical engineering and the mechanic arts, or, in other phrase, the professional education of the mechanical engineers and the industrial education of the practitioners of the arts and trades which underlie that which is coming to be recognized once more as one of the great, and even, as thought by many, the learned professions, may be truly asserted to be, to-day, among the great problems, industrial, social, and even moral, of our time. The great questions propounded at every gathering of the associations of professionals and of practitioners is, and probably must always hereafter be: What are the precise purposes of such education and training? How should they be attained? By what methods and to what extent should education be carried on? What is the best practice to-day? How can the best contemporary practice be improved? What may be taken to constitute the highest efficiency in the operation of such systems of education and training? How may maximum efficiency be attained?

It may be safely asserted that, before attempting to answer with fullness and exactness such questions as these, it is essential that a clear understanding be had of the meaning of terms and the limitations of the field in which we are prospecting. As a basis of discussion in this paper, the following preliminary definitions are made as representing the ideas to be formulated in advance of such discussion:

The art of engineering is that of planning all constructions, of designing all works which are the product of the mechanic or constructive arts. The profession of engineering is that which includes those men whose learning, experience, and ability fit them for the successful practice of that vocation.

The requirements of the practitioner to-day are vastly higher than a generation ago, or in earlier times. The humblest member of the profession, quietly and unobstrusively doing his work, unnoticed and unrecognized by the world, and even, perhaps, by his own colleagues, is required to possess more learning, and a greater practical power of accomplishment, than did the men who were deified by the old Greeks, or those who became famous in the days of Archimedes, or of Michael Angelo, or even of James Watt and Papin. He is necessarily familiar with the nature, the essential characteristics, the methods of production, and the costs of all the available materials of construction; he must be able to employ these materials in the best manner, in the most exact proportions, and with due regard to expense, in any form of construction falling within his field of work. He must be competent to design a required machine or a static construction in such manner as to insure that it shall give the demanded output or result, in good proportion, and with minimum total cost per unit of product throughout the life of the machine or construction, and including costs of maintenance and of replacement.

[1] This paper has been published in Jour. Amer. Soc. Naval Eng., 9 (1897), No. 2, pp. 267-292.

The contemporary practitioner in engineering and his successors are expected to have a school and college training which shall include mathematics and the sciences, in so far at least as they bear upon the work of the profession, and the languages so far as they give him access to modern engineering literature. The requirements for admission to our advanced technical schools and colleges are now higher than is usual with schools of either law or medicine, and the courses of instruction are certainly not less extensive, complete, and exacting. Thus, a law school, of which the entering requirements lie before the writer, demands, when its students enter by examination, the following:

"Candidates for a degree are required to pass an examination in arithmetic, English grammar, orthography, English composition, geography, English and United States history, civil government, plane geometry, and first-year Latin. One year of French or German will be received as an equivalent for the Latin required, and substantial equivalents may be offered for other subjects."

Those entering the engineering schools of the same institution are examined in English, geography, physiology, American history, arithmetic, plane geometry, algebra, solid geometry, advanced algebra, plane and spherical trigonometry, and French or German, or both languages. Some schools demand Latin at entrance. The course of study for the latter is then continued for the four years; that of the law school covers two years, so called, of nine months each. Anyone may enter the law school direct from the high school, and take a place in the so-called "junior" class; while to attain the same rank in the engineering schools, the academic course must be supplemented by two years of exceptionally hard work in the study of mathematics and the sciences.

The lawyer thus enters, after a comparatively easy course and a short one of college work, into a "learned profession;" the engineer, obviously by far better right, is entitled to claim for his the rating of a still more truly learned profession. President Jordan was undoubtedly right when he, perhaps the first among academic college workers, gave currency to the claim that engineering is in fact the only truly learned profession, since it deals constantly with real learning and bases its work absolutely upon scientific truth.

The professional training of the mechanical engineer, however, involves much more than the simple education of the man in the scientific principles which are in the design of machinery. It includes, or should include, so much of knowledge and training in the arts subsidiary to engineering as will permit the designer to intelligently provide for the best construction, and also to supervise the work of construction, erection, and operation, so far as may be essential to the economic success of the work. The practitioner must not only be able to give the parts of his machine proper form and proportion, but should be competent to see just which of various materials is best for his purpose; what modification of form is dictated by the difficulties and exigencies of construction in the shop, and what influence the costs and the methods of the trades employed in the construction should have upon the proportions and the forms of parts, as well as upon the choice of their material. Thus it is important that the arts and trades subsidiary to the profession of engineering should be in large degree familiar to the trained engineer.

