FOURTH ANNUAL REPORT OF THE

BOARD OF TRUSTEES

OF THE

ILLINOIS INDUSTRIAL UNIVERSITY

FOR THE YEAR 1870-1.

EMBRACING

THE ACADEMIC YEAR AND SUBSEQUENT VACATION,
WITH LECTURES, ETC.

SPRINGFIELD:
ILLINOIS JOURNAL PRINTING OFFICE.
1872.

"The great advantage of directing education towards the pursuits and occupations of the people, instead of wasting it on dismal verbalism, is that while it elevates the individual, it at the same time gives security for the future prosperity of the nation."—*Lyon Playfair, Address on Education.*

"That man, I think, has had a liberal education, who has been so trained in youth that his body is the ready servant of his will, and does with ease and pleasure all the work that, as a mechanism, it is capable of: whose intellect is a clear, cold, logic engine, with all its parts of equal strength, and in smooth working order: ready, like a steam engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind: whose mind is stored with a knowledge of the great fundamental truths of nature and of the laws of her operations: one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience: who has learned to love all beauty, whether of nature or of art, to hate all vileness, and to respect others as himself."—*Huxley, on a Liberal Education.*

OFFICERS AND MEMBERS OF THE BOARD OF TRUSTEES.

HON. JOHN M. GREGORY, LL.D.,
PRESIDENT.

HON. WILLARD C. FLAGG,
CORRESPONDING SECRETARY.

PROFESSOR EDWARD SNYDER,
RECORDING SECRETARY.

JOHN W. BUNN, ESQ.,
TREASURER.

MEMBERS EX-OFFICIO.

HON. JOHN M. PALMER, *Governor.*
HON. NEWTON BATEMAN, LL.D., *Sup't of Public Inst.*
DAVID A. BROWN, *President State Agricultural Society.*
JOHN M. GREGORY, LL.D., *Regent of University.*

MEMBERS APPOINTED BY GOVERNOR AND SENATE.

NAME.	DISTRICT.	POST OFFICE.	COUNTY.	TERM ENDS.
Anderson W. B	11th Congressional	Mt. Vernon	Jefferson	1877
Blackburn, Alexander	9th "	Macomb	McDonough	1875
Brayman, Mason	2d Grand Division	Quincy	Adams	1873
Bowen, G. S	3d "	Chicago	Cook	1877
Brown. A. M	13th Congressional	Villa Ridge	Pulaski	1875
Cobb, Emory	3d Grand Division	Kankakee	Kankakee	1873
Cunningham, J. O	2d "	Urbana	Champaign	1877
Edwards, Samuel	5th Congressional	La Moille	Bureau	1875
Galusha, O. B	5th "	Morris	Grundy	1877
Goltra, M. C	10th "	Jacksonville	Morgan	1873
Greenleaf, L. L	3d Grand Division	Chicago	Cook	1877
Griggs, C. R	2d "	Urbana	Champaign	1873
Harrington, R. B	8th Congressional	Pontiac	Livingston	1877
Hayes, S. S	3d Grand Division	Chicago	Cook	1873
Johnson, John S	4th Congressional	Warsaw	Hancock	1875
Lawrence, L. W	2d "	Belvidere	Boone	1877
McMurray, L. B	1st Grand Division	Effingham	Effingham	1871
Mahan, Isaac S	1st "	Centralia	Marion	1875
Pearson, John M	12th Congressional	Godfrey	Madison	1877
Pickard, J. L	1st "	Chicago	Cook	1875
Pickrell, J. H	2d Grand Division	Harristown	Macon	1877
Pullen, Burden	1st "	Centralia	Marion	1877
Scott, James R	7th Congressional	Champaign	Champaign	1877
Scroggs, J. W	2d Grand Division	Champaign	Champaign	1873
Slade, James P	1st "	Belleville	St. Clair	1875
Van Osdel, J. M	3d "	Chicago	Cook	1873
Wagner, D. C	3d Congressional	Shannon	Carroll	1877
Wright, Paul R	1st Grand Division	South Pass	Union	1875

STANDING COMMITTEES.

I.

Executive.—The Regent, Pickrell, Brown, Cobb, Goltra, Lawrence, Griggs, Pearson, Cunningham.

II.

Auditing.—Lawrence, Wright, Blackburn, Galusha, Mahan.

III.

Finance.—Cobb, Hayes, Griggs, Bowen, Scroggs.

IV.

Faculty and Study.—Regent, Bateman, Pickard, Hayes, Slade, Edwards.

V.

Agricultural Department.—Pickrell, Blackburn, D. A. Brown, Harrington, Scott.

VI.

Horticultural Department.—A. M. Brown, Pullen, Galusha, Wright, Edwards.

VII.

Military Department.—Brayman, Anderson, Scroggs, Wright, D. A. Brown.

VIII.

Mechanical Department.—Pearson, Greenleaf, Bowen, Harrington, Goltra.

IX.

Buildings and Grounds.—Goltra, Van Osdel, Cunningham, Greenleaf, Scott.

X.

Library and Cabinet.—Bateman, Slade, Griggs, Pullen, Van Osdel.

XI.

By-Laws and Rules.—Mahan, Pickard, Anderson.

XII.

State of the Institution—Pickard, Slade, D. A. Brown.

BOARD OF TRUSTEES.

BY-LAWS, AS AMENDED AND REVISED.

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SECTION 1. All meetings of the Board of Trustees shall be held at the University building, in Champaign county, and a majority of all the Board shall constitute a quorum.

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SEC. 3. Special meetings may be called, whenever necessary, by the Regent, Corresponding Secretary or any five members of the Board, by mailing to each member of the Board, or personally serving a copy of such call, at least ten days before the day of meeting, provided, that in such notice the business to be attended to at such meeting shall be specified.

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4. Reports of the Executive Committee of all business transacted since the last meeting of the Board
5. Reception and consideration of communications.
6. Reports of officers.
7. Reports of standing committees.
8. Reports of special committees.
9. Unfinished and new business.

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SECTION 1. In discussion, and the disposition of business, the Board shall be governed by the parliamentary rules and usages usually governing deliberative bodies.

Provided, That every motion, or resolution, contemplating any disbursement from the funds of the University, shall either emanate from, or be referred to, some standing committee, before final action thereon.

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SEC. 3. No member shall speak more than ten minutes, or more than twice, upon any proposition, without the consent of the Board.

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The officers of the Board shall consist of the Regent, Treasurer, Corresponding Secretary, and Recording Secretary; and the Board may, from time to time, appoint such professors, tutors or instructors, and such subordinate officers and employès, as they may deem necessary to carry on the Institution.

V. TERMS OF OFFICE.

SECTION 1. The Regent and Treasurer shall be elected at each biennial meeting, and hold their offices for two years, and until their successors are elected and qualified.

SEC. 2. The Corresponding and Recording Secretaries shall be elected at the annual meeting, and hold their offices for one year, and until their successors are elected and qualified.

SEC. 3. Professors, and other officers and employès, shall be appointed at such time, in such manner, and for such term, as the Board shall, by resolution, in each case, direct, and be subject to removal at the pleasure of the Board.

VI. DUTIES OF REGENT.

SECTION 1. The Regent shall be the President of the Board of Trustees, and of all the several Faculties of the University; may vote on all questions or propositions submitted to the Board, and, upon calling any member to the chair, may participate in debate.

SEC. 2. He shall be the chief executive officer of the Board, and shall see that the orders and resolutions of the Board are carried into effect, when the Board shall not otherwise direct; and shall take care that the by-laws and regulations relating to the duties of subordinate officers, instructors and students, are faithfully observed.

SEC. 3. He shall be the Chairman of the Executive Committee, and as such shall report, at each meeting of the Board, the doings of the Committee since the last session of the Board.

SEC. 4. He shall also, as Regent, make an annual report to the Board, exhibiting the progress and condition of the several departments of the University, with such suggestions as he may deem needful for their improvement.

VII. TREASURER.

The Treasurer shall give bond, with approved security, in the sum of three hundred thousand dollars. He shall be the custodian of all moneys and securities belonging to the University, except such as are, by law, placed in the custody of the State, and of the land scrip, until the same shall be sold or located. He shall invest the funds of the University, as directed by the Board, and he shall pay no money out of the treasury, except upon a warrant of the Regent, countersigned by the Recording Secretary. He shall, also, annually, and oftener, when required, make a detailed report to the Board of all receipts and disbursements, since making his last report.

VIII. CORRESPONDING SECRETARY.

The Corresponding Secretary shall perform the duties indicated and required by the act creating his office. He shall hold his office in the University building as soon as the Institution is opened.

IX. RECORDING SECRETARY.

SECTION 1. The Recording Secretary shall perform the duties required him by law, and usually appertaining to his office. He shall keep the books and papers belonging to his office, at the University building, at Champaign, and the same shall be open to the inspection of any member of the Board, or officer of the University. He shall be the clerk of the Executive Committee, and, as soon as the University is open, reside at or near thereto.

SEC. 2. He shall countersign all warrants on the Treasurer, and note on each the date of the order of the Board or Executive Committee authorizing the issuing of the same,

X. SALARIES.

The salary of each officer, professor, instructor and other employé of the University, shall be fixed by resolution at the time the appointment is made, subject to alteration in the discretion of the Board; and a warrant shall be drawn for the same, according to law, on the Treasurer, as the same shall fall due, provided there are funds in the treasury to pay the same.

Salaries shall be payable quarterly, on the first days of April, July, October and January, of each year.

XI. DISABILITIES OF MEMBERS.

No Trustee, except as provided in the charter, shall receive any salary or compensation (except actual expenses) for services as an officer, or while acting under any appointment of the Board; nor shall any Trustee be interested in any contract made with, or on behalf of, the Board: *Provided*, That this section shall not apply to any of the present officers or appointees of the Board.

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At the annual meeting, the following standing committees shall be appointed:

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2. An Auditing Committee, of five members.
3. A Finance Committee, of five members.
4. Committee on Faculty and Study, of Regent and five members.
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9. Committee on Buildings and Grounds, of five members.
10. Committee on Library and Cabinets, of five members.

11. Committee on By-Laws and Rules, of three members.

12. Committee on the state of the Institution, whose duty it shall be, at stated times in each year, to visit the University, and examine thoroughly into the method of teaching in the various departments, and upon the progress of the students, and the general efficiency of the discipline, and report to the Board at each meeting.

XIII. DUTIES OF EXECUTIVE COMMITTEE.

SECTION 1. The Executive Committee shall meet, at the seat of the College, at least quarterly, and oftener if they shall find it necessary, for the transaction of any business necessary to be done in the vacation of the Board.

SEC. 2. The Executive Committee shall, for the purposes for which they were appointed, possess all the powers of the Board : *Provided*, That they shall not revise or change the acts of the Board, nor act upon any matters referred to any committee of the Board, that may be entrusted with any special business; shall not purchase or sell real estate, nor the land scrip, nor bonds belonging to the University, without the consent, in writing, of a majority of all the members of the Board, and shall be strictly confined to such business as cannot be left till the annual meetings of the Board.

SEC. 3. The Committee shall hold their office till the annual meeting next after their appointment; and they shall submit the minutes of their proceedings, or make a report through their Chairman, to every meeting of the Board, of all their transactions since the last meeting of the Board.

SEC. 4. Special meetings of the Executive Committee may be called in the same manner as special meetings of the Board.

XIV. AUDITING COMMITTEE.

The Auditing Committee shall examine and report upon all accounts of the Regent and the Treasurer, and audit all accounts referred to them by the Board or Executive Committee.

XV. FINANCE COMMITTEE.

The Finance Committee shall have the general supervision of the financial affairs of the University, subject to the rules and control of the Board. They shall make to the Board, at the annual meetings, a statement of the condition of the finances of the University, and an estimate of the income from all sources, and of its necessary and probable outlay for the succeeding year. And they shall report at all other meetings of the Board and of the Executive Committee, when required, and shall recommend such measures for the management of the revenues as they may think best.

XVI. COMMITTEE ON FACULTY AND COURSE OF STUDY.

The Committee on Faculty and Course of Study shall recommend, from time to time, suitable persons for positions in the Faculty, in its various departments, and all necessary changes or modifications in the course of study.

XVII. DUTIES OF COMMITTEES ON DEPARTMENTS.

The Committee on Agricultural, Horticultural, Mechanical and Military Departments, shall attend to the several subjects indicated by the titles of the committees. They shall recommend all measures necessary for the advancement of the interest of the various departments.

XVIII. COMMITTEE ON BUILDINGS AND GROUNDS.

The Committee on Buildings and Grounds shall consider and report upon all plans, estimates or proposals for the sale or exchange, repair or improvement of the buildings or grounds belonging to the University, or for the erection of buildings or fences on the same, and for their convenient division; and all orders of the Board for improvements on buildings and grounds (except the farms) shall be under the charge and control of the Committee.

XIX. COMMITTEE ON LIBRARY AND CABINETS.

The Committee on Library and Cabinets, of which the Regent shall be one, shall consider and report upon all matters relating to the care and arrangement of the library and cabinets. They shall have charge of the purchase and exchange, under the direction of the Board, of all cabinet materials, books, pamphlets, periodicals or specimens. They shall report, from time to time, the condition of the library and cabinets, and their future wants.

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The Committee on Rules and By-Laws shall prepare and recommend, from time to time, by-laws for the government of the Board in its business, and rules for the management of all departments of the University.

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The Committee on Buildings and Grounds shall consider and report upon all plans, estimates or proposals for the sale or exchange, repair or improvement of the buildings or grounds belonging to the University, or for the erection of buildings or fences on the same, and for their convenient division; and all orders of the Board for improvements on buildings and grounds (except the farms) shall be under the charge and control of the Committee.

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Lufkin, George A	Civil Engineering	1	Villa Ridge	Pulaski
Lyman, George H	Mechanical	3	Richland	Sangamon
Lynch, Edward	Civil Engineering and Military	3	Wapella	De Witt
Lyon, John L	Chemical and Military	3	Chicago	Cook
Lytle, George W		1	Champaign	Champaign
Mann, Howard A	Mechanical	1	Batavia	Kane
Matthews, James W		3	Mason	Effingham
Mathews, Wilson	Agricultural	1	Freeport	Stephenson
Marsters, Hezekiah E		1	Rantoul	Champaign
Maxey, John F		1	Mt. Vernon	Jefferson
McKinley, William B		2	Champaign	Champaign
McKinley, Thomas	Agricultural	1	Champaign	Champaign
McDannell, Urillo S	Civil Engineering	1	Rock Island	Rock Island
McCauley, John C	Mechanical	1	Lincoln	Logan
Merrill, Warren	Agricultural	2	Astoria	Fulton
Michener, Levi W	Agricultural	2	Homer	Champaign
Miller, Charles W		1	Chicago	Cook
Miller, Benjamin C		1	Carlinville	Macoupin
Miller, Robert W	Mechanical	1	Willow Hill	Jasper
Miller, Jesse	Mechanical	1	Willow Hill	Jasper
Minnich, William		1	Villa Ridge	Pulaski
Mingle, Charles J		1	Clyde	Whiteside
Moore, Edwin F	Agricultural	3	Tolono	Champaign
Morris, John C. C		2	Lincoln	Logan
Morrow, Andrew T	Mechanical and Military	1	Pittsfield	Pike
Mumper, William G	Civil Engineering	1	Tuscola	Douglas
Ness, Joseph		1	Rossville	Vermilion
Newby, Samuel M		2	Mooresville	Indiana
Ockerson, John A	Agricultural	2	Elmwood	Peoria
Pancake, George H	Mining Engineering	3	Mahomet	Champaign
Parker, Calvin E	Civil Engineering	3	Philo	Champaign
Parker, George F	Agricultural and Military	2	Sonora	Hancock
Patch, Emery	Agricultural	1	Janesville	Wisconsin
Paton, John	Mechanical	1	Lincoln	Logan
Peadro, Benjamin F	Mechanical	1	Windsor	Moultrie
Perry, Edward E	Agricultural	1	Beaufort	North Carolina
Philips, Parley A	Agricultural	2	Damascus	Stephenson

CATALOGUE—CONTINUED.

Name.	Course.	Year of attendance.	Residence. Post Office.	Residence. County.
Phœnix, Samuel T	Chemical	1	Bloomington	McLean
Pickrell, William	Horticultural	1	Mechanicsburg	Sangamon
Platt, Franklin C	Agricultural	2	Warren	Jo Daviess
Porterfield, E. Newlan	Military	2	Sydney	Champaign
Prather, Frank	Mechanical	1	Decatur	Macon
Prather, Hamar S	Agricultural	1	Urbana	Champaign
Prickett, Charles M		1	Ringwood	McHenry
Proudfit, Samuel M		1	McLeansboro	Hamilton
Rader, Adolphus L		3	Bristol	Tennessee
Rafferty, James N		1	Vermilion	Edgar
Raymond, Isaac S		3	Champaign	Champaign
Reiss, Willis A	Civil Engineering	3	Belleville	St. Clair
Reynolds, Stephen A	Civil Engineering	3	Belvidere	Boone
Reynolds, Henry S	Military	2	Urbana	Champaign
Rice, Walter B	Agricultural	2	Champaign	Champaign
Richards, Geo. B	Horticultural	1	Seneca	McHenry
Richner, George W	Mechanical	1	Blue Ridge	Piatt
Rickard, Thomas E	Military	3	Springfield	Sangamon
Ricker, N. Clifford	Agricultural	2	La Harpe	Hancock
Rieger, William V	Agricultural	2	Beaufort	North Carolina
Riley, Ozias		2	Urbana	Champaign
Robbins, H. Edward	Mechanical	2	Wenona	Marshall
Robbins, S. Volney	Mechanical	1	Wenona	Marshall
Robinson, Elna A	Mechanical	1	Janesville	Wisconsin
Rolfe, Charles W		2	Montgomery	Kane
Rutherford, Cyrus		1	Oakland	Coles
Salter, Rembrandt R	Military	1	Joliet	Will
Satterlee, Frank W		2	Batavia	Kane
Satterlee, Lewis A		1	Batavia	Kane
Short, Albert R	Chemical	1	Fairmount	Vermilion
Silver, Charles W	Agricultural	3	Urbana	Champaign

Silver, Howard	Agricultural	3	Urbana	Champaign
Singletary, Charles A	Mechanical	1	Macomb	McDonough
Sloan, Thomas B.	Agricultural	2	Urbana	Champaign
Smith, Ira W.	Agricultural and Military	1	Burlington	Kane
Smith, Charles A.	Mechanical	1	Mt. Vernon	Indiana
Soper, Hubell	Agricultural	1	Rantoul	Champaign
Stayman, John M		1	Champaign	Champaign
Stevens, Harmon G		1	Homer	Champaign
Stevens, Francis A	Agricultural	1	Newton	Jasper
Story, George	Civil Engineering	1	Chicago	Cook
Stribling, Edgar N		1	Du Quoin	Perry
Swartz, Alexander C.	Civil Engineering	1	Fairview	Fulton
Swisher, Riley	Agricultural	3	Rossville	Vermilion
Swyer, David E.		2	Belleville	St. Clair
Tackaberry, Elijah	Agricultural	2	Dorset	De Kalb
Talbott, Charles W	Agricultural and Military	1	Harristown	Macon
Tate, Charles M.		1	Rushville	Schuyler
Taylor, Wm. O.	Agricultural	1	Decatur	Macon
Teeple, Jared	Military	3	Elgin	Kane
Tennis, Israel W.		1	Vermilion	Edgar
Terry, Theodore	Agricultural	1	Otter Creek	Jersey
Terrell, James N.	Agricultural	1	Belleville	St. Clair
Thompson, Alonzo O	Agricultural	2	Urbana	Champaign
Titus, William L.	Mechanical	2	Kane	Greene
Town, Henry L	Agricultural	2	Batavia	Kane
Towle, Irvin B.	Civil Engineering	2	Urbana	Champaign
Trowbridge, Silas	Mechanical	2	Decatur	Macon
Tyndale, Hector H	Mechanical	1	Springfield	Sangamon
Walker, Edwin G	Mechanical	2	Monroe City	Missouri
Warder, Walter		2	Vienna	Johnson
Weston, Charles		1	Champaign	Champaign
Wells, Daniel T.		1	Rural Retreat	Douglas
Wharton, Jacob N.	Civil and Mg. Engineering	3	Bement	Piatt
Wharry, Walter W.	Chemical and Military	1	Sycamore	De Kalb
White, Wallace	Mechanical	1	Olney	Richland
White, Alfred		1	Buckley	Iroquois
Whitcomb, Alonzo L	Chemical	2	Urbana	Champaign
Whitcomb, Alva H.		1	Urbana	Champaign
Whitney, Albert S.		2	Sydney	Champaign
Whitney, Lewis C.		1	Sydney	Champaign

CATALOGUE—CONTINUED.

Names.	Course.	Year of attendance.	Residence. Post Office.	Residence. County.
Wilcox, Albert C		1	Alton	Iowa
Williams, Charles A		2	Peoria	Peoria
Williams, Louis E	Agricultural	1	Perry	White
Williams, James A		3	Urbana	Champaign
Winkler, Joseph	Mechanical	1	Oakland	Coles
Winn, George L		1	Woodstock	McHenry
Wood, Reuben O	Military	3	Woodburn	Macoupin
Wood, Abraham D		1	Woodburn	Macoupin
Woods, H. Chester		1	Sterling	Whiteside
Wright, Frank E	Civil Engineering and Military	1	Arcola	Douglas
Yeazel, Abraham	Agricultural	2	Homer	Champaign
Young, Horace D	Civil Engineering	1	Gilman	Iroquois
Baker, Ella S		1	Champaign	Champaign
Chase, Ella		1	Champaign	Champaign
Cheever, Alice		1	Champaign	Champaign
Coffeen, Sadie		1	Sidney	Champaign
Canine, Frances		1	Champaign	Champaign
Detmers, Jennie H. M	Chemical	1	Champaign	Champaign
Douglas, Sarah M		1	South Richland	New York
Field, Ella		1	Champaign	Champaign
Fillmore, Delia M		1	Champaign	Champaign
Goodwin, Frances E		1	Urbana	Champaign
Gregory, Mary E		1	Champaign	Champaign
Gregory, Helen B		1	Champaign	Champaign
Ivers, Mary A		1	Champaign	Champaign
Kellogg, Flora L		1	Champaign	Champaign
Osgood, Anna		1	Urbana	Champaign
Potter, Adelia F		1	Champaign	Champaign
Romine, Mary		1	Urbana	Champaign
Rankine, Lucy E		1	Rantoul	Champaign

Raymond, Jennie		1	Champaign	Champaign
Rea, Margaret A		1	Urbana	Champaign
Summers, Charlotte		1	Springfield	Sangamon
Whitcomb, Abbie		1	Urbana	Champaign
Whitcomb, Emma		1	Urbana	Champaign
Whitcomb, Mary		1	Urbana	Champaign

FEMALES, 24; MALES, 254; total, 278.

RECAPITULATION.

By Studies.

Agriculture	56	Architecture	4
Horticulture	9	Mechanics and Military	5
Agriculture and Military	4		— 71
	— 69	Chemistry	8
Mechanics	37	Chemistry and Military	4
Civil Engineering	21		— 12
Mining Engineering	1	*Military	11
Civil and Mining Engineering	1	†Unassigned	115
Civil Engineering and Military	2		
		Total	278

By Counties, etc., Showing also the Counties not Represented.

Adams	2	Ogle	5
Boone	2	Peoria	2
Brown	2	Perry	1
Bureau	2	Piatt	3
Champaign	86	Pike	1
Christian	1	Pulaski	2
Clay	4	Randolph	3
Clinton	2	Richland	1
Coles	3	Rock Island	2
Cook	6	Sangamon	6
De Kalb	3	Schuyler	1
De Witt	1	Shelby	2
Douglas	10	St. Clair	7
Edgar	3	Stephenson	4
Effingham	4	Union	2
Fulton	2	Vermilion	7
Greene	1	White	1
Hamilton	2	Whiteside	5
Hancock	8	Will	2
Iroquois	5		
Jasper	3	Total from Illinois, 59 Counties	259
Jefferson	1		
Jersey	1	Indiana	3
Jo Daviess	3	Iowa	1
Johnson	1	Michigan	2
Kane	9	Missouri	1
Kankakee	1	New York	3
Lake	1	North Carolina	2
LaSalle	2	Pennsylvania	1
Lawrence	1	Tennessee	2
Logan	4	Wisconsin	2
Macon	5		
Macoupin	4	Total from other States, 9 States	17
Madison	3		
Marshall	2	Asia Minor	1
Mason	1	Germany	1
McDonough	1		
McHenry	7	Total Foreign Countries	2
McLean	2		
Montgomery	1	Grand total	278

*The students marked "Military" take the study of Military Science, besides their regular studies, whatever those may be.

†Students who have not yet selected their vocation, and are not therefore decided upon their course, as also all who are taking elective courses, are enumerated as "Unassigned."

HISTORY OF THE UNIVERSITY.

The Illinois Industrial University is both State and National, in its origin and relations. It was created by a grant from Congress, and its great leading aims were prescribed by a law of Congress. The State, accepting the grant and its conditions, founded the University, and further endowed it with the large donations received from the county in which it is located.

The public movement which gave rise to this University, began a quarter of a century ago. Public meetings of the friends of industrial education were held in all parts of the State, and numerous petitions, signed by thousands of the agriculturists and other industrial classes, flooded the State Legislature. At length, in 1857, the General Assembly adopted joint resolutions asking Congress to make grants of public lands to establish colleges for industrial education. After long discussions, Congress passed the necessary law in July, 1862, making the magnificent grant of public lands out of which has arisen that long list of Agricultural Colleges and Industrial Universities now scattered over the continent.

Illinois, the first to ask, was among the first to accept the grant, and great public interest was immediately excited in the question of its organization and location. Princely donations, in some cases of half a million of dollars, were tendered by several counties to secure the location of the institution in their midst. In February, 1867, a law was passed fixing the location and defining the plan of the University, and in May of the same year the Board of Trustees met at the University Building donated by Champaign county, and finally determined the location. During the year much of the scrip was sold or located, necessary alterations were made in the buildings, apparatus and library were purchased, a faculty partly selected, and preparations made for active work. The 2d day of March, 1868, the University was opened for students, and on the 11th of the same month formal inauguration exercises were held. In 1869, the Legislature appropriated $25,000 to the Agricultural Department for barns, tools, stock, etc., and $20,000 to the Horticultural Department for green house, barns, drainage, trees, tools, etc., besides $5,000 to Chemical Laboratory, and $10,000 for Library and apparatus. The present Legislature has lately appropriated $75,000 to begin the erection of a main building which is to cost $150,000; and $25,000 for a Mechanical Building and machinery, to include a large Drill Hall for the Military Department. Plans have been adopted and the erection of these buildings is to begin at once. The new Mechanical Building is to be ready for use at the opening of the Fall Term, and the walls of the main building are to be erected this year.

The University began in 1868 with *seventy-five* students. The number has rapidly increased, till now its catalogue shows a total number of *two hundred and seventy-eight* in attendance during the year closing June 7, 1871. As fast as required, the several Departments have been organized, till at length all the great industrial classes are represented, including Agriculturists, Mechanics, Engineers, Miners, Architects, Chemists, Merchants and Publishers, and each class may find here the instructions necessary to the best understanding and performance of its work.

In the Autumn of 1870 the University was opened for the instruction of female students, and now it offers all its advantages to all classes of society, without regard to sex, sect or condition.

LOCATION.

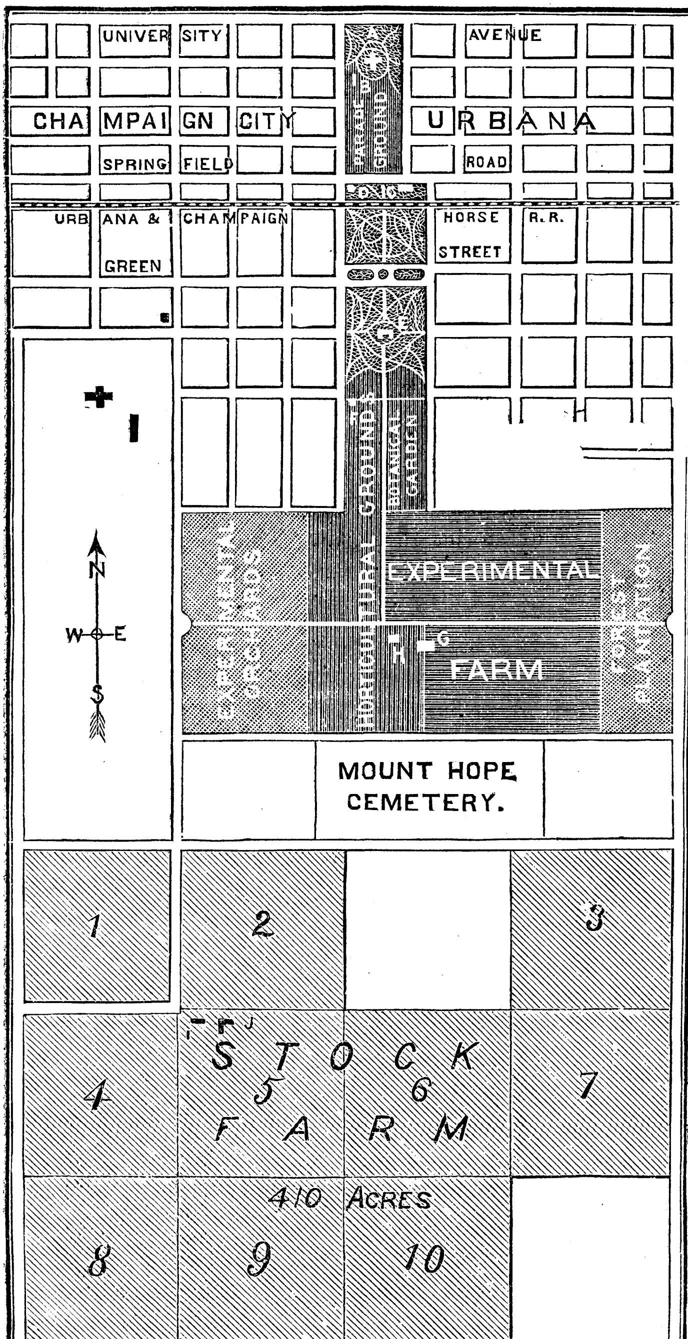
The University is situated in the city of Urbana, adjoining the limits of the city of Champaign, in Champaign county, Illinois. It is 128 miles from Chicago, on the Illinois Central Railroad. The new and splendid Indianapolis, Bloomington and Western Railway passes near the grounds. The county is one of the most beautiful prairie regions in the West. The two contiguous cities, constituting, really, only one community, have together a population of nearly 9,000, well supplied with churches and schools, and affording boarding facilities for a large body of students.

GROUNDS AND FARMS.

The lands occupied by the University embrace about 623 acres, divided as follows:

1. The *Campus*, about 13 acres, including ornamental grounds and a Military Parade ground.

2. The *Horticultural Grounds*, about 130 acres, embracing gardens, orchards, nurseries, arboretum and forest plantations.


UNIVERSITY AVENUE
CHAMPAIGN CITY
URBANA
SPRINGFIELD ROAD
URBANA & CHAMPAIGN HORSE STREET R. R.
GREEN
PARADE GROUND
HORTICULTURAL GROUNDS
BOTANICAL GARDEN
EXPERIMENTAL ORCHARDS
EXPERIMENTAL FARM
FOREST PLANTATION
N
W E
S
MOUNT HOPE CEMETERY.
1
2
3
STOCK FARM
4
5
6
7
410 ACRES
8
9
10

3. The *Experimental Farm*, 70 acres, including the experimental plats and fields.

4. The *Stock Farm*, 410 acres.

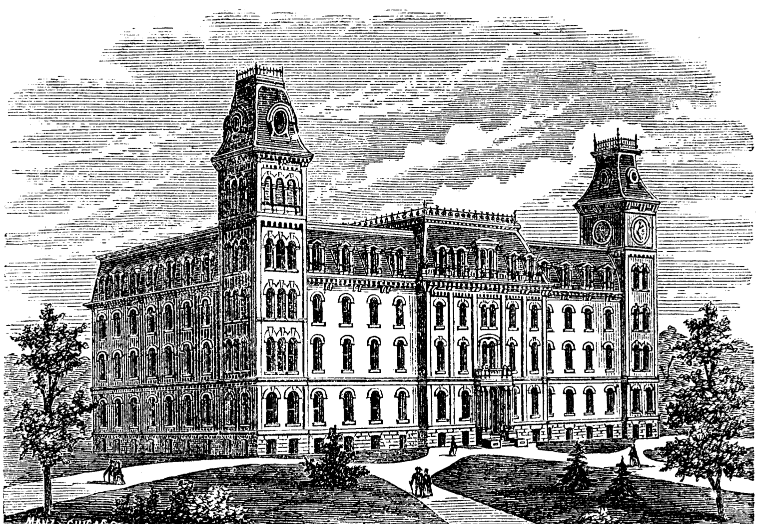
The University owns another farm near Urbana, designed to be sold.

The experimental apple orchard has over 3,000 trees of nearly 1,400 varieties. The pear orchard has, already planted or growing in nursery, over 400 varieties of pears. The other fruit plantations embrace a large number of varieties of various fruit trees and small fruits.

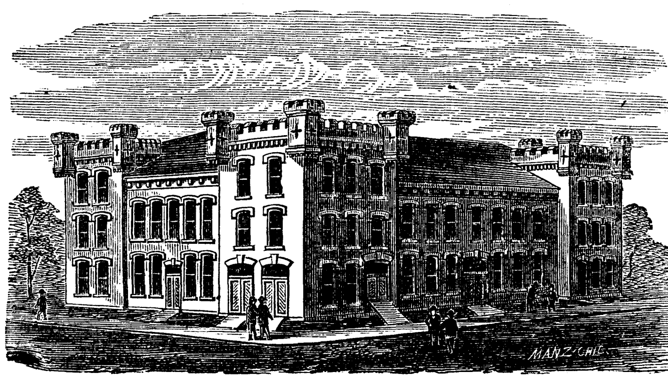
The forest plantations already include 20 acres of timber trees planted in rows, and designed to illustrate artificial forest culture.

BUILDINGS.

The old University Building, now occupied partly by class rooms, library and laboratory, and partly with private rooms for students, is of brick, 125 feet in length and five stories in hight, with a wing of 40 feet by 80 feet, four stories in hight. The building was donated by Champaign county.



The new University Building, of which the above is a cut, is to be 214 feet in length, with wings extending back 124 feet. It is three stories beside basement and Mansard roof. It is designed wholly for public use, and will contain a large public hall for chapel and general exercises, large drawing rooms and thirty class and lecture rooms, sufficient for the instruction of 1,000 or 1,200 students. In one wing, to be made fire-proof, will be provided a spacious library and reading hall, and large and commodious rooms for museums of Natural History and the useful arts. Several large rooms for literary societies will also be provided in the Mansard story. The building is surmounted by companile towers for clock and bells.



The new Mechanical Building and Drill Hall is to be built this summer and to be ready for use in September. It will be of brick, 128 feet in length by 80 feet in width, two stories in hight, with towers three stories in hight, as shown in above perspective view. It will contain a boiler and forge room, a machine shop, furnished with steam engine, lathes, and other machinery; pattern and finishing shop, and shops for carpentery, cabinet work, wood working machinery, paint rooms, printing rooms, draughting rooms, and rooms for models, finishing, etc.

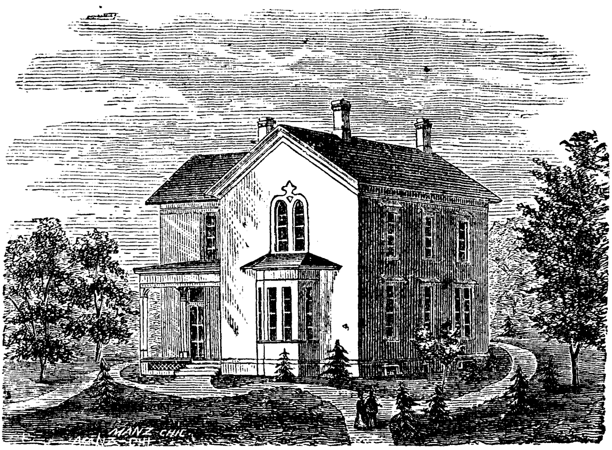
In the second story will be a large drill hall, 120 feet by 60 feet, sufficient for the evolutions of a company of infantry, or a section of a battery of field artillery. On the ground floor of one of the towers will be an armorer's shop, a band room, officer's rooms and a military model room.

The new Green House, shown here, is 70 feet by 24, exclusive of wing containing potting, seed and furnace rooms. There is, besides, another green house 12 feet by 35 feet.

The Veterinary Stables and operating rooms are to occupy the building heretofore used as shops. It is provided with a good yard and sheds, and will be fitted up for practical instruction in the care and treatment of sick animals during the winter clinic.

The University has three barns belonging to the stock and experimental farms and gardens, and three dwelling houses for the superintendents.

We present here the plans and a perspective view of the farm house recently built on the Experimental Farm of the Industrial University. This house is designed to afford a fair model for a farmer's house. It is tasteful in appearance, economical in cost, and compact and convenient in arrangement. We offer it as another contribution to rural architecture.

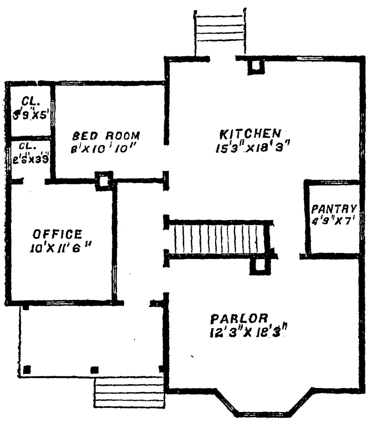


Downing recognized the truth that a house should be in keeping with the scenery by which it is surrounded. One would build a very different style of house among the rugged hills of New England from that which would be appropriate on the prairies of Illinois. The house here shown is not so marked in style as to demand surroundings of any extreme type. If well set off by clumps of conical evergreens, or of tall and branching elms, it will look well on the prairie. The dimensions of the several rooms are given in the plans.

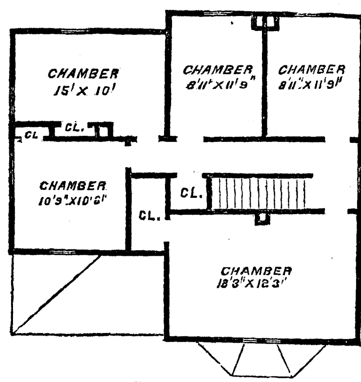
A cellar under the whole, walled with hard brick and having a cement floor, affords a laundry, a large cistern and an ample cellar, in two compartments, one of which may be given to dairy uses and the other to vegetables

The front door is sheltered by a pleasant verandah, and the front hall or entry affords direct admission to office, parlor and kitchen. The "office," a small room which the intelligent farmer will find abundantly useful for his business affairs, will also serve as a library and reading room on wet days, and in the evenings. The "parlor" is a spacious apartment, and rendered doubly pleasant by the bay window. The "kitchen" is also of good size, as many farmers' families make this the "living room," as they call it, where the cooking and eating are both done and the family work goes on. A lean-to, serving as a summer kitchen, and well room, has been added since the building was first erected.

A glance at the second floor will show a goodly number of sleeping rooms, all but two of which are supplied with good closets. There is room both for the farmer's own family and for the largest force he will need to employ in the hay and harvest fields.

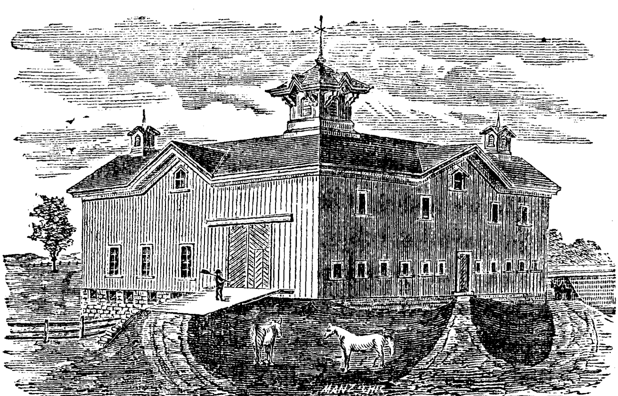


First Floor.



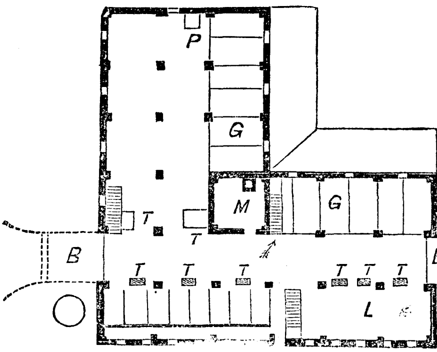
Second Floor.

The entire cost of the house, furnished, and well painted outside and in, was about $2,500. The summer kitchen was added afterwards, and was not included in the above amount.



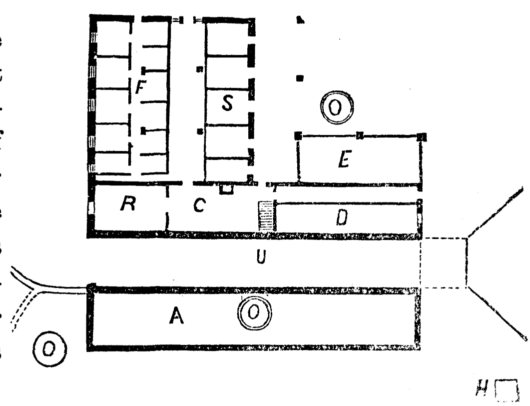
Perspective of Barn.

We present at foot of preceding page the perspective, and below the plans of the basement and first floor of the Barn recently erected on the Stock Farm of the Industrial University. The barn has a north and west front of 80 feet each Each limb, or ell, is 40 feet wide. It is of the kind known as a side hill barn.



Main Floor.

In the *basement plan*, the space marked A is under the horse stalls and has a concrete bottom, sloping towards the cistern, O, designed to catch the liquid manures. The space marked U is a manure pit, open at both ends and sloping to the center with concrete bottom. R is a root cellar. C, the cook room, to be furnished with a steam boiler to steam food, and to run a small engine to furnish power for grinding, threshing and cutting. D is a set of hog pens, and E another set of pens or yard under the shed which extends along both sides of the barn in the angle. S represents a set of bull stalls for the several breeds. S, a series of stalls for fine breeding cows, with calf pens in the rear of each. O O shows the place of the large cisterns taking the water from the roofs. H shows location of the hay scales.



Basement Plan.

In the plan of the first floor, B B are bridges. T T T show trap doors in the rear of horse stalls to allow droppings to be thrown into manure pit. L shows a series of box stalls for breeding mares. G G grain bins. M a harness room. P a large ventilating tube or flue, leading from cattle room below to the cap above the roof. There are doors in the sides of this flue, through which hay can be thrown down for feeding the cattle.

Above the main floor are ample hay lofts.

The foundation walls are of heavy stone work.

PROPERTY AND FUNDS.

Besides the lands and buildings already described, which are with furniture, library, etc., valued at $216,000, the University owns 25,000 acres of well selected wild lands in Minnesota and Nebraska. It has also endowment funds, invested in State and county bonds, amounting to $364,000, besides other property and avails valued at $50,000.

LIBRARY.

The Library, which has been carefully selected to aid the scientific studies required in the several practical courses, includes now about 5,000 volumes, and an appropriation of $10,000 has just been made by the General Assembly for its increase. The large Library Hall is fitted up as a reading room, and richly provided with American, English, French and German papers and periodicals, embracing the most important scientific and art publications, monthlies, quarterlies, etc. The reading room, well warmed and lighted, is open every day and evening, and is constantly resorted to by the faculty and students. The following are some of the periodicals regularly received by the library:

AGRICULTURAL.

Agronomische Zeitung, (German.)
American Agriculturist.
American Bee-keeper's Journal.
Bonham's Rural Messenger.
California Farmer.
Carolina Farmer.
Central Union Agriculturist.
Chemische Ackersman, (German.)
Colman's Rural World.
Cultivator and Country Gentleman.
Farmer's Union.
Fruit Grower.
Hearth and Home.
Journal for Landwirtschaft, (German.)
Journal of Agriculture.
Kansas Farmer.
Landwirtschaft Versuchstation, (German.)
Massachusetts Ploughman.
Michigan Farmer.
National Live Stock Journal.
North Western Farmer.
Ohio Farmer.
Prairie Farmer.
Rural Home Visitor.
Rural New Yorker.
Southern Cultivator.
Southern Planter and Farmer.
Western Farmer.
Western Rural.
Willamette Farmer.

EDUCATIONAL.

Michigan Teacher.

HORTICULTURAL.

Gardener's Monthly.
Horticulturist.
Southern Gardener.
Tilton's Journal of Horticulture.

MECHANICAL.

American Builder.
Architectural Review.
Manufacturer and Builder.
Scientific American.
Van Norstrand's Eclectic Engineers Magazine.
The Workshop.

CHEMISTRY AND NATURAL SCIENCE.

American Naturalist.
American Journal of Microscopy.
Annalen der Physik, (German.)
Comptes Rendues, (French.)
Zeitschrift Annalen Chemie, (German.)

LITERARY.

Blackwood's Magazine.
Edinburg Review.
London Quarterly.
North British Review.
Westminster Review.
Revue des Deux Mondes, (French.)
The Nation.

NEWS.

Centralia Sentinel.
Champaign County Gazette.
Champaign Union.
Chicago Evening Post.
Illinois Democrat.
Illinois Staats Zeitung, (German.)

AIMS OF THE UNIVERSITY.

"Its leading object shall be, 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, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life."—*Act of Congress* 1862, *Sec.* 4.

"The Trustees shall have power to provide the requisite buildings, apparatus and conveniences; to fix the rates of tuition; to appoint such professors and instructors, and establish and provide for the management of such model farms, model art, and other departments and professorships, as may be required to teach, in the most thorough manner, such branches of learning as are related to agriculture and the mechanic arts, and military tactics, without excluding other scientific and classical studies.—*Act of General Assembly* 1867, *Sec.* 7.

In accordance with the two acts above quoted, and under which the University is organized, it holds as its principal aim to offer freely the most thorough instruction which its liberal means will provide, in all the branches of learning useful in the industrial arts, or necessary to "the liberal and practical education of the industrial classes, in the several pursuits or professions in life." It includes in this, all useful learning—scientific and classical—all that belongs to sound and thorough scholarship.

It aims to make the *fields of learning free to all*, and *all free*, that whoever comes may learn what he wills.

It aims also to *make learning practical.* It would avoid the endless, and often useless study of books—of countless words and theorizings—and unite theory and practice, making books subservient to the practical knowledge of things. In its methods it employs the hand and eye, as well as the brain of the student, to the fullest extent, and seeks to fit him to *act* as well as to *think.*

Its practical aims will be best understood by a survey of the following departments of instruction, for which it offers the best facilities :

1. *Scientific Agriculture*, embracing Soil Culture in all its varieties, and for all crops, Animal Husbandry, Stock breeding, feeding, etc., Veterinary Science, Agricultural Chemistry, Rural Engineering and Drainage of lands.

2. *Horticulture*, including Market Gardening, Fruit Growing, Management of Nurseries, Forests, Green Houses, Propagating Houses, and Ornamental Grounds.

3. *Mechanical Engineering*, Theory and practice in construction of machinery, pattern making and working in iron and brass. Study of the Motors, Strength of Materials, and Mechanical Drawing.

4. *Civil Engineering*, including Land and Government Surveys, Railroads, Canals, Bridge Building, Topographical Surveys and Leveling.

5. *Mining Engineering*, embracing Mine Surveys, Sinking and Tubing of Shafts, driving of Adits, and methods of working; Assaying, Treatment of Ores, and Metallurgy.

6. *English Language and Literature.* A thorough and extended course in higher Grammar, Rhetoric, Criticism and Essay Writing, to fit students for editorial or other literary work, or teaching.

7. *Analytical Chemistry.* Chemistry applied to the Arts, Laboratory practice with reagents, blow-pipe, and spectroscope. A full course, to fit students to become Chemists, Druggists and Pharmaceutists.

8. *Architecture.* Architectural Drawing, Styles of Building, Plans, Materials, Estimates, Ornamentation.

9. *Military Tactics.* Manual of Arms, Squad, Company and Battalion Drill, Brigade and Division Evolutions, Bayonet and Sword Fencing, Military Arms, Roads and Fortifications.

10. *History and Social Science*, Political Economy, Rural and Constitutional Law.

11. *Mental and Moral Philosophy*, and Logic.

12. *Modern and Ancient Languages.* French, German, Latin and Greek.

13. *Commercial Science*, Book Keeping, Commercial Law, etc.

14. *Mathematical Science*, Pure and Applied, Natural Philosophy, Astronomy.

15. *Natural History*, Botany, Zoology, Geology, Physical Geography.

FREEDOM IN CHOICE OF STUDIES.

The University being designed, not for children, but for young men and women who may claim to know something of their own wants, powers and tastes, *entire freedom in choice of studies*, is allowed to each student, subject only to such necessary conditions as the progress of the classes, or the convenience in teaching, requires. It is not thought useful or right to urge every student, without regard to his capacity, taste or practical wants, to take entire some lengthened curriculum, or "course of studies." Liberty every where has its risks and responsibilities as well as its benefits—in schools as well as in society; but it is yet to be proved that compulsory scholarship is necessarily better, riper and more certain than that which is free and self-inspired. Each student is exhorted to weigh carefully his own powers and needs, to counsel freely with his teachers, to choose with serious and independent consideration, the branches he may need to fit him for his chosen career, and then to pursue them with earnestness and perseverance, without faltering or fickleness.

It is necessarily required: 1st, That students shall be thoroughly prepared to enter and keep pace with the classes in the studies chosen; and 2d, That they shall take these studies in the terms in which they are taught in course.

It is expected that each student shall have three distinct studies, affording three class exercises each day. But on special request to the Faculty, he may be allowed less or more, to meet the exigencies of his course.

No change in studies can be made after the beginning of a term, without permission of the Faculty.

It is recognized that students will often need advice in the selection of studies and in the arrangement of a proper course. To meet this need the Faculty have carefully arranged several courses of studies which may be wisely followed by those who have no special reasons for diverging from them.

Due care will be taken to prevent, as far as possible, all abuse of the liberty of choice. Students failing to pass satisfactory examinations in their chosen studies, will not be permitted to remain and take other studies without a vote of the Faculty.

DEPARTMENTS AND COLLEGES.

Heretofore the courses of instruction have been exhibited only under the headings of the several Departments. It is found desirable, in order to afford a clearer view of the actual work of the University, to add the sub-divisions into Colleges. This implies no change in the character or plan of the University, but only the adoption of a usage now common in the American Universities, to exhibit more impressively the several courses of studies.

A Department embraces a single branch of study, taught usually by a single professor and his assistants, as the Department of English Literature, or of Mathematics.

A College includes a combined course, made up of the several branches needful for some one calling or profession. Thus, in the older universities, there were Medical Colleges and Law Schools, and in the new Industrial or Polytechnic Universities, are found Colleges of Agriculture, of Engineering, of Mechanical Science, etc.

Under the following several Departments will be found an exhibit of the nature and extent of the instruction afforded in each of the several branches of learning taught in the University. The student may learn from this the character of any branch and the time necessary to complete it.

Under the head of the several Colleges he will find marked out the course of studies needful to fit him for his chosen profession or pursuit. These studies are the same as those shown under the heads of the Departments, but each College embraces studies from several departments, taken not in full, but to such extent as the practical aim of the college course may require.

It is expected that each student will enroll himself in one of the colleges, though he may vary from the course of studies prescribed.

The course of studies, both in the Departments and Colleges, are subdivided according to terms and years, to meet the necessities of class teaching. The student is at liberty to take as many or as few of these terms of any particular study as his needs may require, or his time will allow, but the full course marked out will be found necessary to a complete mastery of the subject.

DEPARTMENTS OF STUDY.

AGRICULTURE.

This Department embraces a thorough course of instruction in the theory and practice of land culture and cropping in its several varieties; Animal Husbandry, including stock and dairy farming; Sheep and Swine Husbandry and the principles of stock breeding. It includes also the principles of the amelioration of soil, veterinary science, and the general management of farming estates. For a statement of the full course of sciences involved in Agriculture, see the article headed "College of Agriculture."

The following presents a full course in this Department:

FIRST YEAR—*The Farm.*—Its measurements and mapping; subdivisions—meadows, pastures, orchards, woodlands, gardens, etc. Fences, hedges, farm buildings. Soil—classification and mechanical treatment of soils, plowing, etc. Drainage. *Plant Culture*—Structure and physiology of plants; classes of the useful plants, their characteristics, varieties, and values. Wheat culture, maize culture, grass culture, root culture.

SECOND YEAR—*The Farm.*—Chemical elements and chemical treatment of soils. Fertilizers—their composition, manufacture, preservation and application. Climate; influence of light, heat and electricity on soils and vegetable growth. Farm implements—principles of structure and use. Road-making. Insects injurious to vegetation. Animal husbandry—breeds and varieties of neat cattle, horses, sheep and swine. Principles of breeding, rearing, training, fattening, etc. Chemical composition of food, and preparation of the several varieties. Sheep husbandry. Poultry. Bees. Veterinary surgery and medicine.

THIRD YEAR—*Agricultural Economy.*—Relation of Agriculture to the other industries and to Commerce. The several branches of Agriculture. Agricultural book-keeping—the farm-book, herd-book, etc. *Rural Law.*—Of tenures and conveyances of land, of highways, of cattle, of fences, of noxious weeds, etc. Laying out of large farming estates. Rural architecture and engineering. Foreign and ancient agriculture. History and literature of agriculture.

The instruction will be aided and illustrated with practical exercises on the experimental and stock farms, and in the management of fine and graded stock of several varieties. But it must be fully understood that it is no part of the business of the Department to teach the mere manual processes of plowing, hoeing, harvesting, etc., these can be learned in the employ of some good practical farmer, such as may be found in every township.

HORTICULTURE.

The studies in this Department will include the formation, management and care of gardens, hot-beds, propagating houses, green houses, nurseries, orchards, tree plantations and ornamental grounds. The instruction will be from text-books, and by lectures in the class room, together with illustrations and applications in the propagating and green houses, botanical garden and arboretum, and upon the vegetable and fruit grounds.

FIRST YEAR—*First Term.*—Composition and classes of soils, with reference to their uses; fertilizers, vegetable physiology, and laws of growth of plants. *Second Term.*—Chemical treatment of soils; manufacture and application of manures; laying out and mapping of grounds. *Third Term.*—Mechanical treatment of soils. Drainage. Insects injurious to vegetation.

SECOND YEAR.—*First Term.*—Fruit growing. Planting and treatment of Orchards. Forest culture. *Second Term.*—Management of Nurseries. Propagating, grafting, etc. Plans of orchards, gardens, etc. Records. *Third Term.*—Management of market and vegetable gardens. Small fruit culture.

THIRD YEAR—*First Term.*—Construction and care of hot and green houses. Propagating house. Conservatories. Floriculture. *Second Term.*—Garden architecture. Ornamentation. Green house work. *Third Term.*—Landscape gardening. Ancient, and Foreign Horticulture.

MECHANICAL SCIENCE AND ENGINEERING.

The studies of this Department are intended to qualify young men for the designing, construction or superintendence of all kinds of machinery. It will embrace a thorough course of instruction in the principles of mechanical philosophy, of mechanical devices and the parts of machines, of pattern making, finishing and mechanical proportion, and of mechanical designing and drawing.

A very important element of mechanical training, too often overlooked, is that of shop practice. Many of the schools of mechanical engineering have met with but partial success from the neglect of this important element of instruction. Here practical instruction goes hand in hand with the study of theory, not for the purpose of teaching mere mechanic art, which can be learned in any of the thousand shops of the country; but to give a practical character and value to the instruction, and to teach more effectually the work of the mechanical engineer.

FIRST YEAR.—*First Term.—Drawing.* The use of draughting Instruments by the student in delineating various objects placed before him. Principles of Projection and Isometrical Drawing. Application of water colors in Finishing drawings by Tinting and Graining. *Second Term.—Descriptive Geometery.* Generation of lines and surfaces of single and double curvature; Graphical solution of various problems by the theory of Projections; Construction of Tin and Sheet Iron workers' patterns.

SECOND YEAR—*First Term.—Designing and Drawing.* Practice in making working drawings of Original Designs. Designing of Machines intended for specific purposes, the parts shaped, proportioned and arranged by the student. *Second Term. Shades, Shadows and Perspective.* Principle of Light and Shade; Use of Water Colors in giving actual external appearance. Projection of Shadows, representing objects as shown in direct light. Finished and Colored Perspectives or Pictures. *Practical Mechanics.* Shop practice in constructing Models or Machines from working drawings of the student's own design; Making Patterns for moulder's use; Moulding and casting brass and other metals; Bench work, filing. *Third Term—Practical Mechanics continued.* Shop practice in constructing machines and models. Study of cutting tools, such as Drills, Counterbores, Reamers' Turning Cutters or Tools, Revolving or Milling Cutters, Taps, Dies, Chasers, Knerls, Dial Plates for Gear Cutters, etc.

THIRD YEAR—*First Term.—Cinematics or Comparison of Motion.* Relative motion of points in any system of connected lines of pieces; motion, considered independent of force; velocity ratio. *Principles of Mechanism.* Cinematics applied to the investigation of the motion of different elementary parts of machines, such as friction wheels; curves in rolling contact; cams and curves in sliding contact; correct working gear teeth; gearing chains; escapements; link work; cylindrical, conical and double screws. *Second Term. Analytical Mechanics.* Equilibrium and resultant of forces; principle of moments and of virtual velocities; determination of "Center of Gravity"; support of bodies on inclined planes; friction considered in connection with motion of bodies upon surfaces; relation of force, time and space when bodies are projected in the air. Motion of rotating and vibrating masses. *Physics.* Properties of matter; liquids and gases; laws of falling bodies; Atwood's Machine; weight in different latitudes; molecular forces; elasticity and compressibility; theory of undulations and vibrations; musical instruments; light; solar spectrum and mode of ascertaining the composition of the Sun, stars and nebulæ. Correction of the aberration of lenses for microscopes, telescopes and other optical instruments. *Third Term—Analytical Mechanies continued.* Motion of Material points as constrained to move in given paths; amount and center of hydrostatic pressure upon surfaces. *Descriptive Astronomy*—Relative size and position of the Earth as compared with other heavenly bodies, and the movement among them; relative mass and density of the distinct bodies of the solar system; parrallax aberration and velocity of light; precession nutation; physical construction of the Sun, planets, comets, stars, nebulæ, etc. *Physics continued*—Heat. Intensity, quantity and effects, latent and specific heat; steam heating apparatus; ventilating and warming of buildings; heating power of fuel; mechanical equivalent heat. Magnetic dip, declination, variation, intensity, etc.; convertibility of magnetism and electricity; identity of lightning and the electric spark; proper form of lightning rods, electric telegraph.