The mechanic arts and manual training thus come within the limits of operation of the engineering school, as well as constitute the field of the schools of mechanic arts and of the manual-training schools of more elementary character. But professional training in engineering, instruction in the mechanic arts, and manual training are, nevertheless, three essentially distinct subjects of technical-school work. Manual training does not necessarily involve trade-school work; nor does the trade school necessarily touch engineering proper. Yet engineering involves a knowledge of the trades, and the trade school necessarily gives instruction in manual training. These distinctions, once pointed out, are self-evident; but their recognition is not always obvious in the arrangement of technical-school work. Perhaps the following may be taken as correctly stating the definitions of the terms thus found nonsynonymous:

Manual training teaches simply the use of tools, and mainly for the purpose of developing the skill of the pupil, and of awakening within him dormant powers, perfecting his symmetry of character and of attainment, and giving him command of an always latent talent in such manner as to add to his ability to make the most of his after life. It has no necessary reference to any trade; but confines itself, in its proper field, to the conferring upon the pupil that sleight which makes tool using a main characteristic of the human animal only. What shall be done with the tool after its use becomes familiar, and skill in using it is acquired by intelligently directed practice, is not a matter which concerns the manual training school teacher. He is making a better boy or girl or man, not teaching a trade.

The trade school, the school of mechanic arts, teaches the pupil the methods of a trade, the purpose of which trade is to make a certain defined class of products, as houses or furniture, horseshoes or chisels, steam engines or boilers, electric motors and generators or hydraulic turbines. The practitioner is a carpenter or a pattern maker, a molder or a smith, a machinist or a brass worker. Instruction in the trade school makes the manual training of its pupils, their instruction in the use of tools, subsidiary and directly contributory to the art which is taught, to the trade which is practiced by its graduates. Its main and ultimate purpose, however, is to instruct in the methods of the trade, and to make the pupil a skilled workman in that particular vocation. Our public schools, in the large cities, often have manual-training schools attached to their academic departments; they are purely gymnastic schools. The great cities of Europe, and especially of Germany, have schools of the trades, often supported largely by contributions from the trades unions. The two classes of schools have thus distinct purposes, and consequently distinct methods of instruction.

Manual training, like the pure mathematics, is instruction for the subjective purpose of improving the pupil; trade instruction teaches the use of the same tools for the purpose of enabling the pupil to produce some useful construction. In the former the use of the tools as gymnastic apparatus is the primary object; in the latter the tool is used as a means to another end, and is simply accessory and subsidiary to the purposes of the trade.

But still another distinction must be observed. The workshops of the engineering school have a purpose distinctly different from those of the trade schools, as well as from those of the manual training schools. The end sought is not the production of a skilled mechanic, primarily, but the familiarizing of the pupil with the use of tools in the various trades subsidiary to the work of the engineer in such manner that he may design intelligently, insure proper construction, and criticise work performed under his contracts with justice and accuracy. It is, like the professional work in which he is taught to take part, a beginning of practical acquirements which he is expected to advance upon, and to continually perfect himself in throughout his professional career. He is not made a mechanic any more than an engineer, but the novice is started along a path which he may traverse with steady gain as long as he maintains his hold upon life and work.

The engineer as designer produces plans for construction which involve the making of patterns in the pattern shop, and other constructions in wood, which demand the services of the molder and of the smith and of the machinist. He can not decide upon the materials or the proportions best suited for any given detail without some knowledge of the methods of work in these shops and until he can, in his mind's eye, see each piece throughout its complete course into and through the pattern maker's shop and the foundry, or the blacksmith's shop and the machine shop, and into its place, finally, in the complete machine in the erecting shop. If he does not know whether to employ cast or wrought iron, or steel, or brass, or bronze, and just how to construct a pattern that will "draw," how to lay the grain of the iron in a forging, how to choose the material for either casting or forging, and how to decide whether a smooth-hammered or a rough forged rod or crank or bar is, on the whole, likely to prove best and cheapest, he will certainly fail often, as the most experienced do occasionally, and will find himself called into one or another shop to witness the difficulties, troublesome always, often insuperable, and invariably more or less expensive, which his lack of knowledge and foresight have produced. Thus the purpose of the trade schools, as incorporated in the scheme of the engineering school, is the instruction of the young engineer in the methods and practice of the arts subsidiary to engineering with the ultimate and main object of enabling him to design and to inspect intelligently. Incidentally he becomes possessed of, usually, as much skill as the ordinary apprentice—sometimes, indeed, of more—as a consequence of the systematic methods of instruction adopted, and thus has not two strings, but a number of strings, to his bow, and may, after a time, earn a living at any one of the several trades taught him to this extent.[1]

The engineer as designer also requires a practical acquaintance with the purpose and the method of operation of the machine to be produced, and a familiarity with the conditions surrounding it and affecting its working, which can only be had after practice and observation have shown him clearly what are the exact qualitative and quantitative limiting conditions, what are those which conduce to efficiency, and what to exaggeration of wastes of power and capital. This, in most cases, can not

[1] As the writer has elsewhere remarked: "In a well-equipped school and with able teachers, the progress of the young man who is naturally well suited to the work is extraordinarily fruitful and rapid;" in fact, it is so fruitful and rapid that the writer has been criticised severely for a statement which might have been made still stronger and more impressive without exaggeration.

As Mr. Outerbridge has remarked: "Manual training as a starting point in the education of the mechanical engineer is a scientific invention and intellectual discovery worthy to rank with many other original inventions of the age, and is destined to produce equally beneficial results in the future."

be acquired in the shops and laboratories of the college; but his habits of observation and of effective manipulation, acquired in those practical departments of his college work, fit him to grasp the situation, and to weigh and measure such conditions promptly and accurately, when on entering into business he is called upon to start in on his final stage of apprenticeship as a designer. In fact, one of the most fortunate aspects of his training is seen in the power conferred upon him of quickly and thoroughly fitting himself into a new situation.

The designer must be competent to compute dimensions and to decide upon the best forms of details of his proposed constructions, as well as to plan the machine, as a whole, for a particular purpose and for maximum efficiency. This constitutes "mechanical engineering" in its accepted and restricted sense, and the profession of engineering takes for its special field of work, for its vocation, that of planning constructions. Highest efficiency is attained when the plans produced are such as will supply to the proposing purchaser and user apparatus which will give him highest returns for a unit of capital expended upon it and expended in its operation and maintenance and final replacement. This will be attained when the machine is so formed and proportioned as to most perfectly do its work, with least cost for satisfactory construction, and with minimum operating expenses, including indirect as well as direct outgo. This, in turn, will be assured when the designer is familiar with the nature, costs, and special adaptations of the materials available, can compute the forms and proportions of details with the result of acquiring the best forms for practical operation and the exact proportions giving uniform strength and minimum volume and weight consistently therewith, and when he understands the art of practically applying that knowledge of his materials, of applied mechanics, and of details of mechanisms to the specific case in hand. Education in mechanical engineering is thus to be directed, as its main purpose, to the instruction of the novice in the theory and art of design from the points of view of both the constructor and the capitalist.

The higher work of the engineer and of the advanced engineering school leads from the stage just described onward, upward, and into the theory and art of construction of completed machines; and this involves, necessarily, some selection, which selection often takes the form of specialization. It is not practically possible to go about the design of all the familiar and standard forms of machines in the comparatively short period of time available for instruction in the upper classes of even the most advanced engineering school, and the schedule of work must be restricted to a few typical machines. As selection must occur, in any case, it is not at all objectionable that this selection should take the form of a real professional specialization, and the student and pupil thus turn his attention largely, if not mainly, to the study, for example, of steam engines, of railway machinery, of electric light and power machinery. In such cases, the machinery selected for study becomes naturally and effectively the illustrative exemplar of the application of the principles of design previously discussed and the embodiment of the theory and the art of general mechanical engineering construction.