FOURTH YEAR—*First Term—Hydraulics, Pneumatics and Thermodynamics.* Flow of Liquids and Gases through orifices, weirs, pipes, and channels. Distribution of water and gas in cities. Machines for raising water. Effect upon temperature by sudden changes in the volume of a gas, as when expanding in engine cylinders, or in compressing air for motor purposes. *Strength of Materials.* Resistance of Beams, Pillars, etc., to flexure and rupture. Curve of Flexure. Maximum Deflection. Strength of Trusses. *Second Term—Prime Movers.* Work developed by Water-Wheels, Wind-Wheels, Steam, Hot Air and Electric Engines, relative economy, and efficiency. *Drawings. Complete Drawings of Machinery;* plans, elevations, sections and details, the same finished with line shading and water colors. *Third Term—Mill Work and Machinery.*—Heavy Machinery and its Foundations, for Mills and Factories. Manufacturer's machinery, engineer's machinery, etc. *Drawing.* Designing of Machinery, drawings and estimates.

CIVIL ENGINEERING.

The studies of this Department extend through four years. Those of the first three will prepare a student for undertaking many engineering operations, such as the building of railroads, canals, embankments, etc. The fourth year is intended for those who wish to fit themselves for the higher engineering constructions, such as the building of arches, trussed bridges, and supporting frames of all kinds.

FIRST YEAR—*First Term.*—Projection drawing. [See Mechanical Department.] *Second Term.*—Descriptive Geometry. Representation and discussion of lines, surfaces, angles, etc., by their projections; Graphical solution of problems.

SECOND YEAR—*First Term.*—Surveying, chain, compass and transit instruments applied to land surveying; laying out, parting off and dividing up land; running perpendiculars and parallels; measuring inaccessible distances and angles; method of survey of the public lands of the United States. Leveling; measuring the difference of hight between two or more points. Maps and plats of surveys. *Second Term.*—Shades, shadows and perspective. [See Mechanical Department.] Topographical surveying and drawing. Surveys made with the transit and leveling instruments in the ordinary way, also by the more approved modern methods as adopted upon the government surveys of the United States, with the stadia, for the determination of hights above a datum plane of different points; location of contour lines passing through points of equal hight; field sketching, etc.

THIRD YEAR—*First Term.*—Roads and railroads. Preliminary surveys and final location of ideal roads by the actual use of engineer's instruments in the field; laying out on the ground of circular and parabolic railroad curves, turnouts, crossings, etc.; elevation of the outer rail; cuttings and embankments; plans, profiles, sections, etc. *Second Term.*—Analytical mechanics and physics. [See Mechanical Department.] *Third Term.*—Analytical mechanics and physics continued. [See Mechanical Department.] Also, three year students: Mahan's Civil Engineering. Building materials; results of experimental researches on strength of materials; masonry; framing; foundations; embankment walls; canal locks; sea-coast improvements.

FOURTH YEAR—*First Term.*—Strength of materials. Tensile compressive and transverse strength and elasticity of steel, iron, wood and stone, when in the form of beams, pillars, etc. Hydraulics. Flow of liquids through orifices, weirs, pipes, canals, rivers, and the distribution of water and gas in cities. Practical Astronomy. Use of the sextant, transit, equatorial and zenith instruments in the determination of latitude and longitude, by the method of equal altitudes; circum-meridian altitudes; meridian transits, and any altitude of a star or the Sun. *Second Term.*—Stability of frames. Derivation of formulæ for the strength and stability of the various members of trussed frames of all kinds, such as trussed bridges and roofs; steel iron, and stone arches; stability of a wall sustaining a building, roof, pressure of water in dams, or pressure of earth in embankments. Construction drawing. Drawing of existing engineering constructions, with due regard to the most approved methods of uniting materials in structures. *Third Term.*—Stone cutting. Application of the theory of descriptive geometry and graphics to the determination of the dimensions and form of stone required in buildings; plain, groined, cloistered, skew, and other arches; lining for tunnels, etc. Geodesy. Determination of the figure of the earth; methods of conducting extended surveys of the earth's surface; ordinary methods of measuring base lines; method by the standard compensating rods of the United States Coast and lake surveys; running of standard meridians and parallels for government land surveys, etc. Drawing. Finished drawings of bridges and other structures.

MINING.

This Department embraces two branches of studies: 1st. Engineering operations; including mine surveys, the opening and working of mines, all mining constructions, etc., taught at present in the College of Engineering. 2d. The subjects of Mineralogy, Metallurgy, Assaying, treatment of ores, smelting, etc., as taught in the College of Chemistry. The course in Engineering and in Metallurgy will be found under the head of those two colleges.

ENGLISH LANGUAGE AND LITERATURE.

In the arrangement of the studies in this Department, the endeavor has been to present so thorough and extended a drill in grammatical and philological study, and in the authors and history of our language, as to afford the advantages, so far as may be, of the ordinary study of Latin and Greek.

The course is arranged to extend through three years, but it may be shortened according to the ability or needs of the student.

Instruction will be given by text books and lectures; and constant practice in essay writing, forensics, presentation of plans and criticisms, will be required. Public declamations, original or selected, and original essays, are required of every student at least twice a term, during his entire connection with the University.

First Year—*First Term.*—Punctuation; use of capitals; sources of the English language; principles of composition and essay writing. *Second Term.*—Primary rhetoric; advanced grammar; philological and grammatical analysis of modern authors. *Third Term.*—Advanced grammar; philological and grammatical analysis of Milton and other authors; history of their times and contemporaries.

Second Year—*First Term.*—Grammatical and philological analysis of Shakespeare and early dramatists; history of the times and contemporaries of Shakespeare. *Second Term.*—

Grammatical and philological analysis of Spenser, Gower, Chaucer, etc., and history of their times. *Third Term.*—History of English literature, essays and criticisms.

THIRD YEAR—*First Term.*—History of English and American literature, essays and criticisms. *Second Term.*—Rhetoric proper; invention; plans, etc. *Third Term.*—Elements of criticism; methods of philological study, etc.

GERMAN LANGUAGE AND LITERATURE.

This language being of quite practical value to the farmer and artisan of this country, it will be taught thoroughly in a two years' course. The first year aims to enable a student to read such German scientific works as his course demands. The second year completes the course, and makes the student thoroughly acquainted with the language.

FIRST YEAR—*First Term.*—Worman's Complete German Etymology, to lesson 28. *Second Term.*—Etymology completed; Conversational Reader; German Echo commenced. *Third Term.*—Syntax; Reader completed.

SECOND YEAR—*First Term.*—Review of Etymology; Classic Reader. *Second Term.*—Review of Syntax; Schiller's William Tell; Gœthe's Iphigenia. *Third Term.*—Lectures on the German Language; conversation and composition; Schiller's Jungfrau von Orleans; reading of German papers through second and third terms.

Books for reference—Grimm's Deutsche Sprachlehre; Adler's Dictionary.

FRENCH LANGUAGE AND LITERATURE.

The course of instruction in French will extend through two years, but students who desire to pursue the language only far enough to enable them to read the scientific works which they may find it necessary to consult, are expected to acquire sufficient for this in a single year. The reading room is well supplied with French Agricultural and Scientific journals, and much of the best French literature.

FIRST YEAR—*First Term.*—Etymology. Oral exercises in French pronunciation; written exercises in translating English into French. *Second Term.*—Etymology. Select readings; *conversazioni* weekly. *Third Term.*—Syntax. Translating; French composition; *conversazioni*, weekly.

SECOND YEAR—*First Term.*—Review of Grammar; classic French literature; *conversazioni*, weekly. *Second Term.*—Modern French Literature, novels, comedies, etc.; *conversazioni*, weekly; composition. *Third Term.*—Modern French Literature continued; history of French Literature; written criticisms of French authors by the class weekly.

LATIN LANGUAGE AND LITERATURE.

Students will not be admitted to this department who are not prepared to enter at once upon the reading of Cicero.

FIRST YEAR.—Orations of Cicero; Latin prose composition begun and continued through the course; selections from Virgil; Latin prosody.

SECOND YEAR.—Selections from Livy; Horace; Juvenal.

THIRD YEAR.—Cicero de Officiis; Cicero de Oratore; lectures on the origin and structure of the Latin language; Frieze's Quintilian. Other authors will occasionally be substituted in the place of some of the above.

GREEK LANGUAGE AND LITERATURE.

This course will resemble that in the Department of Latin.

FIRST YEAR.—First three books of Xenophon's Anabasis; Herodotus; Greek prose composition begun and continued throughout the course.

SECOND YEAR.—Demosthenes; Thucydides; Homer's Iliad.

THIRD YEAR.—Xenophon's Memorabilio of Socrates. Selections from Plato and Greek poets.

Select portions of Smith's History of Greece will be read in course, and lectures given on Greek history and philosophy.

CHEMISTRY.

The full course in this Department will occupy four years, and is designed to make students at home in the applications of chemistry to agriculture, and the arts and manufactures; in a word, to make them thorough chemists.

FIRST YEAR—*First Term.*—Inorganic Chemistry and Chemical Physics. *Second Term.*—Organic Chemistry. *Third Term.*—Qualitative Analysis—detection of the alkalies, the alkaline earths, the earths, the metals, the mineral acids and the organic acids. Use of the blow-pipe and the spectroscope. Crystallography and Descriptive Mineralogy. Instructions on the subject will be given by lectures, and the students will have practice in determining minerals.

SECOND YEAR—*First Term.*—Qualitative Analysis—a series of substances for practice in the detection and separation of the elements. Practice in Mineralogy continued. *Second Term.*—Quantitative Analysis. Salts, minerals, ores, alloys, furnace products, etc. *Third Term.*—Quantitative analysis of soils, manures, ashes of plants and mineral waters.

THIRD YEAR—*First Term.*—Quantitative Analysis continued; assaying; volumetric analysis. *Second Term.*—Organic Analysis. Detection and separation of organic acids and bases, and other organic compounds. *Third Term.*—Quantitative Organic Analysis: 1st, of compounds containing carbon and hydrogen; 2d, of compounds containing corbon, hydrogen and oxygen; 3d, estimation of nitrogen, sulphur, chlorine, bromine and iodine in organic compounds.

FOURTH YEAR—*First Term.*—Preparation of chemicals. *Second Term.*—Chemistry applied to the arts of dyeing, bleaching, calico printing, electrotyping and photographing. *Third Term.*—Lectures on the manufacture of glass and porcelain, the smelting of ores; heating and illumination, etc.

ARCHITECTURE.

This Department is for the present appended to the College of Engineering. Its studies embrace many of those belonging to the course in Civil Engineering. They include, also, Architectural Drawing, the principles and styles of Architecture, the history of Architecture, and plans and estimates for buildings of all kinds.

NATURAL HISTORY.

FIRST YEAR—*Second Term.*—Structural and Physiological Botany. Form, arrangement, structure, morphology, growth and office of the leaves and flowers; forms, growth and office of the stem and root; cellular tissue, cell development, cell contents and cell transformations; structure, parts and uses of seeds and fruits, and the food, nutrition and reproduction of plants—the whole illustrated by living and dried specimens and drawings. Als enough of Systematic Botany to enable the general student to analyze the flowering plants., *Third Term.*—Botany in lectures: 1st, the natural orders, their extent, properties, uses and distribution; 2d, use of the microscope. Vegetable Physiology continued. Classification› distribution and reproduction of cryptogamous plants.

SECOND YEAR—*First Term.*—Systematic Botany. Practical examination and collection of the flowering and flowerless plants from all parts of the State, as far as practicable. Botanical excursions and surveys. Zoology. Principles of Zoology. Development, structure, classification and distribution of animals. *Second Term.*—Systematic Zoology in lectures: 1st, natural orders, families, etc.; 2d, Embryology and peculiar modes of reproduction; alternate generation; Comparative Anatomy as applied to classification. Collection and preservation of specimens, and Natural History of domestic animals. *Third Term.*—Entomology. Classification of insects; habits of those injurious to vegetation, with means of checking their ravages. Habits of beneficial species.

THIRD YEAR — *First Term.*—General Physiology. Comparative Anatomy. Geology. *Second Term.*—Principles of Geology. *Third Term.*—Lithological Geology. Sources and materials of mineral wealth; building stones; mineral veins. Palæontology.

FOURTH YEAR—*First Term.*—Historical Geology. *Second Term.*—Physical Geography and Meteorology. *Third Term.*—Special Geology of Illinois. Method of conducting surveys. Practical excursions.

PURE MATHEMATICS.

The studies of this Department extend through eight terms. Those of the first six are, it is thought, what the general student will require; the seventh is considered necessary, and the eighth desirable for the engineer.

FIRST YEAR—*First Term.*—Geometry, Davies' Legendre, i-v books; elementary principles, ratios and proportions, the circle and the measurement of angles, measurement and properties of polygons, area of the circle. *Second Term.*—Geometry, vi-ix books; planes; polyedral angles; the prism, pyramid, cylinder, cone and sphere, the properties and measurement of; area of a spherical polygon, of a lune; measurement of spherical angles. Algebra, Davies' Bourdon, chapters vi and vii; formation of powers; binomial theorem; extraction of roots of any degree; radicals of any degree; theory of exponents. *Third Term.*—Higher Algebra; series, properties and summation of; binomial theorem, general demonstration of; exponential quantities; logarithms; general theory of equations.

SECOND YEAR—*First Term.*—Trigonometry, plane, spherical and analytical; formation and use of tables; solution of right angled and oblique angled triangles; relations between the circular functions of any arc. *Second Term.*—Analytical Geometry; geometrical construction; point and right line on a plane; properties and measurement of the circle, ellipse, parabola and hyperbola; point, right line, plane and surface of revolution in space. *Third Term.*—Differential Calculus; differentials of algebraic functions of a single variable; Maclauren's Theorem; Taylor's Theorem; differentials of transcendental functions; maxima and minima of functions of a single variable; equations of tangent and normal; expressions for sub-tangent, sub-normal, etc.; differentials of an arc, plane area, surface and volume of revolution. Integral Calculus; integration of monomials, of particular binomials, of rational fractions; applications in the rectification and quadrature of curves, in the quadrature of surfaces of revolution, and in the cubature of volumes of revolution.

THIRD YEAR—*First Term.*—Analytical Geometry; curves in space; discussion of the general equation of the second degree; discussion of the surfaces of the second order. Differential Calculus; differentials of functions of two or more variables; maxima and minima of functions of two or more variables; tendency of curves to coincide; osculatory curves; radius of curvature; evolutes and involutes; envelopes; construction and discussion of algebraic curves, the logarithmic curve, the cycloid, spirals; general surfaces; equations of tangent plane and normal line; partial differentials of a surface and of a volume. Integral Calculus; integration of the differentials of circular functions and of circular arcs; of certain irrational differentials; of differentials containing transcendental quantities; of the differentials of the higher orders; and of differential equations; rectification and quadrature of curves; cubature of volumes in general. *Second Term.*—Calculus of Variations. Method of Least Squares.

HISTORY AND SOCIAL SCIENCE.

The instruction in this Department will be given partly with text books, but chiefly by lectures, with systematic readings of specified authors, and daily examinations on the same. The study of historical geography will keep even pace with the history studied, and the chronology will be rendered as clear and distinct as possible. Written exercises on chronology, and essays in historical criticism, will constitute prominent features of the course.

First Year—*First Term.*—Discovery, settlement and colonial history of the United States, with notices of other American States; American geography. Two lectures (or lessons) a week. *Second Term.*—History of the United States from the time of the Revolution. Two lectures (or lessons) a week.

Second Year—*First Term.*—Ancient History of Greece and Rome, with notices of other ancient nations; ancient Geography. Five lessons (or lectures) a week. *Second Term.*—Mediaeval history. *Third Term.* Modern history—general European history: European geography. Five lessons (or lectures) a week. Political economy.

Third Year—*First Term.*—Constitutional history of England, and of the United States. Two lectures a week. *Second Term.*—History of Civilization; analysis of historical forces and phenomena; notices of the history of the arts and of the inductive sciences. *Third Term.*—Political philosophy; constitutional and international law.

COMMERCIAL.

The course in this Department will occupy one year, the first term of which will be occupied in teaching the principles of book-keeping in general; the second, their application to special lines of business, general business forms and papers, and the third, to the higher operations of a counting house, commercial law and political economy. Students who wish to prepare for a commercial career, and also acquire a general education, may extend this course through two or more years, by taking such collateral studies as their contemplated vocation may render desirable. Studies recommended for this purpose, would be: The English and German Languages, Mathematics, one or two terms of Chemistry (for druggists, etc.), and History.

First Term.—Book-keeping by single and double entry; theory of mercantile accounts, and the several principal and auxiliary books. Penmanship; commercial calculations.

Second Term.—Partnership accounts; commission and shipping; farm books; business forms and papers; notes, drafts, exchange, endorsements; bills of lading; accounts current; account sales; inventories, invoices, etc. Commercial correspondence.

MILITARY SCIENCE AND TACTICS.

This Department is organized under the provision of the Acts of the National and State Governments, requiring the instruction in Military Tactics. The Board of Trustees of this University have adopted the rule, that all students shall, unless excused for sufficient cause, take part in military exercise, as aggregation of numbers is a paramount necessity to render such instruction effective.

The instruction in this Department will be given in two sub divisions, arranged as follows:

1. *Practical instruction in Military Tactics* (for the present, confined to the infantry arm), to all able-bodied students of the University, comprising the following branches:

Manual of arms; squad and company drill; bayonet exercise; skirmish drill; battalion drill; guard and picket duty; evolutions of the brigade; target practice.

The exercises are confined to three hours' drill and instruction per week.

2. *Military Science.* There will be taught a class in Military Science and Art, as far as it is necessary for duties as officers of the line. Students will be admitted into this class after having participated at least two terms in the general military exercises, and shown such proficiency and ability as may secure a utilization of the instruction thus received.

The instruction, theoretical and practical, is to occupy not to exceed five hours each week, and is so arranged as not to interfere with any courses of study, and make it possible for the member of any other course to engage in it as an optional study.

The members of this class will officer the companies, and act as drill sergeants and instructors for the lower classes.

As collateral studies, for such as make this course a specialty, are recommended Mathematics and Surveying, English and Modern Languages, Drawing, one term of Chemistry, History and Political Economy.

FIRST YEAR—*First Term.*—School of the company; bayonet fencing. *Second Term.*—Battalion and skirmish drill; Bayonet fencing. *Third Term.*—Brigade and division evolutions; target practice, and theoretical instruction on the rifle and fire arms.

SECOND YEAR—*First Term.*—Military administration; reports and returns; army regulations and military laws; Sword fencing. *Second Term.*—Outpost and picket duty (Mahon's); sword fencing. *Third Term.*—Military fortification, field and permanent; military bridges and roads; target practice.

THIRD YEAR—*First Term.*—Artillery practice; field artillery; drill at the cannon. *Second Term.*—Military Engineering; Cavalry tactics, theoretical. *Third Term.*—Art of War (Jomini); Military History and statistics; organization and administration of armies.

There is formed now a battalion of four companies, officered by the students of the military class, and battalion drill and skirmish drill were practiced last term.

PHILOSOPHY AND LOGIC.

The studies of this Department extend through the last year of the full courses, and are taught chiefly by lectures, with readings of specified authors and written essays. The course is as follows:

First Term.—Mental Philosophy. Analysis and classification of mental phenomena. Theories of perception; Imagination; Memory; Judgment; Reason; Intuition. The æsthetic. Phenomena of dreaming, clairvoyance, and insanity. Doctrines of the absolute and the unconditioned. The philosophy of education.

Second Term.—Moral Philosophy (three lectures a week). Theory of conscience; nature of moral obligation; moral feeling; the Right; the Good. Practical ethics; Duties. Formation of character. Logic, formal and inductive, (two lectures a week, alternating with Moral Philosophy).

Third Term.—History of Philosophy. Ancient schools of philosophy; Scholasticism; Modern schools of philosophy; Influence of philosophy on the progress of civilization, and and on modern sciences and arts. Inductive logic.

COLLEGE OF AGRICULTURE.

FACULTY.

THE REGENT, Professor of Political Economy.
DR. MANLY MILES, Professor of Agriculture.
T. J. BURRILL, Professor of Horticulture and Botany.
A. P. S. STUART, Professor of Chemistry.
EDWARD SNYDER, Professor of Agricultural Book-Keeping.
S. W. ROBINSON, Professor of Agricultural Machinery.
S. W. SHATTUCK, Professor of Agricultural Engineering.
D. C. TAFT, Professor, *pro tempore*, of Geology of Soils.
DR. H. J. DETMER, Lecturer on Veterinary Science.
HON. W. C. FLAGG, Superintendent of Agricultural Experiments.

The College of Agriculture has two Divisions, which, for convenience, are styled Schools :

1. The School of Agriculture Proper.
2. The School of Horticulture and Fruit Growing.

1.—THE SCHOOL OF AGRICULTURE.

The aim of this school is to educate scientific agriculturists. The frequency with which this aim is misunderstood by the community at large, demands that it shall be carefully explained. Many, looking upon agriculture as consisting merely in the manual work of plowing, planting, cultivating and harvesting, and in the care of stock, justly ridicule the idea of teaching these arts in a college. The practical farmer who has spent his life in farm labors, laughs at the notion of sending his son to learn these from a set of scientific professors. But all of this implies a gross misunderstanding of the real object of agricultural science. It is not to teach *how* to plow, but the reason for plowing at all,—to teach the composition and nature of soils, the philosophy of plowing, of manures, and the adaptations of the different crops and cultures. It is not to teach how to feed; but to show the composition, action and value of the several kinds of food, and the laws of feeding, fattening, and healthful growth. In short it is the aim of the true Agricultural College to enable the farmer to understand thoroughly and profoundly, all that men can know about soil and seed, plants and animals, and the influence of light, heat and moisture, on his fields, his crops, and his stock; so that he may both understand the reason of the processes he uses, and may intelligently work for the improvement of those processes. Not "book-farming," but a knowledge of the real nature of all true farming—of the great natural laws of the farm and of all its phenomena—this is the true aim of agricultural education. And when it is recollected that agriculture involves the principles of a larger number of sciences than any other human employment or profession, it will not be regarded as an unfit end of a sound collegiate training.

The instruction unites, as far as possible, Theory and Practice—Theory explaining Practice, and Practice illustrating and enforcing Theory.

Apparatus.—The College has for the illustration of Practical Agriculture, a large stock farm of 410 acres, provided with a large stock barn, fitted up with stables, pens, yards, cooking room, etc.; and fine stock of several breeds of neat cattle, sheep and swine are to be purchased at an early day. It is well supplied with farm machinery and tools.

There is also an experimental farm of about 70 acres, exclusive of orchards, etc. This is divided up into experimental plats and fields. A clinic for sick animals is held in the Fall or Winter Term, to furnish opportunity for the practical study of Veterinary Science. During the clinic, held last winter, nearly 60 diseased animals were presented for treatment, and the students took active part in prescribing for them.

Surveying and Drainage are illustrated by practice in the field. Chemistry is pursued by work in the laboratory. Collections of seeds, soils, plants, implements, skeletons of animals, models and apparatus are provided to illustrate the several branches of Agricultural Science.

Admission.—Candidates must pass a thorough examination in Arithmetic, English Grammar, Geography and History, and in Algebra to equations of the 2d degree.

The recommended course, which follows, occupies four years:

FIRST YEAR. *First Term.*—Geometry, Chemistry, English or Latin History, 2 lectures a week. *Second Term.*—Botany, Chemistry, English or Latin History, 2 lectures a week. *Third Term.*—Botany, Analytical Chemistry, English or Latin.

SECOND YEAR. *First Term.*—Soils and Fertilizers, Vegetable Physiology, Trigonometry and Surveying, German or Chemistry. *Second Term.*—Plant Culture, Chemical treatment of Soils, Manufacture of Manures, Drawing and Mapping, Zoology, German or Chemistry, Physics. *Third Term.*—Mechanical treatment of Soils and Drainage, Entomology, German or Chemistry, Physics.

THIRD YEAR. *First Term.*—Fruit growing, Orchards, etc.; Comparative Anatomy and Physiology, French or History. *Second Term.*—Animal husbandry, breeding, etc.; Geology, French or History. *Third Term.*—Agricultural book-keeping, Farm records, etc.; Political Economy, French or History.

FOURTH YEAR. *First Term.*—Rural Economy and Rural Law, Mental Philosophy and Constitutional history, History of English and American Literature. *Second Term.*—Veterinary Surgery, Rural Architecture, Physical Geography and Meteorology. *Third Term.*—Landscape Gardening, History of Agriculture, Geology of Illinois, Inductive Logic and History of Philosophy.

2.—SCHOOL OF HORTICULTURE.

The aim of the School of Horticulture is to educate scientific horticulturists. Its course embraces such studies as are necessary to thorough mastery of gardening, fruit growing, and forestry.

Apparatus.—To give a practical character to the special studies of the course, the school is provided with ample horticultural grounds of about 130 acres, including 20 acres of forest plantations, 10 acres of ornamental grounds, several acres of nurseries, and large garden plats. It has an apple orchard of 3,000 trees of about 1,400 varieties, a pear orchard of nearly 400 varieties, and small fruits of many kinds. It has also two green houses well filled with rare exotics and flowering plants. It is supplied with the best garden machinery and tools. It has also many plans of ornamental grounds and parks.

Admission.—The conditions of admission are the same as those for the School of Agriculture.

The course of recommended studies is as follows:

FIRST YEAR. *First Term.*—Geometry, Chemistry, English or Latin; History, two lectures a week. *Second Term.*—Botany, Chemistry, English or Latin; History, two lectures a week. *Third Term.*—Botany, Analytical Chemistry, English or Latin.

SECOND YEAR. *First Term.*—Soils and Fertilizers, Vegetable Physiology, Trigonometry and Surveying, German or Chemistry. *Second Term.*—Plant Culture, Chemical treatment of

Soils, Manufacture of Manures, Drawing and Mapping, Zoology, German or Chemistry, Physics. *Third Term.*—Mechanical treatment of Soils and Drainage, Entomology, German or Chemistry, Physics.

THIRD YEAR. *First Term.*—Fruit growing, orchards, etc.; Comparative anatomy and physiology, French or History. *Second Term.*—Nursery plans and records, Geology, French or History. *Third Term.*—Vegetable garden and small fruits, Political Economy, Book-keeping, French or History.

FOURTH YEAR. *First Term.*—Hot and green houses, Rural Economy and Rural Law, History of English and American Literature. *Second Term.*—Rural Architecture, Physical Geography and Meteorology, History of Civilization. *Third Term.*—Landscape Gardening, Geology of Illinois, History of Philosophy and Inductive Logic.

COLLEGE OF MECHANICS AND ENGINEERING.

FACULTY.

THE REGENT.

S. W. ROBINSON, Professor of Mechanical Science and Engineering.

S. W. SHATTUCK, Professor of Mathematics.

A. P. S. STUART, Professor of Applied Chemistry.

ALEX. THOMPSON, Teacher of Railroad Engineering.

JAMES BELLANGEE, Teacher of Architectural Drawing.

This College, for the present, embraces the following Schools: 1st, the School of Mechanical Science and Engineering. 2d, the School of Civil Engineering. 3d, the School of Mining, and 4th, the School of Architecture.

1.—SCHOOL OF MECHANICAL SCIENCE.

The aim of this School is to fit students to become Mechanical Engineers, and to prepare them to invent, construct and manage all kinds of machinery. The instruction, while severely scientific, is also severely practical, and aims at a thorough understanding and mastery of all the mechanical principles and devices. Shop practice is required as a regular study in the course. The students of this department, under the direction of the Foreman, have manufactured a steam engine, several lathes, and many pieces of finely finished apparatus. They also have done a large amount of work for outside parties, including patterns for castings, models for the Patent Office, a heliotrope for the United States Coast Survey, several thermometer graduating machines, and some pieces of scientific apparatus for other institutions.

Several of the foregoing and some others were invented by the Instructors. Three patents have been allowed for the inventions made in this department during the past year.

Apparatus.—The new Mechanical Building, which is to be ready for occupancy at the opening of the Fall term, in September next, will have a large machine shop fitted up with a steam engine, with power and hand lathes for iron and brass, a planer, drilling machine, a lathe for wood turning, benches and vises for a large class of students. It will also contain a boiler and forge room, with forges and tools, and brass furnace; a carpenter's shop, with benches and sets of bench tools, lathes, buzz and jig saws, etc.; paint and printing rooms, and draughting, finishing and model rooms. The College has also good collections of apparatus for the illustration of the principles of Physics and Mechanical Science.

The following is the course of studies recommended:

FIRST YEAR—*First Term.*—Geometry, Drawing, English or Latin, History, two lectures a week. *Second Term.*—Geometry and Algebra, Descriptive Geometry, English or Latin, History. *Third Term.*—Algebra, Botany, English or Latin.

SECOND YEAR—*First Term.*—Trigonometry, Designing and Drawing; Chemistry. *Second Term.*—Analytical Geometry; Shades, Shadows and Perspective, Shop Practice. *Third Term.*—Calculus, Shop Practice, Chemical Analysis.

THIRD YEAR—*First Term.*—Calculus, Principles of Mechanism, French or German, History. *Second Term.*—Analytical Mechanics; Physics, French or German, History. *Third Term.*—Analytical Mechanics and Astronomy, Physics, French or German.

FOURTH YEAR—*First Term.*—Hydraulics, Pneumatics, Thermo-Dynamics, Strength of Materials, Geology. *Second Term.*—Prime movers and mill work, Complete Drawings of existing machines and tools; History of Civilization Logic *Third Term.*—Mill work and machines; Complete Drawings, estimates and designs, Constitutional Law, or Political Economy, Inductive Logic.

2.—SCHOOL OF CIVIL ENGINEERING.

This school is designed to make good practical Engineers, thoroughly prepared for all branches of Engineering work, Railroad surveys, Topographic and Geodesic Surveying, Bridge building, Government Surveying, etc. Several of the students, though not yet through their course, have already been honored with positions on the Coast Survey, and on important Railroads.

Apparatus.—This school is provided with a good Engineer's transit, a compass, an English level, two leveling rods, two brazed link steel chains, Gunther's and Engineers' instruments for Stadia surveying, adopted in the Government Surveys. It has also a model truss bridge 20 feet in length, with moveable braces, and other apparatus for practical illustration.

The course of studies recommended is as follows:

FIRST YEAR—*First Term.*—Geometry, Drawing, English or Latin; History, two lectures a week. *Second Term.*—Geometry and Algebra, Descriptive Geometry, English or Latin, History. *Third Term.*—Botany, Algebra, English or Latin.

SECOND YEAR—*First Term.*—Trigonometry, Surveying, Chemistry. *Second Term.*—Analytical Geometry, Analytical Chemistry or Rhetoric, Shades, Shadows, and Perspective. *Third Term.*—Calculus, Topographical Surveying and Drawing, Mineralogy and Lithology.

THIRD YEAR—*First Term.*—Calculus, Roads, Railroads, and Mapping, French or German. *Second Term.*—Analytical Mechanics, Physics, French or German. *Third Term.*—(3 year students, Mahan's Engineering.) Mechanics and Astronomy, Physics, French or German, History.

FOURTH YEAR—*First Term.*—Hydraulics and Practical Astronomy, Strength of Materials and Frames, Geology. *Second Term.*—Stability of Structures, Drawing of existing constructions; History of Civilization and Logic. *Third Term.*—Stone Cutting and Geodesic Surveying, Drawings and Estimates, Political Philosophy and Constitutional Law, Political Economy, Inductive Logic.

3.—SCHOOL OF MINING ENGINEERING.

The course for Mining Engineers differs from that of the Civil Engineering, only in the substitution of Mine Surveys and Constructions, Metallurgy, and Assaying, for Roads and Railroads, Topographical and Geodesic Surveying, and stone cutting.

4.—SCHOOL OF ARCHITECTURE.

The course in Architecture corresponds nearly with the course in Civil Engineering, adding to it the course in Architectural Drawing, Styles of Architecture, and the study of public buildings.

COLLEGE OF CHEMISTRY.

FACULTY.

THE REGENT.

A. P. S. STUART, Professor of Analytical Chemistry.

——— ———, Professor of Agricultural Chemistry.

ROBT. B. WARDER, Assistant in Laboratory.

The object of this College is the education of professional Chemists, Pharmaceutists and Metallurgists. It furnishes, also, facilities to such as wish to pursue a course of Chemistry applied to any of the arts, as glass-making, dyeing, tanning, gas manufacture, electrotyping, photography, etc.

The College is provided with a laboratory fitted up with tables, gas pipes, chemicals and chemical apparatus for a large class to practice. It has also sand baths, stills for water, etc., scales of the highest accuracy and finish, a large binocular microscope of English manufacture, spectroscope, blow-pipes, galvanic batteries, and other important chemical apparatus. An appropriation of $5,500 has recently been made by the General Assembly to increase the apparatus and facilities for this department of study, and it is expected that this fund will be expended this summer under the direction of the Professor of Chemistry.

FIRST YEAR—*First Term.*—Geometry, Chemistry, English Language and Literature, U. S. History, two lectures a week. *Second Term.*—Chemistry, Geometry and Algebra, English or Botany, U. S. History, two lectures a week. *Third Term.*—Analytical Chemistry, Botany, English Literature.

SECOND YEAR—*First Term.*—Trigonometry, Analytical Chemistry, German. *Second Term.*—Analytical Geometry, Physics, Analytical Chemistry, German. *Third Term.*—Practical Chemistry; Mineralogy and Crystallography, Physics, German.

THIRD YEAR—*First Term.*—Drawing, Chemistry and Mineralogy, French, Ancient History. *Second Term.*—Practical Chemistry, Rhetoric, French, Mediæval History. *Third Term.*—Palæontology and Astronomy, Practical Chemistry, French, Modern History.

FOURTH YEAR—*First Term.*—Manufacture of Chemicals, Zoology, Geology. *Second Term.*—Assaying and Metallurgy, History of Civilization and of the Inductive Sciences, Logic. *Third Term.*—Assaying and Metallurgy, History of Philosophy, Constitutional and International Law.

The above course will necessarily vary for the student of Agricultural Chemistry, and the student of Mining and Metallurgy.

COLLEGE OF NATURAL HISTORY.

FACULTY.

THE REGENT.

THOMAS J. BURRILL, Professor of Botany.

A. P. S. STUART, Professor of Mineralogy.

D. C. TAFT, Professor, *pro tempore*, of Zoology and Geology.

The aim of this College is to afford a thorough education and preparation for Practical Geologists, Collectors and Curators of cabinets and museums of Natural History, and for Superintendents of scientific explorations and surveys.

The several Departments are being rapidly provided with illustrative collections and other apparatus. The Botanical Department has a large Herbarium of dried plants, collected by the Powell expeditions, which has been largely increased from other sources. It has Lignarium exhibiting woods in section, also *papier mache* flowers, and fruits of gigantic size, made by the celebrated Auzoux, of Paris, a pink, a papillonaceus flower, a cherry, a strawberry, a pea pod with peas, a vetch legume, a grain of wheat, etc. These gigantic specimens are dissected so as to exhibit clearly even the most minute organs and tissues. The Green Houses, and the Arboretum and Botanical Garden, for which preparations are already made, afford also unbounded opportunities for examining the living plants in process of growth.

The Zoological Department has a human skeleton, purchased in Paris, a manikin made by Dr. Auzoux, skeletons of a cow and other mammals and birds, stuffed preparations of a large number of birds, mammals, fishes, reptiles, etc., embracing bears, wolves, foxes, beavers, wolverines, prairie dogs, etc., birds of prey, songsters, etc.; a dissected horse's leg and hoof, a dissected eye, a trachea and vocal apparatus, in *papier mache*, with numerous French anatomical plates of great beauty. It has also collections of shells, fossils and insects, and a full suite of Entomological specimens is in preparation by Dr. Le Baron, the State Entomologist, who is required by the law of the State to make such collections for the University.

The Geology is illustrated by a full suite of specimens from the State Geological Survey. It has still larger collections in Mineralogy and Palæontology, etc., received or purchased from several sources, with preparations of ores, etc.

The College has also a large double camera, or magic lantern, with apparatus for dissolving views, with a large collection of fine paintings for the illustration of Astronomy, Geology, Zoology and History. The collections and apparatus are constantly increasing by purchases, donations and manufacture.

The course of studies recommended is as follows:

FIRST YEAR—*First Term.*—Geometry, Latin or English, Chemistry, United States History. *Second Term.*—Botany, Geometry and Algebra, Latin or English Literature. *Third Term.*—Botany, Analytical Chemistry, Latin, or English Literature.

SECOND YEAR—*First Term.*—Vegetable Physiology, Zoology, Trigonometry, German. *Second Term.*—Zoology, collection and preservation of specimens, Physics, German. *Third Term.*—Entomology, Physics, Mineralogy and Crystallography, German.

THIRD YEAR.—*First Term.*—Comparative Anatomy and Physiology, Mineralogy, Drawing, French. *Second Term.*—Geology, Rhetoric or History, French. *Third Term.*—Lithological Geology, Palæontology, Astronomy, Political Economy, French.

FOURTH YEAR—*First Term.*—Historical Geology, Practical Astronomy, Mental Philosophy. *Second Term.*—Physical Geography, Meteorology, Metallurgy, History of Civilization. *Third Term.*—Geology of Illinois, Geological Surveys, Excursions, Inductive Logic.

COLLEGE OF LITERATURE, SCIENCE AND ART.

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FACULTY.

THE REGENT, Professor of Philosophy and History.
WM. M. BAKER, Professor of English Language and Literature.
EDWARD SNYDER, Professor of German Language.
A. P. S. STUART, Professor of Chemistry.
T. J. BURRILL, Professor of Botany.
S. W. SHATTUCK, Professor of Mathematics.
S. W. ROBINSON, Professor of Physics.
DON CARLOS TAFT, Assistant Professor of Geology and Zoology.
I. D. FOULON, Instructor in French.
——— ———, *Professor of Ancient Languages.

The objects of this College is to furnish a sound and liberal education to fit students for the general duties of life, and especially to prepare them for those business pursuits which require a large measure of Literary and Scientific knowledge and training. It is designed to meet the wants of those who wish to prepare themselves for the labors of the Press as Editors or Publishers, or as Teachers in the higher institutions, or for the transaction of public business. The large liberty allowed in the selection of the special studies of his course will permit the student to give such direction to his education as will fit him fully for any chosen sphere or pursuit.

The Library is well supplied with works illustrating the several periods of English and American Literature.

The several departments of science, also, are provided with a good supply of the works of the best authorities and with a constantly increasing apparatus and cabinets.

In the following recommended course, a number of optional studies are introduced, but it is understood that no student will take more than three studies at a time, without a permit. This course, though not modeled upon that of any other institution, is equal in value to the courses prescribed in our best colleges. Students wishing to take only the English studies and modern languages, may be admitted with the general preparation prescribed for candidates for other courses, but those who wish to take the Latin or Greek language, must come thoroughly prepared in the usual preparatory course in those branches.

*The work of this Professorship is, for the present, performed by other Professors.

FIRST YEAR. *First Term.*—Geometry, first five books, Latin, Cicero's works, English Composition, (Greek, the Anabasis, *optional*), History of U. S., two lectures a week. *Second Term.* Geometry finished, Higher Algebra, Latin, Cicero's works, English literature, (Greek *optional*,) History of U. S., two lectures a week. *Third Term.* Botany, Higher Algebra completed, Latin, Virgil, the Æneid or Georgics, English advanced Grammar, (Greek *optional.*)

SECOND YEAR. *First Term.* Trigonometry, Chemistry, German, English or Latin. *Second Term.* Analytical Geometry or Chemistry, Physics, German, English or Latin. *Third Term.* Mineralogy, Physics, German, English or Latin.

THIRD YEAR. *First Term.* Comparative Anatomy and Physiology, Ancient History, Drawing, French, English or Latin. *Second Term.* Geology, Mediæval History, Perspective, French, English or Latin. *Third Term.* Political Economy and Modern History, Astronomy, French, English or Latin.

FOURTH YEAR. *First Term.* Mental Philosophy, Constitutional History of England and United States, Zoology, Astronomy or Geology. *Second Term.* Moral Philosophy and Logic, or History of Civilization and of the Inductive Sciences, Physical Geography, Meteorology or Analytical Mechanics. *Third Term.* History of Philosophy, or Inductive Logic, Entomology, or Geology of Illinois, Constitutional Law.

SCHOOL OF COMMERCE.

The course in this School may be completed in a single year, and is designed to fit students to become thorough accountants and business men. The special studies of this School may be taken in connection with those of any of the Colleges. For a fuller statement of these studies the reader is referred to the Department of Commercial Science, on another page.

SCHOOL OF MILITARY SCIENCE.

The studies of this school are described fully in the article on another page under the Military Department.

The apparatus of instruction includes a large Drill Hall; 150 muskets and accoutrements complete; 12 cavalry swords; 1 bass drum; 1 tenor drum; 3 fifes; 2 bugles; 18 fencing muskets for bayonet practice; swords, gauntlets and masks, for sword practice; automaton regiment for theoretical instruction; and a large Drill Hall to be erected this summer. The library also includes quite a selection of books on military science, military history and engineering.

REQUIREMENTS FOR ADMISSION.

1. Each student is required, by law, to be at least *fifteen years* of age, but it is believed that few will be found mature enough at this age to enter with the highest profit upon the studies of the University, and it is recommended, as a general rule, that students be at least eighteen years old before entering.

2. The law prescribes that "no student shall be admitted to instruction in any of the departments of the University, who shall not previ-

ously undergo a satisfactory examination in each of the branches ordinarily taught in the common schools of the State." In addition to these, candidates for advanced standing must pass an examination in the studies already pursued by the class, or an equivalent therefor. Those desiring ancient languages must pass in the ordinary preparatory studies in such languages.

3. The examinations heretofore have often exhibited a most lamentable lack of true scholarship, even in the ordinary common school branches. In many cases, it is evident that the fault has been in that too common and sad blunder of teaching, which neglects all thorough drill in definitions and principles, and occupies the pupil wholly with exercises. The student often gains considerable expertness in solving the problems in the book, without being able to answer a single question concerning principles, or to explain, rationally, a single step in the process.

The following statement of topics, to be embraced in the examinations for admission, may help to guard candidates and their teachers against the blunders mentioned:

1st. In *English Grammar*, the candidate must give full and clear definitions and explanations ; in Orthography, formation of derivative words by prefixes and suffixes, and rules for spelling ; in Etymology, classification of nouns, classes and conjugations of verbs, etc., the sentence, its principle parts, classes and modifiers, connectives and their use, modifying words and phrases, adjectives and adverbs, analysis of sentences.

2d. In *Geography*—Form, size, motions and divisions of the Earth by circles ; latitude, longitude and zones ; the continents and their grand divisions ; countries and capitals of Europe and America ; mountain systems and chief rivers and lakes of Europe and America, boundaries, capitals, chief towns, great railroads and canals, of the States of the Union.

3d. *Arithmetic.* Decimal system of notation and numeration, the four grand rules or operations, with clear explanation of processes, reasons and proofs, classification of numbers, reduction, denominate numbers, fractions, terms of fractions, effects of changes in numerator, in denominator, reduction of fractions, addition, subtraction, multiplication and division of fractions, decimal fractions, operations in decimals, percentage, interest, ratio, proportions, involution and evolution.

4th. *Algebra.* Definitions, notation by letters and signs, simple operations, changes of signs and reasons, algebraic fractions, equations, transformations of equations, solutions of problems, methods of elimination, calculus of radicals.

The examinations in other studies need not be described. Candidates for the University should aim to be as thorough as possible in their preparations. If poorly prepared their progress will be slow and painful, and they will run the risk of losing standing in their classes, and failing in their aim.

Frequent and searching examinations will be held to test the progress in study, and to determine each student's fitness to remain in the classes. The University cannot be held responsible for the lack of thoroughness in the common school studies of its students, but will insist on thoroughness in its own proper studies.

A regular examination of all the classes is made at the middle and close of each term. A record is kept of the standing of each student at all the examinations, and from this his final certificate of graduation is made up.

UNIVERSITY UNIFORM.

Under the authority of the act of incorporation, the Trustees have prescribed that all the students, after their first term, shall wear the University uniform. The *University cap* is to *be worn from the first.* This uniform consists of a suit of cadet gray mixed cloth, of the same color and quality as that worn at West Point, and manufactured by the same establishment. Students can procure them ready made on their arrival here. The University cap is of dark blue cloth, and ornamented with the initials I. I. U., surrounded by a silver wreath in front. Students will wear their uniform always on parade, but in their rooms and at recitation may wear other clothing.

STUDENTS' DORMITORIES AND BOARD.

There are in the University building about sixty six private rooms, which are rented to the students who first apply. Each room is designed for two students. These rooms, fourteen feet long and ten feet wide, are without furniture, it being deemed best that the students shall furnish their own rooms.

Good private boarding houses are springing up around the University, where either day board or board and rooms can be obtained with the advantage of the family circle. Boarding clubs are maintained by the students, which furnish meals at a cost of from $1 50 to $2 50 per week. Several students have provided themselves with meals in their rooms, at an expense varying from $1 to $1 50 per week. Coal is purchased at wholesale, and furnished to students at cost.

HOW TO ENTER THE UNIVERSITY.

In answer to the questions often received, the following explicit directions are given to those wishing to enter the University:

1. You must be over fifteen years of age, and of good moral habits. If unknown to the faculty, you should bring a certificate of character.

2. You must possess a thorough knowledge of the common school branches, arithmetic, grammar, geography, history of the United States, and algebra to equations of the second degree.

3. You should enter at the beginning of a term; but you may enter at any other time if prepared to go forward with any of the classes.

4. If doubtful of your ability to enter the department you have selected, write to the Regent, J. M. Gregory, Champaign, and state what branches you have studied, the progress you have made in each, and your wishes as to course and term of study.

HOW CAN I PAY MY WAY?

In answer to that question which often reaches us from earnest young men, eager for an education, but without means, we reply:

1. Your necessary expenses (except for books and clothing,) will be as stated on the next page, under the head of "Expenses."

2. During the Spring and Fall terms, and to some extent during the Winter term you can find work either upon the University farm and garden, or in the shops, or for members of the Faculty and other gentlemen. The large increase in the number of students forbids our promising work to all, but much labor will be provided, and an active, earnest and faithful young man rarely fails to find enough to do. Working *three hours a day*, or eighteen hours a week, will enable you to pay your board, including fuel and lights. Some pay their entire expenses by their labor without at all hindering their studies.

If you understand some common mechanical trade, you will much more easily find work and usually at better wages.

3. You should have, to start with, money enough to pay your entrance fee and bills, to purchase books and cap, and to pay for your half of the furniture of the room. This will require about $35. It will be well also to have enough to pay board for two or three weeks till you can get settled. After starting you will easily go through, as your vacations, if well employed, will afford you enough to pay for clothing and books.

4. You will also find numbers of fellow-students who are working their way, and who will, with true brotherly feeling, advise and assist you. Come on without fear. A good education is worth all it will cost you. Remember that if education *costs much*, ignorance *costs more*. Education gives knowledge at *wholesale*. Ignorance buys it at *retail*, and often gets cheated in the quality.

TERMS.

The college year is divided into three terms, of fourteen, twelve and ten weeks. Students are expected in all cases to be present on the first day of the term. Those unavoidably delayed will be required to make up all lessons which their classes have passed over in their absence.

CALENDAR FOR 1871-2.

Examination for admission	Tuesday, Sept. 12, 1871
Fall term opens	Wednesday, Sept. 14, 1871
Fall term closes	Wednesday, Dec. 20, 1871
Vacation of two weeks.	
Examination for admission	January 2, 1872
Winter term opens	January 3, 1872
Winter term closes	March 27, 1872
Examination for admission	March 28, 1872
Spring term opens	March 29, 1872
Spring term closes	June 7, 1872
Commencement	June 7, 1872

EXPENSES.

(Tuition fee in all Departments.)

Fee for incidentals, per term	$2 50
Room rent in University building for each student, per term	4 00

Each student is required to pay a matriculation fee of $10 on first entering the institution. This entitles him to a membership till he completes his studies. All bills due the University must be paid, and the Treasurer's receipt be shown to the Regent, before the student can enter the classes.

The annual expense of a residence at the University, exclusive of books and clothing, will be nearly as follows:

Room rent and incidentals	$19 50@	$ 19 50
Board, from	54 00@	180 00
Fuel and lights, from	10 00@	15 00
Washing, 75 cents per dozen	10 00@	15 00
Total	$93 50@	$244 50

Many young men reduce the expense to within $90 per year, and pay this by their labor during the year. It ought to be known that *any young man can pay his way through college* who is willing, for the sake of an education, to practice steadily the virtues of industry and economy.

SCHEME OF RECITATIONS AND EXERCISES.

FIRST YEAR.

	7—8.	8½—9½.	9½—10½.	10½—11½.	11½—12½.	1½—2½.	2½—3½.	3½—4½.
1st Term.	Geometry, 1st Division.	Inorganic Chemistry.	German, 1st Div. Agriculture.	Latin, (Cicero.) German, 2d Div.	English, 1st Division.	Book-Keeping. Drawing.	Drawing. Chemical Physics.	History of U. S. Drill, Alternate.
	7½—8½.	9—10.	10—11.	11—12.	1—2.	2—3.	3—4.	
2d Term.	Geometry, 1st Division. (Algebra.)	Inorganic Chem'y. Descr. Geometry. Labor from 10—4.	English, 1st Division.	Botany. Geometry, 2d Div. Algebra, 2d Div.	Latin, (Cicero and Virgil.) German, 1st Div.	Book-Keeping.	History U. S. Agr. Chem. Lec. (Alternate.)	
3d Term.	German, 1st Division, Latin (Virgil.)	Lectures on Chemistry applied to Arts, Botany. Labor from 10—3½.	Botany. Algebra.	English, 1st Division.	Algebra.	Book-Keeping.	Drawing and Agriculture.	Lectures. Drill. Alternate.

SECOND YEAR.

1st Term.	German, 2d Div. French.	English, 2d Div. Botany. Labor from 9—3½.	Trigonometry.	Zoology.	Latin, (Livy.)	Designing and Drawing. Agriculture.	Surv. & Leveling Mil. & Anc. Hist. Alternate.	Drill & Lectures.
	7½—8½.	9—10.	10—11.	11—12.	1—2.	2—3.	3—4.	
2d Term.	Mediæval History. Military, Alternate.	English, 2d Division.	Zoology and German.	Latin, (Horace.) Labor from 9—3½.	Analytical Geometry.	French.		
3d Term.	English, 2d Division.	Calculus. Agriculture.	German. Latin.	Lect. on Chemistry applied to Arts. Mineralogy. Labor from 9—3½.	Entomology.	French. Topo. Surveying. Drawing.	Political Econo'y.	Drill.

THIRD YEAR.

	7—8.	8½—9½.	9½—10½.	10½—11½.	11½—12½.	1½—2½.	2½—3½.	3½—4½.
1st Term.	English, 3d Division.	Orchards and Fruit Growing.	R. R's & Mapping Latin.	Calculus and Analytical Geometry.	Principles of Mechanism.	Constitutional History.	Comp. Anatomy and Physiology	Military and Drill. Alternate.
	7½—8½.	9—10.	10—11.	11—12.	1—2.	2—3.	3—4.	
2d Term.	Latin.	Calculus, Physics. Nurseries and Plans Labor from 9—3½.	Anal. Mechanics. Animal Husbandry.	English, 3d Division.	Geology.	History of Civilization.	Military.	
3d Term.	Analytical Mech. (Desc. Astronomy.)	English, 3d Div. Practical Chemistry 9—3½.	Physics.	Vegetable Garde'g. Mahan's Engineering.	Latin.	Constitutional Law	Geology.	Military and Drill

FOURTH YEAR.

1st Term.	Geology.	Mental Philosophy, Practical Chemistry. 9—3½.	Strength of Materials and Frames. Hot & Green Houses	Hydraulics, etc. Rural Economy, etc	Agriculture.	Practical Astronomy.		Lectures and Drill
	7½—8½.	9—10.	10—11.	11—12.	1—2.	2—3.	3—4.	
2d Term.		Moral Philosophy and Logic. Practical Chemistry. 9—3½.	Prime Motors, Stability of Structures	Meteorology.	Constructive Drawing.	Veterinary Surgery.		
3d Term.	Mill Work and Machines.	Practical Chemistry 9—3½. Hist. of Philosophy. Logic.	Geology of Illinois.	Designing, Drawing and Estimates.	Landscape Gard'g Stone Cutting and Geoedesy.	History of Agriculture.		

DONATIONS.

The following is a list of donations received during the year:

ST. JOSEPH MANUFACTURING Co., Mishawaka, Ind., by Mr. Cooper, Agent, a Challenge Mill for grinding feed.

HOVEY & Co., Chicago, a "Landscape" Lawn Mower.

ROBERT DOUGLASS & SONS, Waukegan, 4 lbs Seeds of Eu. Larch and Evergreens.

GEO. S. HASKELL, Rockford, Ill., 54 papers Garden Seeds, 2 quarts Russell's Corn.

DEPARTMENT OF AGRICULTURE, Washington, Garden Seeds, Seed Wheat, etc.

A. S. FULLER, N. Y., 40 varieties Raspberries, 12 varieties Blackberries, 27 varieties Currants, 7 varieties Gooseberries.

J. BALDWIN, Jacksonville, 50 Choice of Turner's Seedling Raspberries.

MITCHELL, HARPER & Co., El Paso, "Corn Dodger" Cultivator with Harrow attachment.

A. M. & E W. BAKEWELL, one Corn Harrow.

D. M. OSBORNE, one Kirby Two-Wheel Mower.

O. ALBERTSON, Canton, Ind., two Improved Adjustable Hoes.

J. H. PICKRELL, Harristown, two pure blood Berkshire Pigs.

FENNER & CALL, Urbana, Ill., one Trench Plow.

DEERE & Co., Moline, Ill., part price of Plow, $17.

S HUTCHINGSON, Griggsville, Ill., one patent Harrow.

KING & HAMILTON, Ottawa, Ill., part price of Champion Corn Cultivator, $25.

WEIR PLOW Co., Monmouth, Ill., Corn Cultivator.

GEO. MCKINLEY:

Herndon & Gibbon's Valley of the Amazon.
De Tocqueville's Democracy in America.
Sunday School Teacher, 1866–9.
Smith James' Christian's Defense.
Smithsonian Report, 1834.
Moliva's Geographical, Natural and Civil History of Chili.
Dirgald Stewart's Works.

REV. A. S. FARR:

Burton's Anatomy of Melancholy.
Crabbe's Tales.

HILAND HALL, Bennington, Vt.:

Hall's History of Vermont.
The Capture of Ticonderoga.

W. WHITEHEAD, Newark, N. J.:

Four Pamphlets.

E. D. COPE, Philadelphia:

Two Pamphlets.

PROF WM. M. BAKER:

Silk Culture.

IOWA STATE AGRICULTURAL SOCIETY:

Bound Reports, 1859, '66–7–8–9.
Nine Pamphlets.

CALIFORNIA STATE AGRICULTURAL SOCIETY:

Four Pamphlets.

NEW YORK POULTRY SOCIETY:
Two Pamphlets.

N. W. DAIRYMAN'S ASSOCIATION:
One Pamphlet.

NEW YORK STATE LIBRARY:
Catalogue in four Volumes.
Three Pamphlets.

DEPARTMENT OF AGRICULTURE:
Four Copies Report 1869, Copies 1853–5, 67--68.

DEPARTMENT OF THE INTERIOR:
Documents 3d Session 40th Congress, 28 Volumes.

HON. JESSE H. MOORE, Decatur:
Several Volumes of Documents.

CHARLES DOWNING, Newburgh, N. Y.:
About 400 varieties of Pear Cion.

JOHN DEERE, Urbana, Ill.:
Sub-Soil Plow.

HOVEY & Co., Chicago, Ill.:
Lawn Mower.

W. C. FLAGG, Moro, Ill.:
Apple Trees of 44 varieties, raised by him near Alton, Ill.

M. L. DUNLAP & SONS:
Two Standard Apple Trees and one Early Richmond Cherry on its own roots.

PRINCETON MANUFACTURING COMPANY:
One Corn-Stalk Cutter.

DR. HUMPHREY, Galesburg, Ill.:
Collection of many varieties of Apples and Fruits.

R. TAYLOR, Urbana, Ill.:
300 Currant Cuttings.

MRS. S. T. CHASE, Urbana, Ill.:
200 Gooseberry Cuttings.

CERTIFICATES.

The following are the forms of Certificates of Scholarship adopted, in accordance with the charter of the University, which prohibits the conferring of diplomas, but authorizes the issuing of "Certificates of Scholarship," which certificates shall, as far as is practicable, set forth the precise attainments as ascertained by special examination of the parties applying for the same, respectively, in the various branches of learning they may have respectively studied during the attendance in the University:

CERTIFICATE OF FULL COURSE.

The Illinois Industrial University.

Chartered, 1867. { STATE SEAL. } Opened, 1868.

The Regent and Trustees of the Illinois Industrial University, on the recommendation of the Faculty, confer upon .... *This Certificate*, in testimony of his having pursued a *Full Course of Studies* in the College of ...., in this University, in which he has successfully studied and passed *examinations* in the following branches of learning (the number of terms of study, and the per centum of scholarship attained, being marked opposite each branch:)

STUDIES.	NO. OF TERMS.	PER CENTUM.

And having exhibited, during his course, due *fidelity* and *good conduct*, he is, *by these presents*, duly honored with the *commendations* of the authorities of the University.

Given at Urbana, this .. day of ...., 187 .

(Signed) ...., *Regent.*

[Members of Faculty.] [Members Board of Trustees.]

CERTIFICATE OF PARTIAL COURSE.

The Illinois Industrial University.

Chartered, 1867. { STATE SEAL. } Opened, 1868.

The Regent and Trustees of the Illinois Industrial University, on the recommendation of the Faculty, confer upon .... *This Certificate*, in testimony of his having pursued a *Partial Course of Studies* during .... years, in the College of ...., in this University, during which he has successfully studied and passed *examinations* in the following branches of learning (the number of terms of study and the per centum of scholarship being marked opposite each branch:)

STUDIES.	NO. OF TERMS.	PER CENTUM.

And having exhibited, during his course, due *fidelity* and *good conduct*, he is, *by these presents*, duly honored with the *commendations* of the authorities of the University.

Given at Urbana. this .. day of ...., 187 .

(Signed) ...., *Regent.*

[Members of Faculty.] [Members Board of Trustees.]

ACT OF APPROPRIATION.

AN ACT making appropriations for the Illinois Industrial University.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly,* That the sums hereinafter mentioned be and the same are hereby appropriated to the Board of Trustees of the Illinois Industrial University.

For the erection of a main building at a cost not exceeding one hundred and fifty thousand dollars when completed, to contain a hall for public exercises, the library, geological, zoological and botanical rooms, and rooms for lectures and class exercises and offices, the sum of seventy-five thousand dollars.

For the erection of a building for the Mechanical department, at a cost not exceeding the amount hereby appropriated, when completed, to contain the rooms necessary for instruction in mechanical science and military tactics, for collections of models, work shops and other necessary rooms, and for furniture and apparatus for the same, the sum of twenty-five thousand dollars.

For Chemical and Mining apparatus and furniture, and furniture and books for Chemical department, the sum of five thousand five hundred dollars for two years.

For the Horticultural department, for the additional seeds, trees, and labor for the forest plantations, the sum of seventeen hundred and fifty dollars per annum for two years.

For the Agricultural department, for the expenses of field and other experiments, and for expenses of the annual courses of Agricultural lectures held in various parts of the State, the sum of three thousand dollars per annum for two years.

For apparatus and books for instruction in Agriculture and the mechanic arts, and the various branches of learning relating to the same, the sum of five thousand dollars per annum for two years.

SEC. 2. The Auditor of State is hereby authorized and directed to draw his warrant upon the Treasurer of the State for the appropriations for building, in favor of the parties to whom the same may be due, upon proper vouchers certified as correct by the Trustees or a majority of them, and approved by the Governor, and for the other appropriations herein, upon the order of the Board of Trustees or a majority of them, and the approval of the Governor: *Provided*, that no sum greater than $5,000 shall be drawn at one time for other than building purposes: *And provided, further*, that a second warrant shall not be drawn until satisfactory vouchers shall have been approved by the Governor, and filed with the Auditor, showing that all sums previously drawn have been properly expended for the purpose for which the same was appropriated.

SEC. 3. For the construction of said building the Trustees shall not obligate the State for the payment of any sum of money in excess of appropriations made for that purpose; and the said Trustees shall, before either or any portion of said appropriations for building purposes shall be expended, cause to be prepared a full and complete set of plans and specifications of the entire proposed buildings, which shall be accompanied by estimates carefully made of the cost thereof, which shall be considered at a regular meeting of the Board, and by them approved, when it shall be submitted to the Governor for his approval. In case he approves the same, a copy of said estimates shall be filed in the Auditor's office when such appropriations may be expended.

APPROVED April 15, 1871.

CERTIFICATES OF SCHOLARSHIP,

Granted June 7, 1871.

Name.	Residence.	Year	Scholarship per cent.
Jared Teeple, (Elective)	Elgin	3	97—
Isaac S. Raymond, (Civil Engineering)	Champaign	3	89 ✕
Henry L. Town	Batavia	.....	....
James A. Williams	Urbana	.....	....
Elvan F. Moore	Tolono	.....	....
Samuel W. White	Paxton	.....	....
Edwin B. Hazard	Lyndon	.....	....
Edgar Sawyer	Tiskilwa	.....	....
Robert H. Hazlett	Springfield	....	....

NAMES AND STANDING OF STUDENTS

Receiving Certificates of Scholarship June 7, 1871.

Names.	Residence.	Course.	No. Terms.	Scholarship per cent.
Edward B. Hazard	Lyndon	Agriculture	7	91
Robert H Hazlett	Springfield	Elective	4	88
Elvan F. Moore	Tolono	Agriculture	6	87
Adolphus L. Rader	Tennessee	Elective	6	85
Isaac S. Raymond	Champaign	Civil Engineering	9	89
Edgar Sawyer	Tiskilwa	Commercial	4	95
Jared Teeple	Elgin	Elective	9	97
Henry L. Town	Batavia	Agriculture	5	90
Samuel W. White	Paxton	Elective	4	94
James A. Williams	Urbana	Elective	7	82

PROGRAMME OF THE CLOSING EXERCISES

For the Academic Year 1871.

Sunday, June 4, 1871.

Baccalaureate Address, by the Regent, Dr. J. M. Gregory, University Chapel, at 4 P. M.

Monday, June 5, 1871.

Examinations from 8 to 12 A. M. and 2 to 4 P. M. Address before the Industrial Society, by Ex-Governor Richard J. Oglesby, at 7 P. M.

Tuesday, June 6, 1871.

Examinations as on Monday. Address before the Literary Societies, by J. Mahoney, Esq., of Chicago, at 7 P. M.

Wednesday, June 7, 1871.

Exercises of the third year students, commencing at 9 A. M.

1. Music.
2. Prayer.
3. God in Nature. Charles W. Rolfe, Montgomery.

*4. Education necessary to the life of the Republic. Henry N. Drewry, Mason.
5. Columbia's Heroes. James W. Mathews, Mason.
*6. Should our Institutions foster a Military Spirit? Miles F. Hatch, Bliven's Mill.
7. Music.
*8. Chemistry in relation to the world's progress. Milo B. Burwash, Champaign.
*9. The Mineral World. Reuben O. Wood, Woodburn.
10. The Past Decade. Stephen A. Reynolds, Belvidere.
11. Ancient and modern Engineering. Willis A. Reiss, Belleville.
12. Music.
13. Antiquity of Time. Calvin F. Parker, Philo.
*14. Sources of a Nation's Wealth. David E. Swyer, Belleville.
15. Scientific Education. Charles W. Silver, Urbana.
*16. Progress of the Industrial University. Jacob N. Wharton, Bement.
17. Music.
18. Change. Isaac S. Raymond, Champaign.
19. Achievements of the American People. James A. Williams.
20. Misplaced and Appropriate Labor. Jared Teeple, Elgin.
*21. Practical Education. Geo. H. Lyman, Richland.
22. Music.
23. Presentation of Certificates and Address to the Class. The Regent.

† Address before the University, by President Erastus O. Haven, D. D., at 2 P. M. Exhibition Drill of the University Battalion at 3:30 P. M.

*Excused
†Not delivered.

FOURTH ANNUAL MEETING

OF THE

BOARD OF TRUSTEES OF ILLINOIS INDUSTRIAL UNIVERSITY.

URBANA, *March* 7, 1871.

The Board met in the University building, at 4 o'clock P. M.

The scriptures were read and prayer offered by the Regent.

The roll was then ordered to be called, when Hon. Newton Bateman presented a communication from the Secretary of the Senate, informing the Board that the following gentlemen had been confirmed as Trustees to fill vacancies:

O. B. GALUSHA	6th	Congressional	District.
J. R. SCOTT	7th	"	"
ROBERT B. HARRINGTON	8th	"	"
WM. B. ANDERSON	11th	"	"
J. M. PEARSON	12th	"	"
BURDEN PULLEN	1st	Grand	Division.
J. H. PICKRELL	2d	"	"
GEORGE S. BOWEN	3d	"	"
LUTHER L. GREENLEAF	3d	"	"

The roll was then called.

Present, Messrs. Allen, Bateman, Blackburn, Brown of Chicago, Brown of Pulaski, Brown of Sangamon, Cobb, Cunningham, Edwards, Galusha, Goltra, Griggs, Lawrence, Pickard, Pickrell, Pearson, Slade, Scroggs, Scott, and the Regent.

Absent, Messrs. Anderson, Harrington, Hayes, Greenleaf, Johnson, Mahan, Pullen, Van Osdel, Wright, and the Governor.

The oath of office was then administered to the new members present by Judge Cunningham.

On motion, the members of the Board, whose time had expired and whose successors had been appointed, but were not present, were requested to remain and take part in the transactions of the Board, their expenses in attending this meeting to be paid by warrants drawn by the Regent.

It was voted that the reading of the minutes of last meeting be dispensed with, as printed copies of the Annual Report were in the hands of the members of the Board.

On motion, the Secretary was ordered to notify, by telegraph, the newly elected members of the session of the Board, and invite their attendance.

The Regent then read the—

ANNUAL REPORT OF THE REGENT.

To the Board of Trustees of the Illinois Industrial University:

GENTLEMEN—The recurrence of your annual meeting calls upon me to lay before you the annual statement of the progress, condition and wants of the University. I am happy in being able to report to you a year of large progress and prosperity in every department of our work.

The records of the meetings of the Executive Committee, which are herewith communicated, will show you their proceedings during the year—which will, doubtless, meet your approval.

FACULTY AND ASSISTANTS.

There have been on service throughout the year, or some part thereof, the following teachers, lecturers and assistants:

WM. M. BAKER, Professor of English Language and Literature.
W. F. BLISS, Professor of Agriculture.
A. P. S. STUART, Professor of Chemistry.
S. W. ROBINSON, Professor of Mechanical Science.
T. J. BURRILL, Professor of Botany and Horticulture.
S. W. SHATTUCK, Professor of Civil Engineering and Mathematics.
EDWARD SNYDER, Professor of Book-keeping, Military Tactics and German.
JAMES BELLANGEE, Teacher of Architectural Drawing.
HENRY M. DOUGLASS, Librarian and Assistant Teacher.
ROBERT WARDER, Assistant in Chemistry.
I. S. FOULON, Teacher of the French Language.
ALEX. THOMSON, Assistant Teacher of Engineering.
DR. H. J. DETMER, Lecturer on Veterinary Science.
DR. MANLY MILES, Lecturer on Agriculture.
DR. E. S. HULL, Lecturer on Horticulture.

Prof. Bliss, called away by the care of his own farm, resigned the Professorship at the close of the Spring term.

Negotiations are already in progress to fill the vacant chair of agriculture, and also to secure suitable men for the professorships of geology and zoology, and of history and social science. All of these places should be filled before the opening of the next academic year.

The terms of service of the assistant teachers now under employment will expire with the current year, but as the number and kind of assistants required the next year will depend partly upon our success in filling the chairs mentioned, it will be best to refer their employment to the Executive Committee, or to authorize the Regent to employ, from time to time, such assistants as may be required, within such restrictions as to salary as the Board may prescribe.

In the practice departments the following assistants have been on service during the year: H. K. Vickroy, orchardist and nurseryman; Thomas Franks, gardener and florist; J. S. Searfoss, carpenter; Alexander Thomson, machinist; Geo. Upstone, foreman on stock farm.

Mr. Upstone having been disabled by an accident in December last, Mr. G. W. Rice, of Champaign, kindly tendered his services, and was employed to the first of March, giving excellent satisfaction.

The close of Professor Bliss' term of service, the first of September, left the farm without any responsible superintendent, and the Executive Committee, deeming it wise to secure a man of requisite education and experience, to take the responsibility until the chair of agriculture should be again filled, instituted inquiries for suitable candidates, and finally appointed, to the place of head farmer, Mr. E. L. Lawrence, of Belvidere, Boone county. Mr. Lawrence entered upon service the 1st of March.

Mr. Upstone, having been temporarily disabled by the breaking of his leg, while in the service of the Board, was paid his wages for the month of January, and still occupies a portion of the house, by the kindness of Mr. Lawrence. I respectfully suggest that, in consideration of his misfortune, his wages be allowed to the first day of March, or that some allowance be made him to aid in the payment of his doctor's bill.

ATTENDANCE AND STUDIES.

The records of the year show a gratifying progress in numbers and qualifications of students. The attendance, during the several terms since last meeting, was as follows:

During the Spring Term	149
During the Autumn Term	204
During the Winter Term (not yet ended)	226
Total attendance for the year	280
Total attendance of preceding year, to June	196

The number entered for the several courses, the present term, was as follows:

For Agricultural and Horticultural courses	60
For Mechanical and Civil Engineering	44
For Special Chemical course	9
For Commercial	12
For Architecture	4
For Military course	24
Students in Chemical Laboratory	38

Several are entered as students of Mining Engineering, and an early development of this course will be required. Many of the younger students report for a general or elective course, not having yet fixed upon any pursuit or profession.

The representation from the different counties of the State has steadily grown greater as the University has become more widely known, fifty-five counties being now represented. Every year, circulars and lists of questions for the examination of students, have been sent to the County Superintendents of schools, and great credit is due these officers for the generous and efficient service they have rendered the University.

ADMISSION OF FEMALE STUDENTS.

A brief time before the opening of the Autumn Term, the Executive Committee decided upon the admission of female students, and fifteen entered the first term thereafter. The number, this term, is twenty-two, and there is reason to believe the number will rapidly increase hereafter.

TERMS OF ADMISSION.

The law prescribes that "no student shall be admitted to instruction in any of the departments of the University, who shall not have attained the age of fifteen years, and who shall not, previously, undergo a satisfactory examination in each of the branches ordinarily taught in the common schools of the State." This requirement has been interpreted as fixing simply the lowest limits of the qualifications which the Trustees might prescribe, leaving them free to fix such higher qualifications as might seem needful in the progress of time.

A steady advance has been seen in the qualifications of the larger number of candidates for admission, though some have still applied and been admitted under an examination in the common branches.

The increasing number of applicants for admission, and the large increase of work now required by the higher classes, create the necessity for raising the standard of qualifications for admission. It is recommended that candidates for admission the next year be required to pass thorough examinations in English Grammar, Geography, Mathematical, Political and Physical, History of the United States, Arithmetic and Algebra, and that the following year there be added to the requirements the elements of Natural Philosophy and Physiology.

The requirements of those who are candidates for advanced standing, or for classical studies, ought, of course, to remain as heretofore.

I suggest, also, whether, after the next year, it may not be wise to add a year to the required age for admission.

While the University owes no slavish submission to the customs of other institutions, in other and older States, it may wisely, when necessary, restrict its work to those who are best prepared to profit by its instruction, and to fulfill the work which will be required of its graduates. If any departure be allowed from the required scholastic preparation, it should be in favor of students of advanced age, whose employments have given them a mental development and power which younger students could only gain from the study of books.

FINANCES.

The permanent funds have been increased during the past year by the sale of 50,000 acres of land scrip for $44,821.60, and by the sale of 160 acres of the Griggs farm for $9,600. The entire fund, including these additions, now amounts to $363,421.60, and the estimated income from the same to $27,002. The Treasurer's report will exhibit in detail the investments of this fund, as also the items of the annual income from all sources. The list of warrants, accompanying this report, will give you the several items of expenditures.

The total income for the year, from all sources, not including legislative appropriations, was $41,357.01. The total expenditures, excepting those from appropriations aforesaid, was $38,654.69.

The Bookkeeper's statement, which I transmit herewith, will give you the details of the expenditures of the legislative appropriations. I believe the expenditures have been made with strict economy and fidelity, and have given to the departments for which they were made large and useful developments.

The estimated income for next year, from all sources, is $41,426.80. The estimates for the current expenditures have been placed in the hands of the Finance Committee, and will be reported by that committee with such modifications as they may deem necessary. A considerable increase of the appropriation for the expense of instruction will be needed, to meet the expected increase in the number of the Faculty.

A large amount of our funds has remained invested in six per cent. State bonds. This amount can be quite safely invested in good county bonds yielding ten per cent. I submit whether the increase of the wants and expenses of the University do not require an immediate change to be made in these investments.

The increase of the taxes on our lands in Minnesota and Nebraska will be noticed as an indication of the increasing value of these lands. Information received from private sources confirms this inference, and the time is approaching when active measures should be taken to bring them into market.

It will be recollected that we have still on hand scrip for 25,000 acres to be located or sold. A new effort ought to be made this season to secure the location of this scrip. The progress of the new Pacific Railroads will open some very desirable lands for location.

The inventory prepared by the Bookkeeper gives the present gross assets of the University to be as follows:

Real estate	$139,150
Personal property, including all apparatus	65,600
Wild lands located with scrip	
Funds invested	

I suggest that the funds for the several practical departments—as the Agricultural, the Horticultural and the Mechanical—be charged directly with all salaries and expenses attending them, and credited with all proceeds coming from them; and that no amounts be appropriated to them from the general fund, except to meet deficiencies. Their accounts will then show, constantly, the actual profit and cost of each department, and will induce an economy not at all promoted by our present form of accounts.

AGRICULTURAL DEPARTMENT.

The work in this department was under the charge of Prof. Bliss till the first of September, when his resignation took effect. The crops were generally fair and some of them excellent, though the excessive dryness lessened the yield in many cases. A statement of crops raised and harvested will be appended to this report.

From the appropriation of $25,000 made in 1869, for this department, there have been erected two large barns—one on the Experimental farm, 48 by 76 feet, with cellar extending under about three-fifths of it, costing nearly $5,000; the other on the Stock farm, built in form of an L, each limb being 80 feet long by 40 feet wide. A basement with heavy stone walls and cemented floors, extends under it all, containing a cattle department, swine pens, a root cellar, cooking room, manure pit, etc. It is well supplied with cisterns, a well, and a cistern for liquid manures. The total expense of the whole was about $10,000.

The farm is now well supplied with teams and tools. The funds designed for the purchase of some thorough-bred neat cattle, and other stock, was put into stock steers and hogs, for the purpose of feeding out the large corn and hay crop. The increased fund arising from the sale of these animals will enable us to purchase several valuable animals of different approved breeds, with which to begin our experiments illustrating stock breeding and feeding. There remains an unexpended balance of the appropriation, from which there ought to be provided a steam cooking apparatus and some other much-needed machinery, including a windmill for pumping water for stock, and either a small steam-engine or a good horse-power, with cutting and threshing machines.

I believe that at last we have adopted a wise and safe policy in the management of this large farm. A competent Head Farmer has been employed at a minimum salary, and he is given a large pecuniary interest in the successful management, in the offer of a maximum salary, to be paid out of net income of farm. The plans of cultivation are still under the control of the Board, but the Farmer is to be allowed to employ his own laborers. If he is liberally supported he counts confidently on making the farm yield not only his maximum salary, but also a generous surplus for the University.

The Experimental farm will, it is hoped, be provided for by the appropriation (now pending before the Legislature) for agricultural experiments. The amount of this appropriation is $3,000 annually, for two years—$500 a year of this sum being designed to cover the expenses attending the lecture courses through the State.

No part of the work of the University is more difficult to manage successfully than that of sound agricultural experimentation, and no part is more interesting to the agriculturists of the State. To make these experiments really valuable, they must be scientific in character and systematic in scope. An exhaustive series of experiments, covering the entire ground of Agriculture in its several departments, will necessarily occupy many years, and will require the close attention of a skillful superintendent. To provide for such a series of experiments is the object of the appropriation asked; and, anticipating its grant, I have directed the preparation and staking out of a set of experimental plats, containing 1-20 of an acre each, on a plan recommended by Prof. M. Miles, of Michigan. These plats are to be cultivated one or two years without manures, to determine what varieties and differences the several plats exhibit in their natural state. They will then be ready for use in testing the effects of the several fertilizers, and of varying cultivation. A similar set of plats will be prepared for experiments in the several varieties of the different grains, grasses and roots. Experiments should also be undertaken in some of the new cultures recommended so often for introduction into our State. Also, experiments in Animal Husbandry, the feeding and breeding of cattle, sheep, swine, etc.

VETERINARY CLINIC.

Closely connected with Animal Husbandry, and a most important part of an Agricultural education, is the knowledge of Veterinary science. As an experiment in this department, the Executive Committee employed Dr. H. J. Detmer, V. S., to give a course of lectures to the Agricultural students during the Fall and Winter terms. During the present term he is conducting, with great success, a free veterinary infirmary, to give his class, numbering 26 students, opportunity to witness and assist in the treatment of sick animals. His report of the cases treated, which is hereto appended, shows that 55 patients have been presented for advice or treatment.

Although the University has not the means to open a full Veterinary College for the education of veterinary surgeons, still it is desirable to furnish some instruction to our Agricultural students in a branch so important to the stock interests of this State. It is cordially recommended, therefore, that the experiment be repeated another year, and that in case new mechanic shops be erected, the present shop-building be surrendered to be used as a veterinary stable and infirmary. Dr. Detmer's marked success and evident ability will certainly recommend him for appointment, but as there are some questions as to the practicable extent and relations of his course to the Agricultural course, of which it forms part, I recommend that the question of his employment another year be referred to the Executive Committee.

HORTICULTURAL DEPARTMENT.

The report of Prof. Burrill, which I herewith communicate, affords the detailed statement of the work done in his department the past year. This department is understood to include the Ornamental Grounds and Green Houses, the Market Garden, the Nurseries, the Orchards and Fruit Plantations, and the Forest planting. The ornamental grounds continue to improve in beauty, and are exercising an evident influence upon the tastes of the students. The new green house, furnished by the appropriation of 1869, is already well filled, and several of the students, including some of the young ladies, are taking lessons in its management.

The management of the market garden has, as yet, failed to secure remunerative results. The chief and perhaps fatal difficulty is found in the lack of a good home market for the more bulky or perishable vegetables. The effort now is to reduce the crops to such kinds as may either be transported profitably to Chicago, or preserved in cans. The work is too important to be relinquished without further trials.

The nurseries are designed primarily to supply the trees needed for our own orchards and forest plantations, but a large surplus will be raised for general sale. There are now in nursery 177,000 young trees for the forests and shelter belts, and a large number of pear and apple grafts have been prepared during the past winter, affording valuable practice to the students of Horticulture, and enlarging the nursery stock. The apple orchard now contains 2,319 trees, embracing about 1,180 varieties. Over 400 varieties of pears are either in orchard or nursery, and several varieties each of grapes, currants, raspberries, strawberries, gooseberries, and blackberries.

An appropriation has been asked to carry out the forest planting, as it will necessarily involve a large expense for which no return can be expected for many years. A large part of the trees now on hand are ready to go into permanent place this spring.

Nearly twenty acres of the garden ground have been thoroughly underdrained, and there remains a portion of the appropriation sufficient to underdrain the remainder of these grounds, or at least such as it is desirable to underdrain. Prof. Burrill is infusing new life into his department.

THE MECHANICAL DEPARTMENT.

The report of Professor Robinson will give, in detail, the work done in the shop. When it is recollected that this department began its proper work only about one year ago, the report will afford strong evidence of the useful character and brilliant prospects of this branch of industrial education. There has been a steady increase in the number of students in the Mechanical and Engineering courses, and the liveliest interest has been shown in their studies and shop practice. You will see in our apparatus cases a goodly amount of apparatus made in the shops by students. The cases themselves are also their work. The steam heating, introduced into the University building since your last meeting, is the work of their hands. The heating apparatus of the green house was cast from patterns made in the shop, and then put in by student labor. Some valuable pieces of apparatus have been manufactured for other institutions, or for private parties, and if the shop is credited with the value of the apparatus manufactured, and the work performed for other departments, it will be found self-sustaining.

An appropriation of $25,000 has been asked from the Legislature to provide larger and better furnished shops, and for a drill hall, and plans will be laid before you for your approval, for such building. The erection of such a building will greatly facilitate the work of the department and increase its power. I cannot too strongly commend the earnestness and zeal of Prof. Robinson in his work.

OTHER DEPARTMENTS.

It is not necessary to go into detail in reference to the other departments, but it would be unjust to pass them in silence. The department of the English Language and Literature, unsurpassed by any other in its practical every-day value, has been so admirably managed by Prof. Baker as to demand for him your highest consideration. I have never known, any where, more life and energy thrown into this study of our mother tongue; and the students who have received the benefit of his indefatigable instruction will long have reason to remember the thorough drill given them in the correct use and critical knowledge of their vernacular, and of the rich fields of its splendid literature. The classes in this department have been larger than in any other, the class beginning with this year numbering over 70 members.

The department of Chemistry has also exhibited remarkable vitality. The fundamental character of this science, and its wide scope of relations both to the other sciences and to agriculture and the useful arts, give it great importance in an institution consecrated to industrial education. It is, therefore, a matter of profound gratulation that so large a proportion of our students voluntarily seek this course. It is no small proof of the efficiency of its enthusiastic and able Professor, H.

P. S. Stuart, that he should have secured thus early so much interest in his department. The new chemistry class entering last fall, numbered 50 students, and already there are 38 at work in the over-crowded Laboratory.

An appropriation of $50,000 was asked for a Laboratory building, furnished with the necessary apparatus for mining and metallurgical uses, as well as chemical analyses. Its importance was recognized by the committees to which our application was referred, but the extent of appropriations needed by other institutions compelled a present denial of the request. This is the more to be regretted, because, long before a suitable building can be erected, the department will have utterly outgrown its accommodations. It may be found wise to prepare temporary quarters for it in the basement, or some other part of the new main building.

The department of Civil Engineering has also won some laurels under the efficient management of Prof. Shattuck and his assistants. Classes have been trained in both theory and field practice, and the services of some of the students have already been sought by outside parties, in engineering work.

Prof. Snyder has also given much force to the several departments under his charge. The Bookkeeping classes are always crowded, as are also the classes in German ; and the Military Drill has been maintained with more vigor than in any similar institution known to me. With the aid of the new Drill hall, planned in connection with the new Mechanic building, a much greater efficiency can be given to the Military course.

The success attending our efforts to meet fairly the legal requirements laid upon us, to include military tactics in our course of instruction, has suggested the propriety of asking Congress to give additional aid in a work of such national importance. I have sent accordingly to Hon. John A. Logan, late chairman of Committee on Military Affairs in the House of Representatives, the sketch of a plan for a National system of military education, which I herewith submit to you as a proposition touching the future prospects of this institution.

THE LABOR SYSTEM.

The labor system still costs us much care. Two difficulties meet us constantly: First, to provide a sufficiency of such labor as the students can perform; and second, to get such work as we do provide, well and economically performed. The practical value of the labor, as a necessary adjunct of a sound industrial education, can scarcely be over-stated. It would be well if, in all the industrial courses, practice should be required as a condition of graduation. In the Mechanical department Prof. Robinson has made "shop practice" a regular part of the course, not as an apprenticeship to a trade but as a necessary means of giving a practical understanding of the principles of mechanical philosophy. This shop practice is not counted nor paid for as labor, but the student is allowed to labor at other hours for wages. I would recommend that a similar plan be adopted in other departments. The student of Horticulture may be required to give a certain number of hours, during one or more terms, to practice in the green house, the gardens, nurseries, orchards and grafting rooms. The student of Agriculture may, in like manner and with like aim, be required to take daily practice, during certain terms, in the practical operations of the field, or in the stock barns. This would not prevent students working at other hours for wages.

THE APPLICATION FOR LEGISLATIVE AID.

The memorial prepared by direction of the Executive Committee has already been seen by most of the members of the Board, and its statements of our wants need not be repeated here. The bill appropriating $75,000 towards the erection of a new University building, to cost in all $150,000, and $25,000 for the erection and furnishing of a machine shop, has already passed the Senate, and is now pending before the House of Representatives, with a good prospect of speedily becoming a law. I call attention to it now, as its passage will impose at once upon the Board the duty of fixing sites, adopting plans, and preparing for contracts for the erection of the proposed buildings. Some preliminary plans have been prepared, but a most thorough and careful review of these plans will be required. Every feature ought to be scanned with the most jealous attention, both to secure perfection of design and to insure economy in the erection.

An appropriation has also been asked for the library and apparatus of instruction. The report of the Librarian shows the number of books now in library to be 4,538—an increase of 892 volumes during the year, 98 of which were received from donations. Besides these over two hundred pamphlets have been added to the collection.

The library is proving, as it ought, one of the most valuable agencies of instruction as well as a point of most attractive interest to our students, and its early and large increase will add greatly to the real power and value of the University. It will be remembered that the matriculation fees are set apart and apportioned to the library fund.

These fees, the past year, were absorbed in the general fund. They ought now to be added to the library appropriation for this year. We can not easily over-estimate the importance of a full supply of the best and freshest books to the student of science. The rapid and constant advance in the physical sciences—the new and surprising discoveries following each other in rapid succession—frequently invalidate old theories and conclusions, and compel continual reconstructions, making the old literature of these sciences imperfect and unsafe. Fresh books must be constantly added to our stores to keep us abreast with the progress of the scholarship of the age.

CONCLUSION.

I am glad to be able to state my earnest belief that the University is growing rapidly and deservedly in favor. The plans adopted by you at the outset, with such modifications of minor details as experience has suggested, have been found sound in practice as they were sound in theory. Much remains to be done, before we can fully realize all the great ends contemplated in those plans; but the good Providence that has thus far prospered us will still be over us, and the principles thus far found good will guide us to still greater success. I would indulge in no arrogant anticipations; but the future career of the University has an outlook so grand in itself, and so hopeful for humanity, that we may well pledge ourselves to new courage and larger efforts.

J. M. GREGORY.

LIBRARIAN'S REPORT.

DR. J. M. GREGORY, *Regent:*

The Librarian takes great satisfaction in reporting a respectable increase in the size and value of the Library, and more than corresponding increase in its use by the students.

The number of volumes reported last year was 3,480. It seems that some shelves were missed in the count, and that there were actually 3,646 at that time. The present number is 4,538, showing a clear increase of 892 volumes. Of these, 573 are included in the catalogue printed with the last annual report; 53 were bound from our own files, as shown in Schedule I; 168 were purchased since the catalogue was sent to press, as shown by Schedule II; 98 were obtained by donation and exchange, as shown by Schedule III.

Correspondence now in progress will doubtless add one or two hundred volumes with no expense except for transportation. I am confident that during the coming year I can effect an increase of more than one thousand volumes in the same way.

I have given considerable attention to the increase of our pamphlet collection. Its growth has been over two hundred the past year, and will probably be two thousand the next.

By Schedule IV it will be seen that sixty periodicals are received. Of these twenty-nine are agricultural, six mechanical, six scientific, eight literary, six news and political. It might be thought that this is too large a number, but the schedule shows that thirty of these are exchanges and cost nothing but postage and copies of our reports.

The books have been issued to readers on their filing checks with name and the book wished. The check is a charge for the book until it is taken off the file, and this is done when the book is returned. Books are freely taken from the room by teachers in the University, a record-book being kept for their use. Books are taken out by students to a very limited extent, each book so taken being charged to the Librarian or some other teacher. Some liberty of this kind seems indispensable, from the extensive reading demanded by some subjects, and the present arrangement seems to answer every purpose.

A very few books (about ten) cannot be accounted for. As the library is constantly used for a study room, and the shelves are easily reached, students some times, but very seldom, take books to their rooms without permission, trusting to a favorable opportunity to return them without detection. The utmost care will be taken to prevent this, but it cannot be absolutely avoided with the present limited room.

Considerable progress has been made in preparing a written catalogue, such as shall combine the advantages of directing readers with the least search to all the library contains on any given subject, and permitting the insertion of new books without breaking the arrangement. It is proposed to make this catalogue extend to the separate articles in periodical works, thus making it a perfect key to the whole library. I hope that the coming year will see this work complete for all that we shall then have.

Permit me to call your attention to the great interest which might be added to the annual report of the trustees, by inserting such discoveries, inventions and statistics as should make it a place among scientific periodicals. It would thus serve at once to answer the great purpose of the institution in preparing and disseminating useful knowledge, and enable us to make large and valuable exchanges for the library.

About seventy-five dollars is much needed for binding last year's periodicals, and twenty-five or fifty dollars would be well spent in binding the North American and London Quarterly Reviews, going back a number of years.

All which is respectfully submitted.

H. M. DOUGLASS,
Librarian.

The report was referred to the several Committees for action.

It was moved and seconded that the Regent be authorized to sell the S. E. ¼ of the N. E. ¼ of section 21, township 19, range 9, at $55 per acre.

The motion was referred to the Finance Committee.

The following report was next read:

REPORT OF THE TREASURER.

RECEIPTS.

1870.	March 9	Balance	$21,201 40
	April 1	Interest on $50,000 Sangamon county bonds	2,250 00
	May 28	Tuition, etc	174 00
	" 28	Coal collections	87 72
	" 28	Farm produce	214 86
	June 1	Interest on Champaign county bonds	10,000 00
	" 9	Sales from gardens	141 62
	" 9	Farm produce	44 10
	" 9	Coal collections	43 90
	" 9	Tuition, etc	202 16
	" 15	Interest on Morgan county bonds	2,500 00
	July 5	" Illinois state bonds	2,370 00
	" 5	" Chicago city bonds	875 00
	" 5	" Pike county bonds	2,000 00
	August 26	Rent	73 37
	" 27	Tuition, etc	151 50
	" 27	Farm produce	327 99
	" 27	Garden sales	182 03
	" 27	Rent for gardener's house	75 00
	" 27	Broken glass	6 05
	Sept. 1	Rent	429 09
	" 24	Farm produce sales	720 15
	" 24	Garden produce	79 21
	" 24	Fees, etc	1,247 00
	Oct. 1	Interest on Sangamon county bonds	2,250 00
	Nov. 12	Fees, etc	333 00
	" 12	Farm produce	250 80
	" 12	Sale of old stoves	17 50
	" 12	Rent of gardener's house	33 33
	" 12	Fees	3 50
1871.	January 2	Interest on Illinois State bonds	2,370 00
	" 2	" Chicago city bonds	875 00
	" 2	Farm sales	83 75
	" 2	Garden sales	92 38
	" 2	Coal sales	140 90
	" 2	Fees, etc	164 50
	" 2	From Mechanical department	161 92
	" 21	Fees	409 00
	" 21	Garden sales	4 43
	" 21	Mechanical department	150 00
	" 21	Rent	88 00

Receipts—Continued.

1871. Feb.	11	Garden sales	$25 18
"	11	Coal sales	113 75
"	11	Farm sales	108 00
"	11	From Mechanical department	25 00
"	22	Rent	178 94
"	28	Rent	578 05
"	28	Fees	458 00
"	28	Coal sales	42 39
"	28	Farm sales	59 75
"	28	Garden sales	48 98
"	28	Old stoves	12 00
"	28	From Mechanical department	176 58
"	28	Interest on scrip moneys	1,120 00
"	28	Rent	800 00
"	28	Freights, (Illinois Central Railroad donation)	4,605 78
"	28	Farm sales	213 77
"	28	Coal sales	91 37
"	28	Fees	40 75
"	28	Garden sales	19 10
"	28	Lumber, cement, etc	53 52
"	28	Old furnaces	301 52
"	28	Mechanical department	63 52
"	28	Fees	282 00
"	28	Farm produce	241 30
"	28	Old furnaces	75 00
"	28	State appropriation Agricultural department	12,500 00
"	28	" " Horticultural department	10,000 00
		Total	$85,058 41

SUMMMARY OF RECEIPTS.

For Balance	$21,201 40
" Interest on bonds	26,610 00
" Fees from students	3,461 91
" Farm produce	2,264 47
" Garden produce	704 76
" From Mechanical department	577 02
" Coal sold	520 03
" Rent for Griggs' farm	2,147 45
" Old stoves	29 50
" Old furnaces, lumber, etc.	430 04
" Broken glass	6 05
" Freights, (Illinois Central Railroad donation)	4,605 78
" State appropriation Agricultural department	12,500 00
" " " Horticultural department	10,000 00
Total receipts	$85,058 41

DISBURSEMENTS.

For Appropriations of 1869	$482 87
" Expenses of Trustees	1,179 79
" Salaries	20,576 42
" Corresponding Secretary	670 00
" Treasurer	500 00
" Taxes on lands	1,551 29
" Fuel and lights	1,593 70
" Stationery and printing	1,136 58
" Building account	1,589 50
" Incidental expenses	1,177 63

Disbursements—Continued.

For Mechanical department	$1,324 66
" Farm labor	3,093 05
" Fire extinguishers	132 05
" Insurance	337 50
" Steam heating	1,638 07
" Lectures	940 15
On account state appropriations:	
" Agricultural department	22,535 57
" Horticultural department	12,792 19
" Chemical department	1,850 39
" Books and apparatus	3,831 62
Total	$78,933 03
Amount unexpended	$6,125 38

The report was received and referred to the Auditing Committee.

On motion of Mr. Pearson, a committee of three was appointed to present nominations of Standing Committees.

The chair thus appointed Messrs. Pearson, Lawrence and Cunningham.

On motion of Hon. C. R. Griggs, the Board proceeded to the biennial election of officers.

Mr. Brown, of Sangamon, was elected chairman, (the Regent retiring) and Messrs. Edwards and Cobb were appointed to act as tellers.

On motion of Mr. Blackburn, the election of Regent took place.

J. M. Gregory was put in nomination by Judge A. M. Brown; and was elected, unanimously, at the first ballot.

Hon. N. Bateman and Mr. Goltra were appointed a committee to notify Dr. J. M. Gregory of his re-election, who, when reinstalled in the chair, made a short and very appropriate address.

The oath of office was then administered to the Regent.

The election of officers then proceeding, Hon. Newton Bateman nominated Mr. J. W. Bunn, of Springfield, for Treasurer.

The teller announced as the result of the ballot for Treasurer

J. W. Bunn	15 ballots.
B. F. Harris, of Champaign	2 "
J. Bunn	1 "

The chairman declared J. W. Bunn elected.

Hon. W. C. Flagg was nominated for Corresponding Secretary, and elected unanimously at the first ballot.

Dr. Scroggs nominated Prof. E. Snyder for Recording Secretary, who was also elected unanimously.

On motion of Mr. Griggs, the Board adjourned to meet in the evening at eight o'clock.

EVENING SESSION.

The Board reassembled at 8 o'clock P. M., the Regent in the chair.

Messrs. Mahan, Pullen and Van Osdel arrived and took their seats.

The following statement of the Bookkeeper was then read:

STATEMENT OF BOOKKEEPER.

To the Regent of the Industrial University:

I have the honor to submit to you, for the information of the Board of Trustees, the following financial statements:

I. Statement of the real estate, personal property and other funds of the Illinois Industrial University.

II. Statement of expenditures for the year ending March 1st, 1871.

III. Statement of expenditures from State appropriations to March 1st, 1871, and unexpended balance.

IV. Statement of all warrants drawn during the year and abstract of same.

V. Statement of the amount paid for students' labor in the several departments.

Statement of the Real Estate and Personal Property of the Illinois Industrial University, for the year ending March 1st, 1871.

BUILDINGS AND APPARATUS FOR INSTRUCTION.	
University building	$50,000 00
Ornamental and parade grounds	10,000 00
Library, 4,600 volumes	10,000 00
Chemical Laboratory	3,500 00
Cabinets	2,500 00
Engineering instruments	1,000 00
Mechanical shop	
Building machinery, tools, material	3,500 00
Furniture and fixtures	3,000 00
	$83,500 00
AGRICULTURAL DEPARTMENT.	
410 acres of land, at $75	$30,750 00
Two farm houses	1,500 00
Two barns	16,500 00
Teams, $1,000; colts, $200; hogs, $350; 60 steers, $3,500; produce unsold $1,550; implements, $1,500	8,100 00
80 acres, Experimental farm, at $120	12,000 00
240 acres (Griggs farm) at $60	14,400 00
	$83,250 00
HORTICULTURAL DEPARTMENT.	
120 acres, gardens and orchards, partly drained, valued at	$24,000 00
House on orchards	2,850 00
House on gardens	1,200 00
Barn	650 00
Green house	3,450 00
Propagating house	300 00

Statement—Continued.

Implements and tools	$600 00
Teams	650 00
Produce on hand	700 00
Nursery stock	3,000 00
Bedding plants in greenhouse	600 00
	$38,000 00

INTEREST BEARING FUNDS.

Champaign county bonds, at 10 per cent	$100,000 00
Sangamon county bonds, at 9 per cent	50,000 00
Morgan county bonds, at 10 per cent	25,000 00
Chicago city water bonds, at 7 per cent	25,000 00
Pike county bonds, at 10 per cent	30,000 00
Illinois State bonds, at 6 per cent	79,000 00
Proceeds of scrip	44,821 60
24,480 acres scrip on hand, valued	22,032 00
Located in Nebraska, 9,460.09 acres; in Minnesota, 15,973.67 acres; total, $25,433 acres, at $2	50,866 00
Unexpended Illinois Central Railroad donation	40,000 00
160 acres Griggs farm, sold at $60	9,600 00
	$476,319 60

RECAPITULATION.

Buildings and apparatus	$83,500 00
Agricultural department	83,250 00
Horticultural department	38,000 00
Bonds and other funds	476,319 60
	$681,069 60

Statement of the Current Expenditures to March 1st, 1871.

Board expense		$1,179 79
Salaries		20,576 42
Regent J. M. Gregory	$4,000 00	
Prof. W. M. Baker	2,000 00	
Prof. A. P. S. Stuart	2,000 00	
Prof. W. F. Bliss	1,000 00	
Prof. S. W. Robinson	2,000 00	
Prof. T. J. Burrill	1,800 00	
Prof. S. W. Shattuck	1,800 00	
Prof. E. Snyder	1,800 00	
Mr. J. Bellangee	1,000 00	
Mr. H. M. Douglass	1,000 00	
Mr. R. B. Warder	500 00	
Mr. I. D. Foulon	300 00	
Dr. H. J. Detmers	600 00	
Prof. Sanborn Tenney	600 00	
Lectures in January, 1870	176 42	
Fuel and lights		1,593 70
Gas	115 25	
Sundry expenses	32 85	
Coal — coal at mine	752 20	
Coal — freight	619 90	
Coal — hauling	73 50	
Stationery and printing		1,136 58
Stationery	40 45	
Printing reports and catalogues	731 90	
Other printing and advestising	364 23	

Statement—Continued.

Building and repairs		$1,589 50
Painting and glazing	$73 29	
Improvements	454 30	
Cleaning (sweeping, etc.)	114 77	
Whitewashing and scrubbing	173 75	
Repairs	308 09	
Raising shop	50 00	
Coal-house	109 60	
Sidewalks	133 00	
Shop yards and shed	172 70	
Mechanical department		1,324 66
Materials and repairs	365 87	
Work in shop	532 30	
Foreman's salary	972 22	
Carpenter work	18 95	
Hauling	6 00	
	$1,895 34	
By work for other departments	570 68	
Farm account		3,093 05
Blacksmithing and repairs	171 89	
Superintendent's salary	660 00	
Farm laborers	2,593 41	
	$3,425 30	
By hauling for buildings	332 25	
Incidental expenses		1,177 63
Postage	88 10	
Express	41 20	
Janitor's wages	220 48	
Janitor work by students	224 85	
Sundry other expenses	603 00	
Bills unpaid		482 87
Fire extinguishers		132 05
Salary of Treasurer		500 00
Salary of Corresponding Secretary		670 00
Taxes on lands		1,551 29
Insurance		337 50
Steam heating apparatus		1,638 07
Lecture—Dr. Miles, $626 10; Dr. Hull, $250 00; sundry, $64 05		940 15
Total		$37,923 26

Statement of Expenditures from the Appropriations made by the Legislature in March, 1869.

Agricultural department		$24,313 59
I. Barn	$9,914 93	
II. Barn	5,392 08	
Tools, fixtures and implements	1,518 03	
Horses, cattle and hogs	4,753 80	
Seeds	375 28	
Hedges, roads, etc	562 68	
Work in improving wells, cisterns, draining, etc	1,645 27	
Corn crib	151 52	
Horticultural department		18,151 88
Seed and bulbs	171 34	
Trees and grapes	2,738 56	
Gardener's house	1,081 53	
Gardener's barn	628 04	
Labor	1,818 48	

Statement—Continued.

Salaries of foremen	$2,539 43	
Teams, tools and implements	753 75	
Fences, roads and bridges	361 74	
Freight	349 60	
Tile and drainage	1,235 27	
Sundries	207 01	
House on orchard	2,827 07	
Greenhouse	3,440 06	
Chemical department		$3,035 95
Fixtures	540 19	
Chemicals	680 41	
Apparatus	1,815 35	
Books and apparatus		10,078 88
Fixtures	849 30	
Insurance, express, etc	510 39	
Books	5,891 17	
Models from Mechanical department	2,000 00	
Cabinet	837 02	
Total		$55,580 30
Balance		4,419 70

Statement of Expenditures during the year ending March 1st, 1871, *as per Warrants* 1 *to* 746, *inclusive.*

Board expense	$1,179 79	
Salary of Faculty, etc	20,576 42	
Salary Treasurer	500 00	
Salary Corresponding Secretary	670 00	
Taxes on land	1,551 29	
Fuel and light	1,593 70	
Stationery and printing	1,136 58	
Building account	1,589 50	
Incidental expense	1,177 63	
Mechanical department	1,324 66	
Farm labor	3,093 05	
Fire extinguisher	132 05	
Steam-heating apparatus	1,638 07	
Insurance	337 50	
Bills unpaid	482 87	
Lectures in 1871	940 15	
		$37,923 26
State appropriation Agricultural department	22,535 57	
State appropriation Horticultural department	12,792 19	
Chemical laboratory	1,850 39	
Books and apparatus	3,831 62	41,009 77
Total		$78,933 03

URBANA, *March 14th*, 1871.

E. SNYDER.

Statement of Warrants.

No.	Date.		To whom.	For what.	Amount.	
1	March	9	Prof. Sanborn Tenney...	Thirty lectures delivered.............	$600	00
2	"	9	J. H. Pickard.........	Expenses to meeting............	17	50
3	"	9	J. H. Pickrell..........	" "	12	30
4	"	9	Dr. Wm. Kile..........	" "	8	75
5	"	9	A. M. Brown..........	" "	28	15
6	"	9	J. S. Johnson..........	" "	25	00
7	"	9	A. Blackburn..........	" "	26	30
8	"	9	Samuel Edwards.......	" "	24	00
9	"	9	" "	Trees for nursery.................	27	00
10	"	9	W. C. Flagg...........	Payment of lecture expense..........	176	35
11	"	9	J. P. Slade	Expense to meeting..............	23	45
12	"	9	J. M. Pearson..........	" "	19	95
13	"	9	Paul R. Wright	" "	27	75
14	"	9	B. Pullen	" "	21	00
15	"	9	M. C. Goltra..........	" "	11	00
16	"	9	Mason Brayman........	" "	27	75
17	"	9	L. Lawrence...........	" "	26	85
18	"	9	O. B. Galusha	" "	11	00
19	"	9	W. C. Flagg...........	Corresponding Secretary's salary......	470	00
20	"	9	J. W. Bunn	Treasurer's salary.................	500	00
21	"	10	Trevitt & Green	Hardware....................	62	81
22	"	10	J. M. Gregory....... ..	Salary, March..................	333	34
23	"	10	W. F. Bliss...........	" "	166	66
24	"	11	Illinois Central R. R. Co	Advanced freights.................	5	50
25	"	11	H. K. Vickroy..........	Expenses and labor...............	10	94
26	"	11	Champaign Gas Company	Gas fixtures	181	22
27	"	11	Union Coal Company ...	Two cars coal	32	00
28	"	11	W. H. Merritt	Labor.......................	24	19
29	"	11	Henry Swannell	Oil, paint, wall-paper..............	14	84
30	"	11	E. V. Peterson..........	Curtains for chapel................	48	40
31	"	11	J. M. Gregory	Expense for purchases in Europe......	250	00
32	"	14	Wm. M. Baker	Salary, March	166	66
33	"	14	J. C. Burroughs	Expense to meeting...............	17	25
34	"	14	Flynn & Scroggs	Printing	44	10
35	"	15	M. E. Lasher	Raising carpenter shop............	10	00
36	"	16	M. J. & J. F. Jeffrey	Castings and machinery	35	00
37	"	16	Angle & Sabine	Grass and clover seed	110	26
38	"	18	S. W. Robinson........	Material for models...............	34	76
39	"	21	Col. Barringer	Gas pipes......................	115	00
40	"	21	Jas. Vick..............	Flower seeds...................	5	00
41	"	23	T. J. Burrill...........	Stove and pipe..................	8	00
42	"	23	J. Bellangee...........	Drawing paper..................	8	00
43	"	25	American Express Co ...	Reports from Springfield	67	50
44	"	27	S. L. Graves & Son.....	Turning-lathe and saws............	100	00
45	"	29	J. J. Thomas & Co......	Grass harrow and freight............	23	25
46	"	30	E. Snyder	Salary, March..................	150	00
47	"	30	J. Bellangee	" "	83	33
48	"	30	A. P. S. Stuart.........	" "	166	66
49	"	30	S. W. Robinson........	" "	166	66
50	"	30	S. W. Shattuck.........	" "	150	00
51	"	30	T. J. Burrill	" "	150	00
52	"	30	H. Douglass	" "	83	33
53	"	30	J. S. Searfoss..........	" "	83	33
54	"	30	H. K. Vickroy.........	" "	83	33
55	"	30	T. Franks	" "	75	00
56	"	30	R. B. Warder..........	" "	33	33
57	"	30	Pat. Lamb............	" "	40	00
58	"	30	Lowenstern & Graham...	Muslin and thread	6	60
59	April	1	Prof. W. F. Bliss	Salary, April...................	166	66
60	"	1	Fuller, Finch & Fuller...	Glass for green house..............	242	54

Statement—Continued.

No.	Date.		To whom.	For what.	Amount.
61	April	1	David M. Ford	Material and machinery	$38 52
62	"	1	Larrabee & North	Tools and materials	39 86
63	"	1	Prof. E. Snyder	Payment of labor	352 56
64	"	1	Champaign Gas Company	Gas for March	12 80
65	"	5	W. H. Merritt	Work on orchards	24 69
66	"	5	H. K. Vickroy	Petty expense	3 65
67	"	7	Luther W. Lawrence	Expense to meeting	25 10
68	"	7	A. M. Brown	" "	27 50
69	"	7	J. H. Pickrell	" "	13 05
70	"	7	M. C. Goltra	" "	16 50
71	"	9	E. Snyder	Petty expenses	27 44
72	"	9	J. S. Upstone	Farm laborers pay and board	132 17
73	"	9	W. J. Jeffrey	Engine castings	128 88
74	"	9	Cobb & Warriner	Norway oats	26 00
75	"	9	Union Coal Company	Two cars coal	30 00
76	"	9	E. Eldred	Lumber for barns	206 45
77	"	9	C. Foote	2,000 brick for hot house	20 00
78	"	9	G. S. Upstone	Laborers pay and board	104 44
79	"	9	Prof. W. F. Bliss	Postage stamps	5 50
80	"	9	A. Thomson	Work on machinery	84 00
81	"	13	F. M. & A. Avey	Blacksmithing	7 85
82	"	26	Chas. Quinn	One span of horses	250 00
83	"	26	Prof. W. M. Baker	Salary, April	166 66
84	"	26	E. L. Brown	Expense to meetings	42 00
85	"	26	S. M. Newby	Express on seed corn	1 50
86	"	26	Daniel Wicks	Barley for seed	64 30
87	"	26	F. K. Phœnix	Bill of Trees	79 10
88	"	26	R. Douglas & Son	" "	48 50
89	"	26	W. N. Nourse	" "	43 25
90	"	26	Edgar Saunders	Two dozen dahlias	4 00
91	"	26	Hovey & Co	One lawn roller	30 00
92	"	26	Hulburd, Herrick & Co	Nails for green house	28 00
93	"	26	James & Co	Belting	9 17
94	"	27	Lacon Nursery	Bill of trees	53 80
95	"	27	Jennings & Wagdin	Flower pots	9 15
96	"	27	George Ely	Blacksmithing	24 20
97	"	27	Prof. A. P. S. Stuart	Salary, April	166 66
98	"	27	Prof. S. W. Robinson	" "	166 66
99	"	27	Prof. T. J. Burrill	" "	150 00
100	"	27	Prof. S. W. Shattuck	" "	150 00
101	"	27	Prof. E. Snyder	" "	150 00
102	"	27	Jas Bellangee	" "	83 33
103	"	27	H. M. Douglass	" "	83 33
104	"	27	R. B. Wa der	" "	33 33
105	"	27	J S. Searfoss	" "	83 33
106	"	27	Thos. Franks	" "	75 00
107	"	27	H. K. Vickroy	" "	83 33
108	"	27	G. S. Upstone	" "	60 00
109	"	27	Patrick Lamb	" "	40 00
110	"	27	J. M. Gregory	" "	333 33
111	"	28	American Express Co	Express on books	11 75
112	"	28	Purdy & Hance	Bill of small fruit	19 05
113	May	2	W. F. Bliss	Salary, May	166 66
114	"	2	G. S. Upstone	Wages of farm hands	57 10
115	"	2	" "	Board of farm hands	41 53
116	"	2	J. B. Phinney	Seed corn	20 00
117	"	2	American Express Co	Express on grapes	12 05
118	"	2	Nicolet & Schoff	Printing 5,000 Regent's report	131 90
119	"	2	E. Snyder	Payment students labor	500 53
120	"	3	Samuel Edwards	Bill of trees	425 25
121	"	3	A. H. Bridgman	Books for library	5 00

Statement—Continued.

No.	Date.		To whom.	For what.	Amount.
122	May	3	Champaign Gas Company	Gas for April	$11 20
123	"	3	Bicknell & Co	Books for library	27 00
124	"	3	Nash & Fleming	Sand for green house	22 75
125	"	3	H. K. Vickroy	Petty expense	14 18
126	"	3	T. J. Burrill	" "	9 10
127	"	3	H. K. Hosford	Lanterns, globes, chimneys	7 00
128	"	3	W. H. Merritt	Work for April	34 65
129	"	7	J. Blakesley	" "	31 10
130	"	7	J. Bellangee	Expense on plans for barns	6 50
131	"	9	A. Thomson	Salary for April	83 33
132	"	12	J. H. Pickrell	Board expenses	7 05
133	"	12	M. C. Goltra	" "	10 00
134	"	12	P. R. Wright	" "	22 20
135	"	13	J. M. Gregory	Salary, May	333 33
136	"	13	" "	Balance on bill of books	12 12
137	"	13	S. W. Shattuck	Salary, May	150 00
138	"	13	Park & Royer	Lumber	19 87
139	"	13	E. Snyder	Petty expense	40 00
140	"	13	W. C. Flagg	Corresponding Secretary's salary	50 00
141	"	13	E. Snyder	Contingent fund	75 00
142	"	13	T. Franks	Petty expense	9 85
143			(Destroyed)		
144	May	16	J. E. Cantrell	Material for wagon	70 00
145	"	16	Jos. McCorkle	Hardware	13 34
146	"	16	G. S. Upstone	Petty expense	4 80
147	"	16	Nash & Fleming	Three yards of sand	5 25
148	"	16	Beach & Co	Coal	21 25
149	"	16	Union Coal Company	Two cars coal	30 00
150	"	16	A. Thomson	Salary, March 10th to 31st	55 55
151	"	16	M. E. Lapham	Lime and stone	17 51
152	"	16	Hall, Kimbark, & Co	Machinery	39 65
153	"	16	T. J. Burrill	Specimens for cabinet	4 45
154	"	16	Fuller, Finch & Fuller	Paint, glass and alcohol	24 79
155	"	16	S. Edwards	Bill of trees	35 10
156	"	16	J. S. Sherman	5,000 apple stocks	25 00
157	"	16	Store, Harrison & Co	6,000 chestnuts	61 50
158	"	16	W. A. Nourse	White ash seedlings	50 00
159	"	16	J. M. Gregory	Books for library	427 50
160	"	20	H. Shepherd	15,000 brick	165 00
161	"	20	Jas. Rolfe	Mason work on green house	232 94
162	"	20	J. W. Boatman & Co	14,500 Osage orange plants	29 00
163	"	27	N. W. Fire Extingu'er Co	Three Babcock extinguishers	132 05
164	"	27	J. M. Gregory	Petty expense	23 20
165	"	31	W. M. Baker	Salary for May	166 66
166	"	31	A. P. S. Stuart	" "	166 66
167	"	31	S. W. Robinson	" "	166 66
168	"	31	T. J. Burrill	" "	150 00
169	"	31	E. Snyder	" "	150 00
170	"	31	J. Bellangee	" "	83 33
171	"	31	R. B. Warder	" "	33 33
172	"	31	H. M. Douglass	" "	83 33
173	"	31	A. Thomson	" "	83 33
174	"	31	J. S. Searfoss	" "	83 33
175	"	31	H. K. Vickroy	" "	83 33
176	"	31	Thos. Franks	" "	75 00
177	"	31	G. S. Upstone	" "	60 00
178	"	31	Pat. Lamb	" "	40 00
179	"	31	G. S. Upstone	Payment of farm labor	69 24
180	"	31	" "	Board of farm laborers	61 60
181	"	31	Jas. Blakesley	Work on gardens	32 25
182	"	31	W. H. Merritt	" "	36 00

Statement—Continued.