But it should be further observed that the higher work of the advanced courses in mechanical engineering, and even in courses of instruction in mechanical arts and real trade-school work, may and often must involve the highest of all scientific work—that of research. In whatever branch of the education of the engineer, or of the mechanic, work may be done, it may be often found advisable and practicable to attempt the solution of problems which can only be attacked through the methods of scientific investigation and after a somewhat extended study of the laboratory methods of the chemist or of the physicist. Such, for example, are those relating to the qualities of the materials of construction—researches demanded alike by the trade school and the school of engineering and by the profession at large; such are those bearing upon the efficiencies of the systems of electric transmission, or on the economical operation of steam machinery and of other heat motors. This brings in not only the usual courses of instruction in the physical sciences, and the higher grades of this instruction, but also their most interesting and fruitful laboratory methods, and special developments of them by which they are peculiarly adapted to the purposes of the engineer. This constitutes to-day the most advanced work of the professional school in engineering. Work in this field has, during the last ten or fifteen years, produced a great advance in the practice of the profession, and the leavening of its practitioners of the older days and older school with the output of our later schools and more advanced methods and courses has brought about a spirit of ambition, of accuracy in its work, of scientific method, and in favor of exact determination of hitherto unknown facts and laws in the applied sciences of the profession that has favorably and enormously influenced the progress and standing of the whole profession. But a few years ago scientifically taught and professionally trained young men were not sought, and were even, in many cases, undesired, in many important establishments and by some of the leaders of the profession. To-day such men, if of the right sort, are welcomed by all, and anxiously sought by many, of our foremost manufacturers and professional men as valuable aids.

This constitutes the latest and highest development of the modern engineering school, and it has been so far developed in our own country as to have become a usual and matter-of-course part of the contemporary curriculum.[1] Where graduates return, as is now coming to be a frequent occurrence, to secure special and advanced instruction in the lines of professional work taken up by them after leaving college, laboratory methods of engineering practice, and particularly scientific investigations of problems which have come to them in the course of their practice in design or in construction, almost invariably become an important, if not the major part of their post-graduate work. The schools which are sufficiently fortunate to be able to supply this class of instruction and to provide the requisite apparatus for such special researches are thus doing an important work in promotion of the progress now making, both in the development of scientific and fruitful and efficient methods in the work of the profession and in advancing it to at least fully equal rank with the older professions denominated "learned."

Schools of the mechanic arts, trade schools, are the great unsupplied need of our country to-day. The engineering schools are now so numerous and have such a hold upon the profession and upon the people that we need not fear their failure to do all that will come to them to do; but the trade schools are yet to be developed in this country. Engineering schools are now to be found in every State and, in many cases, have attained, or are rapidly attaining, a position and a prestige which must insure the full supply of the best and the highest instruction that the several States can demand. They have attained such a status and have such influence as will assure their progress at fully as great a speed as their constituency can appreciate and avail itself of; but the trade schools, needed for the systematic instruction of every poor man's son and of the great masses of our citizens, have as yet made no real beginning. Many trade schools are needed where one engineering school is required, and the task of their foundation and upbuilding is the greatest, perhaps, that presents itself to-day to the legislatures and the statesmen of our time and country.

Throughout the continent of Europe these schools have been doing their beneficent work for generations, and, of late years, with every facility that government and private means could together provide. They find great and valuable influence, and financial aid as well, coming to them from the trades unions and business associations, and are steadily advancing in Germany, for example, and in Switzerland, into a foremost place among the manufacturing nations of the world—which means, of course, among the wealthiest and most prosperous in all respects, moral, intellectual, and commercial. The tremendous extension of German trade into all parts of the world, and even into the home and foreign markets of the greatest manufacturing and commercial country, Great Britain and her colonies, is unquestionably due largely, probably mainly, to the influence of the German trade schools in the formation of a large body of skilled mechanics and a directing force of highly educated, and even learned, managers and manufacturing capitalists. The country of James Watt and of all early invention in the field of motive power and of textile manufactures is, at last, losing its tremendous lead of the past century, principally, as it may be probably safely asserted, through her comparative tardiness in the promotion of technical education, and especially of trade-school organization. Said John Scott Russell, away back in 1869, of his visit to Germany in 1849: "Twenty years ago professional duty took me to Germany for the first time. I can not forget my first impressions at the sight of whole nations growing up in the full enjoyment of systematic, organized, I might almost say perfect, education. I had already become acquainted with some theories and forms of education. I had read Plato's description of the perfect training for a nation. I was familiar with education in England, Scotland, and France. I was familiar with elementary school-teaching and had enjoyed the advantage of university education and the still higher education of the workshop. I was familiar with the system of Bell and Lancaster, having had personal acquaintance with its authors, and had myself taken an active part in schools of art and mechanics' institutions; but I confess to have been profoundly astonished—I may say humiliated—at the sight of nations whose rulers had chosen to undertake the systematic education of their people, and of people who had chosen to bear the burdens and to make the sacrifices necessary to obtain it. I do not know to what men or class of men in Germany the forethought, organization, and patriotism are to be attributed which made them lay aside personal ambition, political animosity, reli-