No.	Date.		To whom.	For what.	Amount.
183	May	31	E. V. Peterson	Books for library	$441 27
184	June	7	A. P. S. Stuart	Salary, June, July, August	500 00
185	"	7	R. B. Warder	" " "	100 00
186	"	7	E. Snyder	Payment students labor	493 60
187	"	7	W. F. Bliss	Salary, June, July, August	500 00
188	"	7	W. M. Baker	" " "	500 00
189	"	7	S. W. Shattuck	" " "	450 00
190	"	7	A. M. Brown	Expenses to meeting	29 40
191	"	7	P. R. Wright	" "	24 75
192	"	7	M. C. Goltra	" "	10 00
193	"	7	T. J. Burrill	Salary, June, July, August	450 00
194	"	7	E. Snyder	" " "	450 00
195	"	7	J. Bellangee	" " "	250 00
196	"	7	C. Sullivan	Excavating barn cellar	200 00
197	"	7	Fuller, Finch & Fuller	Oil and paints for barns	63 33
198	"	7	C. G. Larned	Hardware and repairs	40 42
199	"	7	C. F. A. Hinrichs	Insect pins for cabinet	5 20
200	"	7	A. S. Davies	Double shovel plow	6 00
201	"	7	Chaddon & Hesse	Sawing timber for barn	10 36
202	"	7	David Ford	Castings for engine	2 42
203	"	8	Hovey & Co	Bluegrass seed	2 25
204	"	8	Angle & Sabine	Seed and Tile	23 75
205	"	8	Champaign Gas Company	Gas for June	2 80
206	"	8	F. M. & A. Avey	Blacksmithing	10 30
207	"	8	E. V. Peterson	Stationery, crayons, etc	16 70
208	"	8	H. M. Douglass	Salary, June, July, August	250 00
209	"	8	T. J. Burrill	Petty expense	21 10
210	"	8	E. Snyder	" "	56 55
211	"	8	S. W. Robinson	Salary, June, July, August	500 00
212	"	8	Dr. J. M. Gregory	" " "	1,000 00
213	"	8	Patrick Lamb	Wages for 11 days	14 70
214	"	12	J. R. Harris	Two horses	350 00
215	"	14	J. Bellangee	Work on farm cistern	7 15
216	"	21	W. H. Crayne	Work in shop	28 13
217	"	21	Wicks & Watson	Hauling stone	50 00
218	"	24	W. Dowell	Painting on barn	13 70
219	"	27	O. W. Hammond	Work in shop	23 25
220	"	30	Harry Cleveland	Work on farm barn	10 38
221	"	30	John Crawley	" "	10 45
222	"	30	H. E. Robbins	Work on models	21 25
223	"	30	Rudolf Jeorg	" "	10 37
224	"	30	N. C. Ricker	Work on green house	30 25
225	"	30	J. E. Cantrell	Balance for wagon	70 00
226	July	1	Wilson Dowell	Work in shop	27 48
227	"	1	W. H. Crayne	" "	21 94
228	"	1	J. A. Ockerson	" "	19 50
229	"	1	H. V. Moore	Barrels and jars	7 32
230	"	1	G. S. Upstone	Payment of day laborers	12 26
231	"	1	" "	Payment of farm hands	88 90
232	"	1	" "	Board of farm hands	80 51
233	"	1	J. S. Searfoss	Salary for June	83 33
234	"	1	A. Thomson	" "	83 33
235	"	1	H. K. Vickroy	" "	83 33
236	"	1	Thos. Franks	" "	75 00
237	"	1	G. S. Upstone	" "	60 00
238	"	1	R. Peacock	Lumber for barn	1,000 00
239	"	1	Jas. Blakesley	Work on gardens	33 50
240	"	1	Jas. C. Craver	" "	26 90
241	"	1	M. B. Burwash	" "	26 90
242	"	2	C. D. Hays	Work in gardens June	24 25
243	"	2	T. J. Sloan	" " "	26 93

Statement—Continued.

No.	Date.		To whom.	For what.	Amount.
244	July	2	W. H. Merritt	Work in gardens, June	$34 61
245	"	6	E. V. Peterson	Books for library	225 00
246	"	6	M. C. Goltra	Expenses to meeting	10 00
247	"	6	A. M. Brown	" "	25 51
248	"	6	P. R. Wright	" "	23 00
249	"	6	Johnston, Huntley & Co.	Agricultural implement	4 05
250	"	6	Ellwanger & Barry	Grapes	32 75
251	"	6	David M. Ford	Castings for engine	3 63
252	"	6	Kankakee Stone & Li'e Co	Lime and cement	102 00
253	"	6	Larrabee & North	Tools and materials	23 04
254	"	6	G. E. Hessel	Harness and repairs	77 65
255	"	6	M. E. Lapham & Co	Thirty cars of stone	420 00
256	"	6	J. M. Gregory	Traveling expense	19 45
257	"	6	Union Coal Company	One car of coal	15 00
258	"	6	F. M. & A. Avey	Blacksmithing	16 25
259	"	6	E. Snyder	Petty expense	68 71
260	"	6	Angle & Sabine	Wagon bed, pump, &c	31 60
261	"	6	Fuller, Finch & Fuller	Paint brushes	4 76
262	"	6	J. H. Pickrell	Expense to meeting	7 55
263	"	8	H. Shepherd	39,585 brick	395 85
264	"	8	W. H. Crayne	Work in shop	6 75
265	"	8	D. Wicks & Walton	Hauling for barns	80 00
266	"	8	E. Fryer	Mason work	200 00
267	"	11	Illinois Central R. R. Co.	Back freights	28 96
268	"	11	Hon. E. Rummel	Packing expenses for catalogue	6 50
269	"	12	D. M. Ford	Three way cocks for engine	4 00
270	"	12	W. Parritt	Piping for engine	3 00
271	"	12	Flynn & Scroggs	Advertising and printing	7 75
272	"	12	Wicks & Watson	Hauling for barn	16 50
273	"	23	Ebenezer Fryer	Mason work	400 00
274	"	23	Patrick Lamb	Work at first barn	49 00
275	"	23	J. Bellangee	Petty expenses	7 50
276	"	23	D. Owens	Digging cellar	50 00
277	"	26	H. M. Douglass	Books for library	16 50
278	"	26	T. Collins	Digging wells	24 00
279	"	26	John Furst	Hauling stone	20 00
280	"	27	J. S. Searfoss	Salary, July	83 33
281	"	27	P. Packard	Hauling stone	12 00
282	"	27	Wicks & Watson	" "	96 28
283	"	27	Patrick Lamb	Work at shop	10 00
284	"	27	A. Herbert	Digging cistern	43 00
285	"	27	H. Cleveland	Work on Experimental farm	14 00
286	August	1	G. S. Upstone	Payment of farm hands	305 26
287	"	1	G. S. Upstone	Petty expense	17 25
288	"	1	G. S. Upstone	Board of farm hands	159 85
289	"	1	D. Owens	Mason work	100 00
290	"	1	John Furst	Hauling stone	30 00
291	"	1	J. H. McKinzie	Hauling sand	5 97
292	"	1	Jacob McKinzie	22½ yards sand	19 33
293	"	1	George Eli	Iron for braces	11 18
294	"	1	James Bellangee	Salary as Superintendent	100 00
295	"	1	J. W. Bunn	Draft on London	306 60
296	"	1	H. N. Holden	Wood and material	38 30
297	"	1	M. E. Lapham & Co	Lime and stone	309 90
298	"	1	W. M. & J. F. Olcott	Thirty tons hard coal	270 00
299	"	1	J. N. Wharton	Work in shop	20 50
300	"	1	J. H. Pancake	" "	10 00
301	"	1	W. Moses	Digging well	8 00
302	"	1	J. A. Ockerson	Carpenter work	37 50
303	"	1	O. W. Hammond	" "	43 50
304	"	1	H. E. Robbins	Work in shop	29 62

Statement—Continued.

No.	Date.	To whom.	For what.	Amount.
305	August 1	N. C. Ricker	Work in shop	$68 75
306	" 1	W. Dowell	Painting	18 00
307	" 1	Larrabee & North	Tools and materials	16 89
308	" 1	Fuller, Finch & Fuller	Lead and putty	17 38
309	" 1	Johnston, Huntley & Co	Agricultural implements	17 70
310	" 1	Trevitt & Green	Hardware	60 24
311	" 1	Thomas Franks	Salary, July	75 00
312	" 1	H. K. Vickroy	" "	83 33
313	" 1	G. S. Upstone	" "	60 00
314	" 2	J. J. Crawley	Work at barn	13 02
315	" 2	T. J. Sloan	Work in orchard	35 00
316	" 2	W. H. Merritt	" "	36 00
317	" 2	A. L. Rader	" "	6 75
318	" 2	C. S. Emerson	" "	14 25
319	" 2	A. Thomson	Salary, July	83 33
320	" 3	F. M. & A. Avey	Blacksmithing	28 48
321	" 3	J C. Craver	Work in garden	35 00
322	" 3	M. J. Blakesley	" "	29 10
323	" 3	M. B. Burwash	" "	35 00
324	" 3	C. I. Hays	" "	30 00
325	" 3	Jas. Cunningham	Barn foundation	10 00
326	" 5	C. W. Ashby	Work on barn	8 12
327	" 5	D. Owens	Mason work	75 00
328	" 5	T. Collins	Digging well	14 00
329	" 5	E. Friar	Mason work	100 00
330	" 5	V. Moses	Work at barns	21 00
331	" 5	J. Furst	Hauling stone	25 00
332	" 13	J. French	Carpenter work	22 00
333	" 13	D. Owens	Mason work	65 00
334	" 13	Dickinson & Collier	Carpenter work	500 00
335	" 13	J. Dick	Mason work	6 00
336	" 15	W. Parrit	Carpenter work	21 00
337	" 15	J. Burt	Threshing and reaping	30 50
338	" 15	Pat. Lamb	Work at barns	28 25
339	" 15	R. B. Musson	Plastering	23 50
340	" 16	W. Dowell	Painting	10 00
341	" 16	A. S. Barnes & Co	Freights on books	19 31
342	" 16	Fuller, Finch & Fuller	Glass for greenhouse	61 85
343	" 16	S Hook	Teaming	22 00
344	" 20	D. Owens	Mason work	50 00
345	" 20	J. French	Carpenter work	16 50
346	" 23	D. Owens	Mason work	50 00
347	" 25	A. M Brown	Board expense	28 90
348	" 25	P. R. Wright	" "	24 75
349	" 25	M. C. Goltra	" "	12 00
350	" 25	L. W. Lawrence	" "	26 00
351	" 26	Dodson & Hodges	Hardware	52 05
352	" 26	Johnston, Huntley & Co.	Implements and repairs	2 55
353	" 26	Fuller, Finch & Fuller	Paints	34 13
354	" 26	Fuller, Finch & Fuller	"	101 62
355	" 26	W. A. James & Co	Crucibles	2 40
356	" 26	J. H. Detmers	Traveling expense	7 55
357	" 26	T. J. Burrill	Petty expense	12 75
358	" 26	D. Van Nostrand	Books for laboratory	130 65
359	" 26	B. Westerman & Co	" "	52 05
360	" 26	D. Van Nostrand	" "	12 23
361	" 26	American Express Co	" "	4 00
362	" 27	J. Knowlen	Work on barn	2 50
363	" 27	Pat. Lamb	" "	14 00
364	" 27	W. H. Silva	Hauling	26 58
365	" 27	E. Snyder	Petty expense	98 73

Statement—Continued.

No.	Date.	To whom.	For what.	Amount.
366	Aug. 27	Trevitt & Green	Hardware	$178 91
367	" 30	C. G. Larned	Guttering and roofing	88 99
368	" 30	M. E. Lapham & Co	Stone and lime	78 85
369	" 30	Thos. Franks	Salary, August	75 00
370	" 30	G. H. Pancake	Work on models	10 00
371	" 30	H E. Robbins	" "	36 00
372	" 30	J. E. Cantrell	" "	25 00
373	Sept. 1	G. S. Upstone	Petty expenses	4 00
374	" 1	" "	Board of farm hands	115 00
375	" 1	" "	Payment of farm hands	147 31
376	" 1	" "	Salary. August	60 00
377	" 1	J. S. Searfoss	" "	83 33
378	" 1	H. K. Vickroy	" "	83 33
379	" 1	A. Thomson	" "	83 33
380	" 1	Walker Brothers	Turning, etc	13 25
381	" 1	W. Dowell	Painting and glazing	56 00
382	" 1	G. R. Pfeiffer	Books on veterinary surgery	12 00
383	" 1	N. C. Ricker	Carpenter work	68 75
384	" 3	J. Q. Smith	5,500 feet oak plank	110 00
385	" 3	Webster, Davies & Dunbar	Lime and cement	240 50
386	" 3	R. Warder	Work in orchard	1 00
387	" 3	W. H. Merritt	Work in garden	33 23
388	" 3	T. J. Sloan	Work in orchards	32 31
389	" 3	J. C. Craver	Work in garden	35 00
390	" 3	C. I. Hays	" "	30 00
391	" 3	M. B. Burwash	" "	35 00
392	" 3	J. Blakesley	" "	33 50
393	" 3	J. K. French	Carpenters work	35 75
394	" 5	Flynn & Scroggs	Printing and advertising	24 50
395	" 5	A. N. Kellogg	Advertising	100 00
396	" 5	R. Peacock	Lumber	1,500 00
397	" 5	H. N. Holden	Material	10 58
398	" 5	Hulburd, Herrick & Co.	Window bolts	6 50
399	" 6	W. Parritt	Carpenter work	21 00
400	" 6	E. Lynch	" "	9 45
401	" 6	Fuller, Finch & Fuller	Paints	40 18
402	" 6	F. W. Satterlee	Whitewashing	100 00
403	" 6	J. W. Bunn	Draft for books	230 00
404	" 6	Dickerson & Collier	Carpenter work	500 00
405	" 6	F. M & A. Avey	Blacksmithing	17 00
406	" 7	O. W. Hammond	Carpenter work	54 00
407	" 7	J. M. Gregory	Salary, September	333 33
408	" 10	G. S. Upstone	Threshing	105 50
409	" 10	D. Owens	Mason work	100 00
410	" 12	J. N. Wharton	Work on models	47 82
411	" 12	Harry Cleveland	Work at barns	56 00
412	" 14	J. Teeple	Work in shop, etc	44 60
413	" 14	N. C. Ricker	Carpenter work	11 75
414	" 14	J. A. Ockerson	" "	82 00
415	" 14	W. Dowell	Painting	25 00
416	" 14	E. Snyder	Payment for scrubbing	73 75
417	" 14	S. Hook	Teaming	42 30
418	" 14	Fuller, Finch & Fuller	Glass	11 93
419	" 14	Nicolet & Schoff	Printing	14 00
420	" 14	George Eli	Blacksmithing	18 95
421	" 15	J. E Cantrell	Work in shop	54 50
422	" 16	D. Owens	Mason Work	237 80
423	" 16	T. J. Burrill	Traveling expense	7 30
424	" 16	H. L. Town	Stove and furniture	14 70
425	" 16	C. I Hays	Work in garden	10 35
426	" 16	J. T. Wier	Plastering	46 20

Statement—Continued.

No.	Date.	To whom.	For what.	Amount.
427	Sept. 17	J. F. Luhme	Chemicals	$64 62
428	" 17	T. J. Sloan	Work on orchards	8 70
429	" 17	R. Peacock	Lumber	1,800 00
430	" 17	Flynn & Scroggs	Printing	44 50
431	" 19	Wilson Dowell	Painting	36 00
432	" 19	Walworth, Twohig & Furse	Boiler and pipes	1,000 00
433	" 23	J. H. Pickrell	Board expense	16 55
434	" 23	A. M. Brown	" "	29 40
435	" 23	H. Shepherd	31,082 brick	310 82
436	" 24	E. Snyder	Petty expense	90 61
437	" 24	C. S. Emerson	Work in orchards	15 00
438	" 24	D. Owens	Furnace flue	30 00
439	" 24	N. C. Ricker	Moulding	10 59
440	" 24	Hon. N. Bateman	Board expense	33 63
441	" 24	J. S. Searfoss	Salary, September	83 33
442	Oct. 1	E. Friar	Mason work	290 98
443	" 1	Jas. Bellangee	Salary, September, and as Superintend't	183 33
444	" 1	S. W. Shattuck	" " " "	150 00
445	" 1	D. Owens	Mason work	110 62
446	" 1	A. P. S. Stuart	Salary, September	166 66
447	" 1	H. M. Douglass	" "	83 33
448	" 1	R. B. Warder	" "	50 00
449	" 1	H. J. Detmers	" "	100 00
450	" 1	I. D. Foulon	" "	50 00
451	" 1	T. J. Burrill	" "	150 00
452	" 1	H. K. Vickroy	" "	83 33
453	" 1	Pat. Lamb	Work at barn and building	52 53
454	" 1	A. Thomson	Salary, September	83 33
455	" 1	G. S. Upstone	Petty expense	19 45
456	" 1	" "	Pay of farm hands	65 16
457	" 1	" "	Board of farm hands	81 69
458	" 1	" "	Salary, September	60 00
459	" 1	S. W. Robinson	" "	166 66
460	" 1	Rudolph Jeorg	Work on farm	51 06
461	" 1	Wm. M. Baker	Salary, September	166 66
462	" 1	W. H. Merritt	Work on orchard	31 85
463	" 1	Emory Cobb	Board expense	12 00
464	" 6	A. Herbert	Digging well	23 50
465	" 6	E. A. Robinson	Work in shop	34 50
466	" 6	J. C. Craver	Work in orchards	14 85
467	" 6	M. B. Burwash	" "	12 15
468	" 6	J. Blakesley	" "	19 18
469	" 6	T. Franks	Salary, September	75 00
470	" 8	J. Wilkinson	Teaming	13 50
471	" 8	Avey & Neff	Blacksmithing	7 16
472	" 8	R. Peacock	Lumber on account	300 00
473	" 8	E. Snyder	Salary, September	150 00
474	" 11	J. Bellangee	Petty expenses	9 00
475	" 11	W. M. Baker	Books for library	14 00
476	" 11	Angle & Sabine	Implements and tile	67 82
477	" 12	J. W. Bunn	Payment for chemical apparatus	639 70
478	" 12	" "	Taxes on lands	1,463 89
479	" 12	G. E. Hessel	Harness and beltings	80 50
480	" 12	Nash & Fleming	Sand and gravel	244 25
481	" 13	A. Jewell	Timothy seed	54 12
482	" 13	Illinois Central R. R. Co.	Back freights	32 90
483	" 13	J. E. Cantrell	Work in shop	50 00
484	" 13	Dickinson & Collier	Carpenter work	500 00
485	" 15	J. M. Gregory	Salary, October	333 33
486	" 15	H. E. Robbins	Expense to State Fair	11 15
487	" 15	D. Owens	Mason work on barn	42 80

Statement—Continued.

No.	Date.		To whom.	For what.	Amount.
488	Oct.	15	A. L. Rader	Work on building	$17 75
489	"	18	D. M Ford	Fire brick and castings	23 75
490	"	18	Larrabee & North	One sheet of brass	7 65
491	"	18	E. V. Peterson	Books	103 81
492	"	18	" "	20,000 brick	180 00
493	"	24	J. Wilkinson	Work on orchards	8 25
494	"	24	Heislar & Coler	One manure fork	1 50
495	"	24	H. Peddicord	Lime and cement	24 25
496	"	24	Palmer, Fuller & Co	Doors and sash	56 75
497	"	24	Walker Bro's	Mouldings	135 48
498	"	24	Beidler & Kratz	Lumber and lime	219 31
499	"	24	O. W. Hammond	Carpenter work	21 00
500	"	24	J. McKinzie	Sand	28 80
501	"	31	W. M. Baker	Salary, October	166 66
502	"	31	A. P. S. Stuart	" "	166 66
503	"	31	S. W. Robinson	" "	166 66
504	"	31	T. J. Burrill	" "	150 00
505	"	31	S. W. Shattuck	" "	150 00
506	"	31	E. Snyder	" "	150 00
507	"	31	J. Bellangee	" "	83 33
508	"	31	H. M. Douglass	" "	83 33
509	"	31	H. J. Detmers	" "	100 00
510	"	31	R. B. Warder	" "	50 00
511	"	31	I. D. Foulon	" "	50 00
512	"	31	Pat. Lamb	Wages, October	35 00
513	"	31	J. S. Searfoss	Salary, October	83 33
514	"	31	A. Thomson	" "	83 33
515	"	31	H. K. Vickroy	" "	83 33
516	"	31	T. Franks	" "	75 00
517	"	31	G. S. Upstone	" "	60 00
518	"	31	Dickerson & Collier	Carpenter work	127 87
519	"	31	Wilson Dowell	Painting	25 00
520	"	31	R. Peacock	Lumber	365 97
521	Nov.	1	G. S. Upstone	Farm labor, etc	245 52
522	"	3	Fuller, Finch & Fuller	Glass and paint	93 71
523	"	3	A. S. Barnes & Co	Freight and duties	53 18
524	"	3	Peterson & Turnell	3,625 brick	32 62
525	"	3	James Vick	Bulbs and seeds	17 87
526	"	3	W. H. Wisegarner	Threshing	17 55
527	"	3	S. Dunlap	Work on orchard	16 65
528	"	3	E. Snyder	Payment of students	557 61
529	"	3	D. M. Ford	Boiler and pipes	126 04
530	"	3	J. Pancake	1,185 feet maple	35 52
531	"	3	J. Blakesley	One month's work	19 40
532	"	5	E. V. Peterson	Books	87 95
533	"	5	Dickerson & Collier	Carpenter work	500 00
534	"	5	Becker & Son	Chemical apparatus	129 46
535	"	7	J. T. Wier	Plastering	100 00
536	"	7	Union Coal Company	Three cars coal	51 00
537	"	9	D. Owens	Mason work	56 92
538	"	9	M C. Goltra	Board expense	10 00
539	"	9	P. R. Wright	" "	26 65
540	"	9	J. H. Pickrell	" "	6 80
541	"	9	L. W. Lawrence	" "	24 80
542	"	9	A. M. Brown	" "	29 40
543	"	12	Union Coal Company	Twenty tons coal	37 00
544	"	12	H. Swanell	Paints and glass	62 11
545	"	12	Angle & Sabine	Draining tile	52 85
546	"	12	Walworth, Twohig & Furse	Iron pipes	146 04
547	"	12	Earth Closet Company	One ash commode	25 00
548	"	12	A. J. Bicknell	Books	67 50

Statement—Continued.

No.	Date.		To whom.	For what.	Amount.
549	Nov.	12	W. Parritt	Gas fixtures	$22 00
550	"	12	W. Sim & Bro	Paints	72 75
551	"	12	J. McKinzie	Sand	12 75
552	"	12	A. P. S. Stuart	Expense for laboratory	33 28
553	"	14	W. C. Flagg	Salary Corresponding Secretary	200 00
554	"	14	Republic Insurance Co	Insurance	75 00
555	"	14	J. M Gregory	Incidental expense	34 15
556	"	14	W. Dowell	Painting	50 00
557	"	14	E. Snyder	Petty expense	38 65
558	"	14	T. J. Burrill	Taxidermist's work	8 50
559	"	14	T. S. Hubbard	Two kegs nails	10 00
560	"	21	Patrick Lamb	Wages to date	28 00
561	"	21	J. T. Wier	Plastering	87 50
562	"	21	D. Owens	Mason work	26 17
563	"	21	G. Eli	Blacksmithing	13 40
564	"	21	State Journal Company	Printing catalogues	700 00
565	"	21	C. G Larned	Hardware	363 45
566	"	23	J. M. Gregory	Salary, November	333 33
567	"	23	George Eli	Four iron rods	49 40
568	"	23	Chaddon & Hesse	Windows, transoms	38 00
569	"	23	Edgar Sanders	Bulbs	6 00
570	"	25	Storrs, Harrison & Co	Assorted grape vines	53 25
571	"	25	Fuller, Finch & Fuller	Glass	39 05
572	"	25	J. W. Searfoss	Work on orchards	30 00
573	"	26	S. A. Harvey	Walnut lumber	25 00
574	"	29	Wm. M. Baker	Salary, November	166 66
575	"	30	A. P. S. Stuart	" "	166 66
576	"	30	S. W. Robinson	" "	166 66
577	"	30	H. Roughton	Iron pipes	86 00
578	"	30	S. W. Shattuck	Salary, November	150 00
579	"	30	T. J. Burrill	" "	150 00
580	"	30	E. Snyder	" "	150 00
581	"	30	J. Bellangee	" "	83 33
582	"	30	H. M. Douglass	" "	83 33
583	"	30	H. J. Detmers	" "	100 00
584	"	30	R. B. Warder	" "	50 00
585	"	30	A. Thomson	" "	83 33
586	"	30	I. D. Foulon	" "	50 00
587	"	30	J. S. Searfoss	" "	83 33
588	"	30	H. K. Vickroy	" "	83 33
589	"	30	Thos. Franks	" "	75 00
590	"	30	G. S. Upstone	" "	60 00
591	"	30	" "	Pay and board of hands	163 07
592	Dec.	1	David Dunlap	Work on orchard	30 00
593	"	1	H. M. Clark	Drain tile	59 50
594	"	1	S. A. Harvey	Lumber	64 15
595	"	5	J. T. Wier	Plastering	40 00
596	"	6	Peabody, Ayres & Dean	Iron pipes	339 54
597	"	7	S. W. Robinson	Expenses Mechanical department	20 20
598	"	8	M. L. Dunlap	Expenses to meeting	4 50
599	"	8	" "	Making cider and 3 casks	24 00
600	"	8	E. Snyder	Students labor	618 74
601	"	9	Peabody, Ayres & Dean	Iron pipes	10 35
602	"	10	D. Butterworth	Taxidermic work	50 80
603	"	10	A. S. Barnes & Co	Freight and duties	21 55
604	"	12	M. C. Goltra	Expense to meeting	8 50
605	"	12	J. H. Pickrell	" "	6 45
606	"	12	P. R. Wright	" "	21 00
607	"	12	A. M. Brown	" "	26 40
608	"	13	E. Snyder	Petty expense	45 05
609	"	13	Palmer, Fuller & Co	Sash and windows	36 59

Statement—Continued.

No.	Date.	To whom.	For what.	Amount.
610	Dec. 13	Union Coal Company....	Four cars coal....................	$80 00
611	" 13	Wm. Price	Painting..........................	210 57
612	" 13	L. Kaufmann	Pear and apple stock...............	80 00
613	" 13	Webster, Davies & Co ..	Cement and lime	169 75
614	" 13	Trevitt & Green........	Hardware	281 50
615	" 13	John Fisher	Flower pots	16 22
616	" 13	L. W. Lawrence........	Board expense	23 80
617	" 13	J. M. Gregory	Purchase of cattle	2,308 14
618	" 14	A. Jewell	Expense in buying cattle	15 00
619	" 15	W. Dowell.............	Painting	34 43
620	" 15	W. J. Foote...........	700 brick	7 00
621	" 21	J. M. Gregory.........	Salary, December..................	333 33
622	" 21	W. M. Baker...........	" "	166 66
623	" 21	A. P. S. Stuart.........	" "	166 66
624	" 21	S. W. Robinson	" "	166 66
625	" 21	T. J. Burrill	" "	150 00
626	" 21	S. W. Shattuck.........	" "	150 00
627	" 21	E. Snyder	" "	150 00
628	" 21	J. Bellangee	" "	83 33
629	" 21	H. M. Douglass	" "	83 33
630	" 21	I. D. Foulon	" "	50 00
631	" 21	R. B. Warder	" "	50 00
632	" 21	H. J. Detmers	" "	100 00
633	" 21	J. S. Searfoss	" "	83 33
634	" 21	A. Thomson	" "	83 33
635	" 21	H. K. Vickroy	" "	83 33
636	" 21	Thos. Franks..........	" "	75 00
637	" 21	Dickerson & Collier.....	Carpenter work	668 20
638	" 27	Liverpool Globe Ins. Co..	Insurance.........................	262 50
639	" 31	J. M. Gregory	20 head of cattle	1,243 88
	1871			
640	Jan. 1	G. S. Upstone.........	Farm expense......................	84 30
641	" 3	J. O. Smith	Oak lumber	69 40
642	" 4	Frank M. Snyder.......	Printing labels	5 25
643	" 5	Flynn & Scroggs	" "	29 38
644	" 6	Illinois Central R. R. Co.	Back freights, &c	51 27
645	" 6	E. A. Robinson	Work in shop	41 69
646	" 6	J. T. Wier.............	Work in orchards	27 12
647	" 6	H. T. Williams	Books	60 00
648	" 6	W. Dowell	Painting	15 00
649	" 7	Gaslight Company......	One quarter's gas..................	64 80
650	" 7	E. Snyder	Students' labor	328 28
651	" 9	Avey & Neff...........	Blacksmithing	8 25
652	" 10	G. S. Upstone..........	Salary, December.	60 00
653	" 10	N. C. Ricker...........	Carpenter work	60 65
654	" 10	J Bishop	Platina tube	47 77
655	" 12	Professor J. B. Turner ..	Expense to lecture.................	12 00
656	" 12	Parker Earle	" "	6 00
657	" 12	David M. Ford	Castings	11 25
658	" 12	Larrabee & North.......	Brass and wire.....................	14 89
659	" 12	Dodson & Hodges.......	Hardware	146 19
660	" 12	Flynn & Scroggs	Binding books	119 50
661	" 12	S. S. Bignall...........	Force pumps	20 68
662	" 16	C. G. Larned...........	Hardware	260 28
663	" 19	M. C. Goltra...........	Board of expense...................	10 00
664	" 19	A. M. Brown	" "	25 40
665	" 19	J. H. Pickrell	" "	4 20
666	" 19	L. W. Lawrence........	" "	25 30
667	" 19	P. R. Wright	" "	24 00
668	" 20	L. A. Parks & Co	Printing for lectures	32 25
669	" 20	Union Coal Company ...	Four cars coal	80 00

Statement—Continued.

No.	Date.	To whom.	For what.	Amount.
670	Jan. 20	Walker Bros	Mouldings	$36 90
671	" 20	Chaddon & Hesse	Sash and doors	10 50
672	" 20	Fuller, Finch & Fuller	Paint and glass	98 14
673	" 20	J. J. Clark	12 hogs	121 20
674	" 20	L. C. Garwood	Keys and waste basket	6 55
675	" 20	George Eli	Blacksmithing	17 35
676	" 20	J. M. Gregory	Sundry expenses	25 45
677	" 20	A. P. S. Stuart	" "	17 24
678	" 20	E. Snyder	" "	7 52
679	" 20	O. D. Wellmann	Farm work	11 54
680	" 20	J. S. Searfoss	Pay of hands at barn	11 28
981	" 20	Dr. E. S. Hull	Lecture	250 00
682	" 20	B. J. Jillson	Lecture expense	28 00
683	" 21	B. J. Jillson	" "	2 00
684	" 21	Wm. Kennedy	Gravel	4 80
685	" 21	J. A. Henderson	Gutters, gardener's barn	17 00
686	" 30	S. E. Lane	Plastering	4 50
687	" 31	J. F. Luhme & Co	Chemicals and apparatus	321 01
688	" 31	A. H. Andrews & Co	50 gross crayons	11 50
689	" 31	J. M. Gregory	Salary, January	333 33
690	" 31	W. M. Baker	" "	166 66
691	" 31	A. P. S. Stuart	" "	166 66
692	" 31	S. W. Robinson	" "	166 66
693	" 31	T. J. Burrill	" "	150 00
694	" 31	S. W. Shattuck	" "	150 00
695	" 31	E. Snyder	" "	150 00
666	" 31	J. Bellangee	" "	83 33
697	" 31	H. M. Douglass	" "	83 33
698	" 31	H. J. Detmers	" "	100 00
699	" 31	R. B. Warder	" "	50 00
700	" 31	I. D. Foulon	" "	50 00
701	" 31	A. Thomson	" "	83 33
702	" 31	H. K. Vickroy	" "	83 33
703	" 31	T. Franks	" "	75 00
704	" 31	J. H. Searfoss	" "	55 56
705	" 31	E. V. Peterson	Wall paper, etc	37 70
706	Feb. 1	G. M. Rice	Farm expense	89 45
707	" 2	N. O. Albert	Work in orchard	16 12
708	" 2	J. T. Wier	" "	27 85
709	" 2	A. Herbert	Digging well	24 00
710	" 2	G. S. Upstone	Board of hands, etc	40 47
711	" 2	G. S. Upstone	Salary, January	60 00
712	" 2	M. Miles	Course of lectures	175 00
713	" 6	Gaslight Company	Gas for January	23 60
714	" 6	M. C. Goltra	Expenses locating land	87 40
715	" 9	L. W. Lawrence	Expenses to meeting	25 10
716	" 9	J. H. Pickrell	" "	10 65
717	" 9	M. C. Goltra	" "	12 00
718	" 9	M. Miles	Course of lectures	451 10
719	" 9	E. Snyder	Students labor	332 31
720	" 15	N. O. Albert	Four hogs	28 00
721	" 15	P. Lochrie	Advertising sales	8 00
722	" 15	Johnson Bogardus	Hay press	151 00
723	" 28	J. M. Gregory	Salary, February	333 37
724	" 28	W. M. Baker	" "	166 74
725	" 28	A. P. S. Stuart	" "	166 74
726	" 28	S. W. Robinson	" "	166 74
727	" 28	T. J. Burrill	" "	150 00
728	" 28	S. W. Shattuck	" "	150 00
729	" 28	E. Snyder	" "	150 00
730	" 28	J. Bellangee	" "	83 37

Statement—Continued.

No.	Date.	To whom.	For what.	Amount.
731	Feb. 28	H. M. Douglass	Salary, February	$83 37
732	" 28	H. J. Detmers	" "	100 00
733	" 28	R. B. Warder	" "	50 00
734	" 28	I. D. Foulon	" "	50 00
735	" 28	A. Thomson	" "	83 37
736	" 28	H. K. Vickroy	" "	83 37
737	" 28	T. Franks	" "	75 00
738	" 28	G. M. Rice	Farm expense	100 88
739	" 28	M. Hollister	One hog	11 70
740	" 28	J. Fisher	Flower pots	30 17
741	" 28	Parks & Herbert	Baling hay	42 00
742	" 28	N. O. Albert	Work in orchard	30 00
743	" 28	Union Coal Company	60 tons of coal	106 00
744	" 28	J. M. Gregory	Petty expense	44 87
745	" 28	E. Snyder	Students' labor	316 19
746	" 28	Ill. Central R. R. donation	Freights for the year	4,605 78
			Total	$78,933 03

The amount paid for students' labor during the year is $3,499 82—divided among the departments as follows:

Farm account	$66 27
Horticultural Department	1,419 53
Mechanical Department	611 22
Library and apparatus	91 26
Building and repairs	74 32
Carpenter shop	600 01
Chemical laboratory	3 40
Steam heating apparatus	118 92
Sundry work	380 79

(Signed,) E. SNYDER.

The report was approved, and referred to the Finance Committee.

Prof. Burrill then read the following

REPORT OF THE HORTICULTURAL DEPARTMENT.

To the Regent of the Industrial University:

During the past year Mr. H. K. Vickroy has remained in charge of the orchards and tree plantations, and has now assumed the charge of the vegetable garden in addition. Mr. Thomas Franks has retained the position of gardener, having in charge the ornamental grounds and green-house. He also had the care of the vegetable garden during the summer. These men have been faithful in the discharge of their duties, and merit the credit due to the practical work of the department. Their further continuance in the respective positions now held by them is hereby recommended. Two men were employed, during the working season, as teamsters, and occasionally a third was engaged for the same kind of work. One only was retained during the winter. The rest of the labor, which in the aggregate amounted to considerable, has been done by the students, who were arranged in classes and under the direction of a foreman worked about two hours each, every suitable day. Not being otherwise engaged upon Saturdays, many worked all day. The student labor problem is not yet however wholly solved. The organization of regular classes and the gradation of pay according to service rendered, are believed to be steps of progress in the solution, for field labor at least; and with the manifest increasing fidelity and efficiency of the students themselves much hope is entertained of an ultimate favorable result. The labor is popular and often very gladly obtained, a few students paying their entire expenses by their work, and all agreeing as to increased health and vigor of body and mind. But the experiment has proved expensive. More, if not better work could have been obtained by hiring ordinary laborers for the money expended. The distance from the University building, the time lost in various ways, the necessity of hand labor where teams might otherwise be employed, the difficulty always growing out of constant changing of forces and kinds of labor, are some of the obstacles encountered. With more system and better supervision these and other things may possibly be avoided, and student labor be made to pay without cutting down the rate per hour. This has been on an average about ten cents, maximum twelve and a-half.

Upon assuming charge of the department I found one horse team valued at $150 and one mule team valued at $357. An additional team of horses was purchased for $250. One horse from the team first mentioned died of lung fever—the loss $75—the others are now in good condition and worth fully as much as they were a year ago. Two students, Messrs. Ricker and Cantrell, constructed for the department of Horticulture a spring wagon, which proves to be as good as the best—cost $140.

In the main, the season was favorable for our crops and work, though the prolonged drouth of the early summer was very trying upon some crops and the newly planted nursery stock and trees.

THE ORCHARD

Has certainly done well. After the hard freeze of October, 1869, the trees were banked with earth, and though the bark has since been found ruptured in some instances, very few have died. Beginning early in the season the necessary pruning has been done and the heads of trees well shaped. In May and June the trunks were washed with soft soap and water or a solution of sal soda and water, with very evident good results. The latter wash seems best. Vacancies and places previously too wet for planting, have been filled from the nursery. The ground has been plowed toward the trees, and the wet places well ridged up for planting this spring. Corn was planted among the trees and the stalks left standing for winter shelter. The caterpillars of the *Datana ministra*, the Cecropia moth and the Hammond Leaf-tyer, have been quite troublesome, but have been closely watched and nearly subdued.

THE NURSERIES

Are in satisfactory condition. Considering the severe drought of the season, a very small per cent. of the young and newly planted trees have been lost. Those that were heavily mulched did the best. Two thousand White Ash seedlings were not received till May 9th, yet they appear to have grown better than any other trees. Mr. Vickroy considers this tree one of the very best for timber plantations; grows rapidly, valuable for many purposes in 10 to 20 years, and exceedingly valuable in older age.

The following trees were received and put in the nursery for the forest tree plantation:

From Samuel Edwards, Lamoille, Ill.:		
Norway Spruce	14,000	
White Pine	8,000	
White Willow cuttings	8,000	
Black Spruce	2,000	
Hemlock	3,000	
Tulip	3,000	
Red Pine	425	
Black Sugar Maple	10,000	
Basswood	4,000	
Robert Douglass & Son, Waukegan, Ill.:		
American Arbor-Vitæ	250	
Red Cedar, (nearly all dead,)	50	
		300
W. A. Nourse, Moline, Ill.:		
White Ash	20,000	
Sugar Maple, (white)	10,000	
White Elms	6,000	
		36,000
Ellwanger & Barry, Rochester, N. Y.:		
Mahaleb Cherry	100	
Auger's Quince	100	
Pear Stocks.	100	
		300

From D. B. Wier, Lacon, Ill.:		
Silver Maples	7,300	
White Ash	600	
		7,900
From Storrs & Harrison, Painesville, Ohio:		
American Chestnut		6,000
Boatman & Co., Champaign, Ill.:		
Osage Orange		4,000
Catalpa--(grown from seed, presented by Hon. W. C. Flagg)		8,000
Total		177,725

Arthur Bryant, Jr., Princeton, Ill.:
3 bbls. Black Walnuts, (seed).
2 " White " "

The total number of trees for forest plantation received, and the seedlings of our own growth, will more than balance the number that have died.

During the winter there have been grafted about 400 varieties of pears, averaging about five grafts each, and about 1,500 pears of standard varieties, also about 10,000 apples of standard varieties. The latter were secured mainly for practice by the students.

SHELTER BELTS.

Received from M. L. Dunlap & Sons, Champaign, Ill., 141 Norway Spruce, for west side of apple orchard.

From F. K. Phœnix, Bloomington, Ill., 170 white pine, for south side of horticultural grounds.

The former have done well, the latter not. Trees were ordered from Albany, N. Y., to set in the vacant tenth rows of the apple orchard, but after considerable delay word was obtained that those of proper size could not be furnished. They were to be Norway Spruce, 2 to 3 feet, and were advertised at $20 per 1,000.

STREET TREES.

From F. K. Phœnix, Bloomington, Ill., 130 white elms. These were set 50 feet apart, 8 feet from hedge, throughout the west side of the Horticulthral grounds, and silver maples planted between, the latter to be finally removed.

SMALL FRUITS.

The only variety of fruit obtained was the Wilson Strawberry, of which we had a fair crop from about half an acre. The plan is to establish if possible a few of a number of varieties of small fruits for experiment, comparison, etc., and then plant on a larger scale a few standard varieties for profit, and by keeping careful accounts, to determine the actual amount realized. For these there have been purchased as follows:

From Purdy & Hance, South Bend, Ind., 11 varieties of grapes, 4 of currants, 14 of raspberries, and 15 of strawberries.

From Elwanger & Barry, Rochester, N. Y., 10 varieties of grapes, 3 of currants, 2 of gooseberries, 4 of raspberries, and 4 of strawberries.

From Storrs, Harrison & Co., Painesville, Ohio, 600 Concord grape vines, 200 Creviling, 100 Delaware, 100 Ives, 50 Clinton, and 50 Catawba, all 1 year old.

VEGETABLE GARDEN.

Crops fair to good, some excellent. The number of varieties of vegetables was great, many of them planted for the purpose of testing the qualities of each, so that considerable information was gained in this particular for future benefit. Financially the experiment was not successful, and probably never can be, excepting with a few crops. For the coming year it is thought best to keep up the large number of varieties, but upon a very small scale, and plant largely of the few paying crops.

Corn—best varieties, from many varieties grown—1, Early Narragansett; planted April 29th; first sold July 15th; 2, Crosby's Early; 3, Stowell's Evergreen.

Cucumbers, best—long green; three varieties planted.

Cabbage—best early varieties; eight varieties grown—1, Early Jersey Wakefield; 2, Early Ox Heart. Best late varieties—1, Marblehead Mammoth; 2, Red Drumhead, (for pickling.)

Carrots—four varieties—Early Scarlet Horn and Early Short Horn, nearly alike, good, early; Improved Orange and Long Orange, similar, good, winter.

Cauliflower—four varities grown—best, Extra Early Dwarf Erfurt. None headed well.

Lettuce—three varieties grown—Early Curled Silesia, best early; Drumhead, best summer.

Musk Melons—five varieties grown—White Japan, earliest, good; Alton Nutmeg, large, very good; Christina, medium early, good.

Water Melons—five varieties grown—Mountain Sweet, best; Joe Johnson, next best.

Egg Plant—New York Improved and Black Pekin; both good, but no market for them.

Parsnips—four varieties grown—Sutton's Student, best. The Turnip Rooted seeded.

Peas—six early varieties grown—Caractus, earliest and best; Early Kent and McLean's Little Gem, second best.

Squash—five varieties grown—Bush Scallop, best early; American Turban, best, late.

Tomatoes—six varieties grown—Alger, Early York and Keyes, all early and good; Gen. Grant, Fegee and Lester's Perfected, all good late varieties.

Many other less important vegetables were grown, with fair success.

A good barn was erected near the gardener's house. Some of the vegetables in the cellar were frozen during the severe weather of December, the thermometer showing 30 degrees below zero on the morning of the 24th.

About acres of the land devoted to the vegetable garden has been underdrained this year, the labor being done by the students. The drains are three to four feet deep, forty feet apart, and run directly down the slope when practical. No collars, nor substitutes for collars, were used with the tile, and upon examination this spring all the drains are found to be in good working order. The good effect is now easily perceived upon the surface..

GREEN HOUSE AND ORNAMENTAL GROUNDS.

In the latter part of summer the grounds in front of the University were all ablaze with showy plants and flowers, tastefully arranged. The trees have done well, and with the addition of others of different varieties, will ultimately make a fine show. The borers have nearly destroyed the silver maples, planted as street trees. About fifty loads of gravel were added to the walks and roads.

The green house has been completed, and pretty well filled with plants. These are largely bedding plants, taken mostly from the grounds last fall. A large number have been propagated from this original stock. Twenty dollars' worth of new varietles were recently purchased from F. K. Phœnix. A collection from the Michigan Agricultural College have just been received, and others are promised. For these we are to send some that we have. Mr. Henry Shaw, of the Botanical Gardens of St. Louis, consented to send a good collection, but owing to adverse circumstances they have not been received. There are now quite a large lot of choice plants in the green house for sale, from which it is hoped to realize enough to pay a large part of the expenses of this division of our horticultural work. Many citizens express themselves gratified with this opportunity of securing plants, and no doubt is entertained of the chance to sell.

DONATIONS.

Charles Downing, Newburgh, N. Y., about 400 varieties of pear scions.

John Deere, Moline, Ill., subsoil plow.

Hovey & Co., Chicago, Ill., lawn mower.

W. C. Flagg, Moro, Ill., apple trees of 41 varieties, fruited by him near Alton, Ill.

M. L. Dunlap & Sons, 2 standard apple trees, and 1 Early Richmond cherry, on its own roots.

Princeton Manufacturing Company, one corn stalk cutter.

Dr. Humphrey, Galesburg, Ill., collection of many varities of apples (fruit).

R. Taylor, Urbana, Ill., 300 currant cuttings.

Mrs. S. T. Chase, Urbana, Ill., 200 gooseberry cuttings.

Respectfully submitted.

T. J. BURRILL.

The Regent read the following—

REPORT FROM THE MECHANICAL DEPARTMENT,

Of the practical work of that Department, from its opening in January, 1870, *to March* 1*st*, 1871.

This statement does not include the work of the carpenter shop, which was already in operation, under the care of Mr. J. S. Searfoss when the Mechanical Department was organized for regular instruction. Shop room was provided by adding a second story to the carpenter shop.

It having been deemed advisable to fit up the machine shop as far as practicable by the labor of the Department itself, the main part of its work for several weeks was employed in the manufacture of a steam engine and other working machinery. Mr. Alexander Thompson was was appointed as Practical Machinist and Foreman, and his time has been devoted chiefly to the work of practical instruction, except when employed in teaching the class in Railroad Engineering.

The following statement will show the expense of fitting up the shops, including tools purchased, materials and cost of labor:

Boiler, pipe and boiler pumps	$360 90
Engine as first started	264 53
Governor and automatic cut off, since put on	61 00
Machinists' lathe and chuck	235 00
Shafting, vises, drills, bellows and anvil	74 46
Saws, chisels, etc. ,etc., to May 1st	198 83

Students' labor	$243 08
Lumber for benches and engine bed	12 56
Grindstone and heater	12 90
Iron work for lathes and saws	100 00
Cost of well	50 00
Piping, belting, etc	23 96
Total cost	$1,637 22

The present estimated value of shop, machinery and appliances which have been added, amounts to $2,480 26.

The estimated value of the materials, models, and unfinished work in shop, the last comprising two thermometer graduation machines, a chronograph, a lawn mower, and several other machines, amounts to $440.

After fitting up the shop, the labor of the department was directed chiefly to the manufacture of models and apparatus for the University itself, and in some cases for other parties. It also gave considerable aid to other departments, making and repairing tools and machinery for the gardens and farms, putting up steam heating apparatus for main building, and making and putting up hot water heating apparatus in the green house.

The apparatus and models made for the University cabinet amount to $425 16. Besides this work, the shop has credits upon various bills for different persons and departments amounting to $899 38. The total credits are $3,644 80.

The total amount paid for machinery and materials of all kinds, up to March 1st, 1871, is $2,364 62.

Amount appropriated to department	$2,400 00
Credit over and above cost	1,280 18
Appropriation minus profits	$1,119 82

(Signed,) S. W. ROBINSON.

Mr. Pearson, as chairman of the Committee on Nominations, reported back as follows:

Your special Committee on the nomination of Standing Committees would respectfully report the following Committees:

Executive.—Regent, J. H. Pickrell, A. M. Brown, E. Cobb, Goltra, Lawrence, Griggs, Pearson, Cunningham.

Agricultural.—Pickrell, Blackburn, Brown of Sangamon, Harrington and Scott.

Horticultural.—A. M. Brown, Pullen, Galusha, Wright and Edwards.

Finance.—Cobb, Hayes, Griggs, Bowen and Scroggs.

Buildings and Grounds.—Goltra, Van Osdel, Cunningham, Greenleaf and Scott.

Auditing.—Lawrence, Wright, Blackburn, Galusha and Mahan.

By-Laws.—Mahan, Pickard and Anderson.

Faculty and Course of Study.—Regent, Bateman, Pickard, Hayes, Slade and Edwards.

Military.—Brayman, Anderson, Scroggs, Wright and Brown of Sangamon.

Library Cabinet.—Bateman, Slade, Griggs, Pullen and Van Osdel.

Mechanical.—Pearson, Greenleaf, Bowen, Harrington and Goltra.

(Signed,) JNO. M. PEARSON,
L. W. LAWRENCE.
J. O. CUNNINGHAM.

The report was accepted and adopted.

The Regent then made a statement of the present prospects of appropriations from the State, and the purposes for which they were designed and given.

On motion, the Board adjourned to meet to-morrow, March 15th, at 9 o'clock A. M.

SECOND DAY'S SESSION—MARCH 15, 1871.

The Board assembled pursuant to adjournment.

Dr. J. M. Gregory read the scriptures, and offered prayer.

The roll was then called.

Present—Messrs. Blackburn, Brown of Pulaski, Brown of Sangamon, Cobb, Cunningham, Edwards, Galusha, Goltra, Griggs, Lawrence, Mahan, Pearson, Pickard, Pickrell, Pullen, Slade, Scroggs, Scott, Van Osdel and the Regent—20.

Absent—Messrs. Anderson, Bateman, Brayman, Greenleaf, Harrington, Hayes, Wright, Johnson, the Governor—9.

On motion of Mr. Brown of Sangamon, the Board took a recess until 1:30 P. M., to inspect the farms and orchards, and give Committees time to meet and report.

AFTERNOON SESSION.

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The Board reassembled at 2:15 P. M., the Regent in the chair.

The report of the Veterinary Surgeon, Dr. J. H. Detmers, was then read:

REPORT OF VETERINARY SURGEON.

The Veterinary Infirmary of the Illinois Industrial University opened January 9, 1871, with four patients, and since that time up to the present date, March 11, ten patients—eight horses, one mule, and one steer—have received feed and treatment in the stable, of which, three horses are yet in treatment. Forty-five other patients, among them one cow, have been brought to the clinic, and have been examined by the students; their diseases and ailments have been discussed and diagnosticated, medicines, where deemed necessary, have been prescribed, several operations have been performed and advice given, so that in all, *fifty five* animals have been examined and treated. These fifty-five patients have been also used more or less for illustrating the lectures on exterior, and in all the discussions especial attention has been paid to the predisposing as well as the exciting causes of the different ailments and diseases, and the means by which the same might have been prevented.

Respecting the treatment, preference has always been given to the most simple rational and effective methods. Complicated and hypothetic treatments have been avoided as much as possible.

The ten patients, treated and kept in the infirmary stable, have received, during the sixty-two days of the existence of the Infirmary, two hundred and twenty-one days feed, which shows an average per diem of three to four patients. The lowest number of patients has been two, and the greatest number five, which is all that can be accommodated.

One steer, suffering with cancer in the superior maxillary bone, has been donated to the University by Mr. Phinney, and has been killed for anatomical purposes.

Deaths have not occurred; but five of the patients have been pronounced incurable, among them the above mentioned steer.

One horse has been presented for examination on account of his behavior like a stallion, and he has been found to be a ridgling.

LIST OF DISEASES.

No.	Diseases.	No. cases	Remarks.
1	Anaemia (general)	1	A cow—better
2	Bronchitis (chronic)	1	Recovered
3	Cancer in superior maxillary	1	The above steer
4	Caries in the nasal cavaties	1	Incurable
5	Catarrh (chronic)	2	Recovered
6	Catarrhalic inflammation of the eye	1	Better
7	Colic	1	Recovered
8	Collar galls	2	Improving
9	Contraction of the flexors of the foot	1	Can be cured only by operation
10	Corrosion of the skin on shoulders	1	Improving
11	Curb	1	Improving
12	Elephantiasis	1	Incurable
13	Cyste in false nostrils	1	Must be extirpated
14	Exostosis on superior maxill-bone	1	Better
15	Fibroid (on lower jaw of a steer)	1	Probably cured
16	Fustula on the withers	6	Cured or better
17	Hoofbound	2	Improving
18	Hoof, part of it torn away by accident	1	Much improving
19	Inflammation of the bag	1	Well
20	Lameness in the flexors of the hoof	2	Cured
21	Periodical ophthalmia	5	Temporarily cured
22	Poll-evil	2	1 cured, 1 improving
23	Polyp in the nose	1	Incurable
24	Rheumatism	2	Recovered
25	Ringbone	1	In treatment
26	Spavin	5	2 improving, 1 not heard from, 2 incurable
27	Strangury	1	Better
28	Stringhalt	1	Well
29	Swelled crest	1	Not known
30	Swelled legs	2	Better
31	Thrush	1	Cured
32	Windgalls	1	Not heard from
33	Worms	2	Recovered

Besides the above named patients brought to the clinic several of my private patients have been visited and examined by the students, and one heifer, belonging to Mr. Oscar Dunlap, at Savoy, has been spayed in the presence of some of the veterinary class.

The whole number of prescriptions written in the clinic, is fifty-five.

(Signed) DR. J. H. DETMERS.

On motion of Mr. Goltra, the Finance Committee were instructed to secure a bond from the Treasurer.

The following resolution of A. M. Brown was adopted as amended:

Resolved, That the general plans for a new University building and the Mechanical Hall, presented at the present session, be approved, and that the Regent be requested to have the said plans revised by a competent architect; and that he also cause careful estimates to be made of the cost of the erection of the buildings, to be submitted to an adjourned session of this meeting to be held on the 12th day of April, 1871, at 3:00 P. M.

Mr. Cunningham offered the following amendment, which was accepted: That the motto, "Learning and Labor," be engraved in relief upon the frize of the portico, as represented in the plans presented by Mr. Van Osdel.

Dr. J. W. Scroggs, Chairman of the Military Committee, made the following report:

Your Committee on Military Department beg leave to respectfully report that the appropriation of $2,000, made at our last meeting, for a Drill Hall, has been found insufficient for the purpose, and $1,600 of it have been appropriated for a steam-heating apparatus in the building, and $400 have been given to the Mechanical Department.

The appropriation of $25,000 from the state funds, now pending, make it unnecessary to ask for any funds in that direction.

The work of the year has been satisfactorily carried on in this department. There has been exhibition drill before several committees of the Legislature, by the University Battalion, and with much credit to that department of instruction.

There is a military band for the battalion, under instruction, which has already attained considerable proficiency.

For continuation of the instruction and expenses connected, and for the purchase of at least one dozen fencing swords, gauntlets and masks, also the cleaning and occasional repair of the 150 stands of arms, we would ask the sum of $300.

For the instruction already given to the University Band, $60 was appropriated from current funds, but owing to the shortness of these, Capt. E. Snyder applied $30 of a fund of $50 for University buttons, etc., to the purpose, and a small amount is yet due the teacher, Mr. I. W. Colberg, of Urbana.

Some instruments were procured for the band from the city of Champaign, and some of the students have instruments of their own.

We earnestly recommend the appropriation of the amount stated, as it is the minimum that will supply the needs of the department:

Forty weekly lessons for band	$160
Twelve fencing swords, gauntlets, etc	96
Cleaning guns and repairs	44
	$300

(Signed,) J. W. SCROGGS,
D. A. BROWN.

The report was accepted, and so much as refers to appropriations referred to the Finance Committee.

Judge A. M. Brown read the

REPORT OF THE COMMITTEE ON HORTICULTURE.

For what has been done in this department during the past year, the committee refer to the Regent's report, and to the statement presented by the Professor of Horticulture. The work for the coming year will consist of the care of the orchard, nursery, garden and ornamental grounds, and the commencement of the forest tree plantations. Your committee recommend some change in the plan adopted by the Board at their meeting held in November, 1868. It is found that a part of the ground designated by that plan for the forest tree plantations will be needed for the experimental farm, and they propose that twenty acres on the east end of the ground, known as the experimental farm, be devoted to the forest, and that the amount of each variety to be planted be suitably reduced, so that the whole will not occupy more than the said twenty acres, leaving the question of extending the planting in another locality for future determination.

As many of the young forest trees now in nursery are of suitable size for transplanting, your committee recommend that as much of this work be done the present spring as the means at command will allow. They recommend that the arrangement of the trees in the plantation, be intrusted to the Professor of Horticulture and Mr. Vickroy, the superintendent of that department—planting with reference to the adaptation of varieties to the different kinds of soil, and not confining the several varieties arbitrarily to squares or rows. They recommend that the cucumber tree be omitted from the plantation, and that not exceeding one-fourth of an acre each be planted of the black sugar maple, silver-leaf maple and catalpa.

Your committee hereby express their approval of what has been done in the collection of different varieties of fruits, both for the orchards and the gardens, and recommend that this be extended as new varieties of promise are brought out. They also approve the recommendations of the Regent and Professor of Horticulture with reference to the vegetable garden.

They also recommend the collection, as rapidly as it can be done without too great expense, of trees and shrubs for the arboretum, which should include, ultimately, every variety of tree and shrub that will flourish in this soil and climate, and especially all kinds that are native to our own State. These trees and shrubs, as collected, may be planted in nursery until the ground intended for their permanent planting can be put in a proper state of preparation.

The committee ask that the remainder of the legislative appropriation to the credit of this department, be appropriated for carrying on the above indicated work, and that further appropriations may be made as they may be needed, by the Executive Committee.

[Signed] A. M. BROWN,
B. PULLEN,
S. EDWARDS,
JNO. M. PEARSON,
O. B. GALUSHA.

Judge Cunningham moved that so much of the report as refers to change of location in forest plantations, be omitted.

The ayes and noes being called for, the vote resulted as follows:

Ayes—Brown of Sangamon, Cunningham, Goltra, Griggs, Lawrence, Pickrell and the Regent—7.

Noes—Blackburn, Brown of Pulaski, Edwards, Galusha, Mahan, Pearson, Pickard, Pullen, Slade, Scroggs and Scott—11.

The motion to accept the report and its recommendations, and refer so much of it as regards appropriations to the Finance Committee, was adopted.

The following resolution of Mr. Pearson was adopted:

Resolved, That Article XII, of the By-Laws of the Board, be amended by adding to the list of standing committees, as follows:

"12. Committee on the state of the Institution, of three members, whose duty it shall be, at stated times in each year, to visit the University and examine thoroughly into the method of teaching in the various departments, and upon the progress of the students and the general efficiency of the discipline, and report to the Board at each meeting."

Messrs. Pickard, Slade and Brown of Sangamon, were appointed as Committee on the state of the Institution.

The report of the Committee on Faculty and Course of Study was read by the chairman, Mr. Pickard, and adopted.

REPORT OF COMMITTEE ON FACULTY, ETC.

The Committee on Faculty and Course of Study would recommend that Professor Shattuck be transferred to the Department of Mathematics, and that Professor Robinson take charge of the Department of Civil Engineering, in addition to his present work; and that in all other matters the appointment and arrangement of teachers be left to the Executive Committee with the recommendations that the three Professorships named in the report of the Regent be filled at the commencement of the next year.

Your committee would further recommend that the requirements for admission, suggested by the Regent, be adopted as soon as practicable.

SAMUEL EDWARDS,
J. M. GREGORY,
JAS. P. SLADE,
J. S. PICKARD.

Mr. Cobb, chairman of the Finance Committee, reported. After being read, the report was recommitted, to be reported back at eight o'clock P. M.

Mr. Goltra reported, verbally, for the Committee on Buildings and Grounds. The buildings were in good repair, and grounds looking well—recommended the usual appropriation for current expenses.

The report was accepted.

The chairman of the Auditing Committee, Judge L. W. Lawrence, made the following

REPORT OF THE AUDITING COMMITTEE.

The Auditing Committee beg leave to report that they have examined the Treasurer's Report and find the same to be correct; that they have examined and canceled warrants numbered from 1, to 746 inclusive, and left them in the hands of the Treasurer for safe keeping.

The committee have also examined the following bills, and recommend that warrants be drawn for their payment, viz:

A. J. Bicknell & Co.	$30 63
North American Review	4 00
Horticulturist	2 50
Scientific American	
T. R. Leal	47 80
F. K. Phoenix	52 85
J. McCorkle	114 83
Journal Printing Company	12 00
Larrabee & North	8 00
Doan House	114 00
Avey & Neff	3 90
Angle & Sabin	4 40
Griggs House	21 00
Dickerson & Collier	31 50
Hovey & Co	12 91
G. S. Upstone	35 12
Trevitt & Green	54 30
Henry Swanell	41 32
E. Snyder	117 71

(Signed,) L. W. LAWRENCE,
O. B. GALUSHA,
I. S. MAHAN,
A. BLACKBURN.

The report was adopted.

Mr. Edwards, on his request, was granted leave of absence.

On motion, the Board adjourned to meet again at half-past seven o'clock P. M.

The Board met according to adjournment.

The chairman of the Finance Committee read the following report, which was voted upon in detail, and adopted:

REPORT OF FINANCE COMMITTEE.

Your Committee on Finance beg leave to report as follows:

It will be remembered that at our last annual meeting, we were instructed, with the Treasurer, to enforce the provisions of a contract then existing with G. F. Lewis, for the sale of 50,080 acres of land scrip at 89½ cents per acre. After considerable correspondence in regard to the matter we received payment as per contract. The committee appointed to locate the balance of our land scrip, report that they have been unable to find suitable locations as yet, but they are of the opinion that there are government lands now being surveyed in Southern Kansas from which we may, during the coming season, be able to make desirable selections. We would recommend that the committee, consisting of Messrs. Goltra and Bunn, be reappointed, and that D. A. Brown, of Sangamon, be added thereto. The amount of scrip to be located is 153 pieces, or 24,480 acres. We also recommend that said committee be requested to keep themselves as well informed as may be in regard to our lands already located, and that when, in their opinion, they can be disposed of at not less than five dollars per acre, that they report the same to the Executive Committee in order that steps may be taken to put them in market, if deemed advisable.

The Treasurer and Chairman of this committee have endeavored, during the past year, to re-invest our six per cent. securities in safe bonds, bearing a larger rate of interest.

We have already arranged and exchanged for $15,000 Champaign county bonds, at 10 per cent. We have delayed investing in bonds issued for railroad purposes, under the act of 1868–9—commonly known as the Railroad Funding Bill—fearing that there might be some question as to their constitutionality, and also that some unfriendly legislation might be made during the present session of our General Assembly. As nothing of the kind has occurred, we now propose to exchange, as soon as possible, for that class of securities where they are issued by our best counties, and their total debt is not excessive. We do not think it wise to invest in town bonds.

During the past year, the Executive Committee, acting upon the order of the full Board at the last annual meeting, contracted or sold 280 acres of the Griggs Farm, at $60 per acre, receiving a small payment down, the balance drawing 8 per cent. interest, payable semi-annually, in advance. We now have a proposition for 40 acres more, which is low and marshy, and not contiguous to a highway, at $55 per acre. The committee recommend the sale, and that Judge J. O. Cunningham be authorized to make all the necessary papers, on the part of this Institution, to consummate this and all other sales that have been made, and deposit said papers with the Treasurer or Regent.

The Bookkeeper's statement, which was referred to this committee, has been examined, and upon comparison with the Treasurer's Report, found to be correct in all essential particulars. Its preparation must have required great care and skill, and we doubt not will be satisfactory to the State Auditor, in the final settlement of our appropriation account for the year 1869–70. We have reason to congratulate ourselves in having in our teaching corps one who is so useful to us in this way.

So much of the Regent's report as was referred to this committee, touching the finances, is in the main concurred in and recommended. The suggestion, however, that the funds for the several departments be kept separate, is, in our opinion, not feasible.

ESTIMATED EXPENDITURES FOR THE NEXT UNIVERSITY YEAR.

Board expenses	$1,200	
Salaries Treasurer and Corresponding Secretary	1,000	
Regent	4,000	
Prof. Baker	2,000	
" Stuart	2,000	
" Robinson	2,000	
" Shattuck	1,800	
" Burrill	1,800	
" Snyder	1,800	
" of Agriculture	2,000	
" Geology and Natural History	1,000	
" History and Social Science	1,000	
Two assistants at $600	12,000	
One assistant	1,000	
Non-resident lecturers	1,000	
Lecturers on Veterinary Science	600	
		$23,200 00
Agricultural department		3,000 00
Horticultural "		1,000 00
Florist, and labor on grounds		900 00
Insurance		400 00
Taxes		2,235 00
Buildings, repairs and care of		1,000 00

Fuel and lights	$1,000 00
Printing, advertising, stationery, etc	1,000 00
Incidentals	2,078 88
Library	1,000 00
Bills not audited	800 00
Safe for Regent and Secretary	100 00
Due on salary account of '69 and '70	800 00
Military department	250 00
Mechanical department	500 00
	$41,263 88

ESTIMATED INCOME:

On bonds	$30,000 00
Interest on land mortgages	1,440 00
Rents	360 00
Farm notes for rents	1,500 00
Matriculation, and other fees	3,500 00
From Agricultural department	3,000 00
Amount in Treasurer's hands	1,626 80
	$41,426 80

The unexpended balance of State appropriations is as follows:

Agricultural department	$686 41
Horticultural "	1,848 12
Chemical "	1,964 05
	$4,498 58

We recommend that the above be appropriated by the Executive Committee to the various departments, from time to time, as needed.

All of which is respectfully submitted,

EMORY COBB,
C. R. GRIGGS.

The report was discussed in detail, and, with slight modifications, adopted.

J. H. Pickrell, chairman of the Committee on Agriculture, made the following

REPORT OF COMMITTEE ON AGRICULTURE.

Your Committee on Agriculture beg leave to report, that after a full examination of the premises, and after a full canvass of the whole matter, they think it is advisable to refer the general management of the farms to the Executive Committee. They approve the arrangement made with E. L. Lawrence, and refer you to the Regent's report for the labor and appropriations of the last year. In relation to Mr.

George Upstone's salary, we find that on the 10th day of December last, Mr. Upstone met with an accident while attending to duties connected with the University, and that his salary has been paid up for January. We recommend that it be paid up to the first of March, and that his house rent be donated to him: *Provided*, that this amount shall be withheld till he may vacate such portions of the dwelling on the stock farm as Mr. E. L. Lawrence may wish to use at once, and full and peaceful possession, as soon as his family can safely be moved. We would further recommend that the bill of Doctors Howard and Martyn, for services rendered Mr. Upstone, be rejected.

J. H. PICKRELL,
JAMES R. SCOTT,
A. BLACKBURN,
D. A. BROWN.

The report was accepted, and the recommendations adopted.

Mr. J. R. Scott moved a reconsideration of the action of the Board on the adoption of the report of the Committee on Horticulture.

Carried.

On motion, the report was recommitted for amendment.

The chairman of the Committee on Horticulture reported back the amended report (see page —,) which was adopted, as amended.

On motion, the Board adjourned to Wednesday, April 12th, 1871.

WEDNESDAY, APRIL 12, 1871.

The Board met at 3 o'clock, P. M., according to adjournment, but no quorum being present, adjourned to meet again on Thursday, April 13th, 1871, at 3 o'clock, P. M. The Recording Secretary was directed to call the absent members of the Board.

THURSDAY, APRIL 13, 1871.

The Board met at 3 o'clock. No quorum present. Adjourned to meet Friday, April 14th, 1871, at 3 o'clock, P. M.

FRIDAY, APRIL 14, 1871.

Board met at 3 o'clock. Adjourned for lack of a quorum, to meet on Saturday, April 15th, at 1 o'clock, P. M.

SATURDAY, APRIL 15, 1871.

The Board met. No quorum present. Adjourned to meet Monday, April 17th, 1871, at 1 o'clock, P. M.

MONDAY, APRIL 17, 1871.

The Board met at 1 o'clock, P. M. There being no quorum present, the meeting adjourned till 9 A. M., Tuesday, April 18th, 1871.

TUESDAY, APRIL 18, 1871.

The Board assembled at the appointed hour, but having no quorum, adjourned to Wednesday, April 19th, 1871, at 1 o'clock, P. M.

WEDNESDAY, APRIL 19, 1871.

Board met at 1 o'clock, P. M. No quorum present, adjourned to meet on Thursday, April 20th, 1871, at 3 o'clock, P. M.

THURSDAY, APRIL 20, 1871.

The board met at 3 o'clock, P. M., agreeable to adjournment, in the Regent's office.

The calling of the roll resulted as follows:

Present—Messrs. Blackburn, Bowen, Brown of Pulaski, Cobb, Cunningham, Edwards, Galusha, Goltra, Griggs, Lawrence, Pearson, Pickrell, Pullen, Pickard, Scroggs, Slade, Scott, VanOsdel, Wright and the Regent—20.

Absent—Messrs. Anderson, Bateman, Brayman, Brown of Sangamon, Greenleaf, Harrington, Hays, Johnson, Mahan, McMurray, Wagner and the Governor—12.

Hon. C. R. Griggs invited the members of the Board to be his guests at the Griggs' House. The invitation was accepted; and, on motion, the Board took a recess until 7 o'clock, P. M.

EVENING SESSION.

The Board assembled at 7:30, P. M.

Scriptures were read by the Regent, and prayer offered by Judge L. W. Lawrence.

The oath of office was administered to the newly appointed members of the Board, Judge J. O. Cunningham and Mr. Bowen, by Judge Lawrence.

Judge Lawrence offered the following resolution, which was adopted:

Resolved, That Judge J. O. Cunningham be requested and instructed to examine the question of the liability of the property in the hands of this Board, in trust, for taxes, which are understood to have been levied, and take such action in the premises as to him may seem necessary.

On motion of Mr. Goltra, the Board proceeded to consider the question of the location of the University building to be erected.

To bring the question directly before the Board, Judge Brown offered the following:

Resolved, That the new University building, to be erected with the proceeds of the appropriation recently made by the Legislature, shall be built upon the crest of the ridge on which the gardener's house now stands, being that part of the University lands lying immediately south of Green street.

In the discussion which followed, Messrs. Scroggs, Blackburn and Scott spoke for the erection of the building upon the present grounds, advocating the purchase of about 24 lots east of the present University grounds. Messrs. Griggs, Lawrence, Brown and others, supported the resolution.

The motion was then put to vote, and resulted as follows:

Ayes—Messrs. Bowen, Brown of Pulaski, Cobb, Cunningham, Edwards, Galusha, Goltra Griggs, Slade, Lawrence, Pickrell, Pullen, Pickard and VanOsdel—14.

Noes—Messrs. Blackburn, Wright, Pearson, Scroggs and Scott.

Mr. Pearson rose to explain his vote. He voted "No" because he thought the building under consideration should be located upon the Experimental farm.

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

Resolved, That the location of the Mechanical buildings and Drill Hall, connected with this University, be entrusted to the Executive Committee.

Mr. Cobb moved the following:

Resolved, That, in accordance with the act of appropriation, passed by the General Assembly of the State of Illinois, and approved April ——, appropriating for Chemical, Horticultural and Agricultural departments, and for books and apparatus, an amount of $25,000, the Treasurer be authorized to draw said sums, from time to time, and that the Regent and Recording Secretary be requested to furnish such certificates as he may require.

The ayes and noes being called on Mr. Cobb's resolution, the vote resulted in—

Ayes—Messrs. Blackburn, Bowen, Brown of Pulaski, Cobb, Cunningham, Edwards, Galusha, Goltra, Griggs, Lawrence, Pearson, Pickrell, Pullen, Pickard, Slade, Scroggs, Scott, Van Osdel, Wright and the Regent—20.

Noes—0.

It was moved and carried that the plans and specifications of the new University building, prepared by Mr. Van Osdel, of Chicago, be acted upon by the Board.

Mr. Van Osdel exhibited the plans, and read the estimates, amounting to $143,700.

The plans were adopted by the following vote:

Ayes—Messrs. Blackburn, Bowen, Brown of Pulaski, Cobb, Cunningham, Edwards, Galusha, Goltra, Griggs, Lawrence, Pearson, Pickrell, Pullen, Pickard, Scott, Slade, Van Osdel, Wright and the Regent—19.

Noes—0.

The specifications were referred to the Committee on Buildings and Grounds, with instruction to report at 10 o'clock A. M. to-morrow.

On motion, Mr. Griggs was added to the Building Committee to inspect the plans before it.

The plans and specifications of the Mechanical building were considered, and referred to the Building Committee, to be reported back to-morrow.

The motion instructing the Building Committee to report to-morrow, was reconsidered, and the committee was requested to report immediately.

The Committee on Buildings and Grounds reported back the plans and specifications referred to them, without alteration.

On motion, Mr. Van Osdel was requested to read the specifications of the University building in full.

It was moved that the specifications read by Mr. Van Osdel, be adopted.

The vote was taken by ayes and noes, as follows:

Ayes—Messrs. Blackburn, Brown, Bown of Pulaski, Wright, Cobb, Cunningham, Edwards, Galusha, Griggs, Slade, Lawrence, Pearson, Pullen, Pickrell, Pickard, Scott, Van Osdel, Goltra, and the Regent—19.

Noes—0.

Judge Brown offered the following:

Resolved, That the plans of Drill Hall and Mechanical Building, presented to the Board, be approved and adopted, except that the end elevation shall be altered to correspond with the side elevation; and that the said plans be referred to Mr. Van Osdel, with directions to make said alterations before the same are placed in the hands of the Governor.

Resolved, also, That the specifications and estimates for said building, be approved, but that they be referred to Mr. Van Osdel, to be put in better form before they are presented to the Governor.

The resolutions of Judge Brown were adopted by the following vote:

Ayes—Messrs. Blackburn, Bowen, Brown of Pulaski, Cobb, Cunningham, Edwards, Galusha, Goltra, Griggs, Slade, Lawrence, Pearson, Pickrell, Pullen, Pickard, Scott, Van Osdel, Wright, and the Regent—19.

Noes—0.

Mr. Pearson offered the following:

Resolved, That Section 1 of Article III, of the By-laws for the government of the Board, be amended, by adding to said section the following: "*Provided*, that every motion, or resolution, contemplating any disbursement from the funds of the University, shall either emanate from or be referred to some standing committee, before final action thereon."

The resolution was adopted.

Mr. Pearson also moved that the Recording Secretary be instructed to have the by-laws and lists of the Standing Committees printed on cards for the use of the Board.

Carried.

Judge Cunningham moved, and it was voted, that the Regent receive bids for the erection of the buildings agreed upon, and that such bids be reported to the Executive Committee on the third Wednesday in May, for its approval.

On motion of Mr. Pickard, the Secretary was instructed to furnish transcripts of the action of the Board upon the plans and specifications of the new buildings, to accompany the plans when sent to the Governor.

On motion, it was voted that the vouchers for money drawn from the State appropriations, be first audited and signed by the Executive Committee, and then sent to the other members of the Board for their signatures.

The Board then adjourned.

MINUTES OF MEETINGS OF THE EXECUTIVE COMMITTEE, 1870-71.

FRIDAY, AUGUST 26, 1870.

The Executive Committee met pursuant to call, in the Regent's office, at the Illinois Industrial University, at 3:30 P. M., Dr. Gregory in the chair.

Present—Messrs. Brown, Goltra, Griggs, Lawrence, Pickrell and Wright. Messrs. Cobb and Cunningham arriving after a short time.

The minutes of last meeting were read and approved.

The Regent then read the report of the Professor of the Mechanical Department, giving account of work done and articles manufactured—and also gave a brief verbal report of the progress of the work on the University farm—and the contemplated alterations in the building. Dr. Gregory, as chairman of a committee to negotiate with Professor Miles, of Michigan, for the chair of Agriculture, stated that Professor Miles had declined, but that he had entered into negotiations with several persons, qualified for that chair. These reports were accepted.

The Regent then stated that, according to instructions, he had thoroughly advertised the opening of the University for the next year.

The report of the Bookkeeper was then read and approved, and an amount of $98 73, for petty expenses, disbursed by him, was allowed.

A number of bills was then audited and approved.

On motion, it was ordered that gas fixtures be put in the rooms of the Literary Societies.

On motion of Mr. Goltra, the Regent, Judge Cunningham, and Hon. C. R. Griggs, were appointed a committee to have the University building furnished with a steam-heating apparatus, to warm all public rooms and offices, and $2,000 were appropriated for the purpose.

The financial statement of expenditures, from March 12, to August 25, 1870, was then read and approved.

Statement of State and Current Appropriations and the Expenditures therefrom, till August 25, 1870.

Current Appropriations.	Appropriation made Mar. 11, 1870	Expended to date.
Deficit of 1869 and 1870	$1,728 00	....
Salaries	20,000 00	$10,676 24
Board expenses	1,000 00	671 61
Salary of Corresponding Secretary and Treasurer	1,000 00	970 00
Taxes on lands	1,500 00	....
Fuel and lights	1,000 00	439 30
Printing, stationery, etc	1,000 00	194 05
Building and repairs	1,000 00	175 14
Incidental expense	1,000 00	535 07
Drill Hall	2,000 00	....
Mechanical Department	1,000 00	388 87
Farm labor	1,000 00	1,340 44
Three fire extinguishers	225 00	132 05
Insurance	400 00	....
Audited accounts	500 00	482 87
State Appropriations:		
Carpenters account, chargeable to State appropriation	....	$1,073 41
Agricultural Department	$25,000 00	7,479 94
Horticultural Department	20,000 00	10,279 48
Books and apparatus	10,000 00	8,686 10
Chemical Laboratory	5,000 00	1,442 88
Total State appropriation expended		$28,961 81
Total Current appropriation expended	....	15,873 59
Balance	....	$18,479 41
Total State appropriations	....	$60,000 00
Expended in 1869	$14,570 53	
" to August 25, 1870	14,391 28	
		28,961 81
Balance	....	$31,038 19

E. SNYDER,
Book-keeper.

Judge J. O. Cunningham offered the following resolution :

WHEREAS the Trustees have already recognized the right of females to admission to this University; and, whereas, the public sentiment of the State seems to require an early fulfillment of the promise made by the resolution of the Trustees; and, whereas, the other leading Universities of this country have provided for the instruction of females; and, whereas, a number of young ladies have already made application for admission here; and, whereas, though our buildings are inadequate to the demand that will thus be made upon them, and though we have no rooms to offer for the special convenience of female students, and no special courses organized for them, we confidently look to the wisdom and generosity of the State, to assist us in our efforts to meet the public demand, made so imperative upon us; therefore, be it

Resolved, That the Regent and faculty be authorized to admit to the classes of this institution for instruction, such female students of proper qualifications, as may apply; provided they be first satisfied that the parents and guardians have provided for them proper homes.

After considerable discussion, the vote was called for, resulting as follows:

Ayes—Messrs. Brown, Cunningham, Pickrell, Wright, and the Regent—5.

Noes—Messrs. Cobb, Goltra, Griggs, and Lawrence—4.

On motion, the Board took a recess to the call of the chair.

The Committee met again at 7:30 P. M.

On motion of Mr. Pickrell, it was voted that an appropriation of twenty dollars be made from the Library fund, to be expended by Dr. Detmers in procuring additional books on Veterinary Surgery for the University.

A further appropriation of $1,000 was then voted for the Farm Account, and, on motion of Judge Cunningham, an exchange of lots in the southwest quarter of section 7, township 19, range 9, was agreed upon as desirable, and the Regent instructed to execute and deliver to Jane Hubbard the deed of a lot belonging to the University, upon the said Jane Hubbard executing and delivering to the University the deed of the lot belonging to her.

On motion of Judge Cunningham, a committee of three, Judge Brown, Messrs. Cobb and Pickrell, was appointed by the chair to report at the next meeting on the contemplated sale of a certain part of the Griggs farm.

On motion, Judge Cunningham was continued a committee for renting and collection of rents of the Griggs farm.

On motion of Hon. C. R. Griggs, the employment of a competent head farmer, until the chair of Professor of Agriculture would be filled, was referred to a committee, consisting of the Regent, Messrs. Pickrell and Goltra.

On motion, it was voted that tuition in this University be free.

Judge Cunningham moved that the question of the arrangement and work in gardens and orchards, and the employment of foremen there, be referred to the Regent and Prof. T. J. Burrill.

Carried.

On motion, Dr. Gregory was authorized to use one recitation room for a Preparatory Department.

The Committee then adjourned to meet again on Friday, September 23, 1870, at 3 o'clock P. M.

FRIDAY, SEPTEMBER 23, 1870.

The committee met at the Regent's office on Friday, September 23, 1870, at 4:30 P. M.

Present—Messrs. Brown, Cunningham, Cobb, Pickrell and Regent.

Absent—Messrs. Goltra, Griggs, Lawrence and Wright.

The committee on employment of a Farm Superintendent and foreman of orchards and gardens, reported and were discharged.

On motion of Mr. Pickrell, it was voted, that the lands of the University be divided into three departments:

1st. The Stock Farm.

2d. The Experimental Farm, with the gardens, nurseries and orchards.

3d. The Ornamental Grounds and Greenhouses; and that hereafter a foreman be employed for each.

On motion of Judge Brown it was decided that the compensation of the foremen of Stock and Experimental farms be fixed at $60 per month, that they be furnished a house, the use of one cow, and garden vegetables for the use of their families; provided that they be required to board hands employed on the farm in their departments at reasonable rates, and provided further that each employment commence the 1st of March in each year, and continue one year, unless sooner discharged.

The compensation of Mr. Franks, the gardener, was continued at $75 per month to the 1st of March, 1871.

On motion, it was further resolved, that foremen and superintendents be required to reside on their grounds.

On motion of Judge Cunningham, a sidewalk was ordered to be constructed in front of the lots on the south side of Springfield road and on the east and south side of the University Grounds.

It was further decided to inclose the yard south of the Mechanical shops with a tight board fence.

The following rules for the compensation of students' labor, were adopted:

I. As far as practicable, students wishing to labor shall be arranged in classes and assigned to the several departments *each month*, and such classes shall be governed by the same rules in regard to attendance as other University exercises.

II. The wages per hour shall be eight (8) cents, but may vary below this to nothing, and above to twelve and one-half ($12\frac{1}{2}$) cents, according to the efficiency and faithfulness of the student. To receive the highest price he must be fully competent to do the work and must be faithful in its performance.

III. The price per hour of work for each student shall be fixed by the Committee of the Faculty upon students' labor, at least one day before each monthly payment.

IV. Each Professor, with concurrence of the Regent, shall have the direction and control of the labor assigned to his department.

V. Efforts shall be made to furnish labor to all students asking for it, but nothing contained in these rules shall be so construed as to oblige any department to furnish labor when the interest of said department does not warrant it, neither shall students be prohibited from working in special cases by the piece or job.

The committee on sale of certain parts of the Griggs farm, reported as follows:

To the Executive Committee :

The committee appointed at the August meeting to consider the propriety of selling the northwest quarter of the northeast quarter of section 21, township 19, range 9—a part of the Griggs farm—to C. R. Griggs, report that they have examined the land and considered the subject, and recommend that the sale be made at the rate of $60 per acre, reserving, however, the right of way from the county road to the forty acre tract adjoining the foregoing on the east.

Respectfully,
A. M. BROWN,
EMORY COBB,
J. H. PICKRELL.

To the Executive Committee :

The undersigned, sub-committee appointed to sell the Griggs farm, would report that they have bargained to Christopher and William Burnett, the southeast quarter, section 21, at $60 per acre, and the south half southwest quarter, section 21, at $60 per acre, to Geo. W. Burton, upon condition that all deferred payments on the same bear 8 per cent per annum, payable semi-annually in advance.

Respectfully,
C. R. GRIGGS,
J. O. CUNNINGHAM.

These reports were adopted and approved.

The report of the Bookkeeper was then read and accepted, and an amount of $90 61 of petty expenses was audited and ordered to be paid.

A bill of Fuller, Finch & Fuller, for paints—$48 17—was allowed, and an account of Johnson, Huntley & Co. for a reaper was laid over until next meeting.

On a report of Prof. E. Snyder, two dozen of fencing swords were ordered to be bought, and $25 appropriated for the purpose.

On motion of Judge Brown, Messrs. Pickrell and Cobb were appointed a committee to purchase four car loads of stock cattle, to be paid for from the funds set aside for stock purchases.

The Regent was authorized to have last year's agricultural and scientific periodicals bound, and such other binding done as may be necessary in the University Library.

Dr. J. M. Gregory and Prof. T. J. Burrill, were authorized to employ foremen on farms and orchards.

The Committee then adjourned to meet again on Wednesday, November 2, 1870.

THURSDAY, NOVEMBER 10, 1870.

The Executive Committee met at the Regent's office, on Thursday, November 10th, 1870, at 6:30 P. M., Dr. Gregory in the chair.

Present — Messrs. Brown, Cobb, Goltra, Lawrence, Pickrell and Wright.

Absent—Messrs. Cunningham and Griggs.

The Regent read the report of Prof. S. W. Robinson, of the Mechanical Department, of the work and cost of the shop, and also his statement of the cost of the steam-heating apparatus put into the building under his direction. Total cost of material, freights, etc., $1,469 83.

The work was entirely done by the students of the Mechanical Department, and, on recommendation, the committee allowed a compensation of $100 for the work, to be adjusted by the Regent and Professor.

It was further voted that the unexpended amount of $400 from the appropriation made for the steam-heating apparatus, should be assigned to the Mechanical Department, to be expended in the manufacturing of models and apparatus for that department.

Dr. Gregory then read the report of Prof. Burrill, of the Horticultural Department, of the state of orchards and work done there, reporting also a number of donations of flowers, plants and trees for the department.

The report was accepted.

The Bookkeeper's statement of expenditures to date was then read and approved; an amount of $38 56, expended by him from the contingent fund, was audited and ordered to be reimbursed.

The bills presented for payment were then audited and allowed.

On motion, Dr. J. M. Gregory and Hon. W. C. Flagg were appointed a committee and authorized to arrange courses of lectures at Pekin, Cobden and some point to be selected in the northern part of the State.

It was further resolved that the Regent be authorized to engage Dr. Hull to give a course of lectures on Horticulture and Dr. Miles to give a course of lectures on Agriculture during the winter term.

On motion, it was decided that the sum of $400 be appropriated for the payment of insurance premiums, and that the Regent and Judge J. O. Cunningham be a committee to arrange the insurance on the various buildings as they may judge most proper.

The Regent then read a petition signed by 16 students, who, being provided with brass instruments, asked for instruction in music that they might act as a military band to the University Battalion.

After deliberation, the amount of $60 was granted for such instruction.

The meeting then adjourned, to reassemble on Monday, December 12th, 1870, at 3 o'clock P. M.

MONDAY, DECEMBER 12, 1870.

The Executive Committee met at three o'clock P. M., December 12, and proceeded to visit and inspect the University farm and gardens.

Present—Messrs. Brown, Cunningham, Goltra, Pickrell and Wright.

Absent—Messrs. Cobb and Griggs.

At 6.30 P. M., the Committee went into session at the Regent's office. It was decided that the reading of minutes of last meeting be dispensed with.

The following resolution of Judge A. M. Brown was adopted:

WHEREAS, Mr. A. C. Burnham has offered to sell to the University, bonds of the county of Champaign to the amount of $6,800, at par, and bonds of the township of Champaign, in said county, to the amount of $2,000, at the rate of 97½ per cent; and, also, bonds of Blue Ridge Township, in Piatt county, to the amount of $29,000, at the rate of 92½ per cent.; therefore,

Resolved, That the Regent, Treasurer and Chairman of the Finance Committee be, and they are hereby, authorized to purchase said bonds, or any part of them, if they are satisfied said bonds are secure.

The Regent then made a verbal report of the work carried on in the different departments.

In the Horticultural Department, drainage of a part of the Experimental grounds was continued. The heating apparatus was being put in the newly-erected greenhouse, by the students of the Mechanical Department, under direction of their Professor.

On the farm the work of the season was going on; 40 head of cattle having been bought lately for feeding purposes. In the building the services of a janitor have been dispensed with, and the work divided among the students. This method is giving full satisfaction.

The Regent then read a report made by him to the Governor, on the work of the University, and the contemplated wants for the next two years.

The report was approved. The general plans and suggestions of the Regent in regard to new buildings, were approved, and he was authorized to consult an architect and procure plans and drawings of them.

The financial statement of the Bookkeeper, of the expenditures and collections, was read and approved. Bills presented for payment were audited and ordered to be paid. Also an amount of $45 05 disbursed from the Contingent fund.

The bill of the "Illinois State Journal Company" for printing catalogues for the past two years, amounting to $786 14, was referred to the Hon. W. C. Flagg, the Treasurer, J. W. Bunn, Esq., and Mr. J. H. Pickrell.

The amount of $2,308 14, expended for the purchase of 40 head of stock cattle, was audited, and a warrant ordered to be drawn for the amount.

It was further decided, that twenty more young cattle be bought at the same prices.

The Regent was authorized to procure rope ladders, reaching the fifth story of the building, for use in case of fire.

On motion, certain surplus horses were ordered to be sold.

The following resolutions were then adopted:

Resolved, That the establishment of Agricultural Experiment Stations, such as conducted by Laws C. Gilbert, in England, and as those which have been established in such numbers, and have wrought so much good in Germany and France, is, in our opinion, vital to the agricultural advancement of our State.

Resolved, That we heartily concur in the petition to the Legislature to provide means for the establishment and care of such stations.

A petition having been presented by a number of the students for a course of lectures on English literature during the Winter Term, it was decided that, as other lectures had been provided for that term to the full extent of means, the request would be considered at some future time.

The meeting then adjourned, to meet again at the call of the Regent.

THURSDAY, JANUARY 19, 1871.

The Executive Committee met on Thursday, January 19, 1871, at 3 o'clock, P. M., pursuant to call of the Regent.

Present—Messrs. Brown, Cunningham, Goltra, Lawrence, Pickrell, Wright and the Regent.

Absent—Messrs. Cobb and Griggs.

The reading of the minutes of the last meeting was dispensed with.

The Regent made a verbal report on the work carried on in the various departments.

The sickness of the head farmer, Mr. G. S. Upstone, had necessitated the engagement of Mr. G. M. Rice, of Champaign, who being present, gave a statement of the work on the farm, and also concerning the stabling, feeding, and present condition of the cattle and hogs recently purchased.

In the Horticultural Department, grafting was in progress. Four hundred scions, of leading varieties, had been received from Mr. Chas. Downing, N. Y., and quite a number from Hon. W. C. Flagg, of Alton. Preparations for the spring work were being made.

One of the horses ordered to be sold at the last meeting had since died.

The heating apparatus in the new green-house has been completed, and is in full and satisfactory operation.

In the Mechanical Department, desks for eighteen students in the Chemical Laboratory had been made. Two large cabinet cases for the reception of zoological specimens and philosophical apparatus, are nearly completed. A thermometer graduating machine for an eastern manufacturing establishment, had been constructed, for which $150 were received.

The winter term of the current year had been entered upon with an increase of twenty-seven new students, and the lecture season of two weeks is closing to-morrow.

A clinic for the treatment of sick animals was established under the direction of Dr. H. J. Detmers, Veterinary Surgeon, using for that purpose the old stable south of the shops, and a class of twenty-six students were receiving instruction in the diagnosis and treatment of diseases.

The report of the Bookkeeper of the expenditures since last meeting was then read and approved; expenditures to the amount of $7 52 in excess of the contingent fund was allowed.

The bills presented for payment were then audited.

The Regent, as chairman of a committee on insurance, reported that the University Building had been insured in the Liverpool Globe Insurance Company for $35,000, at three-quarter per cent.

Dr. Gregory reported that rope ladders for fire-escapes had not yet been purchased, and recommended iron steps instead. The matter was referred to him and Prof. S. W. Robinson, with power to act.

The action of the Regent purchasing twelve hogs to follow the herd of cattle, was approved, and authority given to purchase more if needed.

The chairman of a committee on the employment of a superintendent on the farm, made a verbal report, giving names of several applicants. After a brief discussion, Judge J. O. Cunningham was added to the committee, and they were instructed to select and appoint such superintendent.

On motion, the cost of house built east of the orchard was transferred from the Agricultural to the Horticultural appropriation. It was decided that the rent of that house (now occupied by Prof. T. J. Burrill) be fixed at $150 per annum.

The Bookkeeper was instructed to credit the Mechanical Department for all their earnings, and the work done for other departments.

The meeting then took a recess.

Re-assembled at 9 o'clock, P. M., after attending the evening lecture of Prof. Miles.

It was moved and carried that a committee, consisting of the Regent, Messrs. Cobb, Cunningham and Goltra, be appointed to prepare a memorial on the wants of the institution, and submit the same to the Legislature in session.

It was also moved that the Regent be directed to dispense with the services of the carpenter, and any other employee whose services are not needed.

An account of Judge J. O. Cunningham, for sundry expenses, was referred to the Regent to be audited and allowed.

The Committee adjourned to meet at the call of the Regent.

WEDNESDAY, FEBRUARY 8, 1871.

The Committee met at the call of the Regent.

Present—Messrs. Cunningham, Goltra, Lawrence, Pickrell, the Regent.

The Regent reported that the sub-committee charged with the duty of employing a head farmer, had tendered the appointment to Mr. E. L. Lawrence, of Boone county, and it had been accepted. The terms of the engagement were indorsed by the Committee.

The following resolutions offered by Mr. Goltra, were adopted:

Resolved, That the thanks of the Committee are due and are hereby tendered to Mr. G. M. Rice, for his efficient services rendered at an extreme emergency, as foreman upon the farm.

Resolved, That the thanks of the Committee are likewise tendered to Mr. G. S. Upstone for his long and faithful services; and likewise the sympathy of the Committee is tendered him in his affliction, brought upon him by the breaking of his limb while in the service of the University.

Adjourned.

FRIDAY, APRIL 21, 1871.

The Executive Committee met after the adjournment of the full Board, at 1 o'clock, A. M., April 21, 1871.

It was moved that the question of the engagement of the Hon. W. C. Flagg as Superintendent of Experiments, on the grounds known as the Experimental Farm, be referred to a committee consisting of the Regent, Judge Cunningham and Hon. C. R. Griggs.

The Regent, as chairman of a committee appointed for the purpose, made a report on the salary of Orchardist, Mr. Vickroy, recommending that he be allowed $1,000, and charged $100 for rent of house. The recommendations were adopted, and it was further voted that he be allowed the use of one cow and pasture for same.

The question of engaging Dr. H. J. Detmers as Veterinary Lecturer for the next academic year, was referred to the Regent, Messrs. Cobb and Pickrell, with instruction to report at next meeting.

The proposition of the sale of stock cattle, and an exchange of horses, by Farm Superintendent Mr. Lawrence, was referred to Mr. Pickrell, chairman of the Farm Committee, with power to act.

The Regent was authorized to procure engravings of the new buildings and green-house, for the next catalogue.

It was voted that the Regent be authorized to make, with the concurrence of the Faculty, purchases of books from the Library Fund. (Current appropriations.)

The Committee adjourned to meet on the first Wednesday in June, 1871.

WEDNESDAY JUNE 7, 1871.

The Committee met on Wednesday, June 7th, 1871, at 9 o'clock, A. M., in the Regent's office.

Present—Messrs. Brown, Cunningham, Cobb, Lawrence, Pickrell, Pearson, Goltra and the Regent.

The reading of the minutes of the last meeting was dispensed with.

Upon recommendation of the Faculty, the Committee granted certificates of scholarship to the following students:

Messrs. Jared Teeple, Elgin; Isaac S. Raymond, Champaign; Henry L. Town, Batavia; James A. Williams, Urbana; Elvan F. Moore, Tolono; Samuel W. White, Paxton; Robert H. Hazlett, Springfield; Edwin B. Hazard, Lyndon; Edgar Sawyer, Tiskilwa.

Mr. J. M. Van Osdel was invited to sit and deliberate with the Committee in this session.

The Committee then took a recess to attend the commencement exercises, and re-assemble at 1:30, P. M.

The Committee met at 1:30, P. M.

The Regent made a verbal report on the plans, bids and proposals for the buildings to be erected, stating that the approval of the Governor had been obtained, and a number of bids received.

The Committee, thereupon, proceeded to open all the bids received.

On motion, the proposals were referred to a committee consisting of Messrs. Van Osdel, Cobb and Goltra, with direction to arrange these proposals, and report.

The Committee adjourned then, to meet again at 5 P. M., to attend the exhibition drill of the University Battalion.

EVENING SESSION.

Committee assembled at 5 o'clock, P. M.

Mr. J. M. Van Osdel made his report on bids, as chairman of appointed committee, as follows:

To the Executive Committee of the Industrial University:

Your Committee, to whom were referred the bids for classification, etc., would respectfully report as follows:

BIDS FOR UNIVERSITY BUILDING.

J. A. Glover	Chicago	Plastering	$11,300 00
Fowler & Carr	“	Carpentry	73,392 00
William Sollitt	“	“	55,400 00
A. Grannis	“	“	51,760 00
Allen & Bartlett	“	“	62,840 00
J. W. Smith	“	“	59,990 00
J. W. Smith	“	Complete, but cut stone	122,895 00
Peter Neu & Co	“	Cut stone	8,415 00
W. C. Deakman	“	“	9,295 00
Cavanagh, Merriman & Co	“	“	11,800 00
J. L. Bassett	“	Gas fitting	654 00
E. Price	“	Mason work	62,995 00
R. Jones	“	Painting and glazing	3,962 00
Holmes, Pyatt & Co	“	Iron work	6,480 00
N. S. Bouton & Co	“	“	6,400 00
L. H. Boldenweck	“	Cut stone	10,500 00
Joseph Hogan	“	Plumbing	545 00
J. Irons	“	“	800 00
J. Irons	“	Gas fitting	450 00
E. McFarland	“	Tin, copper and slate	5,164 00
E. Gehlman	Springfield	Complete	113,954 00
Fitzhugh & Rhodes	“	“	114,230 40
Bloomington Manufact'g Co.	Bloomington	“	130 000 00
Hopping & Ridgely	Springfield	“	130,781 00
N. C. Terrell	Kankakee	“	116,589 00

BIDS FOR MECHANICAL AND MILITARY BUILDING.

Fowler & Carr	Chicago	Carpentry	$10,165 00
William Sollitt	“	“	13,059 00
A. Grannis	“	“	10,807 00
Allen & Bartlett	“	“	14,200 00
J. W. Smith	“	“	11,550 00
J. W. Smith	“	Complete	21,200 00
E. Price	“	Masonry	9,650 00
R. Jones	“	Painting and glazing	715 00
N. S. Bouton & Co	“	Iron work	400 00
E. McFarland	“	Tin work	1,131 00
Tobias & Besore	Urbana	Complete	20,000 00
W. S. McWilliams	“	“	19,500 00
Swayze & Arthur	Champaign	“	19,000 00
Walker Bros	“	“	24,300 00
E. Gehlman	Springfield	“	16,361 00
Fitzhugh & Rhodes	“	“	21,692 00
Bloomington Manufact'g Co.	Bloomington	“	22,000 00
N. C. Terrell	Kankakee	“	24,155 00
Heafer & McGregor	Bloomington	Masonry	45,000 00

MISCELLANEOUS BIDS.

Bloomington Manufact'g Co.	Bloomington...	Both buildings	$149,900 00
R. Greenler	" ...	"	151,000 00
N. C. Terrell..............	Kankakee	"	143,744 00
R. Peacock...............	Champaign	Lumber, sash and doors	6,502 00
Wilson Dowell............	"	Painting, glazing, glass and putty to be furnished	1,900 00
Wilson Dowell............	Champaign	do. on Drill Hall.....	700 00
D. Wicks	....	Hauling lumber, 75 cts. per M., stone $4 50 per car....	....
J. Bellangee..............	....	Hauling lumber, 75 cts. per M., stone $4 60 per car; lime, 6 cts per bbl.; cement, 7 cts. per bbl	....

From the above figures, it appears that E. Gehlman is the lowest bidder for both buildings: On University Building, $113,954; on Drill Hall, $16,361. Next lowest on the University Building, Fitzhugh & Rhodes, $114,230 40; on Drill Hall, Swayze & Arthur, $19,000; 3d on University Building, $116,589; 3d on Drill Hall, W. S. McWilliams, $19,500.

The lowest bid for the several parts aggregated $119,262.

J. M. VAN OSDEL,
Chairman.

The report of committee was received, and, on motion, it was

Voted, That the proposition of Mr. E. Gehlman, of Springfield, to build both buildings, be accepted, and the contract be executed, upon the necessary security being given: *Provided,* that any alteration in the plans and specifications as now presented for said building, involving extra expense, shall be paid for upon the award of a disinterested committee—selecting one by each contracting party, they two selecting the third.

On motion of Judge A. M. Brown, the drawing of the contract and the approving of securities was referred to a committee, to consist of the Regent, Messrs. Cunningham, Griggs and Goltra.

It was further decided that the bonds for the University Building be fixed at $50,000; on the Mechanic and Drill Hall, for $10,000.

The Committee adjourned to June 8th, 1871, at 7 o'clock A. M.

THURSDAY, JUNE 8, 1871.

The Executive Committee met at 7 o'clock A. M., according to adjournment, and proceeded to locate and inspect the building site of the Mechanical and Drill Hall.

On motion of Mr. J. H. Pickrell, it was decided that the building for Mechanic shops and Drill Hall be located on the lots owned by the University, situated between Springfield road and the horse railroad, bringing the center of the building opposite the center of ——— street (east side of parade grounds,) the north side of said building being placed not less than eight feet from south side of said Springfield road. It was further voted that the foundation of the above building be laid as low as to bring the level of the ground-floor one foot over the present sidewalk.

On motion of Judge A. M. Brown, the Regent was authorized to contract for and have done, the excavating for the University Building; also, wells and drainage for same.

On motion of Judge A. M. Brown, it was—

Resolved, That the contracts for the construction of the University Building and Drill Hall shall provide, that at each monthly meeting of the Executive Committee, the contractor shall present an account of the value of materials for said buildings, placed on the ground by him, and also the value of labor done, which account shall be first submitted to Mr. J M. Van Osdel, the architect, for his approval. Upon his certificate of the correctness of such account, the same shall be allowed and proper orders for the money be drawn as required by law.

A report of the Corresponding Secretary, Hon. W. C. Flagg, of the work of the past year, etc., was accepted, viz:

REPORT OF THE CORRESPONDING SECRETARY.

Not being able to be present at the annual meeting of the Board of Trustees, I respectfully ask leave to report at this late day.

Our third annual report has been duly published and distributed, with the exception of 600 copies left in the hands of the State Binder to be bound in muslin, which were destroyed by fire with other State documents. By countermanding an order for distribution, 500 more copies were placed in the binder's hands, and I hope will soon be ready for use.

The increasing demand for bound copies of complete sets of our reports suggests the desirability of increasing the number of bound copies, which has hitherto, for economical reasons, been confined to 500 annually. We still have on hand, in paper, a large number of reports that can, as fast as needed, be bound in muslin, and in that shape will be more valued and better preserved by those who receive them. For the future I believe it will be better to ask the State authorities to bind the entire edition.

I have sent, as required by law, copies of our last report to the Secretary of the Interior and to the several colleges founded on the national grant, so far as such are known to exist; and to the Secretaries of the various States and Territories in which no colleges have yet been organized. I have also sent packages, by express, to gentlemen at those points where Industrial University lectures have been held, for distribution among persons who attended the meetings, and have made a very considerable distribution through members of the General Assembly, the Secretary of State, and the Secretary of the State Board of Agriculture.

Agricultural lectures and discussions were held at Champaign, January 9th to 20th, 1871; at Springfield, between January 12th and 18th; at Pekin, between January 23d and 26th, and at South Pass, February 6th to 9th. I was unable to be present at any except those held at Springfield, but learn that they were as a whole successful, though not always as well attended as could be desired. The fact that since we commenced these annual courses such institutions as the Iowa Agricultural College, Cornell University, and probably others have organized similar courses, goes to show that the plan is approved and imitated by industrial teachers in other States, and may encourage us to persevere in the same direction.

The exact cost of these lectures is not yet ascertained, but excluding those of Dr. Hull and Dr. Miles, who were primarily engaged to lecture before the students, they will cost considerably less than last year.

Applications have already been made for lectures at other points, and in case the Board approves, arrangements ought to be made at an early day for the next winter courses. We now have a State appropriation to aid us, which makes it perhaps obligatory to do so.

The time has come when, as I would respectfully suggest, the Board should make further provision than it has yet done to enable me to make the annual report of this Board a more thorough and complete attempt to collect our statistics bearing on the industries, and to obtain and set forth facts of observation and experiment.

We ought to have—

I. Meteorogical observations—of which I already have a large amount, collected from different observers in the State, but which should be carefully made, also, here at the University, by some person appointed for the purpose. Probably this could be done most cheaply by the employment of a careful and thorough person from among our students. It would furnish him remunerative employment, and insure the doing of a work which is too great for Professors already over-taxed.

II. Trials of Implements.—At least once in each year there should be held on the University farm a trial of plows, cultivators, harrows, reapers, mowers or some other class of implements, agricultural or or other. Our leading agriculturists should be invited to assist at these trials, and give their aid and counsel. The University would thus became more a center of attraction to the farmers and mechanics of the State, and its name and objects become better known.

III. Experiments in the effects of different degrees of heat, light, electricity and moisture on vegetation, should be carefully made, probably under cover, so as to better control the conditions.

IV. Chemical experiments, bearing upon the industrial pursuits, are of course still desirable and, as soon as the chemical-teaching force is sufficient to admit of so doing, ought to be zealously prosecuted. We need analyses of soils, coals, manures, plants, and annual products.

V. Experiments in practical agriculture, especially the growing of field crops and the breeding and feeding of animals. For this purpose, and the carrying on of annual courses of lectures, we have an appropriation of $3,000 per annum for two years, which should be applied to the best advantage for 1871 and 1872. On the Experimental farm there remains about 70 acres to be cared for this year, and which may be used next year for experimental culture. A small portion of this has already been staked into one-twentieth-of-an-acre plots, and a part has already been sown with grains and grass seed. The remainder of the staked ground, it has been suggested, might be planted to corn with a view of determining the variability between different plots in their productiveness. There still remains a large tract of land on which it would cost too much to endeavor to institute any detailed experiments, but on which, planted mostly to corn, a variety of experiments in varieties of grain, different kinds of seed, different depths and distances of planting, and the like, might be roughly tried. Several crops of other kinds ought to be tried in small amount—such as field peas and beans, rutabagas, carrots, parsnips, sugar beets, flax, hemp, broom corn, hops, mustard, etc.

VI. The collection of statistics, and their exposition by maps, tables, etc., is desirable. In this connection I would call attention to the maps of Mr. Fred. P. Wines, Secretary Board of Public Charities, exhibiting the corn and wheat crop of 1870, in this State, the density of population, etc., as affording some valuable hints.

In our last annual report I called the attention of the Governor and of the General Assembly to some of the above points, and, as we now have a partial appropriation, I hope that we may be placed in such condition as to go on and do more than we have yet done in observation, experimentation and statistics.

Respectfully submitted, W. C. FLAGG.

Dr. J. M. Gregory presented a report of the Professor of Mechanics, S. W. Robinson, asking for an appropriation to begin the construction of necessary machinery for the mechanical shops.

On motion of Mr. E. Cobb, $2,000 were assigned for the purpose aforesaid, and the Regent and Mr. J. M. Pearson appointed a committee to expend these funds.

A committee, consisting of the Regent and Messrs. Pearson and Goltra, was instructed to determine upon a compensation, to be paid by the contractor, Mr. E. Gehlman, for the use of working room in the present mechanical shop, and such machinery thereof as he may desire to use, and can be spared.

The Regent and the chairman of building committee were authorized to have such repairs and alterations done in the present University Building, as they may deem necessary, not to exceed the appropriation of $1,000 made by the Board.

The Regent was further authorized to allow the use of rooms in University to such students as may be employed here, and deserving such favor.

On motion of Mr. Pearson, it was—

Resolved, That the Committee on Contracts be instructed to prepare a proper form for the bills for the contractor on the buildings, and that some of these bills be sent in blank to the members of the Board of Trustees to secure the necessary number of signatures, so that when the signatures of the Executive Committee be added, the bills may conform to the law of appropriation for these buildings.

It was moved and carried that Dr. M. Miles be employed as Professor of Agriculture; that he give his services through the winter term, and receive a salary of $1,000.

The statement of Bookkeeper of expenditures was then read and approved, a number of bills presented for payment were audited and allowed, and a contingent fund of $75 for defraying petty expenses was placed in the hands of the Bookkeeper.

It was ordered that the balance of salaries for the academic year be paid.

The committee appointed to report on employment of Dr. H. J. Detmers, recommended the following resolution, which was adopted:

Resolved, That Dr. H. J. Detmers be employed to give a course of instruction in Veterinary science during the winter term of the college year; said instruction to comprehend the diseases of domestic animals, and the care and medical treatment of same, and the holding of a free clinic for the illustration of such treatment.

Resolved, That there be appropriated the sum of $600 as compensation for such service.

It was moved and seconded that $120 be allowed for the services of Prof. D. C. Taft, teaching geology during the spring term, 1871.

Carried.

J. H. Pickrell, Esq., of Harristown, presented to the University farm, two pigs—pure Berkshire breed.

Mr. Goltra moved that the gift be accepted, and the thanks of this Committee be extended to the generous giver.

Carried.

The Secretary was instructed to express the thanks of the Committee, in behalf of the University, to Messrs. Fenner & Call, of Urbana, Ill., for the donation of one superior Trench plow, patented by Mr. R. R. Fenner.

The Committee on contracts of Buildings was also authorized to temporarily employ a Superintendent of Buildings, if necessary, until the next meeting of this Committee.

On motion of Judge Lawrence, it was voted that the whole matter in reference to purchases for the library and chemical apparatus, be referred to the Regent, with power to act.

The Regent was further instructed to buy a pair of blooded pigs for University farm.

The Committee then adjourned to meet again at the call of the Regent.

FRIDAY, JULY 14, 1871.

The Committee convened at the Regent's office, at 10 o'clock, A. M., Dr. Gregory in the chair.

Present—Messrs. Cobb, Cunningham, Lawrence, Pickrell and the Regent.

The reading of the minutes of last meeting was dispensed with.

REGENT'S REPORT.

To the Executive Committee:

GENTLEMEN:—Since your last meeting, the contracts with Mr. E. Gehlman for the erection of the new mechanic shops and new University Building have been made in due form, according to your instructions; and the work on these buildings has already begun with great vigor. Mr. Gehlman's accounts for work and materials to date, will be laid before you. As these accounts must be signed by a majority of the Trustees before any money can be drawn on them from the State appropriation, they will need the signatures of the Executive Committee, and at least eight other Trustees.

The Committee charged with the choice of a Superintendent of Building, have employed, temporarily, Col. Shattuck. Under his directions the excavations, not provided for by the contract, have been made; and two wells have been sunk for the Mechanic Hall, and two for the new University Building.

The Agricultural experiments are going forward under the charge of Hon. W. C. Flagg. The general work on the farms and Horticultural grounds is more satisfactory in character that in any former year, and the condition of these departments is steadily improving. The machine shop has been provided with some new and valuable machinery, and the patterns are in preparation for a new steam engine, of sixteen horse power, for the new Mechanical Building.

Changes and improvements are in progress in the University Building, to fit it for the largely increasing numbers of students. Every room was bespoken for the next year, before the close of the past term, and seventeen names were left on file of students for whom no rooms remained. The applications now daily coming to hand, make it evident that something will need to be done to meet the demand for rooms the coming year. Doubtless, something will be done by private enterprise, and already there are parties proposing to erect cottages for the occupancy of the students. Should they fail, then it may be necessary for the University to carry out the plans heretofore proposed for the erection of a group of cottages.

In the new arrangements, provision is to be made for the greater convenience of female students, of whom a much larger attendance is expected next year. Having decided to attempt the education of young women at the University, it is due that every practicable provision shall be made to afford them the highest facilities for such education as they may need. Having this in mind, I recently visited the School of Design at the Cooper Institute, in New York city, to ascertain how far its plans are adapted to the University. In the selection of additional teachers—especially the teacher of drawing—the wants of our female students should be held in view.

In accordance with your vote, the annual circular has been issued, and 20,000 of the same, in paper form, are now being distributed through the State.

I herewith present the Bookkeeper's statement, and the accounts to be audited.

J. M. GREGORY,

Regent.

The report of the Bookkeeper, containing statement of expenditures, abstract of vouchers and collections, was then read, and bills presented for payment were audited and allowed.

Judge J. O. Cunningham offered the following resolution, which was adopted:

Resolved, That Mr. E. Gehlman be permitted to use so much of the clay on the west side of the site of the new University Building, for making brick, as he may require, provided he replace the clay thus used, by soil, to the required grade; and provided, further, that the surface soil be removed to the east side of the building, and that all rubbish be removed immediately upon the burning of the brick.

On motion of Mr. E. Cobb, vouchers were drawn and signed by the Committee for the following amounts:

E. Gehlman, on certificate of Superintendent J. M. Van Osdel, for material, etc., for Mechanic Hall	$6,812 50
For material, etc., for University Building	202 00
Dr. Gregory, expenses for plans, etc	83 90
S. W. Shattuck, excavation wells for University Building	322 93
S. W. Shattuck, excavation wells for Mechanic Hall	64 00
C. L. Rice & Co., machinery for shops	1,273 50
J. W. Bunn, State appropriation	5,000 00

The Committee on employing a Superintendent, reported that they had temporarily employed Prof. S. W. Shattuck to act, under instructions of Mr. J. M. Van Osdel, the Architect.

The report was approved, and Prof. S. W. Shattuck continued as local Superintendent of the building in progress of erection.

On motion of Mr. J. H. Pickrell, the Committee adjourned to meet again on Wednesday, August 2, 1871, at 3 o'clock, P. M.

WEDNESDAY, AUGUST 2, 1871.

The Committee met at 3 o'clock, P. M., in the Regent's office.

Present—Messrs. Brown, Cobb, Cunningham, Goltra, Pickrell and the Regent.

The reading of the minutes of last meeting was dispensed with.

The report of the Bookkeeper, his statement of expenditures to date, and of collections, were read and approved.

The bills presented for payment were then taken up, audited and allowed.

The Committee took a recess till 7:30 P. M.

The Committee re-assembled at 7:30 P. M.

Dr. Gregory and Judge Cunningham were appointed a committee, with power to act, to have lightning rods put on the barns and house on Horticultural grounds.

The Regent was authorized to employ the following assistants and teachers: Mr. R. B. Warder, assistant in Chemical Department, at a salary of $1,000 per annum.

Mr. I. D. Foulon, as teacher of French, and general assistant, at a salary of $75 per month, for ten months. A private Secretary at a salary of $50 per month.

The Regent reported the progress of negotiations to obtain a competent drawing teacher, and was authorized to employ the candidate named at a salary of $1,000 per annum.

It was voted that there be employed a competent assistant Professor of Civil Engineering, at a salary not exceeding $1,500.

The Faculty were authorized to change the course of Veterinary lectures from the winter to the fall term, if found desirable.

A hard wood floor was ordered to be laid in the main hall and corridors of the first story.

On motion, permission was given to the Farm Superintendent to sell the old hay press, and dispose of implements worn out or not desirable—excepting those that were donated to the University.

It was moved and carried that the Regent be directed to have the garden barn moved, and fitted up in rooms for students.

The Regent was also authorized to have students' rooms fitted up in the Agricultural Museum, if it should become necessary.

Voted to purchase scales required for Experimental farm.

The purchase of thirty tons of hard coal, and one hundred tons of Illinois coal, for winter storage, was approved.

On motion of Judge A. M. Brown, it was

Resolved, That the Regent and chairman of the Agricultural Committee be authorized to purchase a male and female of the Hereford cattle, mentioned in a recent letter from Dr. Miles to the Regent; and that they are also authorized to purchase such individuals as they may deem necessary of other breeds of cattle or other stock, provided that such expenditures shall not exceed the sum of $3,500.

The making of the necessary settees, library cases, desks for Chemical Laboratory, and purchase of matting for library, was referred to the Regent, with power to act.

On Mr. Cobb's motion, the Regent and Judge Cunningham were made a committee to purchase a bell, weighing at least 1,000 pounds, for the new University Building.

The following preamble and resolution of Judge J. O. Cunningham were adopted:

WHEREAS it is represented that the Architect of the new University Building recommends the use of iron columns under the floor of the chapel in the southeast wing; therefore,

Resolved, That the contractor for construction of said building be requested to put in such columns, in lieu of the brick piers, provided that the size and shape of such iron columns be approved by the Architect.

The following bills on new building were then approved, and vouchers drawn and signed for the same:

E. Gehlman, main building, material and work	$8,429 20
E. Gehlman, Mechanic and Military Hall, same	5,952 58
S. W. Shattuck, summary of bills for wells, brick for same, grading, superintending services, etc	315 39

The Committee then adjourned to meet again on Wednesday, the 30th of August, 1871, at 4 o'clock, P. M.