[1] The German commissioners sent to the United States in 1893 to report upon the technical education of this country and on the progress shown at the International Exhibition at Chicago considered this the most striking feature of our system of professional instruction. The chairman of the commission has informed the writer that its members have determined to use their influence, individually and as a commission, in favor of introducing some of its more valuable and, with them, unknown features into the system of German, and especially of Prussian, technical education.

gious sectarianism, and state parsimony in order to unite all classes of people in unanimous effort to raise every rank in society to a higher condition of personal excellence and usefulness and, by diffusing equality of education, to extinguish the most grievous of class distinctions."

And to-day Germany is, under a carefully adjusted and moderate protective tariff, finding full reward for her foresight and public spirit in the rapidly increasing wealth and intelligence of her people. She is even alarming the business men and statesmen of Great Britain by the rapidity with which her manufactured products are being sent into the markets of that country. She is compelling the respect and admiration of all countries by her progress in all the great industries. All this is, we may confidently assert, the outcome of her grand system of technical and trade-school education of her youth.

Our own country is especially favored by the intelligent quality of its people and their ready adaptation of their talents to the demands of the moment; but they have to-day no systematic instruction, as a nation, and our own task in the development of a true system of engineering, trade, and manual-training schools is, as yet, hardly commenced. Sooner or later, unless we perfect such a system promptly, it may be safely predicted our own country will suffer as Great Britain seems to be suffering to-day, by the relative gain of other nations, taught to produce by scientific and systematic methods, and thus enabled to excel in both the fruitfulness and the excellence of their skilled industries.

As the writer has more than once stated, in official reports and in private communications relating to this subject, "to educate our own people as well as the most favored parts of Germany, we should have 20 technical universities, with 50 instructors and 500 pupils each; 50 trade schools and colleges, with 20 instructors, at least, and 300 students each; 2,000 technical high schools, or manual-training schools, of 10 instructors and 200 pupils each, at the very least."

To educate the youth of this country properly and in such manner as to fit them effectively for their later work and to insure maximum prosperity to the nation, we probably ought to have to-day not less than 1,500 university professors, with 10,000 or 15,000 students under their care, studying the higher branches of technical work; an equal or greater number of college professors and students developing this work on a lower grade and preparing to fill the superior positions in the arts and manufactures of the nation; twenty or thirty thousand teachers engaged in the special trade and manual-training schools in the instruction of four or five thousand boys and girls proposing to become skilled workmen and efficient women. There are in this country not less than twelve millions of families, with at least eighteen millions of boys and as many girls, of whom one-half should be in the last-named class of schools; their education should cost about a half dollar in gold per capita, additional to the present taxes. The inauguration of such a system of schools for the people now constitutes the greatest and most pressing task of the statesmen and legislators of our country. Every citizen having sufficient intelligence to see where we and the world now stand, and having patriotism enough to induce him to give his aid in promoting the best interests of his country, will see in this movement his grandest opportunity.

W. S. Aldrich, of West Virginia, presented a paper on "Engineering experiment stations," an abstract of which is given below.

Engineering Experiment Stations.

Engineering experiment is coming to be required by the exigencies of business and the keen competition of trades at all related to engineering development. The increasing value of the work done by the testing departments of any of the large manufacturing concerns, as well as that now thoroughly organized and prosecuted by the principal railroad companies, has stimulated the development which comes of such research along many industrial lines. In addition to this, there have been many skilled experimentalists, trained in the laboratories of our representative technical schools, who have rendered invaluable service in advancing industrial development in many of the States where they have located. It is equally patent to all careful observers that the development of the foreign market for our manufactured products depends also upon the thorough organization and development of our industries and their utilization of the latest results of scientific research.

The advancement of engineering science and the promotion of engineering education are of similar importance in this relation. They alike demand attention to the newly developed instrument of service in the hands of the educator, the scientist, the engineer, and the manufacturer, namely, the research laboratory. Technical education alone is not sufficient to promote the development of engineering, mining, and manufacturing industries of the several States. On the other hand, the application of scientific method to all such lines of industry is now recognized as essential to their success.

The object, therefore, of such engineering experiment stations should be to promote scientific investigation, engineering research, and experimental testing in the chemical, physical, and economic sciences with special reference to their applications in the industries of life.