J. M. GREGORY,
Regent.

E. SNYDER,
Recording Secretary.

COURSE OF AGRICULTURAL LECTURES AND DISCUSSIONS.

Agricultural lectures and discussions were held at the University, January 9th to 20th, 1871; at Springfield (evening meetings), January 12th to 18th; at Pekin, January 23d to 26th; and at South Pass, Feb. 6th to 9th.

A few of the lectures delivered, that seemed, from the nature of the topics discussed, to be of special interest, are subjoined.

The programme of lectures was as follows:

AGRICULTURAL LECTURES AND DISCUSSIONS AT THE UNIVERSITY.

The Third Annual Course of Agricultural Lectures and Discussions will begin at the University, in Urbana, Champaign County, on Monday, January 9th, 1871, and continue two weeks; five days of each week, and with three sessions in each day.

The attendance of all persons interested, and especially of the young Farmers of Illinois, is cordially invited, for the purpose of discussing the best methods of agriculture, and the crops and animal products of the West. No charge is made for attendance. The University provides a hall, properly warmed and lighted, and pays the expenses of the gentlemen who have consented to open the discussions. Each lecture, address, and talk, will be followed by a discussion of the same topic, in which all are invited to participate.

Good boarding places can be had, convenient and at reasonable rates. Railroad companies will be solicited to return persons in attendance at reduced rates.

J. M. GREGORY,
Regent of the University.

W. C. FLAGG,
Corresponding Secretary Board of Trustees.

ORDER OF BUSINESS.

MONDAY, January 9th—2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., Dr. J. M. Gregory, Place of Agriculture in Political Economy.

TUESDAY, January 10th—9 A. M., Dr. M. Miles, History of Agriculture; 2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., Professor J. B. Turner, Climate and our Climatological and Agricultural Wants.

WEDNESDAY, January 11th—9 A. M., Dr. M. Miles, Relations of Science and Agriculture; 2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., Parker Earle, of South Pass, Pears.

THURSDAY, January 12th—2 P. M., Dr. M. Miles, Tendencies of Pioneer Farming; 2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., Dr. Wm. LeBaron, State Entomologist, Entomology

FRIDAY, January 13th—9 A. M., Dr. M. Miles, Principles of Mixed Husbandry; 2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., Professor S. W. Robinson, Work and Force and their Practical Application.

MONDAY, January 16th—9 A. M., Dr. M. Miles, Rotation of Crops; 2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., Prof. A. P. S. Stuart, Agricultural Chemistry.

TUESDAY, January 17th—9 A. M., Dr. M. Miles, Rotation of Crops; 2 P. M., Dr. E. S. Hull, Horticulture.

WEDNESDAY, January 18th—9 A. M., Dr. M. Miles, Rotation of Crops; 2 P. M., Dr. E. S. Hull, Horticulture.

THURSDAY, January 19th—9 A. M., Dr. M. Miles, Manures; 2 P. M., Dr. E. S. Hull, Horticulture.

FRIDAY, January 20th—9 A. M., Dr. M. Miles, Manures; 2 P. M., Dr. E. S. Hull, Horticulture; 7 P. M., S. T. Burrill, Flowerless Plants.

NOTE.—In addition to his lectures given in the above course, Dr. Miles will deliver before the students of the University, about twenty other lectures upon Agricultural topics, making about thirty in all, covering the whole ground of field culture, domestic animals, manures, etc. The whole of this longer course would be highly desirable to any farmer, and is strongly recommended to young farmers who can afford to spend a month at the University. A fee for "incidentals," amounting to $2 50, is the only charge.

AT SPRINGFIELD.

It is proposed to hold a short series of evening meetings at Springfield, under the joint auspices of the Illinois State Agricultural Society and of the Industrial University, during the session of the Executive Committee of the Agricultural Society and of the General Assembly, many of whose members are farmers, or others interested in agricultural progress.

The following gentlemen have consented to be present and address the meeting, on the evenings named:

Thursday Evening, January 12.

Dr. Manly Miles, Professor of Agriculture in the Michigan Agricultural College, will lecture on Agricultural Education and Experimental Stations.

Friday Evening, January 13.

Dr. E. S. Hull, Horticultural Lecturer in the Industrial University, will deliver an address upon Horticulture.

Monday Evening, January 16.

Prof. J. B. Turner, of Jacksonville, will lecture on Climatology, and our Climatological and Agricultural Wants.

Tuesday Evening, January 17.

Prof. J. B. Turner will lecture in the continuance of the same subject.

Wednesday Evening, January 18.

Dr. J. M. Gregory, Regent of the Industrial University, will lecture on the Political Economy of Agriculture.

AT PEKIN.

The following series of free lectures and discussions, on Agricultural topics, will be held under the auspices of the Illinois Industrial University. The farmers of Tazewell and adjoining counties are cordially invited to be present, and assist in the discussions:

Monday, January 23.

2 P. M.—An Introductory Address, by Lemuel Allen, Esq.; Drainage and Irrigation, a lecture by Prof. S. W. Shattuck, of the Industrial University.

7 P. M.—The Political Economy of Agriculture, by Dr. J. M. Gregory, Regent of the University.

Tuesday, January 24.

9 A. M.—Dr. E. S. Hull, on Horticulture.

2 P. M.—Dr. E. S. Hull, on Horticulture.

7 P. M.—Dr. Manly Miles, Professor of Agriculture, Michigan Agricultural College, on Principles of Mixed Husbandry.

Wednesday, January 25.

9 A. M.—Dr. Miles, on Rotation of Crops.

2 P. M.—Dr. Miles, on Manures.

7 P. M.—Prof. A. P. S. Stuart, of the Industrial University, on Agricultural Chemistry.

Thursday, January 26.

9 A. M.—B. S. Prettyman, Esq., on Cultivation and Husbandry of the Cereals.

2 P. M.—Prof. W. M. Baker, of the Industrial University, on Ancient Agriculture.

Each lecture, address or talk, will be followed by a discussion of the topics embraced therein.

AT COBDEN OR SOUTH PASS—FREE.

Under the auspices of the Industrial University, the following lectures or addresses, each to be followed by a discussion on the topics embraced therein, will be held at Cobden, February 6th to 9th, 1871:

Monday, February 6,

2 P. M.—Prof. T. J. Burrill, of the University, will lecture on Flowerless Plants, including the Fungi.

7 P. M.—Dr. J. M. Gregory, Regent of the University, will lecture on the Political Economy of Agriculture.

Tuesday, February 7.

9 A. M.—Dr. Wm. LeBaron, State Entomologist, on Entomology.

2 P. M.—Dr. E. S. Hull, on Horticulture.

7 P. M.—Dr. E. S. Hull, on Horticulture.

Wednesday, February 8.

9 A. M.—Dr. Manly Miles, Professor of Agriculture in the Michigan Agricultural College, will lecture on the Principles of Mixed Husbandry.

2 P. M.—Dr. Miles, on Manures.

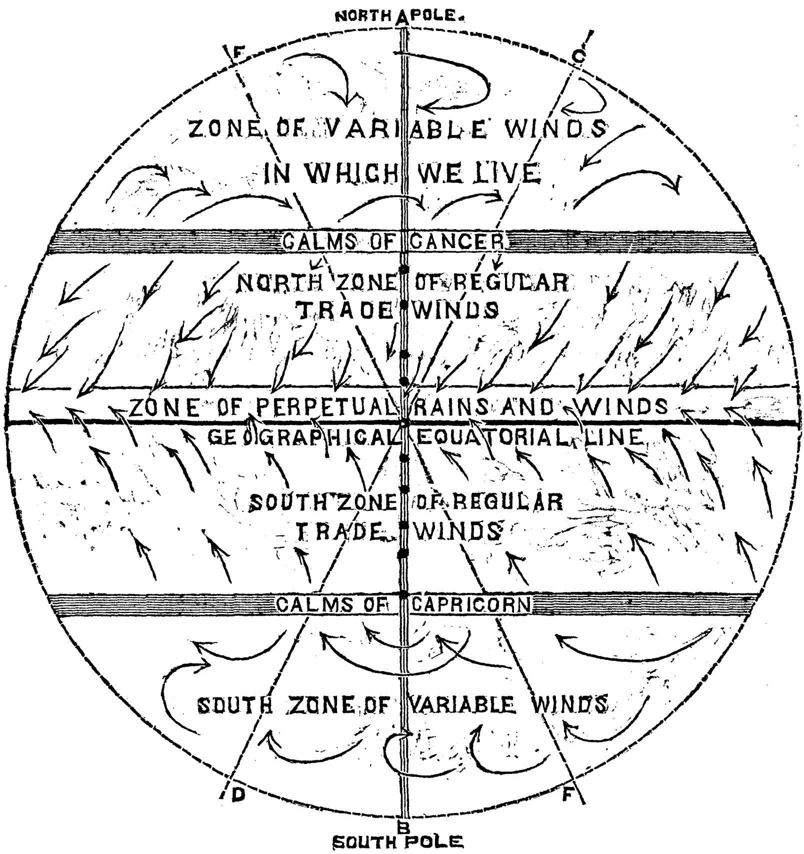
7 P. M.—Judge A. M. Brown, of Villa Ridge, one of the Trustees of the University, will give an address.

Thursday, February 9.

9 A. M.—Prof. A. P. S Stuart, of the University, will lecture on Agricultural Chemistry.

A DISCOURSE ON CLIMATE.

BY PROFESSOR J. B. TURNER, OF JACKSONVILLE.



EXPLANATION AND REMARKS ON THE DIAGRAM.

I. The Meridianal or diurnal line or belt of maximum heat (A. B.) revolves round the globe every twenty-four hours, with the sun, and over each meridian about three o'clock in the afternoon, at right angles to the equator.

The Equatorial, or *annual line*, or *belt* or *zone*, of maximum heat, on the contrary, swings from north to south between the tropics parallel with the equator, advancing and receding with the sun, and the returning seasons of each year. The point, or area, or focus, of greatest heat on the globe is where these two lines intersect, as at **O O O**, which point of course revolves around the globe every twenty-four hours, and tends to draw all the great surface air-currents after it, and to deflect all the other currents toward it. The upper return currents of air, including what are called the *counter trade winds*, move in directly the opposite direction to the surface currents (as indicated by the arrow-heads of the diagram), when not disturbed by local forces. The perpetual intersection of the several parts of this great cross-belt of maximum annual and diurnal heat, with its maximum focus of heat at its center, is the natural and necessary cause of the deflection of the trade-winds toward the west, and the upper return currents toward the east, so generally, however foolishly, attributed to the varying velocities of different parallels of latitude—as any one can see from a moment's reflection. For it is plain that the zone or belt of maximum heat or wind-power on the earth's surface is not a single belt, encircling it from east to west near the equator, as is commonly represented, but a cross of belts, the one running east and west with its annual slides, the other at right angles to it, with its diurnal rotation and focus of maximum heat ever attending it. It may be, to some, an interesting coincidence, that our natural sun, at the maximum of his effulgence and power, exerts his paramount influence on our globe through a form of a cross, and not, as scientists have taught us, through one continuous mathematical line or belt around it. An adroit devotee to analogies, or correspondences, could write a whole ship-load of books on this simple fact, not wholly without interest.

II. When the sun is over the equator, and the days and nights are equal, the *crepuscular line*, as it has been called, or line of daylight, is parallel with the meridianal line of maximum heat, (A. B.); and the point or forces of greatest heat (O) will revolve on the equator. But when the days are longest, and the sun is over the tropic of Cancer, this line of daylight will be E. F.; which line will bound the hottest hemisphere of the globe, toward which all great air currents must tend E. A. C. F.; being deflected toward a line at right angles with the line E. F. This of course strengthens the tendency to our south and southwest winds in summer; for precisely the opposite reason, when in our shortest days in winter, the sun is over the tropic or calms of Capricorn, and this crepuscular line has swung around to C. D., and C. F. B. D. becomes in turn the hottest hemisphere of the globe, all our winds tend more strongly to blow from the northwest toward the line C. D.—while our prevalent west winds, in March and September, are also measurably owing to this very obvious and simple course, as this line is then due north and south, or at A. B. These are the principal well-known primal causes, which determine the perpetual flow and reflow of the great air-currents, and the peculiar climate of our globe. In a single word it is the power of the sun; and what a mighty power that is; and yet how gently, and quietly, and silently it works, through all its infinitely varied rounds and tasks! The means are as simple as the ends are various and infinite. Doubtless other local and modifying causes are as endless as they are varied; but here, alone, we find the great primal moving cause of all we behold in these incessant changes of seasons and years.

DISCOURSE.

It will be my object, in this discourse, to give the present impressions which all my previous readings and reflections have made on my own mind, in regard to climate, without intending to cite at length the proofs of their correctness, nor indeed to affirm it at each and all points in question.

Everybody knows that we are at present in no sort of condition to present a science of meteorology, and may not be for five hundred years to come; and the best way perhaps to help it along is for each one to state frankly his own impressions, a free-will offering to the common stock.

For the sake of brevity and directness, I shall, without intending to dogmatise, give my discourse wholly the dogmatic form, and let it pass for what it may seem to each one to be worth. I found myself necessitated to give some general view of the whole subject, in order to get any one of its parts into its true relations, and to lift our minds, if possible, out of those miserable ruts of mere authority, which, if apposite to anything on earth, surely has no place in any mere physical inquiry. Telling you what I think, may possibly aid you in finding the same great laws and facts in nature I fain would describe; but if not, my words are of no more consequence to you than the chirping of a grasshopper.

Were the whole solid body of the earth made up of one homogeneous material, and were its surface covered on all sides to an equal depth with water, there can be scarce a doubt that all the currents, both of the ocean and of the air, the distribution of heat and cold, of sunshine and rain, at the same latitudes and in the same seasons of the year, would be as uniform as the return of the seasons, or as the rising and setting of the sun, or its advance from one tropic to the other—though probably the varied position of the moon, or of the other planets, would add another item of a more or less disturbing force. All, or nearly all, our present irregularities in our ocean currents and air currents, and dependent changes of heat and cold, or drought or rainfall, are due therefore to the irregularities of the earth's structure and surface, more than to all other causes combined.

The solid parts of the earth are composed of a great multitude of heterogeneous or diverse materials, differing very widely in specific density and gravity in their capacity of holding or attracting water, heat, electricity, etc., while only parts of it are covered with water of very unequal depth, and other parts spread out in plains, or piled up into mountains of very unequal hight. The continents land-lock and interrupt the regular ocean flow and throw immense floods of warm water toward the poles, wholly revolutionizing the distribution of heat and cold, under the varying law of these currents, while the icebergs of the nothern seas, are perpetually carting millions of tons of solid rocks, sand and earth, from the nothern pole toward the equator, in some cases, as in the banks of Newfoundland, building up whole new continents of land under our present seas.

Such is also the present shape of our continents that nearly all the immense debris and wash from the action of water or frost, in our Northern Hemisphere, by the course of our rivers toward the south, or the action of glaciers and icebergs at the mouth of those flowing to the north, combined with the existing course of our present winds and ocean currents—all this debris is at last borne from north to south, or piled up, so to speak, toward the equator: while the whole Southern Hemisphere presents, so far as we know, absolutely no counterbalancing series of actions or of forces.

Do our extant savans really believe that if you should shovel dirt, even with a teaspoon, from the fore end of an evenly-balanced cart toward the hind end, the cart would at last inevitably tip up, even though it might take millions of years, if the rate of removal was slow enough? If so, it is just as inevitable, under present well known conditions, that the earth must have an insensible revolution, or at least oscillation, from pole to pole, as really and inevitably as it has a more rapid daily revolution from east to west; and that, sooner or later, this inevitable movement, if continued in the same direction, would produce the astronomical change of bringing the pole where the equator now is, and throwing the equator where the poles are, even though it might take millions of years to effect the change, and though all our instruments for fixing latitude might prove quite too coarse to detect any change since they became known to man. The inevitable results of this constant change of our actual equator and polar line are quite self-evident, though not, so far as I know, anywhere adverted to. The polar diameter of the earth being twenty-six miles shorter than the equatorial diameter, should this change of poles be made at once, it would whelm each pole some thirteen miles under the seas, while the strain of the tremendous centrifugal force at the equator, on the solid and immovable parts of the globe, would generate new forces of heat and electricity all round and near the equator, and in two or more divergent lines toward the poles, which would either generate or expand and explode gasses, and produce earthquakes, volcanoes, etc., etc., enough in those regions to blow the earth all to pieces, and force it to resume substantially its present normal shape, under its new conditions.

But all this does not and cannot happen at once; hence the very same phenomena are more moderately distributed over a very long series—probably of millions—of years. But they are all actually here, and daily before our own eyes, if we will but open our eyes to see them.

Of course the watery and fluid parts of the earth, that lie unconfined on its surface, easily readjust and conform themselves to every change as it progresses. Hence we find the European and Greenland sides of the globe apparently sinking, as it is said, but actually rising toward the equator, and of course dipping under the new adjusted seas, to which they cannot yet conform. All history shows also that these European climates have been growing warmer from the earliest records;

that is, that while they thus dip under the sea, they in fact rise toward the equator, and become warmer, and relatively to the ocean lower, at one and the same time. Coincident with this, other parts of the earth are relatively rising, or moving toward the poles, and growing colder, at one and the same time; while all well know that all parts of the earth show that they have sometime been beneath the seas, and probably many times; and all the regions of the equator and lower latitudes bear still the marks of polar glacier or avalanche furrows made while they were under or near the poles; and all parts of the frigid zone are filled with the remains of tropical animals and vegetable life, that were produced when nearer the equator, and buried there under the incessant earthquakes, land-slides and other catastrophes necessarily perpetual in those regions, from the simple cause above indicated, and there preserved, buried perhaps for ages, till again disemboweled in their changed position by the action of polar frosts and the new sweep of polar waters and seas.

These evidences of the action of the seas, over even the highest parts of the continents, are so universal and so obvious to all common-sense observers, that no writer on cosmogony, sacred or profane, has been fool enough to wholly overlook them, or to pass them by without his own account of a flood, or some other catastrophe adequate, in his view, to account for the facts so self-evident and open to all.

But now we also find the great sea itself is giving up its secrets, if not its dead, and disclosing the fact that the same stratas of coal, chalk, limestone, sandstone, etc., that we find on the continents, are now in process of formation beneath its depths, preparatory to future upheavals, or changes in position. So far as I am aware, the constantly recurring fact of volcanos, earthquakes, and violent convulsions near the equator, and formerly along the lines converging to the poles, as indicated by the extinct volcanic mountain ranges of America, and the still active ones on the other side of the earth, through the Japan Islands, at the present day, and other facts which it would require volumes to recapitulate, all concur in supporting this very simple, but still potent theory; so that we have after all really no need to fill good old mother earth with water, or fire, or wind, as if we would throw her into a fit of the cholic, or alternate fits of fever and ague; or explode it into vapor or gas, in order to rationally account for her very sober, and steady, and uniform, and perpetual work, done before our own eyes, as much, and as fast, and as silently and effectually as in any age before so far as we can know. All the facts go to show that there have been numerous submergals or dipping in and out of the waters, of the very soil on which we stand; and if present laws and causes continue to operate, there must be many more of them; so that when Solomon said that there was "nothing new under the sun," he spoke more truth than probably he himself was aware of.

But I am at present interested only in noting the tremendous effect such geological and astronomical changes must have on the local climates of our globe; putting seas where continents have been, and *vice versa;* heaving up new mountain ranges and islands; creating new deserts or fertilizing old ones; generating new volcanoes or local heats, or feeding old ones; and all from a primal cause as easy, simple and silent as the revolving of a grindstone, or of the action of gravity itself. Where our valley will be a million years hence, how near to the then equator or poles, or how deep under the seas, it is of course impossible to predict; but that we shall not be exactly where we now are, even one hundred years hence, is as mathematically certain as it is that the laws of gravity and of heat and force will continue to operate, though however slowly.

We can, perhaps, form some idea of the heat that must be generated near the equator by this simple disturbance of the earth's equilibrium, when we reflect with what force a revolving grindstone sometimes flies apart, and that the velocity of the whole surface of the earth near the equator is some twenty times faster than that of the most rapidly running locomotive wheel; and that all this interrupted force, by the law of conservation of force, must run into heat, on the lines of its greatest strain, at or near the equator, and on some converging line toward the poles. The general effect of this, on local climates and changes of climate, are self-evident, though not sufficiently known, as yet, to justify detailed predictions.

In a paper read before the Natural History Society of Illinois, and published in the Transactions of our State Agricultural Society, I had occasion to notice the effects which the great "avalanche of the ocean," —as I termed it for want of a better name—has on the climates of the globe. I wish now only to remark that it is self-evident that those causes which affect the equilibrium of the earth about its poles, must, also, to the same extent, affect those great ocean currents, and change their influence on all climates.

The temporary and permanent effects of spots and changes on the surface of the sun, on the climate of our globe, are too little known to be definitely described or predicted; though, when we reflect that in the former revolution of the sun's spots in 1859, a sudden efflorescence of his disc, as observed by two astronomers, instantly produced an universal meteoric storm, which affected all the electrometers and telegraphic wires throughout America, Europe, Asia and Australia, so far as known, we must believe that such changes in the source of our solar light and heat must exert a great influence on the climates, as well as on the condition of health or disease in all animal or vegetable life.

Another astronomical cause is the tidal waves raised both in the ocean and the atmosphere, through the influence of the sun and the moon. Prominent among these is that peculiar effect observed and symbolically described by people half around the globe, savage and civilized, by the "horns of the moon being up or down," or the "wet and dry moon," as they sometimes term it. I am aware that some philosophers, so-called, are accustomed to deride this, and all other observations of the unsophisticated common people, expressed in their peculiar symbolic and unscientific language; but it would be proper in this, as well as in many other cases, for a real philosopher to inquire how so many and diverse peoples—farmers, sailors and Indians, men of all races, and from both continents, whose business and interest it is to watch the sky—happened to hit upon the same sign of rain, if there is nothing in it, and to express it much in the same way. Let us simply translate this same fact into current scientific popular language, and see how the case then stands. It is agreed on all hands that rain is produced by commingling cold and warm currents of air, and the greater the agitation of the air, from whatever cause, the more sure the rainfall, all other things being equal. Now, when the horns of the moon are up, it is following directly in the path of the sun, and both the sun and the moon produce but one and the same tidal wave in the atmosphere, like the wake of two steamboats following each other in the water; but when the horns of the moon are one of them down, the moon is running wide of the sun, and they are producing two conflicting tidal wakes which meet like the two conflicting wakes of two steamboats running side by side, and of course must produce a greater agitation of the air where these wakes meet, and, all other things being equal, tend strongly to the production of rain, if there is at the time any moisture in the air out of which rain can be made; but if there is none, as in long droughts sometimes happens, of course that sign or cause, like all others, must fail.

The manner in which the regular trade winds set in toward the equator on the open seas, and, meeting, thread through each other near the equator, producing a narrow belt of almost perpetual rains and thunder storms just north of the equator, nearly round the whole globe, in their conflict in meeting and in passing; and how the return currents, sometimes called the counter-trade winds, thread through and flow on in the higher regions of the air, over the same lines, toward the northeast in our latitude, producing on each side of the equator a zone about twenty degrees or some twelve hundred miles wide of regular trade winds and periodical rains, and, descending, to wheel into line again, for a new advance toward the equator, producing a wide belt or zone of variable rain storms, under which we live, that swings toward the north or the south as the sun advances or recedes, with some little degree of regularity, giving us what we call our equinoxial and other storms—all this is well known to all. The manner in which this return current or counter-trade wind, blowing toward the northeast, high up over our heads, and bringing us all our greatest rain or snow storm, continues to bear along its watery clouds, and steadfastly refuses, for whole days or weeks in succession, to mingle with the lower currents, from whatever quarter they may blow, carrying their own burden of lower clouds, may be seen by any one who will lie down on his back and watch as they pass these two different and often directly opposite currents of winds and clouds, though the reason why such currents refuse so obstinately to mingle together cannot be fully explained by any one, no more than we can explain why the waters of the Gulf Stream refuse to mingle with that of the surrounding ocean, in despite of the awful force of all possible storms, winds, waves and tides. It may be that they are in a state of constant electrical repulsion, like the redoubling rings of smoke blown from the bowl of a pipe.

These are perhaps the principal geological and astronomical causes of changes of climate to any extent known to us. I have made no account of the well-known fact that the temperature of the earth seems to increase in a regular ratio as we descend into it, because, to my apprehension, that fact has as yet taught us nothing but the bare fact itself. It may proceed simply from the different ratios of the absorption and radiation of heat from the surface, or from the centrifugal force and force of gravity co-operating with the force of the heat derived from the sun, to augment the heat in a spherical plane at a small distance below the surface of the earth, as Dr. James seems to have supposed; or it may arise from a thousand unknown causes, which would limit the phenomena wholly to the surface, or near the surface of the earth, without implying that there is heat, or indeed anything else but air or gas, it may be, at the center of the globe. Certainly, it is no proof that there is now or ever was in that center any heat, not constantly generated by its natural and constant actions and forces, from simple causes above described. If the gadflies in boring into an elephant's hide, should find it, wherever they punctured, growing hotter and hotter, and tougher and tougher as they went in, they would know simply that fact; but if the gadfly philosophers should proceed to infer that the elephant was all a lake of fire within, or all tough hide through and through, the gadfly philosophers would surely be mistaken.

I have no faith, therefore, in any deductions about climates, either in the present or the past, based on such slender supports as these, however fashionable they may become, or however sustained by illustrious names. Should it be inquired how the earth was first made, I answer, we have no proof, or even semblance of proof, from philosophy, that it ever was made at all, or that both matter and force, as well as spirit, are not eternal; and if any proof comes, it must come wholly from some other source. That the earth has been changed and refitted or recreated many times, and is undergoing the same constant changes even now, we have the fullest proofs; that it ever was non existent, substantially in its present form, we have no particle of proper proof.

Perhaps these last mentioned changes of the tides, swing, flow and reflow, interlacings, dip, interaction and reaction, and swinging into line again of the great air currents, that are somewhat constant and uniform in their motions, might better be classed with mere ærial than as astronomical causes, though their great motive power is in the sun. There are other ærial changes, or changes of currents, which seem to proceed from mere local causes, either electrical or mechanical, or both combined—such, for example, as the effects of railroads, canals, telegraph wires, burning of forests or cities, cannonading, etc. It can hardly have escaped the notice of men somewhat advanced in life, that the frequency and severity of thunder storms has very materially abated in this country during the past twenty-five or fifty years. It seems also to be well established that the rains on the Great American Desert have very much increased within that period, while the severity of their droughts seem to have increased in California and in regions west of this desert, and perhaps, also, on the regions east of the plains, quite to the Alleghanies. The droughts in France and Western Europe seem also to have increased in severity, while rainless Egypt is again blessed and surprised with an increasing frequency of showers, much as seems to have been the fact when her old canal connected the two seas, as her new one now does. Now, all these changes, or seeming or reported changes, may be only temporary recurrent paroxysms of climate, soon to pass to the other extreme, it is true; but to one who knows the powerful part which electricity plays in the affairs of our earth, and especially in this matter of storms and rainfall, it will not seem impossible that our thousands of miles of railroads and canals and telegraph wires, uniting all the great seas and oceans of the globe as they were never before united, either by water currents or iron rails, or both, and forming quick and ready conductors of electrical currents over the dry and parched summer earth, the whole globe around, and throwing their heavy iron arms abroad, for tens of thousands of miles, in all directions over the continents—I say it will not seem impossible that our canals and railroads should at last be found to be powerful in new distributions of the rainfall, as well as in that of goods and merchandise. It is, at all events, a subject that deserves the close attention of our philosophers and economists. Indeed, I think it hardly possible that so subtile and instantaneous an element as electricity, and other cloud-gathering and distributing forces, should be otherwise than very materially affected by interlacing the whole surface of the earth with such first-rate, continuous and uninterrupted conductors of electricity. I believe that no train of railroad cars was ever known to be struck with lightning, in the history of the world; which in itself shows how easily and surely those iron tracks, in fact, dispose of this erratic and vagrant, but still resistless force.

The burning of forests and the cannonading of armies and cities, seem also to produce marked effects on climate, and especially on the local rainfall. I watched these effects with great interest during our last war; and more usually after a great battle, the papers reported a heavy rain storm as the speedy result. Very soon, last fall, after the seige of Strasburg by the Germans commenced in earnest, the papers reported that the unparalleled drought in that part of France was wholly broken up, the river rose in hight, and even their cellars were fil'ed with water, a state of things wholly unprecedented at that season of the year. So common and almost uniform have these results been in all wars, that it has incited the belief in many minds that drought might be practically broken up and local rainfalls excited by simply firing of cannon, as well as by the burning of forests. And when we reflect that these southwest counter-trade winds, laden with moisture, are almost incessantly passing over our heads, just above the thin strata of the lower surface currents, and gliding in opposite directions in immediate contact with them, and that all that is really wanted at almost any time, to produce rain, is simply to compel these two repellant currents to intermingle with each other, by some mechanical force, or by working some change in their electrical relations to each other, I confess that I am inclined to the opinion that this may not only be practically, but most profitably done; especially when we consider what vast stores of wealth are often dependant on a single rain storm, and how apt are these repellant stratas of air to continue to mingle and pour down their rain, even over wide regions, when their original repellancy is by any cause, at a single point, for once broken up. If Napoleon had determined to burn some small part of his gunpowder in this needful service of mankind, in order to break up the then existing drought of France, instead of trying to use it for the destruction of the political power of Prussia, he might have made his reign memorable and blessed in the history of our race, instead of ignominously terminating it as he did.

Suppose we should fit out a heavy, powerful and oblong French balloon, load it with some suitable fire arms or torpedoes, that could be safely exploded at any desired point in mid air; attach to it a copper electric conducting wire, which also should be attached at the lower end to one of our longest lines of railroad and telegraph wires; amount it loft to the point, or near to the point, where these opposite currents of air and clouds glide over each other, and anchor it there by means of suitable ropes or cords, and at the most proper moment discharge its whole artillery up into that upper strata, thus at one and the same time forcing a commingling of these strata and electrically connecting them both by means of the wire with each other, and with wide areas of land beneath. In view of what we now know, is there any thoughtful and well informed man who really believes that such an experiment, carefully and scientifically conducted, would be likely to entirely fail to break up, or at least make serious inroads into any drought that is likely to occur? And if this is so, why should it not be done? and why should not some of our States, or the general government, prepare to make the experiment for us? If it succeeded, it would save the country untold millions, both from droughts and from necessary excesses and devastations of rains and floods, at other places and times. If the simple lateral concussion of the entirely lower strata of air, in cannonading, produces the effect so generally ascribed to it, what might not be expected from a suitable apparatus thus manned and mounted, and discharged at the very point where its effect is needed? We all know the result of a clap of thunder on a gathering storm cloud; whether it is the cause or the result of the condensation that breeds the well-known rainfall, we are not quite so sure. It may be both a cause and a result, at one and the same time, just as the spark and the instantaneous flame are both the cause and result of the explosion of gunpowder. By means of an endless chain, rope or belt, a continued succession of discharges might be run up and let off through a whole week, if need be. (See Loomis, "Telegraph Wires in Storms," 173.)

Is it asked that I expect that feeble man will learn to control the winds and the waves, the seas and the storms? I answer emphatically yes; for Holy Writ informs us that he was created for this very end, in the image of God himself, for the express purpose that he might gain dominion, masterdom, lordship, over all the earth and every living thing in it, to replenish and subdue it; and we have already grappled in with the steam, the lightnings and the oceans, and taught them to measurably behave themselves, and now is just the time to take hold of the storms and the thunder clouds, and God aiding us, we shall at last succeed, and obediently do what He has already told us to do—to make even "the desert to blossom as the rose." We will obey our Father in Heaven in this as in other things, for He is evermore good to us, and only good.

Another marked phenomena in these different and repellant currents of air is the apparent sudden dip of the upper strata down to some point on the surface of the earth, causing sudden and extraordinary changes of temperatures, especially from warmth to cold, over a region more or less wide. In Texas, and south of this, such dips of the upper current from the north are quite common, and called "northerners"—sometimes suddenly sinking the thermometer some forty or fifty degrees, and bringing with it most destructive frosts and snows, far south of other regions, which may still remain warm and calm. When we reflect that the most intense polar cold forever reigns, both summer and winter, only a very few miles over our heads, we can readily see what must be the effect of the sudden dipping down of some stream or part of this cold upper air, over some spot or area on the earth. But it is not easy to divine the cause that produces these sudden dips; and it is still more wonderful that they do not occur far more frequently than they do. This upper strata, though heavier from cold, is also lighter from relief of pressure, as well as from the fact that it is not so continuously weighted down by absorption of water, from the evaporation of the earth and the waters, so that, on the whole, though colder, it is still lighter than the lower strata of commingled air and water, that floats under a heavier compression near the surface of the earth. Why, then, should this upper current ever descend? or, if at all, why not oftener than it does? Supposed electrical changes are the only answer we can give. And this leads us to further hope to break in upon these strata to produce rainfall, by inducing the needful electrical changes at the proper place and time, in some way as above intimated.

There is another phase of these greater northern and southern upper and lower general air currents, which is particularly interesting to us, as determining to a great extent the prevailing character of our winters, which may be called their *general drift*. Since the entire *moving force* of the great trade winds, or of those winds that move from the pole toward the equator, is in the south toward the sun, the return current is, so to speak, left to get out of the way, or to get back to the north, as best it can, with no specific northern force to attract it thither; it is simply rolled and pushed back by the constant accumulation and piling up of air at the equator, drawn there by the constant power of the sun and its heat. Of course this return current seeks the easiest way back again to the poles which it can find, or elects the path of least resistance, and this will be, of course, over the warmest and dryest parts of the earth, as there the opposing northern current will have least weight and force,and the returning south current will meet there with least resistance. Now, it naturally and almost invariably happens that the greater bulk of the flow from the north goes down south over one continent, while the greater volume of the return current goes up north over some other continent, in some other part of the world; or the one volume may go down south on one side of a continent or high mountain range, and return north on the other side of it. Of course, on the one side, the prevailing winter winds are north and it will be cold, while on the other side or continent their prevailing winds will be from the south return current, and they will have a mild, warm winter. So absolutely inevitable is this, that whenever we read, or hear, or know of an extremely cold winter over one wide reach of longitude, over which the northern winds are flowing southward, we know that we shall hear, and must hear of some parts of the earth or sea, over which this cold current returned again, made warm from the south, and bringing them a winter as genial and warm as that on the other side, or over the other parts, was cold and severe—inasmuch that a cold winter all over the globe, at one and the same time, is an utter impossibility. The present condition of warmth that has prevailed over this continent throughout the fall, as contrasted with the extreme cold reported from around Paris and in Europe, is only one very common illustration of this inevitable law. In countries where the wind-flow from the north predominates, they have now and then warm and hopeful days, with south winds; but after every storm, the wind whisks again round into the northwest, and blows cold enough to take the hair from off a man's head. But where the opposite southern flow, or flow from the south prevails, although they have cold days, or cold weeks it may be, still the storms seem to die away beneath the lull of the south and west winds, and it suddenly turns warm, even when everybody expects it is going to be cold.

Can we now determine the laws and causes of these great and important changes that determine these *general drifts* of our northern and southern air currents, so as to predict the general course of our winter seasons? If we can, it is evidently a matter of great practical moment to our farmers and horticulturists—and I think we can.

We have here in this Mississippi Valley a thousand miles square or more of soil of a very similar and uniform character. It becomes so heated by our hot summer suns as sometimes to absolutely crack down for ten or twelve feet in depth. When so heated, it inevitably operates just as an immense hot iron would do, to heat all the air over it; and so long as it retains that heat, it insures that the return warm currents of air from the south should be over us, on the principle above stated; and it is simply impossible that we should have a cold winter. But so long as this immense mass of soil continues dry, it holds its heat, or parts with it only slowly and with great reluctance, because, when dry, it is an exceedingly bad conductor of heat, but once thoroughly wet through, it becomes a good conductor, and parts with its heat and its power of keeping the air warm almost at once, and the cold northern currents, with their cold winter, are sure to set in over us, while the genial south currents seek their return to the north over some more feasible and genial route, by the same inevitable law of gravity that air enters a heated room by the colder and goes out by the warmer route. All this would happen from the simple force of gravity alone, although it may be that there is an additional direct affinity and attraction between the warm air and the warm lands, just as there seems to be between moist and rain-bearing air and storms, or moist or shaded lands. Given first, then, a thousand miles square of mostly dry lands in this valley, or lands not yet wet through by the fall rains, and a cold winter is clearly impossible; but let this same land once be drenched with water, and therefore part with its heat, and a warm winter is equally impossible. There is one seeming temporary exception to this rule, and I know of only one: sometimes, as has happened this year, the northern current, from some unknown cause, takes a sudden dip down over a region more or less wide, and flares abroad to the far south, whole islands, continents or promontories of snow, covering wholly in the warm earth, and making it, for the time being, wholly ineffectual in warming the air above it, simply because the snow prevents it; and a more or less cold snap will ensue, for the cold northern currents will always roll down over continents of snow, as a matter of course. But the reserved heat beneath will soon expend its force on this alien and unnatural snow, and cold, snow and all will soon be gone, and the genial south breeze return again. But can we know the condition of this wide range of soil, so as to fairly base our predictions upon it, in the fall of the year? I answer, we can. Of course, the actual condition of any single town, or county, or even state, can decide nothing, among causes so wide reaching, with any great certainty. Though here, again, the common people—Germans, English, Irish and Indians—have given us their symbolic signs, true and useful in the main, though, as usual, scouted at by the philosophers, falsely so called. These diverse peoples, who watch the skies and the facts, and not the theories and the books, all say that when the beavers build their dams and houses high it is a sign of a cold winter, and when the husks of the nuts and the corn, and the feathers on the water fowls, etc., are dense and thick, it is a sign of a cold winter, and *vice versa.*

Now, when do these phenomena occur, and what is their real cause? Beavers, of course, build their houses high only where the water is high in the fall in the rivers, showing that the whole country is already covered with water and has parted with its reserved heat, or must soon do so. Everybody knows, too, that our soil, when dry, is one of the most sterile of all soils, so hard and dry and compact that even grass will not grow on it; but when wet and moist, all growths are excessively rapid and heavy. They know equally well that all these husks and shucks of all sorts grow mainly in the last part of the year, and that therefore they are thick and heavy, or light and thin, precisely according as the ground is either wet or dry, or according to those same conditions that determine the great air currents, and the heat or cold of the season for months to come. Everybody knows equally well that the feathers of water fowl will grow thick and close when they can everywhere finds pools and ponds of water to splash and dabble in, near to their feeding places, and that they will grow thin and light when they cannot. That is again exactly balancing with those great universal causes that determine the seasons.

When shall we learn that the Lord, when He made this world, understood His business, and knew what He was about, and everywhere nicely adapted and adjusted one thing to another by the most simple, and still by the most inevitable means? He did not blunder, after all, on the beavers or the water fowls, nor on the corn shucks, nor on the climates, nor on anything else; and the same resistless forces that insure a hard winter, suitably provide for and insure all things needful against it.

To be sure, the Indian, or the Englishman, or the German, who should reason only from the fowl in his own range or yard, or the shucks in his own field, or the springs and streams in his own county, would reason from a basis altogether too narrow, and be as likely to miss the mark, in many cases, as to hit it.

And this suggests to me our great and urgent need of two special things—a daily or weekly report of the guage-hight of the water in all our large rivers, which would show the general condition of the whole country as regards its wetness or its drought; a daily report of the advance of the snow line along our northern borders in the fall of the year, and especially of the width and reach of those jutting promontories of snow, like the last great storm, thrown down over areas more or less wide, by the apparent dip and sudden commingling of the great air currents overhead. The cost of all this would be but very little, and, if well done, would enable us to so far forecast the coming season as to lay our plans with some degree of intelligence, and save the country millions of money. As it is now, millions of men either rest upon their oars or work with great fear and hesitation after a certain season of the year, because they fear every day that all their plans are liable to be suddenly interrupted and cut short. Give us such items as the above, and give us a good system of storm signals, already inaugurated by the government, for each county, and can it be doubtful that it would save the country untold millions of money, and of lost time, often more valuable than money? Even with such meagre reports as now get into the papers, an intelligent man can, greatly to his advantage, forecast the general character of our coming winters. There really is no more mystery about it than there is about the wind that comes in at the bottom and goes out at the top of the door-crack; and this whole movement of the general drift of these currents depends exactly and inevitably on the same principle. Set a cake of ice or snow over the top door-crack, and the whole motion will be for a time reversed. A very simple apparatus would show this whole thing to the eye of the learner.

The peculiar function of our thunder storms, in breaking up our long droughts, needs some particular notice here. It is often truly remarked that the whole tendency of these greater air currents, before described, are such, in our climate, that when it begins to rain it can never stop, and when it stops raining it can never begin again. This would be literally true, were it not for the swing of the sun from north to south with the seasons, bringing us under continually new conditions and for the action of our local thunder showers, in breaking up our long droughts. When once this spongy soil of the west with its varied products of trees and herbage, becomes thoroughly drenched and flooded with water, exhaling by myriads of hogsheads every hour from its surfaces of leaves and plants, as well as intensely evaporating from every foot of its hot and spongy surface, the lower surface winds, whose office it is, as feeders, to lick up this watery vapor, and bear it upward to the bosom of those great storm-bearing clouds, that perpetually sail over our heads from the southwest, the surface of the whole country then becomes almost infinitely more productive of the materials for rain than any ocean possibly can be, and what is spilled down on us at one point, one hour, is soon gathered up again, and spilled down at some other point, the next. It seems to rain so easy, that it can almost do it without clouds of any sort; and it does seem as though it never could stop raining. But as the sun advances, this rain-belt swings on to the north of us; and the increasing power of the hot suns, and the dry south and west surface winds lick up again all surplus moisture, and bear it over to the rain-belt already passed to the north of us. And now the reverse condition soon ensues. Nothing is left on the hot, dry surface out of which rain can be made. The heavens and the earth seem changed to iron and brass; clouds, of threatening and portentious look, in the great southwest currents, are soon dissolved into thin and treacherous air again; it tries hard, day after day, but it really seems that it never will, or can, rain again; and so far as these great upper southwestern storm-clouds are concerned, it never could begin again. But right here the entirely new system of our local northwest thunder storms set in, to break up this terrible drought, and prepare new material for again feeding those greater resources of rain and of storm. The excessive heat and drought itself seems to engender these local thunder storms; they gather here and there, before our very eyes, the surface winds at first always blowing toward their centers to feed them, and finally, whirling them off with terrific force and grandeur, to scatter their accumulated rain over acres, or townships, or whole counties, here and there, till thus the whole country becomes sufficiently wet to render the recurrence of the great southwest storms possible again. This usually comes round in September, if not before, when the rain-belt again reaches us in its second swing toward the south. Nothing can be more simple in fact, or more sublime and beneficent than this perpetual action and re-action, this everlasting play and inter-play of these two great complementary systems of southwestern and northwestern storms will be found to be, when once even tolerably understood. I say tolerably, for so many and varied are the forces of electricity, and heat and drought, of evaporation and condensation, perpetually involved, that for ages to come we can hardly hope to fully comprehend their movements, only in the barest outline; the more minute details will perpetually, for the present, baffle and elude us. I cannot forbear remarking, however, that, little as we know how these local thunder storms are produced, which are the necessary natural instruments of breaking up our great droughts, all that we do either know, or rationally surmise, gives us strong encouragement to make trial of artificial means, similar to those I have suggested, for effecting precisely the same result.

We come now to notice some of the effects produced on our climate by the changes in the general surface of the earth itself, such as changes in the average hight of the under-ground water-line, by culture, tramping, herding, drainage or otherwise, from the planting or extermination of forest trees and wind-breaks; of various crops, exhaustive culture, etc., etc. In every consideration of the phenomena of the rain fall, it should be remembered that either a cubic yard of air, or of vacuum, at 50° will hold one-half a cubic inch of water; at 75° Fahrenheit, a whole cubic inch; and at 100°, two cubic inches; that is, air, at 100° will hold four times as much water as air at 50°; and air at 87° is reported by another authority to hold four times as much as air at 32°; so that when either of these two lower and higher temperatures of air are, by any means, commingled, more than half of their common stock of watery vapor is precipitated into a rain fall. Any other mode of cooling down the higher temperatures would obviously have the same effect, whether it be from the cool, moist earth beneath, or from the sudden dip down or wider sweep of the great air currents above, or from the simple tidal waves, commotions and wakes produced by the attraction and inter-action of the sun and moon, referred to under a preceding head. One hundred cubic inches of air weighs about thirty grains, and a cubic foot of water weighs about 1,000 ounces, or 62½ pounds, as reported. From these data interesting deductions might be made, did time and space allow.

It is obvious that in a new and unsettled prairie country, the whole surface of the earth is exceedingly spongy and porous, full of humus, and everywhere shaded, and roughened and clogged, by tufts and tussocks of both fallen and growing grass; so that all water that falls from the clouds, is everywhere held fast, and impeded, and dammed up in little cups, pools, and puddles, in its attempts to run from the soil toward the rivers and the ocean side. The water is thus held upon the soil, until it is either evaporated by the sun, or sinks down into the earth to raise its springs and fountains, and the sum total of its great general underground water level. Hence springs and streams once ran that are now perfectly dry, and wells from which water could be dipped from the top, have settled their water level some ten to twenty feet, and cellars once annually flooded with water are now always dry.

For when the herdsman comes with his herds, these rough prairie surfaces are trodden and smoothed down, and made more compact and solid; the plow and harrow cuts and rakes all down to a dead level; cities are built and roofed and paved; streets are opened and drained and trodden; and ditches, furrows and drains, both above and under ground, over millions of acres, in all possible ways, hurry the falling waters off toward the sea, instead of allowing them to sink quietly and sullenly into the earth to perpetually raise its average under ground water-level.

If it be true that cold, damp soil attracts on the great scale the cold and dense currents of air, while the warm and dry soil attracts the moist currents, the general effects of this culture, and constant sinking of the underground water line, must be apparent, as well in respect to the changes of cold and heat, rain and drouth, as in respect to the nature and growth of the crops, from what has already been said. And the real effects, this generation of men have seen with their own eyes, all over this great valley. They need therefore no further description from me.

We come now to consider the effects of forests and tree culture on climate; and with this general survey before us, we are somewhat prepared, I trust, to estimate it at its true and real value, with no undue or absurd exaggeration of its real importance, amid causes so universal, irresistible, incessant, far-reaching, well-balanced, and eternal. It is of vast importance to us, because, like the drainage and culture, the explosions amid the upper strata of air, by means of balloons and torpedos, and their electric connection with wires to the railroads of the continents; or like the reports of the river water-guage, or the northern snow-line, or the approach of the southern rain-belt, it is one of the few, the very few means, of practical forecast, or of guidance or control, that we seem to have in our own hands, but shall hardly supersede the laws of gravity, the all-controling power of the great staring sun, the forces of heat and cold, and electricity and magnetism so called, or the consequent sweeps and swings, and tides and whirls, of the great circumambient air and the whirl of the great globe itself, like a cannon ball, shot through infinite space, or its rotations, and rocking, and strains, and agonisms and creakings; its belchings, and earthquakes and volcanoes, as it submits to the iron grasp of these mighty concurrent forces, that evermore handle it with the same ease as a boy spins and lashes his top upon the marble floor; or if you ever become able to dispense with any one or all of these, by any process of culture or art, I would like to call in and hear you lecture on climates.

In every possible economic point of view, however, I consider it wholly impossible that the people of the West should pay too much or too early attention to tree planting; but all work done on a solid and real basis of simple truth, is generally quicker and better done than work incited by extravagant and exaggerated fancies. Let us then find, if we can, the real facts in the case.

That local clouds and rains tend to follow streams and damp, shaded timber-belts, all other things being equal, results inevitably from principles already laid down; that such is the case also in fact, thousands of unsophisticated observers bear witness, in all parts of the country. That the millions of pointed leaves of the forest trees do in fact operate as a sort of electric conductors, performing naturally the same office of changing the electric relations of repellant air-currents, and causing them to commingle, and give up their latent rain, on the same principle that I propose to produce the same effect, by a conducting wire attached to a balloon, or otherwise elevated, there can be scarce a doubt.

That such trees shade the earth and keep the underground waterline in summer much higher than it would be if they were swept off; that on the other hand they arrest the sweep of the cold winds, and especially if evergreen, blanket over, so to speak, the earth in winter, and cause it to radiate, or part with its accumulated summer heat, much more slowly than the naked fieds do, admits of no doubt at all. So far, then, the effects of forests are and must be very great over any given locality.

But there is another point, not so commonly considered. I refer to the vast amount of water that a forest itself daily draws up and pumps out, or throws off into the air. According to Haler, the grape vine throws off about one-half ounce of water to every square foot of surface, every twenty-four hours; the apple tree and the sunflower exhale or throw off nearly a full ounce, in the same time, to the same surface; and other trees and plants still more than these. It is also estimated that a large tree contains from four to six acres of natural foliage, while a moderate sized tree would afford one acre of foliage; if, then, there were only forty such trees to the acre, each acre would pump up into the air, every twenty-four hours, two thousand five hundred barrels of water of fourty gallons each. I say pump up, because such is the fact; all this immense quantity of water is not simply evaporated from the surface by the power of heat, but it is actually pumped up, from the depth of the earth beneath, by the force of those myriads of little vegetable cells, of which all trees are composed, passing from cell to cell by a principle called endosmose and exdosmose attraction, not wholly unlike the interaction of pump valves, only vastly more simple, curious and effective, and when each drop of this water has performed its office of bearing in solution its portion of solid matter to the leaves or stems of the tree, it is thrown out into the air, as of no more use to that plant or tree. Is it possible that such an operation should go on incessantly, night and day, over large areas of land, without furnishing to surrounding fields a large increase of those material, out of which the dews, the rains and the thunder showers are made? We well know that it is not. It is true that other vegetable products proportionally exhale water in the same way; but that from a grass or grain field is comparatively small, and active only in the early part of the season; that from a corn field is much larger, and more continuous; hence a corn field is well nigh able, if kept in vigorous growth, so to speak, to pump its own water; to throw up enough by day to make is own dew by night, if the lazy plowman will but keep his plows running, so that the loose soil can drink up again what actually falls down upon it. But none of these compare, in the amount of their exhaled water, with a forest or a timber-belt, nor in the depth below the earth, from which they are able to draw up their watery supplies.

With such plain facts as these before us, how can we well over-estimate the beneficent effects of forests, groves and timber-belts, in moderating the extremes of heat and cold, of floods and droughts, aside from all their profit, and beauty and comfort, to man and beast, wherever they are judiciously applied? I am most profoundly convinced that it is possible to double the real value of every acre of land in Illinois, within twenty years, by a judicious and universal system of tree planting alone.

I have thus, my friends, given you as best I could a sort of a naked and bare-boned skeleton view of this beautifully sublime and sublimely beautiful subject of climatology.

Whatever young man of you ever arrives at even a tolerable understanding of this one simple science of the agriculturist—only this one, among the multitude, so nearly and intimately connected with our most beautiful and interesting of all professions, and of all arts—will derive therefrom more solid and ennobling knowledge, more true culture, more real discipline of the highest and best powers of the human mind; more true power of practical analysis and reason; more that in all regards, elevates, and blesses, and adorns, and inspires human souls and human beings, than all the old Greeks and Latins ever knew, or the joint knowledge of all their peculiar literatures can ever afford. Still, I would by no means depreciate or interdict the study of the classics, wherever those studies are either apposite or appropriate. But I would say to all their devotees, as the Saviour of men said to the Jewish conservatives of old, "These things ought ye to have done, but not have left the other undone."

LECTURE ON INSECTS.

BY WILLIAM LE BARON, M. D., STATE ENTOMOLOGIST.

Insects constitute the most numerous class of the third primary division of the animal kingdom, designated by the name Articulata. They are so called because their bodies and limbs are divided into many segments, united by a corresponding number of joints or articulations.

Two of the other great divisions, the Mollusca and the Radiata, of which the oyster and the star fish may be taken as respective examples, are soft-bodied animals which are usually enclosed in a shell, and which exhibit scarcely any trace of proper articulations.

The primary division of the animal kingdom or the Vertebrata have parts, it is true, to which the segments of the Articulata are, for the most part, analogous, but they are less distinct and less visible externally, so that the term Articulata happily expresses the most prominent characteristic of this class of animals.

The name insect, derived from two Latin words meaning cut in two, is founded upon the same peculiarity; and *entoma*, the Greek word for insect, from which our word entomology is derived, means precisely the same thing.

Let us see for a moment how extensively this idea of segmentation is carried out.

In the first place, the body of an insect presents three principal divisions, usually separated from each other by deep incisions. They are called the Head, the Thorax, and the Abdomen. The head is attached to the thorax by a narrow neck, and the abdomen is often joined to the thorax by a narrow footstalk called the peduncle. This peduncle is sometimes so short that it is not externally visible, and in some whole orders of insects the abdomen is joined to the thorax by the greater part of its breadth, in which case it is said to be sessile.

If we examine the thorax critically, we find that it is composed of three parts closely consolidated, but usually distinguishable by superficial or slightly incised lines. These parts are called the prothorax, the mesothorax and the metathorax. Each of these three segments is furnished on the underside with a pair of legs, so that all insects are hexapods, or six legged animals. Those creatures, therefore, which have more than six legs, like the spiders which have eight, or the millipedes, which sometimes have more than a hundred, though they are generally called insects, are not regarded as strictly belonging to this class. To the thorax also are attached the wings or organs of flight, the front pair being attached to the mesothorax, and the hind pair, when they exist, to the metathorax.

The abdomen consists of a number of segments in the form of rings, more or less movable on each other, each ring usually overlapping a little that which is next behind it. The number of abdominal segments varies somewhat in different families of insects. In the larva or caterpillar state, in which the annulose structure is more simple, the body is divided into 12 rings, besides the head. As the thorax in the winged or perfect insects, exhibits three segments, it follows that in order to make up the number 12, the normal number of abdominal rings must be supposed to be nine; and in the male earwigs (Forficulidæ) this number is actually found to exist, though the usual number is not over six or seven. The number of joints in the antennæ or horns of insects is very variable. In the large order of Coleoptera or beetles, the number is, with very few exceptions, eleven; and this may be taken as not far from the average number in the class of insects—some orders as the Orthoptera, Neuroptera, Lepidoptera, and the majority of the Hymenoptera, having more than eleven, whereas the Hemiptera, Homoptera, a part of the Hymenoptera, and the greater part of the extensive order of Diptera, have less than eleven. The mouths of insects, as a general rule, are composed of an upper and lower lip, a pair of upper and lower jaws, and two pairs of palpi or feelers, which are short articulated appendages, consisting usually of three and four joints respectively, or 14 joints in all four of them. The legs of insects, without including the generally immovable hip joint, are composed of the thigh, the leg, and the tarsus or foot, which is usually 5-jointed, making seven pieces in each leg, or 42 in all the legs combined.

In counting up the number of distinct pieces of which an insect is composed, therefore, we may reckon 13 segments for the head and body, 22 for the antennæ, parts of the mouth, 20; wings, 4, and legs 42; making in all 101 joints or pieces; and in the insects with many-jointed antennæ, this number would, of course, be considerably increased. In round numbers, therefore, we may say that an insect is composed of about one hundred distinct pieces or segments—connected together by movable joints.

I have run through this calculation to show the remarkable appropriateness of the term Articulata, meaning many-jointed, for the animals of this class; but I should not have taken up so much time for this purpose, had it not given me an opportunity, at the same time, to give you a brief sketch of the component parts and external organs of insects.

Of the number of actually existing species of insects it would be impossible to make an accurate estimate, and almost as difficult to form an adequate conception.

In 1854 Lacordaire estimated the number of species of Coleoptera, or beetles alone, to be 80,000 actually known to exist, and it would be safe at the present day to put the number at 100,000; and this is only one of eight orders; three others, of which the Hymenoptera, or wasp-like order, the Lepidoptera, or butterfly and moth order, and the Diptera, or two-winged order, are not much inferior in number of species to the beetles. The number of species of insects actually known, or reasonably supposed to exist, cannot, therefore, fall short of 500,000, or half a million. The number of species already found in the United States is upwards of 30,000.

Now, in contemplating such a vast variety of insect forms, we should become absolutely bewildered, if it were not for the incalculable aid we derive by applying to them the well-known and established principles of classification.

It is found that this almost countless host of insects can all be reduced into seven or eight large groups designated by the name of orders. Where these orders approach or run into each other, certain intermediate or osculant forms are found to exist which can sometimes be classed with one of the adjacent orders about as well as the other, and in other cases we cannot very satisfactorily include them in either. This has led some classifiers to elevate these intermediate groups to the rank of orders. But it is very questionable whether either scientific or practical entomology has gained by this step. The English entomologists have generally adopted this more numerous subdivision.

Mr. Stevens, in his catalogue of British insects, divides them into fourteen orders, and Mr. Westwood, in his modern classification of insects, admits thirteen. Linnæus, the great founder of classification and nomenclature, included all winged insects in six orders but he, of course, had much fewer species to deal with than we now have.

The great French author, P. H. Latralle, who has been styled the prince of modern entomologists, preferred the more simple and comprehensive classification, and admitted but eight orders in the class of insects, and my personal friend and preceptor in entomology, Dr. Thaddeus Wm. Harris, of Cambridge, Massachusetts, who was certainly second to no entomologist that America has produced, in his well-known treatise on noxious insects, comprises them all in seven orders, excluding the Neuroptera from the list of orders containing noxious species.

The great advantages derived from classification depend upon the principle that all natural objects constituting a natural division, whether it be a class, an order, a family, or a genus, have certain characters in common, so that if we know the characters of one of its constituent species we know to a certain extent the characters of all.

If you show to an experienced entomologist, for example, an insect which he never saw or heard of before, he will, in most instances, tell you, at a glance, a great part of its history.

We cannot therefore familiarize ourselves too much with the characters of natural groups, beginning with the few primary divisions, and descending, as we may have time and opportunity, to those of inferior rank.

We repeat, then, that all the countless hosts of insects, collected from all parts of the globe, and which people the earth, the air, and the water, can be arranged under seven great divisions, which are designated by the name of orders. These orders are as follows: The Coleoptera, or beetles; the Orthoptera, composed chiefly of the grasshoppers; the Hemiptera, or bugs, properly so-called; the Neuroptera, including the dragon-flies and the Ephemeræ, or May-flies, the Hymenoptera, or wasps and bees; the Lepidoptera, or butterflies and moths; and the Diptera, or two-winged flies.

I wish to dwell for a few moments upon the meaning and extent, and force of these few great primary divisions of insects. And I beg you, my friends, to divest your minds of the idea that, in so doing, I am dealing in technicalities, or scientific abstractions. Far from it. These orders are, to entomology, what the continents are to the geographer, or the four cardinal rules of arithmetic are to the mathematician.

They are seven arches on which rests a stupendous superstructure. They embrace the seven primary ideas or principles which enable us to take the world of insects, as it were, in our grasp, and bring within the scope of our comprehension half a million of diverse forms.

They are the keys to the seven inclosures in which we may suppose all insects, whether noxious or otherwise, to be contained, and which we must possess ourselves of if we would become acquainted with their appearance, their characters or their habits.

It will be observed that the names of the orders of insects (Coleoptera, Lepidoptera, etc.,) all have the termination *ptera*. This is the plural of the Greek word πτερον, meaning a wing. The primary divisions of insects, therefore, are founded upon the diversities in their wings; and the wings of insects being their largest and most conspicuous organs, we are able to apply the principle of classification thus happily selected, at a glance, and without any minute and laborious examination. This mode of classifying insects was suggested and commenced by Aristotle, and almost perfected by Linnæus.

J. C. Fabricus, a learned German entomologist, subsequently divided winged insects into eight primary groups, founded upon differ ences in the parts of the mouth, arguing that the organs used in seizing and masticating food, are of more importance in the animal economy than the organs of locomotion. However philosophical this view might, at first sight, appear, it was found not to lead to satisfactory results. In other words it was a step backwards in the history of entomology. This system has, long since, been abandoned, all modern authors having adopted the simpler and clearer classification of the great masters. The term *Coleoptera* is compounded from two Greek words χολεος a sheath or case, and πτερα wings. It embraces the great order of beetles, which are distinguished from other insects by having their wings inclosed and protected under horny sheaths or wing-cases, designated in scientific language by the word *elytra*. Most insects have four membranous wings. The beetles have but two. The elytra represent and take the place of the anterior pair. They are not used in flight, but are held erect and motionless so as not to obstruct the motion of the true wings. The wings are much larger than the elytra, and in order to be covered by them require to be folded two ways, that is both longitudinally and transversely. The beetles are, as might be supposed, comparatively poor flyers. Some of them have no wings under their cases. Many which have wings seldom or never use them; and many others, like the curculios and the leaf-beetles, or Chrysomelidæ, when alarmed do not attempt to escape by flying, nor by running, but by contracting their legs and wings close to their bodies and dropping to the ground, usually amongst dead leaves or grass, where it is often impossible to find them. It was to take advantage of this singular habit that the contrivance known as Curculio-catcher was constructed.

The Coleoptera are the most numerous, the most diversified, and the most generally collected and studied of all the orders of insects. They are the most easily captured, and preserved, of all insects, and therefore always constitute a large proportion of every general collection or catalogue. From this it undoubtedly follows that their numerical importance, as compared with some of the other large orders, such as the Hymenoptera and Lepidoptera, is considerably over-rated. Nevertheless, I think it will generally be admitted to take the precedence in this respect.

It is also the most numerous and diversified in noxious species, no other order approaching it in this respect, except the Lepidoptera. It contains the extensive and destructive family of Curculionidæ or snout-beetles, the Chrysomelidæ, or leaf beetles, he Melolonthidæ, or leaf-chaffers, the Cantharides, or blister-beetles, and all the extensive tribes of wood borers, except a very small proportion of the larvæ of the Lepidoptera.

The second order of insects is the Orthoptera. This name is also composed of two Greek words ορθος (straight) and πτερα (wings). They are so called because the inferior or true wings are folded only lengthwise, like a fan. It includes the grasshoppers, crickets, cockroaches, and a few other families. These insects also have the wings covered by a case, analogus to the elytrum of the Coleoptera, but it is different in form and consistency, being longer, straighter and more flexible, resembling in texture, parchment more than horn. The wing-covers of the Orthoptera are called *tegmina*, to distinguish them from the elytra of the Coleoptera; unlike the elytra, they are, by some species at least, used in flight. Under these tegmina the wings, as I have said, are folded straight or lengthwise, whilst under the shorter cases of the Coleoptera they require to be folded also crosswise. In this connection I have a great mind to tell you a little anecdote of my own early studies in entomology, as furnishing a pretty good illustration of the difficulties which often beset the path of the juvenile student. When, as a boy, I began to be interested in the study of insects, some 40 years ago, nothing had been published upon this subject in this country, except some of the descriptions of Mr. Say, scattered in several periodicals, and some of the earlier writings of Dr. Harris, and a few others. No elementary work had been attempted here, and the only work imported from Europe was a few copies of the first edition of Kirby & Spence's Introduction, in four octavo volumes, a work of great value but still greater rarity, and which, at any rate, would have been beyond the reach of my pecuniary means. We had in our home library, however, that vast compendium of knowledge, and father of dictionaries, known as Rees' Cyclopedia, in about forty large quarto volumes, which some of my hearers may possibly be old enough to have seen. In this work was an article of considerable length on the subject of insects, defining the orders and some of the leading genera under each. With this cumbersome and imperfect guide, I launched out upon the boundless ocean of entomology. I was as ignorant of the subject scientifically as a babe unborn, and did not know one order from another. One of the first insects which I captured and attempted to analyze, was a pretty copper-colored beetle, three-fourths of an inch in length, which I have since learned to be the Dicerca Divaricata, belonging to the family of Buprestidæ; the same family which contains the flat headed borer of the apple tree, and the larva of this species is injurious in the same way to the cherry and the peach tree. My first object was to determine to what order my specimen belonged. So opening my big compendium, I found that the order Coleoptera contained all those insects which have their wings folded both lengthwise and crosswise under their cases, and the Orthoptera embraced those which have their wings folded only lengthwise under their cases. Upon raising the wing covers of my specimen and examining the wings, I found them to be folded lengthwise only. It must therefore belong to the order of Orthoptera. The next thing was to find to what genus it belonged. But after trying it in all manner of ways, I could not make it fit any of the described genera. After puzzling over it till I was tired, I threw it aside in despair—or in disgust, I cannot tell now which. Many years afterwards, when I came to know more about insects, I learned that this family of Buprestidæ is the only one in the whole order of Coleoptera which has the wings folded straight like the Orthoptera. I had at the very outset run against one of those exceptional cases with which nature seems to delight to qualify her generalizations, lest, perhaps, we should fathom her secrets too easily.

I pass on to the third great division of insects, the Hemiptera. This term is derived from the Greek ημιδυ, *half* and πτρεα, *wings*. They are the half-winged or more properly the half-and-half winged insects, because the basal half of their wing-cases is thick like parchment, and the terminal half, thin and membranous. This is the order of *bugs*, strictly so called. They do not have gnawing teeth like the two former orders, but a kind of beak or sucker through which they imbibe liquid nutriment. It includes the brown squash-bug, the chinch-bug, and the bed-bug. Most of the insects of this order have a fetid odor, similar to that of the three species which I have just mentioned. This order contains but few noxious species, but most of these are of a very serious character. It is divided into two strongly marked sections, in one of which the wing-cases do not present the contrasted character above described. Most modern authors consider this section entitled to the rank of a distinct order, to which they have given the name Homoptera, meaning wings of the same consistency throughout. This section contains the Aphides and the Bark lice.

The next order is that of the Neuroptera, a term compounded of νευρον, a *nerve* or *sinew*, and πτερα, *wings*, so called because the four wings are composed of a thin membrane spread over a complicated network of nerves or veins, a structure with which you are all familiar in the wings of the dragon flies or devil's needles, which constitute a leading family in the order. This is the great aquatic order of insects, and is considered as holding the same place in the circle of insects that fishes hold in the circle of the vertebrata, and that ducks and geese hold in the circle of birds. It is not, however, exclusively aquatic, but more than half of the families which compose it are aquatic in their larva state, and the perfect insects are usually seen in the neighborhood of ponds and water courses. This order is remarkable for not containing a single species injurious to the farmer or horticulturist. Most of the species are carnivorous, and some of them are useful by aiding us in keeping noxious insects in check. The dragon flies are the hawks of the insect tribes, and prey largely upon other insects. The order also contains the famous little lace-winged flies, which are one of our most efficient aids in the destruction of the Aphides or plant-lice.

The fifth order of insects in this arrangement, is that of the Hymenoptera, a word derived from *humen* a membrane, and *ptera* wings, and so called because the wings are composed of a thin transparent membrane or skin, without cases, and with comparatively few veins. This is the order of the wasps and bees, or rather of wasp-like and bee-like insects.

It is one of the most exclusive orders, being usually ranked in this respect next to the Coleoptera. It holds a very peculiar relation to human interests. It contains a few noxious species, mostly confined to one family, that of the saw-flies. This family contains the rose-slug, the pear-slug, and the destructive saw-flies of the currant bush, the elm, and the pine.

But the great importance of the Hymenopterous order lies in the fact that it contains the great majority of those small but numberless parasitic insects, which perform so important a part in maintaining the balance between the world of insects and that of plants, and which, more than all other agencies combined, serve to check the excessive multiplication of noxious insects.

There is but one family of insects, outside of the order of Hymenoptera, that contains any considersble number of parasitic species,* and that is the family of the Tachinidæ in the order of Diptera. With the exception of this one family, nearly all the hosts of parasitic insects belong to three families of the Hymenoptera, namely, the Ichneumon flies, the Chalcis flies, and the Proctotrupidæ. Of these the Ichneumon flies are the largest, but they probably do not average more than one quarter of an inch in length, and the species of the other two families do not average one-tenth of an inch. Of the numbers of these insects we can form no conception. In the British Islands alone, where much attention has been given to these minute insects by entomologists, 265 genera have been recognized and described. Some of these genera contain upward of a hundred distinct species, and the number of individuals appertaining to many of these species could only be enumerated by hundreds of millions. These innumerable and almost infinitessimal insects perform an all-important and indeed indispensable part in the economy of nature. To their instrumentality it is now well known we owe our deliverance from some of the most destructive insects. It is moreover an interesting thought that these minute creatures ply their busy avocations wholly irrespective of our co-operation and in spite of our opposition. Man, by the wanton destruction of the insectivorous birds, can temporarily disturb the harmony of nature, can create a slight eddy or backwater, so to speak, in the onward flow of a beneficent providence, and might, indeed, in his

* The Dipterous families of Conopsidæ and a part at least of the Mydasidæ, and probably all the species of the anomalous order of Strepsiptera, are parasitic.

ignorance or his perversity, inflict irremediable injury upon his own interests, were he not saved, in spite of himself, by the all-pervading and uncontrollable instrumentality of the parasitic Hymenoptera.

The Hymenopterous order is also remarkable for the social habits and wonderful instincts of some of its species, which is strikingly illustrated by the well known histories of the ants and the bees.

The next order of insects which we are to consider is that of the Lepidoptera. This term is derived from υμην a *scale*, and πτερα *wings*. These insects are so called because their wings are covered and ornamented with minute scales, overlapping each other like shingles, appearing to the naked eye like the finest dust, but giving to the wings a peculiarly soft and beautiful surface.

This is the order of the butterflies and moths. It is an order of great extent, being about equal in the number of genera and species to the Hymenoptera, and is equally remarkable for the beauty and attractiveness of the winged insects, and the voracity and destructiveness of their larvæ, commonly known by the name of caterpillars. These, with one or two rare and abnormal exceptions, are all vegetable feeders, subsisting mostly upon the leaves of plants, but also in some instances upon the fruit. It contains the tent-caterpillar, the army-worm, the codling-moth, the canker-worm, the clothes-moth, and many other destructive species too numerous to mention. Next to the Coleoptera it contains by far the most destructive species, both to the products of the farmer and the horticulturist, and it is questionable whether it does not even exceed that order.

The seventh and last order of insects, in this enumeration, is that of the Diptera, a word derived from the Greek δις, *double*, or of *two parts*, and πτερα, *wings*, so called because these are the only insects, with a few anomalous exceptions, (Coccidæ and a part of the Ephemeridæ) which have but two wings. All other insects have either four wings, or two wings and two cases, which represent the other pair. This order contains the gnats and mosquitoes, the horse-flies, the bot-flies, and the house-flies, and though it is inferior to some of the other orders in the number of its families and genera, it is by no means certain that it does not surpass them all in the number of its individuals. It contains comparatively few species injurious to the agriculturist, but a portion of these are of the most destructive character, the most notorious of which are the Hessian-fly and the wheat-midge. It also contains, as we have before stated, the extensive family of the parasitic Tachinidæ.

Having taken this general survey of the leading divisions or orders of insects, let us look at them a few moments collectively, and see i we can arrive at any further generalizations which will be interesting or useful.

We may classify insects, like other natural objects, in different ways, according to the point of view from which we observe them. Thus we might divide insects, as we do birds, into land insects and water insects, and we might subdivide the former into those which live in or upon the ground, those which burrow into trees, and those which spend much of the time on the wing. Or we might divide them as we do quadrupeds, into the carnivorous and the herbivorous kinds. Or, again we might make their metamorphoses the leading principle, and divide insects into those which retain essentially the same form and are active in all their stages, and those which become inactive in the pupa state, and undergo a more complete transformation. And every such classification would have a certain advantage over any other, inasmuch as it would present certain important characters in a strongly contrasted light. But they are not always practicable nor philosophical, because they group animals together which, though they agree in one important respect, differ too much from each other in other important characters.

There is another division of insects, however, to which I wish to call your attention, which is so interesting and of so much practical importance that it has been actually adopted and put in practice by some entomologists of acknowledged rank, though not by all. This is the division into the mandibulate and the haustellate insects. By mandibulate is meant those insects which have mandibles, or teeth for gnawing. They are sometimes designated as the biting insects. By haustellate insects are understood those which have a proboscis or sucker, through which they imbibe liquid food. This, I have said, is an important practical distinction, for the reason that those repulsive substances which we apply to the leaves and other parts of plants, such as ashes, lime or soap, and even poisonous applications, like the hellebore and Paris green, whilst they prove obnoxious or fatal to the gnawing insects, have little or no effect upon the sucking insects, because these last, by inserting their probosces into the substance of the plant, imbibe their nutriment from the inner tissues, which our outward applications do not reach.

I have tried sprinkling the most poisonous substance which we have ever used for killing insects—namely, the Paris green—upon leaves infested with, perhaps, the tenderest of all insects, but belonging to the haustellate or suctorial division; I refer to the Aphides or leaf-lice. And though so strong an application seemed to damage some of them, yet there was none of that direct and wide spread fatality, which follows its application to the coarse potato-beetles, and other gnawing insects, which, in eating the foliage, also actually swallow particles of the poisonous substance.

For the reason here stated, it is evident that the haustellate insects must be the most difficult to deal with, of all our insect foes, and such, in proportion to their numbers, is, in point of fact, the case.

Let us now take a look at the several orders of insects which have just been delineated, and see how they stand affected with regard to this important principle of classification:

If, in accordance with the practice of most modern entomologists, we divide the Hemipterous order into two, namely, the Hemiptera proper, or as they are now usually called, the Heteroptera, and the Homoptera—making eight in all—we shall find that the orders of insects are equally divided between the mandibulata and the haustellata. In the former section, the mandibulata, we find the Coleoptera, the Orthoptera, the Neuroptera, and the Hymenoptera. In the haustellate division, are the Hemiptera, the Homoptera, the Lepidoptera, and the Diptera.

If now we inquire how we stand affected in our economic interests, to these two classes of insects, we shall find that though some of our worst insect enemies, and the most difficult to be overcome, are found amongst the haustellata, yet, by far the greater proportion of damage which we suffer from insects, is effected by the mandibulata—for the simple reason that they are very much the more numerous. Three of the haustellate or suctorial orders, the Hemiptera, the Homoptera, and the Diptera, have comparatively few noxious species, though, as we have just said, some of these are of the most serious character; and the other, the great order of Lepidoptera, is utterly harmless in the perfect state. Some are very short-lived, some take no food, but only propagate the species and then perish, and the others subsist upon the nectar of flowers. I say the Lepidoptera are harmless in their perfect or winged state; and this brings before us the remarkable fact that some insects, of which the Lepidopterous order furnishes the most striking examples, are haustellate in their perfect state, but mandibulate in their larval condition; and whilst the suctorial butterflies and moths not only inflict no injury upon us, but adorn our fields and gardens with their beauty and animation, their mandibulated larvæ, the caterpillars, are our most voracious and destructive enemies.

The suctorial order of Diptera, also, are mandibulate in the larva state. But as these soft grubs, commonly known as maggots, usually subsist upon decaying animal and vegetable matter in a semi-liquid state, they can hardly require to use their mandibles—which are always small and imperfect—for the purpose of gnawing, but more probably, only, for breaking down the soft tissues by which they are surrounded. The fluid nutriment must be imbibed by them, directly through the mouth-aperture, without the intervention of a proper suctorial organ. The mouths of the larvæ of the Diptera, therefore, would seem to be of a sort of intermediate character between that of the proper mandibulate and haustellate insects.

In a strict classification of insects according to their manner of taking their food, we should have to make a qualification, also, in the case of the bees and other Hymenoptera, which live upon honey or other liquid food, and which, though possessed of mandibles, are known to take their food, as was long ago observed by Kirby and Spence, by an operation similar to lapping.

The consideration of the supposed suctorial power of many insects leads to a curious question in insect physiology, which it may not be uninteresting to turn your attention to for a few moments, more especially, as I presume that I have some juvenile philosophers in my audience at the Champaign Universty. A butterfly or sphinx moth extracting honey from the bottom of a deep tubular flower, by means of its long tongue or proboscis, suggests at once the simple idea of sucking a liquid through a tube, just as, in old times, we used to suck cider through a straw. Of course, the boys of the present day do not indulge in any such immoral practices. This operation is effected, you know, by the pressure of the atmosphere forcing the liquid up the tube to fill the vacuum produced by the voluntary exhaustion of the air in the cavity of the mouth. But insects do not breathe through the mouth as we do; and they have no oral cavity in which to produce a vacuum. Whether the result be effected by the successive contraction of the parts, similar to the contraction of the esophagus in the act of swallowing; or whether there be a genuine suction effected through the whole length of the proboscis, instead of any special cavity, I am unable to say, and I have never seen the nature of the operation satisfactorily explained.

If there are any young Newtons or Faradays in the Industrial University, I hope they will, one day, enlighten the world upon this subject.

I have adverted above to the very serious character of some of the noxious insects of the suctorial division, and to the difficulty of counteracting their injuries. With the view of giving a practical conclusion to my discourse. I will briefly refer to a few of the most notorious of them.

As we have seen that the extensive order of Lepidoptera must be excluded from the class of noxious insects in their perfect and haustellate condition, we must seek our examples from the other three suctorial orders, the Hemiptera, the Homoptera and the Diptera. Fortunately the number of noxious species in these orders is comparatively small. The chinch-bug, in the order of Hemiptera, and the bark-lice, in that of the Homoptera, are perhaps the only ones in this division which are entitled to the rank of first-class noxious insects, though a number of others, such as the *Capsus linearis*, or Tarnish-bug, the Aphides, or leaf-lice, and several species of Tettigoniæ, especially the *Tettigonia vitis*, or leaf hopper of the vine, may be regarded by many as having a just claim to this bad pre-eminence. The Hessian-fly and the wheat-midge, in the Dipterous order, are noxious insects of the most serious character, but they do their damage in their larval and mandibulated state, and therefore do not strictly come within the pres ent category. But the mosquitoes and horse-flies, which are so excessively annoying to man and beast, are genuine examples of noxious insects the haustellate division. The notorious chinch-bug, though a repulsive insect, both from its destructive habit and fetid odor, is nevertheless interesting in one respect, at least, inasmuch as its history furnishes the most remarkable example on record of the efficacy of meteoric or climatic influences in exterminating noxious insects. The chinch-bug delights in hot, dry weather. Even a moderate degree of moisture seems to be repugnant to them, for it has often been noticed in localities where they have prevailed, that in cases where a wheat field embraced a portion of both high and low ground, the insects would be very destructive on the high and dry portions, while few or none of them could be found in the moister low lands. From this we might naturally infer, what is actually found to be the case, that the excessive moisture caused by frequent rains would be fatal to them.

In accordance with this view the excessively rainy season of 1869, embracing, as it did, the whole month of June, which is chiefly both the feeding and the propagating season of the chinch-bug, almost exterminated this destructive insect from the State of Illinois.

The almost unprecedentedly hot and dry summer of 1870 would have made the wheat-growing State of Illinois the chinch-bug's paradise, had it not been that there were not enough of them left over from the preceding unfavorable year to propagate the race to any considerable extent.

But though greatly reduced in numbers we must not suppose that they were wholly exterminated. Nature indeed does not easily permit her species to be lost. Individuals perish and their wrecks strew the earth, or moulder beneath its surface; but not without many throes and many resuscitations does nature permit a species to become extinct. Nor does she seem to make any discrimination with respect to rank or character, but saves from extinction the fragile wheat-midge and the nauseous chinch-bug, as well as the gigantic elephant-beetle, and the gorgeous butterfly; just as the human mother guards and cherishes, not her beautiful and hopeful children alone, but throws around her most deformed and sickly progeny the protecting ægis of her imperishable affection.

I repeat, then, that the chinch-bug still lives, and though, for the reason stated, they have not been sufficiently abundant to do much damage the past season, yet there is reason to believe that there have been enough of them under the favorable influences of the season to plant their colonies pretty extensively for another raid upon us in the summer next to come. Complaints have come to me from different parts of the State, especially in the more central portions, of their being found in considerable abundance; and several gentlemen, with whom I conversed at the recent annual meeting of the State Horticultural Society, gave their testimony to the same effect; and I have myself seen them in considerable numbers, in my own county of Kane, apparently secreting themselves for winter under the husks and sheaths of corn-stalks. I think, therefore, that in some localities, how many I cannot say, there is reason for the gravest apprehension with respect to the spring wheat crop of the coming year. In view of this prospect for one of his most important products, the farmer may be said to be somewhat in the condition of the mariner on the swelling tide, who sees the flashes of lightning in the horizon, and hears the muttering of the distant storm; and almost as helpless as the mariner when the storm has burst upon him, is the farmer when the countless hosts of chinch-bugs have once made their onslaught upon his fields. But in this, as in many other cases, though we may not be able to stem the tide, we can, at least, furl our sails and to some extent elude the storm.

In the first place, it will evidently be the part of wisdom, in those localities where the chinch-bug has been seen in considerable numbers, the last fall, to sow more sparingly of spring wheat the next year, than might otherwise be done.

In the second place, the most important precautionary measure we can take is to get the seed into the ground as early as possible. It is not the chinch-bugs which winter over that do the harm, but their countless progeny, which do not usually make their appearance till near the middle of June. If we can get our crop pretty well matured previous to that time, we shall in a great measure escape the effects of their ravages. For this reason the winter-wheat crop is rarely much injured by them.

It is also a good precaution to burn up the old corn-stalks or other litter that lie about the fields and fences, where the bugs have been seen, and in the shelter of which many of them are known to pass the winter. This is best done late in the fall, as this kind of rubbish is, in most seasons, made too wet to burn, by the snows of winter and the rains of the early spring.

If, however, through ignorance or shiftlessness or the unfavorable character of the season, the wheat should be got in late in the spring, and the month of June should come off hot and dry, and if the chinch bugs should have the impudence to believe that the good things of this world were made for them as much as for their more pretentious fellow creatures who, however, are only furnished with two legs instead of six, and if they should come to visit you, and should bring all their relations with them, and should come to stay,—then what?

Why then, my friends, I am very much afraid that your case will be beyond the reach of the State Entomologist. But as it is said that as long as there is life there is hope, and as the faithful physician does not desert his patient so long as the vital spark remains, so perhaps you will expect me to give you some consolation, even in this desperate extremity. Various methods have been suggested and put in practice to meet such an emengency as this. As chinch bugs seldom or never attack a whole wheat field at once, but commence their depredations in spots upon the highest and dryest parts of the field, the idea has naturally occurred that if we should cut down the wheat on these patches, let it lie a few hours to dry, and then rake it together, and burn it, we might destroy a large part of the insects. I cannot learn that this experiment has ever been attended with much success, and for two obvious reasons: first, because this operation does not reach the eggs and young insects which infest the roots, and secondly, because in cutting the wheat you will necessarily knock a great part of the insects onto the ground, and they will be just as likely to run into the surrounding grain, as into the straw which you are preparing for their funeral pyre.

The favorite food of the chinch-bug is spring wheat. It is not probable that this insect would ever multiply to any great extent if spring wheat were not cultivated. But having commenced and raised their first brood upon the wheat, they do not hesitate to attack barley, if it is within their reach, and they seem to flourish well upon it. Oats they will not eat until driven to it by absolute necessity. The rye raised in this part of the country being mostly winter rye, is, like the winter wheat, too early advanced in the spring to be much injured by them. After the small grains have been devoured by them, or have become too much matured to afford them nutriment—for it must be born in mind that we are now treating of an insect of the haustellate division, which does not devour the substance of the plant, but only imbibes its juices—it is well known that they pass on to the Indian corn, and find in its succulent stalks an abundance of sweet and congenial food. But by the time that this takes place, this magnificent plant has usually made such a luxuriant growth, that it does not easily succumb to their attacks, and generally only a few of the outer rows are seriously injured by them. But there have been times and places when whole fields of corn have been laid waste by the countless hordes of this prolific and destructive insect. In view of these facts the very important practical question arises whether there be any way in which we can prevent the chinch-bug from migrating from one field to another?

Fortunately the chinch-bug, though capable of flying sufficiently well, rarely uses its wings. It has been said by some, that they only take to flight during their love seasons. Be this as it may, experience has shown that in moving from one field to another, they generally, if not always, migrate on foot. Several plans have been resorted to to arrest their progress. The simplest and most obvious method is to plow a number of furrows a foot or two apart, and as deep as possible, having the perpendicular part of the furrow on the side farthest from the insects, so that, in passing, they will have to climb up a succession of perpendicular barriers of crumbling earth. It has also been suggested to lay dry hay or straw in the bottom of the furrows, to be set on fire when it shall have become well charged with insects. A more elaborate method is to make a barricade of fence boards set edgewise in the ground, the upper edge being smeared with coal tar, which it is said the insects will not pass, especially if it be renewed a few times so as to keep it moist. Short gaps are left in this fence every two or three rods, and under these deep perpendicular holes are dug into which the crowding swarms of chinch bugs may be precipitated.

The efficacy of all such methods must necessarily depend very much upon the thoroughness and ingenuity with which they are carried out. The testimony with regard to them, as might be expected, is somewhat contradictory and unsatisfactory. I mention them so that if necessity require, you may give them a thorough trial.

And now, my friends, in conclusion, I wish to improve this opportunity to enjoin upon you the importance of making memoranda of any interesting experiments or observations that you may make in connection with practical entomology, and communicating them to some central authority where they may be made generally available; and as I am, at present, holding the office of State Entomologist, there is an evident fitness in making me the center of such communications. By taken a little pains in this way, many valuable facts and observations may be preserved from oblivion; my own reports will be made fuller and more valuable; the useful facts thus accumulated can be condensed, classified and disseminated; and much benefit may accrue to you, to me, and to the State, and to some extent, possibly, to the country at large, and to the world.

ON THE ORIGIN AND THE PHYSICAL AND CHEMICAL PROPERTIES OF THE IN-ORGANIC MATTER OF SOILS.

BY PROF. A. P. S. STUART, OF CHAMPAIGN.

It has been said that soil is the raw material on which the farmer's industry is exercised to produce his harvests. If this be so, and the statement seems, in the main, just, the natural inference is, that the more perfect his knowledge of the material, the more successful will he be in working it. This, certainly, is the way we reason in other kinds of business. He, who will manufacture excellent woolen goods, must be well acquainted with the material he uses. So fundamental and essential to success is this elementary knowledge, that the young man who will become a successful woolen manufacturer, is at once set to the disagreeable task of sorting different kinds of wool in order to learn their different qualities. Now, what is true of this, is true of all kinds of business. The clearer and deeper our insight into the nature of the materials we use—the more precise and comprehensive our understanding of the principles and laws involved in their processes—the greater will be our power to modify conditions to produce desired results. Of this we have a remarkable illustration in the different kinds of thoroughbred stock. The results produced in this branch of husbandry by an intelligent and skillful adaptation of means to ends, are truly surprising, and they suggest the possibility of similar improvements in the different kinds of field crops.

On the present occasion, your attention is invited to the consideration of the origin, the physical and chemical properties of the in-organic matter of soils. This theme has been selected in pursuance of a general plan which is being carried out as rapidly as circumstances will permit, viz: an examination, both mechanical and chemical, of the soils of Illinois, to the end that a more definite knowledge of their constitution may prove beneficial to agriculture. It is not claimed that such knowledge, alone, will materially benefit this great industry, any more than the mere knowledge of the constitution of different ores will enable one to extract the precious metals. It is rather only a part of what every intelligent husbandman should know, not simply to conduct his business successfully, in the ordinary acceptation of the term, but to improve it; that is, to originate new and better methods of culture, based on clearly recognized relations of his soil to the crop he will raise on it, and thus to transmit to the future, something more than he has received from the past.

Soils are rocks more or less pulverized, and usually intermixed with variable quantities of organic matter. Originally, organic matter can have formed no part of soils, since, by going back, we approach the beginning of life, when no such matter existed. They are all underlaid by different kinds of massive rock, the surface of which has either been decomposed to form the soil above it, or been ground away and transported to forms soils elsewhere. The former of these results has been produced by certain atmospheric agents, as oxygen, water, and carbonic acid, aided by favorable climatic conditions; the latter chiefly by water and ice.

Wherever the underlying rock is exposed to the atmosphere, it gradually wears away .The alternate expansion and contraction caused by heat and cold, tend to loosen the particles. Moisture is absorbed within its pores, and frozen, by which the particles are forced still farther asunder, and when the frost melts, the particles become detached from the parent rock in the form of soil. A soil thus formed must evidently be of the same nature as the rock from which it was derived. In this way, perhaps, the primeval soils of our planet were formed. At least, if the theory of La Place be true, glaciers can scarcely be supposed to have been concerned in their formation. Some rocks, like mica, slate and limestone, yield with comparative ease to atmospheric influences, while others, of firmer texture, withstand them a long time. In certain parts of Pennsylvania, the underlying rock is a kind of gneiss or mica slate, in others, it is limestone, and both, under the above mentioned influences, have furnished some of the most fertile soils of the State. In the same way, boulders and pebbles, particularly those of not very firm texture, gradually wear away and crumble to powder. Even the hard granitic rocks scattered here and there over the prairie, are slowly undergoing disintegration, and contributing their mite to the soil. But what is of special importance in an agricultural point of view, is, that to these same influences is due the further comminution of those particles that constitute our soils. As a rock exposes a vastly larger surface when broken into fragments than it did before, it is easy to see that the disintegrating influence of the atmosphere must be increased, provided the particles are all of the same kind, and the atmosphere has easy access to them. Hence, we see how intimately the mechanical treatment of soils is connected with atmospheric and climatic influences. If we would have a finely comminuted soil, and, therefore, the benefit of those ingredients essential to vegetable growth, we must expose it as much as possible to the disintegrating influences of the atmosphere.

Another and very important agent in the formation of soils, is water. Most of our prairie creeks, especially after rains, are turbid with finely divided matter, held in mechanical suspension. This matter is carried into larger streams, and thence into still larger ones, until finally, it reaches the gulf, where it is spread out in the form of a plain or prairie to constitute the soil, perhaps, of husbandmen of some future age. Whoever has seen the great rivers of this mighty valley, thick, almost, with the material with which they are freighted, has seen illustrated on a grand scale, the transporting and leveling agency of water. It has been calculated that the mean annual amount of solid matter carried by the Mississippi to the gulf, is one cubic foot for every three thousand cubic feet of water, and some have estimated it considerably higher, making the total annual amount deposited in the gulf by the Mississippi alone, near four billion cubic feet, a mass equal to about one square mile in area, and 241 feet deep. Similar phenomena are observed at the mouths of all rivers. The Po, the Rhine, the Rhone, the Amazon, the Nile and the Ganges, have transported so much earthy matter to the sea, that even within the historical era, large areas of fertile soil have been formed, and cities that once were seaports are now many miles inland.

This material, which is fine at the mouth of a river, and which becomes coarser as we ascend towards its source, is the result of the mutual grinding of rocks against each other by the force of running water. This constant attrition reduces coarse rock to pebbles, pebbles to sand, and sand to the impalpable powder so often found in soils. If the country between the source of a river and its mouth is traversed by mountains or highlands, forming deep depressions here, and broad expansions of uneven surface there, lakes will be formed, and during heavy rains inundations will flood those portions of country but little elevated above the river's channel, and cover them with deposits of coarse or fine material, according to the violence of the current. Gradually the lakes will be filled with sediment, and become valleys, with the river winding through them, and the uneven expansions of country will be changed into broad plains; and thus it is that the rocks of mountains are transformed into fertile valleys or extended prairies.

It will be at once apparent that the agricultural resources of a State depend, in large measure, on the nature of these deposits, which constitute its soils. Their physical and chemical constitution, as well as the peculiar climatic conditions to which they are exposed, will determine the nature of the vegetation; and as transported soils are formed by the grinding up, not simply of one kind of rocks, but of many, extending often over large areas, they must naturally contain all the constituents essential to a luxuriant vegetation. Such, in general, are the soils of the prairie. We find in them pebbles of almost all kinds of rocks, showing that the agent that brought them hither, took them from as many different localities.

But this attrition of rocks is not limited to the beds of rivers and mountain torrents. It is in constant and active operation on the seacoast, where in storms and by the action of tides, the surf beats the pebbles and sandy particles against each other, reducing them to powder, and depositing it in the sea. Often, also, from marine currents or prevailing winds, the sea encroaches on the land, undermining cliffs and depositing them in the sea. The coasts of England, in several counties, are thus washed away at the rate of several yards a year, and the names of several places, once towns of note, exist now only in history. The cliffs of the Bay of Fundy, which often rise from fifty to several hundred feet above tide water, are subject to similar erosion and are constantly receding.

But a clear and more impressive conception of the erosive and transporting agency of water is derived from its effects as seen in those immense systems of strata that bear the name of geological formations. From these it appears that a large part of the earth's crust has, at one period or another, passed through changes similar to those now taking place. These strata were once pulverized by attrition, spread out as fine sediment on the bottom of the sea, formed the abodes of different species of marine life, became in turn, by the pressure of superincumbent strata, hardened into rock, and finally upheaved, and exposed again to atmospheric or acqueous influence, are either softened into soils, or carried again to the sea.

Another agent, in connection with water, that has had much to do with the abrasion and transportaiion of rocks, and which has impressed one of its most prominent features on the New England landscape, is ice. Icebergs, freighted with bowlders, gravel and finer material, are annually floated from cold to warm latitudes, where, enveloped in fog, they gradually melt and drop their burden. The same process, on a smaller scale, is taking place every winter in latitudes not much higher than our own; and even in our own it is not uncommon for ice to form in our rivers, inclosing rocks that line their banks, and bearing them in spring down the stream, grinding and furrowing, it may be, the rocks of the river's bed, where the water is shallow. The coast ice, which forms on the shores of the Bay of Fundy, incloses blocks of trap and bears them out into the Bay, where it deposits them; and a most interesting fact in this connection, to the geologist at least, and which teaches that this process has been in operation during an unknown lapse of time, is, that on the very spot where this is now taking place, blocks of old trap, partially decomposed, yet having their angular form as sharply defined as when first broken from the parent rock, are seen imbedded in the cliffs of the new red sandstone, where they must have been deposited by ice in a former geological era. Blocks of granite line the shores of the river and gulf of St. Lawrence, whither, with gravel and finer material, they have been carried and deposited by ice; and in the Baltic Sea, where the water freezes to a depth of five or six feet, immense masses of rock, with the usually accompanying debris, are frozen in, and on the breaking up of the ice, are floated to great distances. Could the Bay of Fundy be drained, its bed would most certainly be found covered with bowlders of trap; and could the floor of the Atlantic, between Greenland and the Gulf stream, be laid bare, it would most certainly present a scene not very unlike a New England landscape, thickly bestrewn with bowlders and earth as different in composition as the sources whence they came, and diminishing in size and quantity as we go southward. The same fact is true of the bowlders of this State, and is similarly explained. They are all of northern origin, very unlike in constitution and diminish in size as we advance southward. This fact is true even of the soils of the central and southern parts of the State. The sand of a Union county soil is much finer than that of a Champaign county soil. This may be owing, perhaps, to local causes; but if the soils examined are average specimens of their localities, and due to the same cause, they show that it diminished in intensity as it moved southward.

Another agent, that has been concerned in the formation of soil, is the glacier; and so important is this, in the judgment of some, that all others, in comparison with it, sink into insignificance. The theory had its origin in the study of the Alpine glaciers, those immense masses of ices, which move slowly down the valleys, carrying on their surface the rocks that fall from the cliffs above, and pushing along the rocks beneath and grinding them against their rocky bed. The effects of this enormous friction, resulting from the pressure of a mass of ice several thousand feet deep, are, first, to reduce to powder an immense amount of rock, which is swept by water to lower levels to form soil, and secondly, the scratching and furrowing of the rocks that form the sides and bed of the valley. These scratches and furrows, when covered and thus protected from atmospheric influences, remain as a permanent mark of glacial action; and it is assumed by those who trace the origin of soils chiefly to such action, that those furrows, wherever found, indicate the existence at some time of a glacier. Now it is well-known that the underlying rocks of a large part of this country, extending from Nova Scotia to, as some say, the base of the Rocky Mountains, are covered with grooves and scratches, having, in general, a direction from north to south, and extending to about the 38th degree of latitude. These furrows are not found scattered here and there, as if produced by an occasional and accidental cause, but the whole surface of the rock exhibits unmistakable evidence of having been ground away by some gigantic and uniformly acting cause. It is scarcely possible to dig through the alluvium of any part of New England on to the underlying rock without finding these furrows. Their similarity to those found in the Alps, and the conviction that no other known cause can adequately account for them, has emboldened some to assume that the whole northern part of this continent was once covered with a vast unbroken sheet of ice, several thousand feet deep, moving slowly towards the south, grinding away the rocks beneath, and producing the formation commonly known as the drift.

At the same time, there are those, who, admitting in general the agency of glaciers in pulverizing rocks, have still grave doubts whether the cause has been as extensive as is claimed by some; whether the grooves and scratches are all due to glaciers, or in part to icebergs, and perhaps other causes, and particularly whether the ice of the glacial epoch extended over all this valley, as far as the gulf.

Now, to arrive at truth here, it is necessary, as in every other question, to study carefully and thoroughly all the facts relating to it, and then, unbiased by any preconceived opinion, to judge impartially. Every pebble and every fossil of the prairie, whether vegetable or animal, found by digging through its strata, should be most sacredly preserved and studied, and made to testify of forces and conditions which led to the present state of things. And here it may be said that a rock imbedded in the earth, and thus preserved from atmospheric influences, will indicate the kind of action to which it has been exposed. A rounded pebble has received its form in the bed of a stream, or on the sea coast, or other similar place, where it has been dashed against its fellows until its angular parts have been worn away. Another has an even surface, as if made with a plane, polished, it may be, or covered with grooves and scratches. Such a rock has been exposed to entirely different conditions. Instead of having been rolled about, it has been firmly fixed in some material, like a precious stone in its setting, and its surface ground away by rocks that have been swept over it; or it has been frozen into ice, and borne by the current of a stream, or of the sea, over other rocks—having been thus ground itself as well as having ground the rocks against which it impinged. Sometimes rocks exhibit marks of both kinds of action. With a generally rounded form, a pebble will have one side planed off, so that the intersection of the curved and plane surfaces is so sharply defined that the forces which acted become as apparent as the effects produced. Even the direction of the motion, relatively to the rock at least, is easily distinguishable on the surface. Besides the strata themselves, of fine material, will often thow light on the conditions to which they have been subjected, and the changes which they have undergone.

Now, although opportunity for this kind of observation and study of the prairie deposits has thus far been limited, still certain facts have been noticed which may not be uninteresting to state, and which may have a bearing on the question, whether a glacier several thousand feet deep once covered this State and prepared it soils.

As we descend through the strata in this locality, the first fact that arrests the attention, after passing through some four and a half feet of rich black soil, is a coarse gravel about eight feet deep, composed of the most heterogeneous materials, indicating a great diversity of origin. The particles of quartz are generally more or less rounded, some of them as much as those found on a sea beach, while the coarser materials, consisting largely of different kinds of slate and chert, are more angular, showing that they have been exposed to less aqueous action, than the rounded and polished pebbles of quartz. Among these small fragments, not larger than hazel nuts, are sometimes found, though seldom it is true, specimens with distinctly furrowed surfaces. Passing then through a layer of sand seven feet thick, we come to the blue clay, the interesting feature of which is its numerous pebbles with grooved surfaces. These pebbles represent many kinds of rocks, mostly of northern origin, including granite, syenite, metamorphic slate, quartzite, greenstone and magnesian limestone. They are remarkable examples of glacial action, and impress one with the energy of the force with which their furrowed surfaces have been ground away. These pebbles are more abundant in the hardpan below the blue clay than in the blue clay itself, and are found occasionally in the red clay below the hardpan to a depth of fifty or sixty feet. One of their most singular features and difficult to explain, but which, so far as we are able to judge, points rather to the glacier than to any other cause, is the fact that they are often grooved on two opposite surfaces. These surfaces, though sometimes parallel, are usually inclined at some angle, giving to the pebble the form of a keystone. The grooves on one surface, although parallel in the main to each other, are seldom if ever parallel to the grooves on the opposite surface, a fact showing that the surfaces were abraded at two different, though perhaps immediately successive times. Often also two, and even more sets of grooves are distinguishable on the same surface, which may have been produced by the slipping or turning partly round of a pebble, as the ice pushed it along over an uneven bed. This is conceivable and even probable; and even the turning completely over of a pebble, so as to produce two opposite grooved surfaces, may be, by no means, impossible. A rounded pebble with a plane surface, having two or more sets of grooves, indicates something more than glacial action; at least it is difficult to see how the smooth oval part could have been produced by the same cause that produced the plane with its grooves. Perhaps the most reasonable explanation is that the stream under a glacier produced the oval form, while the ice in which the pebble was afterwards entrapped and forced along, produced the plane with its different sets of grooves.

Another fact of importance in this connection is, that not only pebbles and small bowlders, two or three feet in diameter, occur in the prairie deposits, but huge blocks of several tons weight, which must have required large masses of ice, either in the form of a glacier or of icebergs, to bring them hither. At Chatsworth, a bowlder of magnesian limestone, weighing some ten tons, and having its surface grooved, was found only one or two feet below the surface, and lying, if we mistake not, on a stratum of earth. It seems scarcely possible to account for this in any other way than by an iceberg. All these facts are extremely important and interesting, since, when correctly interpreted, a pebble is not only made to tell its own individual history. but to throw light on those mighty forces which prepared for us our soils.

Passing through the red clay we reach at a depth of seventy-six feet a layer of black, peaty material, rich in ammonia and other nutritious matter, with occasional fragments of wood, and filled with the remains of several species of fresh water shells. It is evidently an old soil, and in this particular instance, probably a marsh. It is without doubt a continuation of the same soil that was struck in two places at Bloomington, at a depth of 118 feet, where logs were found scattered promiscuously about, and the stump of a conifer still standing where it grew At Jacksonville the same soil with trunks of trees (cedar) was struck at about the same depth, and at Crawfordsville, Indiana, it was found at a depth of ninety feet, also with trunks of trees. It has been traced as far north as Beloit, Wisconsin, and several other places, but with no animal remains, so far as known, except in this instance. Here then we have the old surface soil of this valley covered with dense forests at the close of the tertiary and the beginning of the glacial epochs; for on this soil lies the drift.

It will be seen that this old soil has a direct bearing on the question whether a glacier extended over all this valley to the gulf during the glacial period, and by melting left its debris in the form of drift. Whatever glaciers may have existed in ages previous to that of the drift, is a distinct question by itself; but that a mass of ice several thousand, or even one thousand feet deep, could have moved from the north over this valley to the gulf during the glacial period, without having obliterated every trace of this old soil, is certainly very difficult to understand. And yet the materials of the prairie deposits do plainly point to the glaciers; and the only reasonable explanation of this, so far as observation has yet taught us, seems to be, that during the glacial period, glaciers did exist at the north of us, but did not extend so far south as the northern limits of this State; that this valley was all under water, and that the relation of land to sea was very like, perhaps, what now obtains between Greenland and the Atlantic Ocean, where phenomena are now taking place perfectly similar to what once, probably, prevailed here. If this be so, these grooved pebbles, gravels, sands, and even soils, perhaps, of the prairie, many of which are more or less stratified, were formed at the north of us by glaciers, and transported hither by water and ice, which scattered them over a large part of this valley. Still, this view of the subject is not without its difficulties, and it is better to wait for the light of new discoveries than to assert dogmatically what may hereafter prove untrue.

Perhaps an apology is due for having dwelt so long on this question. Our only excuse is, there are very many otherwise intelligent persons, who have very queer notions of how their soils have been produced. An anecdote will illustrate this. In a certain State where bowlders are far more abundant than here, a person was once upon a time actively engaged, with mechanical appliances and animal strength, in removing from a field the bowlders which nature had most lavishly distributed there. A passer by, curious to know his ideas of the drift, inquired, whence he supposed those bowlders came. Pausing a moment, and lifting his eyes with astonishment on the inquirer, that so simple a question should be asked, he replied: Why the Almighty placed them there when he laid the foundations of the earth.

The more practical part of the subject now presents itself, viz.: The Physical and Chemical Properties of Soils. By physical, are meant those properties which distinguish soils with reference to their consistence, density, porosity; their power of absorbing and retaining moisture, heat, gasses, and particularly their power of absorbing and retaining certain alkalies and alkaline earths, together with phosphoric and silicic acids, whether added as manure, or set free gradually by the decomposition of the mineral or organic matter of soils. These physical properties, on which, when existing in proper degree, depends so much the fertility of soils, vary chiefly with the sand, clay and humus of soils. A soil consisting entirely of sand, it matters little whether it be silicious, calcareous, feldspathic, or other material, has but little, if any consistence. As its particles touch each other at but few points, it is too porous for successful cultivation. If it readily admits the rain, it as readily parts with it both by drainage and evaporation, allowing thus the materials to escape which should be retained for plant growth. Moreover the interstices being large, but little moisture rises by capillary attraction, and but little is absorbed from the atmosphere, so that the soil being dry, not only becomes unduly heated by the sun, but retains the heat to an extent ill-suited to vegetation. Besides such a soil affords but slight support to the roots of plants, and is easily blown about by winds.

Nevertheless a sandy soil made up of very finely comminuted particles of all kinds of rocks may be, and often is, very fertile, for a reason to be given hereafter. Such, to a considerable extent, are the soils of the prairie. They are due, originally, as we have seen, to the pulverization, rather than to the disintegration or the decomposition of a great variety of rocks, for it must be borne in mind that these three terms indicate very different kinds of action. Pulverization is the grinding up of rocks by friction against each other. Disintegration is the breaking up of a rock into small integrant particles by heat and cold, as when a rock, heated and plunged into water, crumbles easily to powder. In nature the changes of temperature are neither so sudden or so great as in this case, but yet effectual, especially when aided by frost. Decomposition is the resolution of rocks into new chemical compounds, the process by which the food locked up in them becomes available to plants, and it is greatly promoted either by pulverization or by disintegration. Hence the finely divided state of a soil is a physical property intimately connected with its fertility.

On the other hand, a purely clayey soil has exactly opposite properties. It has great consistence, is slightly porous, absorbs water with avidity, and parts with it reluctantly. When moist it is plastic, and adheres firmly to whatever it touches, and is thus difficult to cultivate. In rainy seasons it cannot be worked until late, and even then with difficulty. It is not only wet but cold, from the constant evaporation at its surface. In dry weather it bakes, and becoming hard, prevents the roots from penetrating it. Its most remarkable property is its power of absorbing ammonia, potash, lime, magnesia, phosphoric and silicic acids, substances essential to the healthy development of plants; and it is doubtless to this property, that is due the fertilizing nature of clay in soils.

Such are some of the physical properties of two extreme kinds of soils, known generally as light and heavy, sometimes, also, as lean and fat soils, neither of which is desirable for tillage. Between these extremes exists an indefinite number of other soils, with physical properties varying with the relative quantities of sand and clay contained in them. A soil containing such an admixture of these substances as will mutually compensate the defects of each—which is neither too wet in rainy seasons, nor too dry and hard in drouths—which, by cultivation, readily becomes porous, so that roots can easily penetrate it, and the atmosphere circulate through it—is best suited for agricultural purposes, and will yield the most remunerative returns. The clay in such a soil is even more effective in absorbing the constituents required by plants than when pure, because the water containing these substances is more readily absorbed by such a soil than by a purely clayey one. This is illustrated by what formerly took place here on the burning over of the prairie. The country, of course, was covered with a layer of ashes, rich in potash, and when the rain fell too rapidly to be all absorbed, it flowed from the surface, carrying the potash with it, and imparting to streams a strong, alkaline property. Had the water passed through the soil, the clay would have absorbed most of the alkali, and retained it for future use. For the same reason but little alakaline matter is usually found in the water of drains. In the decomposition of the vegetable and mineral matter of porous soils, the ammonia and other alkaline substances are absorbed by the clay; and it is clay also to which is due the decolorizing and deodorizing nature of soils, a property which, in consequence of a special application in the form of earth closets, has, of late, been pressed on the public attention as something new.

But a few years since this absorbent property of soils was specially investigated by Way. He found that sewer, and other foul water, when filtered through a layer of porous earth, thirty-four inches thick, was entirely deprived of its smell, its ammonia, potash and phosphoric acid; in fact, that all substances essential to the nourishment of plants are absorbed and retained to such an extent, that a soil, ten inches thick, when saturated in this way, would contain twenty times as much nutritious matter as is usually spread over it for fertilizing purposes. Could all the sewer water, now passed from cities into rivers and thus lost, be distributed over the soils of the adjacent country, what an immense amount of plant-food would be utilized, and what an increase of harvests would accrue through the agency of this property of soils.

If we seek for the cause of this absorbent property of clay, we shall find it, probably, in a powerful surface attraction, similar to that by which gasses and coloring matters adhere to the surface of porous charcoal. Some have supposed, however, that the action is more chemical than physical in its nature, and that the absorption of the alkalies is accompanied by the formation of insoluble silicates, resembling the feldspars. The results of certain experiments made to decide this question seem to point in this direction. It is by no means easy to draw the dividing line between physical and chemical forces—to say exactly where one ceases and the other begins—any more than it is to fix the precise point of time when a person ceases to be a boy and becomes a man. They graduate, so to say, into each other; and it is by no means improbable that in this strong attraction of clay for the alkalies, we have the incipient manifestations of the force which, under favorable and prolonged conditions, produces the chemical compounds known as the feldspars.

Again, the decomposition of organic and mineral matter is largely dependent on a suitable mixture of clay and sand: that is, on a proper consistence of soil. Such decomposition is best promoted by a moist and porous soil—one neither too wet nor too dry, and to all parts of which the air is easily accessible. Indeed, such decomposition is entirely prevented by the exclusion of the atmosphere. The underlying rocks, that were furrowed and then buried beneath deep deposits, retain their furrows, as sharply defined to day as when they were originally engraved. Where they have been exposed to the atmosphere for a considerable length of time, not a trace of them remains. The old pliocene soil, one hunded feet beneath us, with its trees and shells before referred to, is apparently as fresh now as when first covered with the drift. In like manner the fine particles of ground-up rocks—in other words, our soils—when protected from atmospheric influences, remain unchanged, and the elements in them suited to plant growth, are as useless for this purpose as if they did not exist. That this is so, is shown by isolating the sand of almost any soil, and analyzing it. In this way, we learn that the fine sand of soils from Union and Champaign counties contain the alkalies soda, potash and lithia. These three alkalies have also been detected, in very small quantities of soils, from Greene and Kane counties in this State, also in soils from Indiana, Ohio and Pennsylvania. Indeed, it would be a matter of surprise, if, in a quantity of any soil not larger than a pea, all these alkalies could not be found. The sand of a Union county soil is especially rich in these alkalies, a fact somewhat singular, since the soil has been under cultivation forty years without any manure, not even a green crop plowed in, with only two to four inches depth of plowing, and a continued cropping of wheat or corn, chiefly corn. And yet this soil, containing some ninety per cent. of an unpalpably fine sand, as fine as the finest emery, is rich to day in all the elements of fertility, excepting, perhaps, sulphur, of which there is only a trace. To such an extent has this compact soil, containing but three per cent. of organic matter, been protected from the action of decomposing agents, that its sand has apparently an ample supply of plant food for some time to come. The fertility of this soil seems to be owing to the slow and constant weathering of its sand, which, though not very much exposed, is sufficiently so to set free the requisite amount of mineral matter as fast as it is removed by cropping. This soil, however, seems to be exceptional in its character; at least, it would not be safe to treat all soils as this has been treated, unless the object were exhaustion. In the experiments of Way, made to ascertain the effect of the constant cropping of barley, potatoes, turnips and miscellaneous crops without manure, signs of exhaustion were apparent even in nine or ten years; and the soils of the prairie, although somewhat more durable, perhaps, have shown, in many instances, similar results.

We pass now to the chemical properties of soils. By these are understood those properties in virtue of which new chemical compounds are formed, and especially those which are in some way concerned in the production of the proximate constituents of plants. It may be laid down as a fundamental proposition, that certain mineral substances, as potash, lime, magnesia, phosphoric and silicic acids, and some others, are essential to the healthy development of plants. Of this, there can be no more reasonable doubt than that a skeleton is essential to the normal condition of a vertebrate. And yet, not long ago, it was a grave question with thinkers on this subject, whether these substances, constituting the ash, were essential or merely accidental constituents of plants. The establishment of this fact marks a step forward in this era of thought and progress. The intelligent agriculturist of to-day, if, indeed, one can lay claim to intelligence whose knowledge of the functions of the substances in plant life is still very indefinite, stands on firmer ground than he did half a century ago. If he does not yet know exactly how they act, he knows, at least, their presence is necessary to vegetable growth, and that it is his interest so to manage his soil that they shall be present in the proper condition and quantity for the use of his crops.

But to be a little more particular: what is meant by a chemical property, and especially an active one? In general, it may be said to be the tendency of a substance to combine with another, and form a third different from either; and an active chemical property is this tendency existing in a remarkable degree. Thus, if lye obtained from wood ashes be touched to the tongue, it will attack it, or if added in the form of soap to the hands, it will attack them, destroying the cuticle of the skin and giving to it that slippery, slimy feel, so familiar to every one; or again, if added to sawdust, it will attack that, decomposing it, and disposing the atoms to arrange themselves in the form of oxalic acid, a substance with properties exactly opposite to its own. When, therefore, wood ashes are spread over a soil, lye is put on it, and a chemical property is imparted to it. The ancient farmer did it because experience or tradition taught him that wood ashes in some way served some good purpose. They made his soil more fertile, he got a better crop. The modern farmer does it, or should do it, because science teaches him that he cannot have a crop without them, or something equivalent to them; that he might as well attempt to make brass without copper, as to raise a kernel of corn without potash.

In like manner soda imparts to soils a chemical property peculiar to itself; so do lithia, and lime, and magnesia; so do phosphoric and silicic acids; and so do many other substances. These chemical properties all differ from each in kind as well as degree. Some are energetic, others indifferent; but each has an individuality of its own; and it is to this labyrinth of chemical properties or forces, modified by every variation of climatic influence, that all the reactions and compounds of a soil are due.

The oxygen of the air also has its peculiar chemical property, and in the form of ozom, a remarkably active one—a state of unrest—an apparent desire impelling it to seek out and unite with some companion; and then, as if tired of the union, shortly after, perhaps, to get divorced. The same is true of carbonic acid, and to a certain extent of water itself.

Now let us trace the effects of these chemical properties in the production of soils. We speak often of the weathering of rocks, when exposed to atmospheric influences. They disintegrate and finally crumble to powder. Not only so, they undergo chemical decomposition, and give rise to new chemical compounds. Take the granitic bowlder lying exposed to the atmosphere. Its surface is rough, caused by the more rapid decomposition of some of its parts than of others. The angular, but often more or less rounded prominences are quartz, a very insoluble mineral, at least in water. The depressions are caused by the dissolving out of the feldspar, a mineral composed of silicate of alumina and of silicate of an alkali or alkaline earth. Now when rain, containing carbonic acid from the atmosphere, falls on the bowlder, it not only tends itself to decompose and dissolve the feldspar, but it brings the carbonic acid into intimate contact with it. The chemical property of the carbonic acid is to combine with the alkali at the expense of the silicic acid, forming a carbonate instead of a silicate. This alkaline carbonate being soluble, seems to have the property of dissolving the silicic acid which has been displaced, and thus both are carried to the soil, and made available to plants. This process goes on, of course, with extreme slowness, especially when the rock has a very firm texture. Nevertheless the surface, when carefully examined, exhibits evident marks of decay, looks quite different from a freshly fractured one, and is often coated with a perceptible quantity of white silicate of alumina or kaolin, which remains after the removal of the alkaline carbonate and silica. When the water penetrates through the interior of the bowlder, the decomposition advances with equal pace, and the rock gradually becomes less coherent, until finally it breaks easily into fragments. In such cases it is not uncommon to find a fine white incrustation lining the crevices of the interior. This is usually carbonate of lime, and has been formed by the lime of the rock combining with the carbonic acid of the water, or of the alkaline carbonate. If the rock contains an iron compound, the carbonic acid often decomposes it, and forms a new iron salt; and when this is exposed to the air, the iron is often attacked by the oxygen and changed to iron rust, causing the dark brown spots so often seen on rocks, as well as the iridescent film often seen on the surface of stagnant water.