Such an experiment station should be established and maintained in each of our States and Territories. In this way its official testing station would come to be of great value to each State in developing its engineering interests and industries as well as in aiding its activity for the advancement of science and the promotion of engineering education in connection with such State college or university by the side of which it should become to be established.

Similar testing stations are found in connection with many of the German universities and technical schools, of which the parent organization is the Physikalische Technische Reichsanstalt at Charlottenburg, established in 1887. In fact, the twofold work of such experiment stations should be found along the lines laid down for the above Reichsanstalt, namely, (1) "the development of pure research; (2) the promotion of new applications of science for industrial purposes." The first division, or physical section, "has for its object the solution of scientific problems which present a practical or theoretic interest, and which necessitate the use of methods, apparatus, and duration of study which are beyond the command of individual investigators or schools of instruction. The second, or technical section, (Mechanisch-technische Versuchsanstalt), is under the management of Dr. A. Martens, and has for its object 'to develop the results acquired by the physical section, render them useful for practical purposes, and especially to test and rectify instruments of measure and precision.'"

While the smaller German testing stations are of more or less local importance they are still subsidiary to the Reichsanstalt, Berlin. The engineering experiment stations which it is proposed to establish in each of our States should partake alike of the local value and educational affiliations of these German testing stations on the one hand, and on the other, it is clear that we should have at least as fully developed a department as the technical section (Mechanisch-technische Versuchsanstalt) of the great national institution at Charlottenburg, Berlin.

"The technical section is divided into four subdepartments, each under the control of a chief, and supplied with all known apparatus and every facility for the prosecution of its work. The first of these departments is devoted to testing the strength of metals, chains, cordage, belts, woods, etc. The second department is devoted to testing building materials, such as natural and artificial stones, bricks, tiles, slates, wood, glass, lime, cement, mortars, pipes for water, gas, and sewerage. The third department treats of all forms of paper and textile fibers and fabrics; and the fourth department is devoted to lubricants."

Very much of the present commercial success of Germany is due to the characteristic thoroughness of her method of training. The details of every branch of business is carefully entered into. The manufacturer is ready to avail himself of the opportunities which the Government affords for thorough inspection, testing, and experimental determination of the value of his products. The official testing stations of Germany are continually in search of knowledge that will be of interest in some line of her national development and welfare.

Germany has been probably fifty years in preparing the way. It is to-day a great and successful nation. It has won as great victories in peace as in war. In both, the same methods have been pursued, namely, studious preparation in advance and the intelligent prosecution of scientific investigation.

German thoroughness, German methods, German patience and industry, German training and researches are commanding world-wide attention. The States, cities, and even villages have given freely of their means to promote such industrial development. They are now earning their reward in the steady growth of their markets at home and abroad.

The engineering experiment station will greatly benefit the people in general through the development of the natural resources of their respective States. It will aid in the promotion of the mining, manufacturing, and other industries concerned in the utilization of these natural resources and likewise dependent upon a highly advanced state of engineering science.

It will serve to increase our commerce and trade abroad. It will open up still further the foreign markets of the world to the products of American industries. It will enable us to maintain our present high standard of excellence in these lines. It will enable us to advance the same beyond the highest point of similar industries in other nations in which such aid is not given to the development of engineering science.

In coordinating such engineering experiment stations with existing State colleges or universities they would afford increased facilities for instruction in experimental engineering and the post-graduate work of accredited engineers. The publication of bulletins, quarterly or oftener, would diffuse the work of the station among the people and give practical information on engineering science and the State's resources for industrial development.

This paper was discussed in some detail by Messrs. R. H. Thurston, O. P. Hood, A. Kingsbury, C. F. Allen, J. A. Myers, W. F. M. Goss, H. W. Tyler, L. S. Randolph, and G. H. Hamlin. Approval of the work done by Professor Aldrich and his associates in the interest of the engineering bill was expressed, but it was decided not to bring the matter before the general convention.

Other papers presented were "The engineering laboratory in its relation to the public," by W. F. M. Goss, of Indiana; "Bicycle dynamometer tests," by C. A. Perkins, of Tennessee; "Mechanic arts in the schools of the South," by H. C. Powers, of Florida; "Shop courses in relation to engineering education," by L. S. Randolph, of Virginia. The last paper created an interesting discussion.

INDEX OF NAMES.

INDEX OF SUBJECTS.[1]

[1] Supplementary to Table of Contents, page 3.