The yellow sulphide of iron, often mistaken for gold, and so frequently seen in soft coal, is the most apparent as well as the most common example of the action of oxygen in producing changes in rocks. In this case both the iron and the sulphur are oxydized and converted into copperas; and when this is further exposed to the air, the iron is changed to iron rust and deposited as bog iron ore. Sometimes this iron salt filters through a soil charged with organic matter, and the iron is not converted into iron rust until it reaches the subsoil, where it acts as a cement, binding the gravel and pebbles together into a kind of rock called hardpan. Other substances, also, as lime, silica and clay, act as cements, but in a somewhat different way.

The solvent power of carbonated water on limestone, due chiefly to the chemical property of carbonic acid, scarcely need be mentioned. It is well known to be the source of a large part of the lime dissolved in our soils and springs, and to have excavated those immense caverns so frequent in limestone regions.

Before closing, I wish to call particular attention to the solvent power of pure water, and the relation of this power to the fineness of the material on which it acts. In this way the relation of the fineness of a soil to its fertility will become apparent. It is a common notion that many kinds of rock are insoluble. At least they are often spoken of as such. The truth is, there is scarcely a rock but yields more or less to the action of water, and the more in proportion to the amount of its surface exposed. The experiments of the Messrs. Rogers are very instructive on this point. They pulverized a large variety of minerals, usually considered insoluble, and treated them with pure water and with carbonated water, carrying on the two sets of experiments side by side, and observing all the necessary precautions. When the mineral was very finely pulverized and treated with pure water a considerable time, and then filtered, the first drops of the filtrate gave an alkaline reaction, while with carbonated water the effect was recognizable in less than ten minutes. With pure water the effect was much weaker than with carbonated water, still it was perfectly decisive in almost all the minerals tried. By digesting finely powdered feldspar, hornblende, grammatite, epidote, mesotype, chlorite, serpentine, and some twenty others, in pure water a week, and in carbonated water 48 hours only, they found that silica, alkalies, lime, magnesia, iron and alumina, had been dissolved to an extent equal to from .4 to 1 per cent. of the minerals taken. The solvent power of water was, doubtless, increased by digestion, but it can scarcely be doubted that the same effect would have been produced by cold water in a long time.

The application to soils of the truth taught by these experiments, is plain. The soils of the prairie contain, without doubt, more or less of all these minerals; and it is evident the more finely pulverized they are, the more readily they will be dissolved by water, and the more mineral food will they furnish for the crop. In this way, a very finely comminuted soil, like that of Union county, or of some river bottoms, seems to have an inexhaustible fertility, because the decomposition of mineral matter keeps pace with the demands of vegetation. Were the particles of soil coarser, or less exposed to the combined influences of water, carbonic acid and oxygen, the supply of mineral food might fall below the demand; that is, there would be, to that extent, exhaustion, to be remedied by manure or fallow.

It is very probable that this is not the only principle involved in the explanation of the apparently permanent fertility of soils; but that it finds a place in it, seems to be plainly taught by experiment; and we will only add that these chemical changes taking place in a soil with greater or less activity, according to its more or less favorable conditions, sustain an intimate relation to an intelligent system of agriculture, and commend themselves to the careful attention and study of farmers.

MINERALS TESTED BY THE MESSRS. ROGERS.

Soda Feldspar,	Hornblende,	Prehnite,
Potash Feldspar,	Grammatite,	Talc,
Lithia Feldspar,	Ashertus,	Steatite,
Glossy Feldspar, (Sanidin),	Olivina,	Chlorite,
Labrador Feldspar,	Chalcedony,	Serpentine,
Mica,	Epidote,	Obsidion,
Leucite,	Analcime,	Lava,
Tourmoline,	Mesotype,	Greenstone,
Augite,	Scolerite,	Gneiss,
Coccolite,	Axinite,	Hornblende Slate.
Hypersthene,		

FLOWERLESS PLANTS.

BY T. J. BURRILL, PROFESSOR OF HORTICULTURE.

Our common idea of a plant is a living growing structure, fastened by roots in the soil, bearing leaves that are elevated upon stems and branches to catch the sunlight and air, budding and blossoming in charming beauty and delightful fragrance, and finally bending under a heavy load of seeds or fruits. But if we should work these things into a definition, it would exclude every one of a host of vegetable forms, with which we have now to deal. The distinctive characteristic of the plants under consideration, is that given as the heading of this paper—flowerless. Let us fully understand what a flower is. The cultivated rose, with all its beauty, can not lay claim to it, for the arts of man have destroyed the essential parts, and turned them into showy but useless appendages. No seed is started into existence by our double-flowered roses. On the other hand, many of the forest trees—the oaks,the elms, the hickories—are popularly supposed to have no flowers, when, in fact, they produce countless numbers of true flowers. Botanists call the outer-whorl of usually leaf-like bodies in the flower a *calyx*, its individual parts *sepals*; the next row is the corolla, and the parts petals. These are the most conspicuous parts of the flower, yet are wholly unessential. It is to the center of the flower that we must look for organs, really useful in the reproductive process. These are the stamens and pistils, answering respectively to the male and female sexes among animals. It is not necessary that these should be in the same flower, nor indeed upon the same plant, but no seed, in the proper sense of that term, ever comes into existence, without a previous combination of these two parts of the flower. The stamens produce the pollen, which is carried about by the winds, or by insects, or in many cases falling directly upon the pistils, quicken, in some mysterious way, the embryonic cell into new and hitherto unknown life, thus beginning the formation of a seed. Now, though the flowers may be unnoticeable with common observation, all our trees, shrubs, grains, grasses, vegetables, weeds and any other plants with us, having a woody stem, a fourth of an inch, or more, in diameter, and any that are made generally useful, as food or covering, for man or beast, do produce true flowers, and bear true seeds. Notwithstanding all this, at least one-sixth of the named plants belong to the flowerless type, and the time undoubtedly was when they constituted almost the entire vegetation on the globe. And there still remain thousands of other species, waiting for the botanists' researches, and names, to swell the number of flowerless plants now existing, even beyond the recorded number of flowering species. Of these the microscopic world has myriads of specific forms, which have, until recently, been almost unknown, and what is most strange, many of these minute beings, long classed as animals, on account of their free and evidently voluntary motions, are now positively known to be true plants. It is no longer an unsettled question about the rapid and varied movements of the lower orders of purely vegetable forms. But a large number of flowerless plants are by no means microscopic. The ferns, the mosses, the mushrooms, the moulds, are fair examples. Who ever saw a flower upon a puff-ball, or a toadstool? How many aquatic plants are there that never bloom?

Linnæus named these plants *Cryptogamia*, meaning hidden marriage, while those with flowers were named *Phenogamia*, open marriage—the latter, owing to the fact that the stamens and pistils were readily seen, and the reproductive process could be readily traced, while analogous parts, and analogous processes, could only be guessed at in the Cryptogamia, or flowerless plants. Extended research has proved, however, that they have something answering to these parts, though disguised under a multitude of forms, and their operations varying in wonderfully different ways. Instead of seeds they produce spores, differing from the former in not having within an embryo or rudimentary plant, and by germinating irregularly without the fixed point for beginning, as in seeds.

It was said, a moment ago, that all the plants in our region of country, which attained any considerable size, or which furnished any of the staple article of use, whether as food, or materials for building or clothing, were flowering and not flowerless plants. What then are the uses of the latter, and why spend our time in their study? Let us see.

(1.) They are the simplest in structure of all plants, and as the vegetable processes are the same as in the higher plants, we may far more readily study their secrets in the work of elaborating food, of increasing in size, and of giving rise to new beings like themselves. Hence, he who would know the requirements and action of vegetation of any kind, must begin with these humble beings so peculiarly fitted for his examinations. When we descend to the lowest plants, a simple, isolated, round microscopic cell, performing all the complicated functions of vegetative life, meets our astonished gaze. The red snow plant, of the Polar regions, and another of the same genus (*Protococcus*), with us, sometimes seen in red streaks and patches, looking like stains of blood upon the shaded and moistened side of rocks and banks, are of this character. The cell has an outer and inner coat, and a thick fluid mass within. They individually obtain their nourishment from the air or water, and increase in number by self-division, but are also known to give rise to young plants by two cells uniting and mingling their fluid contents. The green scum that forms upon stagnant water is another example of these lowest of plants, sometimes one-celled, sometimes many-celled, constituting a thread-like filament.

(2.) The study of the flowerless plants helps us to understand the past history of our mother earth, when she produced little or nothing of a higher organization. The coal we now use for fuel, came in great part from flowerless plants. Those were the good old days for the Cryptogamia, when moss-like plants grew to the giant size of oaks, and ferns vied with the towering palm.

(3.) The information, gained by a careful study of the development of these plants, throws much light upon the mooted theories of spontaneous generation of living beings—theories so often advanced, and sometimes so seductively argued. The advocates of the doctrine that living beings can be produced by the union of certain chemical elements, or brought into existence by chance, or through the agency of any of the natural laws, other than those referring to direct parentage, always point for illustration to the lowest forms of vegetable and animal life.

It *is* indeed strange that water, left for a few hours in a warm place, will be found, when examined by the microscope, swarming with moving bodies; and the question naturally suggests itself, where do they come from? And when the water is previously boiled to kill all living things, and then kept in an air-tight vessel, the wonder is much increased to find the same maze of living, eating, growing bodies, seemingly enjoying to the utmost their lease upon life. So it is passing strange that moulds, which are as true plants as the evergreens in our door yards, appear whenever and wherever any moist organic substance is found, for their development. A piece of cheese put away in a damp cellar, will as surely rear upon its surface a pigmy forest of bluish vegetation, as will a well-seeded and tilled field, under favorable conditions, produce its crop. So, too, it is strange that young timber of a different kind from that previously cut, should spring up from "cleared" land, yet no observing man will for a moment doubt but that these young trees came from true seeds. The weeds appearing the first season after we turn over the prairie sod, are likewise known to start from seeds. Now when we find, by prolonged observation, that these minute forms in a drop of water are subject to the same laws as the above trees and weeds, in regard to life and development, we may cease to speculate upon the possibility of living beings—plants or animals—originating from the inorganic elements, without the intervening power of a creator. Prof. Henry James Clark, whose experiments upon this subject are recorded in his book called Mind in Nature, now in the University library, thinks he has proved the spontaneous production of animalculæ in closed vessels, but he is also candid enough to record the fact that when his fluids are boiled for a long time or for a short time under high pressure, and then kept sealed, no living things afterward appeared. Evidently, simply boiling for a short time did not kill the germs, and the prolonged boiling did kill them. In order, however, to account for the production of plants, in many cases, we must assume the almost ubiquity of seed-like germs. Without doubt, if we could sharpen our vision sufficiently, these bodies would now appear floating in the air around us—settling as dust here and there, ready always to germinate and grow when the conditions prove favorable; and these same particles, though ever so minute, are as fully endowed as we are ourselves with that mysterious vitalizing principle which we know distinguishes us from the dead, inert, inorganic clods of earth. The whole world of chemical elements, aided by the combined wisdom of men, evidently cannot originate the smallest life germ of the humblest plant.

(4.) The next reason we advance for the study of these plants, is their usefulness to ourselves. Though we have said no flowerless plant with us produced any staple article of food for man or the higher animals, there are some which do far more than mean service in this particular. The so-called Reindeer moss (*Cenomyce rangiferina*) supplies, not only that animal with food, but renders existence possible to a large number of human beings in the cold regions of earth. The plant is peculiarly adapted to its use, for the deer has only to scrape away the snow to find it in perfect condition in winter. Though dry, it is not dead. The pasture is absolutely never failing; through heat or cold, drouth or excessive rain, the flowerless plant vegetates, and grows in sufficient quantities to meet the demand. Lichens and Algæ have often been used for food, but within the last few years a peculiar process of manufacturing has furnished the world wlth a new article of food from them, named "Sea Moss Farine," now too well known to need further mention. Some of the Fungi are extensively cultivated, and used for food. The common mushroom grows in almost every part of the world, and forms with the morel and truffle, in some European countries, a large supply of food. I venture to predict, that some enterprising individuals in our own country will yet make their fortune by the cultivation of the mushroom, and if so, they will furnish to the people an article of food as delicious and healthful as it will be new to many.

Some of the flowerless plants perform an office in nature for which they get very little credit, but which is eminently important to the well-being of man. Their home is upon decaying and putrifying masses of organic matter, whose pernicious gases they imbibe and change into their own harmless structure. We know not what fearful pestilences would ravish and desolate the earth, nor how often they have been stopped by the influence of these humble instruments—the scavengers of the vegetable kingdom. Another important service is also rendered by the lowest plants in their pioneer attempts to create a soil for the growth of those to come after, higher in rank. The surface of a naked rock, left exposed to the air, soon becomes coated with mosses and lichens, which, drawing their nourishment from the air, elaborate the elements, die and decay upon the spot for generation after generation, until a soil is formed upon the hardest rock, for the production of more noble forms of vegetable growth. This work has been in progress during the long ages of time, and has changed the earth from arid wastes of cheerless sand, to the fertile valleys and generous soils which so bountifully supply the wants of man.

(5.) The last, and perhaps the greatest reason which we mention here, for the study of these plants, is the well known injurious qualities and habits of some of them. Some are rank poison to man and beasts; some cause disease and often death by their attacks, as parasites, while myriads of the parasitic type prey upon our choicest fruits, vegetables and trees. So true is this, that the very name of fungus suggests to us misfortune and calamity—destruction before our eyes, while we stand with our hands in our pockets, with woe-begone faces, resigned to our fate. Neither is the feeling a mere superstition. Indeed, it is probable that where we suspicion one of these parasites with evil, a score of them are busily, and steadily, and vigorously, and maliciously, and successfully intent upon their work of destruction.

These, then, are some of the facts in the history of our flowerless plants, and these characters, good and bad, when investigated, partially answer the question, "What are their uses, and why call attention to them?"

Flowerless plants are divided into orders, as follows: Lycopodiaceæ, Marsileaceæ, Equisetaceæ, Filices, Musci, Hepaticæ, Characeæ, Lichens, Fungi and Algæ; and these orders are more or less subdivided by different authors. For this paper, which does not pretend to be an exhaustive treatise, these divisions are exact, and full enough for our purpose.

The Lycopodiaceæ, or club-mosses, as they are called, are moss-like plants, having a woody stem and branches, some of them almost exactly resembling, in minature, pine trees. They scarcely exceed a hight of three inches with us, but in tropical countries are much larger. In the past geological ages they grew to immense size, and are now represented by the Sigillaria, Stigmaria and Lepidodendrons of the coal fields.

It may as well be said here that the seed-like bodies in all the Cryptogamia are called *spores*, and the inclosing case a *sporangium;* the organ corresponding to the pistil of flowering plants, a pistilidium or archigonium, and to the anther (the pollen-sack) an atheridium. The names are changed, for the function and structure of the parts are not the same as in flowering plants. Thus a spore is a minute body, having no embryo or rudimentary plant, as have all true seeds, but begins germination at any point of its surface. Again, a seed gives rise directly to a plant, which we shall see is not always the case with the spore.

The fruit of the Lycopods is borne in the axils of the leaves. If we examine carefully we shall find a little rounded sack filled with four spores, and other little sacks filled with an immense number of exceedingly minute particles, that rise in a little cloud of dust when disturbed. Under the microscope these will be recognized as single cells, each having coiled, within, a peculiar thread-like body, which finally escapes by the bursting of the cell membrane, and exhibits the wonderful phenomena of an active stage of the plant. Its motions are rapid and evidently self-caused. This is the spermatozoid, and has for its office the fertilization of the spore. It thus corresponds then to the pollen in flowering plants. This powder is very inflammable, and has been used in theatrical performances to produce artificial lightning. It is also sometimes used by druggists as a coating for pills. In germinating, the spore forms within itself a little cellular substance, known as a prothallus. Upon this the archigonium is formed, which, when fertilized by the spermatoid, reproduces the plant. Some of the Lycopods are quite ornamental, and are favorite pets of many, the arts of man having changed their forms very greatly. But little value is attached to the order, though undoubtedly they are the highest in rank among the Cryptogamia.

The Marsileaceæ consists of a few aquatic plants formed in ditches and streams of sluggish water. Their fruit is like the Lycopods, but they have one instead of four spores. They are of no known specific use, but are certainly harmless.

The Equisetaceæ are the horsetails, or scouring rushes, which we so often see in low grounds. They have hollow stems, the joints of which are easily separated. Upon the top of the stem is a cone-shaped body, bearing upon its surface little stalked scales, diminutive umbrellas, upon the inner side of which the sporangia, containing many spores, are situated. The outer-covering of the spore splits up into four long arm-like pieces, retaining hold of the spore by one end, and developing upon the other a rounded knob. These arms will be found either tightly wrapped around the spore, or extended, according to the state of the atmosphere. Germination is the same as in the Lycopods, save that the prothallus protrudes from the spore, and develops both the archigonium and the antheridium, the latter producing spiral spermatozoids. The plants are of little use, neither need we fear their depredations.

The Filices are ferns, with which, I suppose, we are all more or less acquainted. They grow abundantly in damp woods, shooting up their large, green, variously figured fronds (leaves), which bear upon their backs little brown dots. The latter are clusters of sporangia, each containing many spores. Their germination and reproduction are like the Equisetaceæ. Ferns are very ornamental and often thrive where other plants fail. They must have a moist atmosphere, but otherwise are easily accommodated. Some of the thickened roots have been used for food, but furnish very little in this respect. Others are still popular in medicine. . In tropical countries the ordinary prostrate root stock rises above ground to the size of trees, and good evidence is not wanting of their great size, in past geological ages. Very many species of ferns are now found in the fossil state. If not friends, the ferns are surely not enemies to man.

The next order, Musci, contains the mosses, a name sometimes made to include all of these little green plants. The true mosses, however, may be known by always having a distinct stem and leaves, without woody tissue in either. They are harmless plants, drawing their nourishment from the air, and, by their decay, ultimately furnishing a soil for higher plants. Peat is principally formed from mosses. The still spermatozoids, in these and the remaining plants, are not spiral, but manifest the same intensity of motion. The spores are borne in little stalked sporangia, arising from a rosette of leaves. The Esquimaux use the dried rootlets for lamp-wicks, and considerable use is now made of moss as packing material.

The Hepaticæ, or Liverworts, are usually flat, loose-tissued plants, growing upon moist rocks, trunks of trees, and upon the ground. They send out many rootlets from their under surface, but use them simply as hold-fasts, drawing their nourishment from the air. Their fruit is similar to that of mosses, but the stalks to the sporangia are often wanting. Unlike the mosses, the sporangia bursts irregularly. The plants are of no prominent use and do no special injury.

The Characeæ contain a few aquatic plants, composed of tubes, and only noted for the facility they give for studying the circulation of the fluid contents of the cells.

The Lichens include the tufted or leathery plants found in dry places upon the bark of trees, old rails, rocks, etc. They vary greatly in form and color, sometimes consisting of little cups containing variously colored spores or gemma (buds), and sometimes radiating from a center into a large patch of green. The spores are found in little sacks contained in the walls of little cup-like bodies variously scattered over the surface. Their tenacity of life is truly wonderful. When dried so that they may be crumbled to powder, they only need a fresh supply of moisture to assume all the activity of life. Many are used for food. The so-called Reindeer-moss has been elsewhere alluded to. It is a true Lichen. Lecanora esculenta, found in Asia and Africa, consisting of a round moss, without attachment to anything, and often blown about by the winds, has been thought to be the ancient manna. Quite a number are used in medicine, and more, perhaps, in the arts. The coloring matters known as orchil and cudbear, are from Lichens, and from the various species of Rocella is manufactured the litmus, so important to the chemist. A sample of the crude plant from Sicily was pronounced worth $20,000 per ton.

Now, we come, in order, to the most noted as well as the most infamous of the class—the Fungi; but as we want to speak more in detail about these, we skip them for the present, and notice the Algæ. These are aquatic plants of tender structure, but of wondrous variety of form and color. Some are totally invisible to the naked eye except in masses, while others, as the sea-weeds, extend a half mile in length. Our aquatic flowerless plants almost all belong to this order. In fresh water they are usually green. Some species flourish in running streams, other only in stagnant water. They obtain their nourishment from the water, and in their growing state are eminently serviceable to man by depriving the water of noxious gases. The green scum upon water may show that the latter is unfitted for our use, but not because of the vegetable moss, for this is acting all the time as a purifier. It may, and probably does often happen, that they become harmful when the waters in which they grew subside and leave them to decay. Some have, also, a bad name as parasites, living in the fluids of the human and other bodies, causing disease and death, but many of these supposed species of Algæ are now known to be peculiar forms of Fungi, and the time may come when all of these injurious forms will be included under the latter order. If so, it leaves one only, out of the ten orders of flowerless plants, that is injurious to man.

Returning, now, to the Fungi, we find many things which widely separate them from most other plants. They are never green. Most of them are white or hyaline, while others pass through the whole series of shades, green excepted. They are parasitic, either getting their nourishment from living plants and animals, or from decaying organic substances. Their vegetative system consists of numerous thread-like cells, often matted or flocose. These threads are called the *mycellium*. The fruiting bodies may be large as in the mushroom, seeming to constitute the entire plant, or may be very small, as in many moulds. Sweden is said to produce the most species* of Fungi, and the United States next.

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* Spores Naked.—Hymenomycetes—Hymenium free, open, sometimes closed at first, but soon open; Mushro om, Polyporus, etc. Gasteromycetes—Inclosed puff-ball. Coniomycetes, (Dust Fungi)—Spores seated on inconspicuous threads. Puccinia graminis, Æcidium, Conidia, Stylospores, Spermatia, Ascospores, Hyphomycetes—Moulds, spores free, cheese, silk, meal, sugar, etc.

Spores in Sacks.—Yeast (Penicillium glaucum)—Botrytis or Peronospora. Physomycetes, Sporangia from threads—Moulds on decaying matter. Ascomycetes, Sporangia from a hymenium—Eusyphæ Berberry. Morels and Truffles, Burning forests—Codyceps and Spæriæ.

Much study has been bestowed upon these plants, and very many interesting facts observed. Owing to their injurious habits, they have been looked upon as the vandals of the vegetable world. They are outcasts from good vegetable society; among plants they are the fallen angels, wicked and fiendish, plotting for the ruin of the world. But their work is not wholly destructive. Their office as scavengers has been mentioned before, and in this we find their best service to man. The mushroom, morrel, etc., are largely used for food. Mylitta Australis forms the native bread of the Australians, and a Cittaria, growing upon the twigs of trees, is one of the staple articles of food to the Fuegians. The list of good qualities is, however, short, and we turn to the more popular if not more pleasing task of berating and denouncing them. Some species of mushroom, like plants, are very poisonous, as the ergot of rye is well known to be. Another, similar to the mushroom, is used by the inhabitants of Kamtschatka instead of, or with whisky, for the purpose of producing intoxication, which it does effectually. Moulds upon articles of food are either very unwholesome in themselves, or induce an unwholesome state in the substance. Neither is the effect entirely avoided by scraping off the mouldy surface, for, quite invisible, the mycelium often penetrates to great depths, and spreads itself far and wide.

Whether Fungi produce disease in plants and animals *directly*, or are themselves only a *result* of disease, is a question often asked and variously answered. Some observers hold one and some the other opinion, to this day; but the truth undoubtedly lies between them. Some species are positively known to attack, without scruple, the healthiest living tissues. With these, all that is required for their propagation is to scatter the spores upon the surface usually attacked. Many species have been tried upon both plants and animals, with the result mentioned. Smut in wheat can be readily induced by sowing the spores with the grain. Many leaf-blights can be more directly traced to the germinating spores. Muscardine, the silk-worm malady, can as certainly be produced by dropping the spores of a mould upon the outside of the body of the caterpillar, as a crop of corn can be produced by placing the seed in suitable soil.

But it may be asked, "How can the germinating thread from the spore, or the latter body, itself gain entrance to the tissues upon which it preys?" As a rule, the spores themselves do not gain such admission, but when we consider the immense force exerted by other germinating seeds, pushing up lumps of earth, many times their own bulk, and then think of the delicate cell walls of most plants, and the loose structure of many animals, we may form some conception of a possible mode of procedure.

Some species, doubtless, prey only upon weak or diseased structures, yet these, by once gaining a start, so decompose the matrix and poison the fluids that the otherwise local injury, or disease, becomes general, involving the whole in as speedy death as in the former case. But the spores are not the only part of these plants which propagate them. All Fungi increase by division of the mycelium. In the cultivation of the mushroom the mycelium threads are made to penetrate prepared earth, which is afterwards cut into so-called wicks, and bits of these, though dry, are planted as seeds. So, too, the least particle of sap, or solid matter, from a tree, attacked by a fungus, may contain a sufficient quantity of the latter to communicate the disease to a healthy tree.

The Fungi vary greatly in size, from two feet in diameter to the minuteness of as near nothing as anything material can be. The microscope itself often fails to bring them into visibility; but with all difference in size the spores are invariably small. The cloud of dust issuing from a disturbed puff-ball is made up of minute rounded spores and particles of the cellular tissue. I have attempted to count the number of these spores, caught upon the moistened surface of a piece of glass an inch square, by holding it a moment in the fumes escaping from one of these mimic volcanoes, but the leaves in the forest, or the sand on the shore, might as well be counted. Mr. Cooke, in his book entitled Microscpic Fungi, estimates the number of spores, each of which he considers capable of reproducing the fungus plant produced upon a single diseased leaf, at 500,000,000. Now if one should be counted every second of time, for ten hours per day, and for three hundred days in the year, it would require something over forty-six years of labor to finish the task—a job I am not at all anxious to undertake. Nor is this all, for, as we shall see hereafter, there is more than one kind of seed-like bodies in the Fungi, and in this case the germination of each spore gave rise, not directly to a plant, but to several other smaller spores, so we must multiply our number by four or five to find the true number of vitalized germs, upon our poor besieged leaf. Many of the Fungi produce spores, of which it would require 100,000, laid *end* to *end*, to measure an inch, but some are much larger. They easily float in the air. I should, indeed, be surprised if proper examination did not find them, at times, at least in every place tried. Over the water and over the land, up the mountain steeps, and down the cavern's rugged walls, no place is so inaccessible they cannot climb, no place so secret they may not enter. Some are exceedingly tenacious of life. The spores of a mould, which some years ago affected the bread in Paris, were not killed by subjecting them to the temperature of boiling water.

Others seem to withstand any degree of cold, but some are easily destroyed. Probably nothing is so generally fatal as dryness. All Fungi love darkness and moisture, while by far the greater number thrive only in a warm temperature. Continued darkness would kill all known vegetation, Fungi excepted. Blot out the light of the sun, and retain the heat, and all green plants would perish, while the Fungi would riot upon their decaying masses. Hence, Fungi are far more prolific in damp summers than in dry ones, and in wet days than those full of sunshine. The granular substance, which gives plants in general their green color, is essential in the elaboration of inorganic materials, and, though this color sometimes gives way to shades of red, yellow, etc., with probably a loss of assimilating power, no known kind of white vegetation can elaborate food for itself out of earthy or atmospheric materials. Yet this is the condition of very many Fungi. As was said before they are nearly always white in their vegetating state, and are never a true vegetable green. They are therefore compelled to depend upon animals, or other plants, for food, a thing which they do not in the least seem to regret, neither are they over-modest about helping themselves. The whole hosts of Fungi are parasites, either consuming directly the juices of plants or animals, or living upon decaying organic substances. The mildews of the grape and gooseberry, and the rusts upon grains are examples of the former class, and the mushroom and toadstool of the latter.

Though flourishing only with moisture, Fungi are seldom and perhaps never truly aquatic. When submerged they seem to lose the power of producing spores, but a few species rapidly increase by cell division, in water or other fluids. Yeast is well-known to be such a fungus, and the vinegar plant is another, if not the same one. Fermentation is largely due to the action of Fungi. Milk is soured by the aquatic form of a mould; the vegetable juices are turned into wine by a fungus. He who drinks beer is sure to swallow more or less of a fungus plant. The decay of wood is often caused or accelerated by the penetrating mycelium of Fungi. The putrefaction of animal substance is supposed to be due to kinds of living organisms called vibriones, which have been classed with the animal kingdom, but which are in all probability plants. There is much obscurity here, and more study is needed to clear up this most interesting point. Whether the bad odor from decaying substances is due to a liberation of gases by the respiration of these minute forms, or whether they come from their excrement, or from their dead bodies, or from any of these, is not now known, but we may confidently believe that the time is not distant when much that is now obscure will be made plain, and processes of development and of action will be found governed by fixed laws, and in a measure under the control of man. It is already well-known that Fungi are disorganizers. In a solution of sugar they liberate carbonic acid and form alcohol; this in time, by a similar process, they convert into vinegar, and the vinegar at last into water. And all this is probably caused by one species of plant, though assuming very different forms. In one form it is yeast, consisting of a simple chain of cells; in another is the beer fungus, consisting of minute threads, with the ends becoming septate or partitioned, each part to be finally thrown off as a reproductive body; in another form it is the vinegar plant, forming a thick, matted coat upon the surface; and finally it is a common mould, well-known to the micologist under the name of *Penicillium glaucum.* But through all these forms its action has been the same: a continued reduction of the compound to the simpler elements. Now let us turn to the action of Fungi upon other plants. We are well aware that the elaborated sap of our ordinary plants is little else than a solution of sugar. Indeed, in certain stages of this sap, all we have to do with it is to evaporate the water to find the pure sugar, and, as in the corn, we know that the sweet juice of the green stalk is stored away in the grain as starch, and when we further remember that yeast acts as readily upon starch as upon sugar, we find we have in this sap of plants, whatever its particular condition, the very elements of food for our parasitic fungus. There is one thing alone which may, and undoubtedly very often does, prevent the action of the fungus. The green-leafed plant has taken the simple chemical elements from the soil and the air, and, by the aid of sunlight, its peculiar *power* has organized these elements for its own use. This mysterious life-power has accomplished its work in direct opposition to the ordinary workings of chemical laws, and the same wondrous and potent influence will continue to manifest itself until something stronger crosses the pathway of its progress. Then, and not till then, the vital function yields, giving over its accumulated wealth to the spoils of another vital, but directly opposite, acting force. This is the warfare which I believe is continually raging between the common useful plants and the Fungi. And as the constitutional vigor of the individuals of each class varies, so will the result be. Some kinds of flowering plants may, always, in all times and under all con-

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ditions, while living, prove too strong for any Fungi to cope successfully with them; but the moment vitality ceases, the parasites run riot through the accumulated products. Others, especially under unfavorable circumstances for themselves, and favorable for their foes, are easily conquered, even in the midst of active vegetation. It is certainly too late in the day to suppose that Fungi cannot attack and destroy healthy living structures. Some species do not even wait for specially favorable circumstances, but accomplish their destructive work under all ordinary conditions. Other and numerous species are entirely confined to dead matter.

In the absence of positive knowledge, I theoretically account for the destructive effect of many Fungi, by assuming that they change the character of the sap, as a solution of sugar is changed into alcohol, etc., and at the same time robbing the elaborated fluid of its peculiar vitality, acquired by its digestion in the leaves. With this view it is not necessary that the Fungi should penetrate the whole structure of the plant. It is sufficient that the parasite gains access to any part of the plant through which the fluids are passing. If this is only in a particular spot of the body of a branch, the whole limb may perish, every leaf wither, without a trace of the fungus itself ever approaching them. And I think any one who has carefully examined the blighted limbs of the pear and apple will be inclined to come to some such opinion. Certainly no forms of fungus can be found in many parts of the affected branches. Yet we must remember that it is positively known, that the mycelium often ramifies itself through the tissues of plants, and may in some cases spread over large areas. I can not believe that the parasitic plants spread from a given center, or nidus, if you choose to call it such, in vegetable organism, in any other way than by mechanical rupture of the cell walls. The spores can not possibly pass with the fluid through the cell walls, neither could any other solid, however small, if still visible with our best microscopes, for these have failed to detect the least opening where the sap is known to pass through.

As for the fungus passing through in a fluid condition, and reproducing itself afterward, if any choose to believe it, let them. I am incredulous. In the animal system the transportation of spores, or vegetable bits of the mycelium, would not be so difficult, provided they once gained access to the blood.

But many Fungi, growing upon living plants and animals, do not seem to be further destructive, than in mere robbery. They live upon the elaborated juices, but leave intact what they do not consume.

These, unless greatly multiplied, are comparatively harmless. Such is the curious yellow fungus ball upon the red cedar, the mycelium being perennial. Such, too, is the blackberry fungus, and a host of similar leaf productions.

What we want, then, is a profound knowledge of the laws of vegetable growth in general, and of the habits of individual plants, flowering and flowerless, in particular. If a particular species of Fungi can only prey upon another plant, when weakened or in some way diseased, then our protection will be in keeping the latter in a healthy state. This seems to be the case with the pear. We well know that overfeeding, both in plants and animals, tends to impair the vital functions. A petted, pampered animal is the first to succumb to disease, and a plant from the hot-bed perishes alone by the side of its neglected but surviving companion. If such is the case then when we fear the fungoid diseases, wisdom will teach us to avoid manure and high culture with plants, and rich, excessive feeding with animals. Excessive and ill-timed pruning of trees will undoubtedly give aid and comfort to the enemy, and the perpetrator ought to suffer the consequences. At the same time any affected parts of trees or plants, of any kind, should be promptly removed and burned, both to kill the fungus, and to prevent the vitiated sap from mingling with other parts. Sulphur and its compounds seem to be universally destructive to Fungi, and lime has proved itself an efficient antidote. There are many other substances which really kill the parasites when they can be applied, but the difficulty attending this operation will usually prevent the application. Seed wheat can be cleansed of smut with brine, and as this fungus is known to begin in the seed, its attacks can be prevented; but the case is different with the wheat rust, for the attack is apparently made upon the growing stem. Sulphur sprinkled over the leaves of the vine has been found useful as a preventive, but not a cure for the grape rot. But with our present information, I am inclined to the opinion that all the acids, alkalies, and whatnots we can bring to bear will be of really little service. Protection will be secured, if at all, by a careful selection of varieties, and a judicious treatment of the plants. With these, the future is as safe as the past has been, for there are no more parasitic plants now than there was in the good old days gone by, save as we have given them better facilities of growth, neither are their habits more destructive to-day than they were years before the microscope had revealed their true nature. The balance of power has not passed over to the destroyer. This hue and cry after the thieves is only an indication of our own vigils, and is the first promise of vengeance to come.

TRIAL OF IMPLEMENTS.

The following report gives the result of a trial of Implements made on the University Farm in June, 1871, a precedent which, it is hoped and anticipated, will be followed by more work in the same direction:

UNIVERSITY FARM, *June* 15, 1871.

To the Corresponding Secretary of the Industrial University :

At the request of Prof. T. J. Burrill, a number of farmers met for the purpose of examining and testing several corn cultivators and other implements for stirring the soil. The undersigned were selected a committee to examine the implements and to report to the University the result of their investigations.

In accordance with this arrangement of the farmers present, we respectfully submit the following report.

Before proceeding to the examination, we agreed upon a scale of points, as follows:

No. 1.	Quality of work	20
No. 2.	Ease of management	20
No. 3.	Adjustability	20
No. 4.	Capacity for working crooked rows	20
No. 5.	Durability	20
	Total	100

WALKING CULTIVATORS.

(Cost at depot, $35 each.)

PRAIRIE QUEEN—Made by Messrs. Peabody & Ayres, Champaign.

No. 1, 20; No. 2, 20; No. 3, 18; No. 4, 20; No. 5, 18. Total, 96.

CORN DODGER—Made by Messrs. Mitchell, Harper & Co., El Paso, Illinois.

No. 1, 18; No. 2, 20; No. 3, 18; No. 4, 20; No. 5, 18. Total, 94.

DEERE—Made by John Deere & Co., Moline, Illinois.

No. 1, 18; No. 2, 20; No. 3, 18; No. 4, 20; No. 5, 18. Total, 94.

Champion—Made by Messrs. Gilman, King & Hamilton, Ottawa, Illinois.

No. 1, 18; No. 2, 20; No. 3, 18; No. 4, 18; No. 5, 18. Total, 92.

Wier—Made by W. S. Wier & Co., Monmouth, Illinois.

No. 1, 20; No. 2, 20; No. 3, 16; No. 4. 18; No. 5, 16. Total, 90.

RIDING CULTIVATOR.

(Cost, $55.)

Bertrand & Same—Made by Messrs. Bertrand & Same, Rockford, Illinois.

No. 1, 10; No. 2, 20; No. 3, 18; No. 4, 10; No, 5, 18. Total, 76.

The committee would here remark that it may be seen, from the above figures, that it was no easy task to decide which was the best implement, when all were so excellent, nor were the members quite unanimous on two or three points, but fully so on all others.

As regards the Riding Cultivator, the committee would desire to call attention to the fact that its chief value is in its use for invalids, boys and persons who cannot do a day's work when compelled to walk. That this class of implements can be made to do as good work as the walkers, is quite possible, but the committee have not seen this point reached as yet.

THE THOMAS SMOOTHING HARROW.

This was tested also, and we think will never find a place of usefulness in our corn fields. In very clean land it might be of little value as a pulverizer, but among stalks and clods it would be worse than useless. In short it has no real merit as compared to a common harrow, field roller or plank drag, for use in preparing or cultivating the soil for corn.

BAKEWELL'S IMPROVED HARROW WITH CULTIVATOR ATTACHMENT.

This implement is only designed for use in the early stages of culture. When the surface is rough and uneven in consequence of imperfect preparation of the land, we should judge that it might be useful.

HARPER'S HARROW ATTACHMENT.

The above implement was tested on the Corn Dodger Cultivator, by taking off the cultivator teeth, but it is adapted to all cultivators.

The same general remarks apply to this as to the above harrow; useful only in the early stages of culture, with the additional value of the latter to break the crust in case of heavy rain storms, for the purpose of ærating the soil. The former is a valuable field harrow, and for many purposes the cultivator attachment will be found useful.

The land on which the trial was made was in fine condition, with almost straight rows, having been planted with "Haworth's Check-Row Planter." The rows were worked at right angles to the time of dropping, and also diagonally. Had the land been in bad condition, and the test more exacting, the result might have been different; but good farming does not require a cultivator adapted to rough surfaces, and no such test is desired.

J. J. BOGARDUS,
J. G. CLARK,
M. L. DUNLAP,
Committee.

CONVENTION OF FRIENDS OF AGRICULTURAL EDUCATION.

In accordance with the call of a circular issued after correspondence with persons interested in the Agricultural Colleges founded on the national grant of lands, a convention was held at Chicago, on the 24th and 25th of August, 1871.

In view of the interest manifested in this meeting, and its objects, by practical and scientific educators and others throughout the country, it has seemed desirable to place its discussions, although informal, and somewhat crude, in a more permanent form; and to add the correspondence of gentlemen unable to attend, and an editorial from the "New York Tribune" of September 6th, 1871.

CIRCULAR:

To the Friends of Agricultural Education:

After correspondence with those more immediately interested, it has been decided to call a convention of Presidents of Agricultural Colleges, Professors of Agriculture, or other persons in the United States or British Provinces who are engaged or interested in promoting the art or science of Agriculture by experiments in the field or laboratory, for the purpose of organizing, consulting and co-operating in the great work of advancing the cause of Agricultural knowledge and education, especially by experimentation with similar crops under similar conditions, at all the Agricultural Colleges.

Accordingly a meeting will be held, commencing on Thursday, August 24th, at 10 o'clock, A. M., in one of the halls in The Prairie Farmer Building, 112 Monroe street, in the City of Chicago, at which the attendance of all interested, but especially of the representatives of the Agricultural Colleges of the country, is earnestly invited.

Papers upon various topics related to the objects of the meeting are expected from several gentlemen, and are solicited from all who have any suggestions to make thereon.

This meeting is called with the approval of the following gentlemen, most of whom expect to be present:

T. C. Abbot, President of the Michigan State Agricultural College.

Manly Miles, Professor of Practical Agriculture, Michigan Agricultural College.

J. M. Gregory, Regent of the Illinois Industrial University.

W. C. Flagg, Secretary of the Board of Trustees Illinois Industrial University.

W. W. Daniels, Professor of Agriculture University of Wisconsin.

A. S. Welch, President Iowa State Agricultural College.

Wm. W. Folwell, President University of Minnesota.

Joseph Denison, President Kansas State Agricultural College.

J. B. Bowman, Regent of Kentucky University.

W. S. Clark, President of the Massachusetts Agricultural College.

Wm. H. Brewer, Professor of Agriculture Sheffield Scientific School of Yale College.

Geo. C. Swallow, Professor of Agriculture University of the State of Missouri.

Hunter Nicholson, Professor of Agriculture East Tennessee University.

Hon. John Carling, Commissioner of Agriculture, Province of Ontario.

Prof. Buckland, Toronto University.

Hon. Horace Capron, late Commissioner of Agriculture.

Andrew D. White, President of Cornell University.

PROCEEDINGS OF CONVENTION.

In accordance with the call of a circular, published throughout the country, the following gentlemen convened in one of the halls in The Prairie Farmer Building, on Thursday, August 24th, 1871, at 10 A. M.:

1. Dr. J. M. Gregory, Champaign, Illinois, Regent of the Illinois Industrial University.
2. Dr. Manly Miles, Lansing, Michigan, Professor of Practical Agriculture Michigan Agricultural College.
3. Dr. Joseph Denison, Manhattan, Kansas, President Kansas Agricultural College.
4. D. C. Gilman, New Haven, Connecticut, Professor of Physical Geography and History Sheffield Scientific School.
5. Professor A. N. Prentiss, Ithaca, New York, Chair of Botany and Horticulture Cornell University.
6. John Hamilton, Agricultural College P. O., Pennsylvania, Professor of Agriculture Pennsylvania Agricultural College.
7. E. W. Hilgard, Oxford, Mississippi, Professor of Chemistry University of Mississippi.
8. G. C. Swallow, Columbia, Missouri, Professor of Agriculture University of Missouri.
9. Dr. E. S. Hull, Alton, Illinois, Lecturer on Vegetable Physiology and Fruit Growing Illinois Industrial University.

10. W. W. Daniels, Madison, Wisconsin, Professor of Agriculture and Analytical Chemistry University of Wisconsin.

11. Rev. R. D. Parker, Manhattan, Kansas, Secretary of the Board of Regents Kansas Agricultural College.

12. W. W. Folwell, St. Anthony, Minnesota, President University of Minnesota.

13. S. H. Peabody, Amherst, Massachusetts, Professor in Massachusetts Agricultural College.

14. A. S. Welch, Ames, Iowa, President of Iowa Agricultural College.

15. I. H. Roberts, Ames, Iowa, Farm Superintendent of Iowa Agricultural College.

16. W. W. McAfee, Madison, Wisconsin, Farm Superintendent of Wisconsin University.

17. W. C. Flagg, Moro, Illinois, Corresponding Secretary Board of Trustees Illinois Industrial University.

18. Edward Snyder, Champaign, Illinois, Professor of Military Tactics, &c., Illinois Industrial College.

19. Dr. H. J. Detmers, Champaign, Illinois, Lecturer on Veterinary Science Illinois Industrial University.

20. H. D. Emery, Chicago, Illinois, Editor "Prairie Farmer."

21. W. W. Corbett, Chicago, Illinois, Editor "Prairie Farmer."

22. G. E. Morrow, Madison, Wisconsin, Editor "Western Farmer."

23. T. H. Glenn, Chicago, Illinois, Editor "Western Rural."

24. Julius Silversmith, Chicago, Illinois, Editor "Amerikanischier Farmer."

25. C. W. Murtfeldt, St. Louis, Missouri, Secretary Missouri State Board of Agriculture.

26. Milton George, Chicago, Illinois, Editor "Western Rural."

27. Edward Young, Joliet, Illinois.

28. Mansfield Young, Joliet, Illinois.

29. William Watkins, Joliet, Illinois.

TEMPORARY ORGANIZATION.

Dr. Miles, Professor of Agriculture in Michigan College, called the meeting to order, and nominated Dr. Gregory, Regent of Illinois Industrial University, as Chairman *pro tem.*

Dr. Gregory said that this Convention represented an interest never before represented in a like manner in this country. Practical men like those there assembled, believed in deeds rather than words. If he apprehended the object of the convention, it was to deliberate about the peculiar duty, as practical scientific men, to whom vast public interests had been committed, about which great solicitude was felt. There were many things to be done about which the only light they had came to them from over the waters, consequently there were many changes to be made, and many new things to be attempted. To meet these claims, and to do their duty and fulfill the objects of the Congressional land grant, they desired a free and full discussion, and to secure co-operation, especially so as to Agricultural courses and Agricultural experiments. In this country the business was new and raw. To secure uniformity of proceeding in experiments and mutual understanding this Convention was called.

The Hon. W. C. Flagg was nominated as Secretary *pro tem.*, but at his urgent request his name was withdrawn, and Prof. Prentiss, of Cornell University, chosen.

COMMITTEES.

A motion to appoint a committee of three on Permanent Organization was carried, and Dr. E. S. Hull, Mr. Glenn, of the "Western Rural," and Prof. Daniels, of Wisconsin, were elected as such committee.

A motion to select a committee of five on Order of Business, resulted in the choice of Dr. Miles, of Michigan; Prof. Gilman, of Sheffield; W. C. Flagg, of Illinois; Prof. G. C. Swallow, of Missouri, and the Rev. R. D. Parker, Secretary of Kansas Agricultural College.

The question of how long the Convention would sit was sprung. Dr. Miles was willing to stay until the business which may come up was concluded.

Mr. Flagg moved that the Convention endeavor to conclude its business by to-morrow evening. This expression, offered as a motion, carried.

EXPERIENCE MEETING.

The Convention resolved itself into a sort of experience meeting.

Dr. Miles, of Michigan, was called upon, and spoke substantially as follows:

"Our College, as you all know, was started several years before the Congressional land grant act was passed, to aid in giving prominence to the practical Agricultural Department. My own experience has been with the practical, of which we have two distinct departments, the Horticultural and Agricultural. I have had charge of the latter for the last eight years. Our students are required to labor three hours per day; we do not think labor interferes with the studies, and generally the best students inside are also the best workers outside. We find great difficulty in conducting an Agricultural experiment satisfactorily, because it is difficult to get a proper standard of comparison, and also with animals; for instance, there is a great difference between old and young. We now place animals each by themselves; all animals which are not found in proper condition to assimilate food are thrown out.

"In our experiments, we have found that animals consume more food in the first stages than afterwards. We have about 400 acres. A large amount of work is done by the students. I should have stated above, that all our students work at the same time. We have, however, men enough employed to carry on the farm independent of the labor of the students."

Prof. E. W. Hilgard, of Mississippi, being called on, said he had come here to get information, and, therefore, would ask of Prof. Miles: "Does your farm make lucrative returns, or is it an expense?"

Prof. Miles—It is not an object primarily to make the farm pay, but our's pays as well as other farms. We propose to carry on the farm operations economically, but do not farm for profit.

President Gregory--If you did not make any more than the ordinary expenditures of other farmers, would it pay as well?

Prof. Miles—Yes, certainly. There are a few things which we do not expect to pay, as, for instance, the keeping of male animals of different breeds, which must be kept pure, and can serve only a few females.

To the question as to how many of the graduates of Agricultural Colleges become, or rather remain, farmers, Dr. Miles said he could not answer the question very accurately, but he felt safe in saying nearly 75 per cent.

Prof. W. W. Folwell, of Minnesota University, said he had no report to make. Although the Agricultural Department had been opened technically, they had as yet done but little. They did have a good piece of land for an experimental farm, a good deal of hope, and some confidence.

Prof. D. C. Gilman, of the Sheffield Scientific School, of New Haven, Conn., in answer to a call, responded that that institution could not properly be called an Agricultural College, though they had two Professors of Agriculture and half as many students; that it was a distinct college, although a part of Yale. They had constantly recruited students from the farms, but were sending but few back; if they had any distinctive work it was to train up scientific men.

President Denison, of Kansas Agricultural College, said that Pennsylvania had much experience, and he therefore would call on Prof. Hamilton, from that State.

Prof. Hamilton said he did not like to go into detail at that stage of the meeting, but would do so at a future time. But, being urged to speak, he said that Pennsylvania had three model and experimental farms; one near Philadelphia, one near Pittsburgh, and one in Centre, where the college buildings are located. By this division, they secured a diversity of soil and climate. Each of these farms contained about one hundred acres. Thirty-five acres of each hundred were used for experimental purposes; the rest as a model farm, in the sense of elevating the general standard of farms. In order to provide the necessary stock, each farm had received as donations from citizens of Pennsylvania, about $5,000. The same experiments were carried on on each of the farms, and were carried on continually. There were about forty-four plats on which experiments in the rotation of crops were tried, including experiments with manures, domestic and commercial. Then they had another lot of plats, for grains, seeds, and vegetables, and another for forage plants for the soiling of stock. The students, seeing these experiments on one farm, saw all; but it was in contemplation to have all the students visit each farm.

To the question of how much labor was required of each student, Prof. H. answered by saying four hours every other day, or eight hours one week, and twelve the next. The freshmen and sophomore were the only classes that labored, students of a higher grade not working. They started out with the idea that labor was honorable, and that all should work three hours each day, but the Regents did not think the plan worked well. The students seemed to think that they were supporting the College, which could not be denied. They then agreed upon the present plan; the labor was not paid for, except when performed extra. The Professor seemed to think that much of the labor required at first, such as picking up thousands of four-horse loads of stone, was not very agreeable. The present system had been in force two years, and worked well. They kept hands enough to carry on the farm independent of the student labor. In answer to a question, he said students generally did not care for the animals, or to work with teams.

The question was asked: "Did the labor required of the students have any connection with their immediate studies?" He said: "Not so much as it ought to have."

President Denison, of Kansas, being called upon, said that new States and new institutions had but few experiments to report. He would say that they had had a fine opportunity to select lands. They had sold about one-half and had now an income of $20,000, which would still be increased. They had until recently, eighty acres of land with the College building, and enclosed by a stone wall, which cattle respected. The land had been increased to 415 acres. They hoped to devote a part of this to a nursery for fruit and forest trees, which would pay. Men and women were admitted, and thus far the women had been able to hold their own in the studies. They required one hour's labor per day of each student, male and female; if more was performed it was paid for. The Faculty numbered twelve professors.

PERMANENT ORGANIZATION.

The Committee on Permanent Organization presented the following list of officers:

President—Hon. J. M. Gregory, LL. D., President Illinois Industrial University.

Vice-Presidents—Dr. Manly Miles, Professor of Agriculture in the Michigan Agricultural College; Rev. Joseph Denison, D. D., President Kansas Agricultural College, and Professor D. C. Gilman, of the Sheffield Scientific School.

Secretaries—Professor A. N. Prentiss, Cornell University, and Professor John Hamilton, of the Agricultural College of Pennsylvania.

The officers were elected, after which the meeting adjourned until 2 o'clock.

AFTERNOON SESSION.

The Chairman—We were in the midst of reports. It is for the Convention to say whether they shall be continued.

Mr. Flagg—Mr. President our members are not all in yet, I believe, and I would like to bring up a little matter while they are gathering, if in order—the question of arranging for continuing this organization in future years. Some of us had a plan under consideration of forming a permanent organization, to meet from year to year, or oftener, for the purpose of continuing consultation, experimentation, and comparison of experimentation, and the continuous laying out of experiments to be performed in common—doing that much at least. Perhaps the organization ought to go further. Perhaps it ought to be an organization of the Agricultural Colleges and the Technological Schools. I want what would be best, and would like to bring before the meeting the question of continuing the organization in the future, and get an opinion upon it.

The Chairman—Will the Convention take any action on the matter of future permanent organization?

Mr. Hilgard—I would move it be referred to a committee.

The motion was carried.

The Chairman—I will appoint Prof. Hilgard, of Miss., Hon. Mr. Flagg, of Ill., and President Folwell, of Minn.

The report of the Committee on Business will be in order if they are ready to report.

The Committee on Business submitted a report, naming the following for discussion this afternoon: "What experiments should the Agricultural Colleges try in common, and what should be the method of conducting them?"—Dr. Miles, of Michigan Agricultural College, to open the discussion. For this evening: "The relations of schools of applied science to one another and to other institutions."—Prof. Gilman, of the Sheffield Scientific School, to open the discussion.

On motion of Mr. Hilgard, the report was adopted.

The Chairman—According to the programme, the discussion of the experiments which may be made in common by the several institutions, will be opened by Dr. Miles.

WHAT EXPERIMENTS SHOULD THE AGRICULTURAL COLLEGES MAKE IN COMMON, AND WHAT SHOULD BE THE METHOD OF CONDUCTING THEM?

Mr. President, and Gentlemen of the Convention:

The subject is a difficult one to present. The number of experiments that might be tried by the agricultural colleges, and those interested in agricultural improvement, is almost without end.

The programme provides for the discussion of the experiments that it would be desirable to conduct in common by the different institutions, and also the method of conducting them. In presenting this subject, I shall reverse the order and speak for awhile in regard to the method of conducting experiments, and the difficulties in the way of their prosecution.

Very often we speak of experiments for the promotion of agriculture in a very loose and indefinite manner. It seems to me desirable, on the start, to draw a line of distinction between those experiments which tend to improve the *science* of agriculture, and those which have for their object the improving of the *art*. Art is one thing, and science is another. Art has to do with practice; it has to do with the ways and means of accomplishing objects. Science has to do with the explanations of those processes which are made use of in the art. We may have a rule of practice in the art, derived from observation and experience. Science may step in and explain that rule. The rule, as such, has been developed experimentally; it has been developed empirically—that is, by a series of trials. The explanation of this rule constitutes the science. Science has nothing to do with the practical application, in its strict signification. Science has to do with causes and effects. It matters not to the scientific man what the pecuniary results are; but he is concerned simply in the changes taking place in the matter which he is investigating. Now, if we attempt to combine, or rather if we confuse these two terms in our experiments, we shall not meet with the success that we ought to expect from a systematic effort at improvement. Field experiments—experiments in the cultivation of different crops, the application of manures, analysis of soils, feeding of animals—all have to do with the art. We are simply making methodical hints for the sake of getting at rules to guide us practically. The scientific man may step in and make his investigation for the sole purpose of explaining these principles, or rules, which guide us in practice. Now, I apprehend at the present time no one can claim that we have any rules of practice that are derived from the teaching of science. I know of none in the art of agriculture. The rules of practice have been derived from experience and observation. The world of science has stepped in and explained these rules. The rule is of no more force in practice than it was before. It simply serves to suggest new lines of inquiry for future experiments. On the start it seems to me important that we make this clear distinction in regard to the experiments we would make.

In the next place I will speak briefly of some of the difficulties—I alluded briefly to that this forenoon—in the way of successful experimentation, and in this discussion I wish to be understood as limiting my remarks entirely to those experiments which we inaugurate for the purpose of improving our practice—experiments for the improvement of the art.

In the first place, we have a great variation of soils. Unfortunately they are variations we are not able to detect except by experimental trials—soils apparently similar, so far as their compositions are concerned, and so far as their physical characters are concerned, give very different results. In the experiments at the Michigan Agricultural College this was one of the most striking points brought out by our first experiment. Ordinarily field experiments have been conducted by taking a single manured plat, and then comparing with it different plats to which had been applied different varieties of manure. The experiment was supposed to be complete. The comparison of the unmanured plat with the manured plat would apparently give an indication of the result. But such experiments misled us. We found on quite a number of unmanured plats, on soils precisely alike, so far as we could judge of their character and composition, a very great difference in yield. Peculiarities of climate and seasons will have much to do with varying the experiment, and this seems to be one reason why it would be desirable to try experiments at quite a number of different points, having all the conditions precisely alike, so far as we can, making the conditions that vary simply those of climate, soil, etc.

There is another difficulty in the way of conducting field experiments, which is exceedingly difficult to obviate, that is, the difference arising from variations in the cultivation. The time of the cultivation of each plat should be the same. Not only the same amount of labor should be expended on each plat, but that labor should be performed at the same time. From this you will see the difficulty of experiments on very large plats. If your plats are very extensive, and you have a large number of them, you cannot harvest them all at the same time. You cannot put in all the seed at the same time. Some two years ago at the Agricultural College we sowed a field of turnips. One-half of the field was sowed on the third of July, and the balance on the fourth, the seed being all from the same package, the same drill being used, and the same person running the drill. There was no difference in condition, so far as we could observe, except a slight shower in the intervening night, which would apparently give the advantage to the latest sowing. The result was that the turnips sowed the first day produced a very large crop; those sowed the second day were hardly worth harvesting. There were four or five times as many turnips from the field sowed the first day as those from that sowed the second day.

This shows that we should exercise great caution in regard to cultivation; that it should be uniform, not only as to amount, but as to the particular time of performing the labor. It is important that field crops subjected to experiment should be weighed at the same time. If you have a large number of plats, that are to be compared, and these plats are quite large, it must occupy considerable time. If so, there will be a difference in the amount of moisture, and this will vary the result. I had a striking illustration of it the present year, in the continuation of some experiments we started several years ago.

A field had been planted with corn for several years in succession, the plats all being treated alike. We found a great variation in the yield. Corn was put on the next year, and there was a great difference in the yield, but the plats that gave the largest yield the first year, did not give the largest yield the second year.

After this part of the plats were manured, and we followed on through a rotation of crops until we came to the clover crop, which was harvested this year. As soon as the crop was cut, we endeavored to put on sufficient force to do it in a short time. The clover was weighed green. It was then stirred up and exposed to the action of the wind and sun, and put up in cocks. The next day it was spread out again, and when it was supposed this crop was in a fine condition for going into the barn, the plats were weighed; but it was thought there might be some variation from this cause, and they were allowed to remain and afterwards weighed again. This second weighing it was thought to be dry enough to go into the barn, and not excessively dry afterwards. I give the results of the second and third weighing of the same plat:

SECOND WEIGHING—*Pounds.*—261, 84, 100½, 41, 251½, 119½, 211, 101, 165½, 93½.

THIRD WEIGHING—*Pounds.*—185½, 61, 68½, 30, 175, 88, 151, 73½, 121, 71.

It showed the manner in which we may be deceived by relying on our senses entirely.

You will readily perceive if we had a large number of plats, and they were of considerable size, you would get more difference in results if it was carried on in rotation, commencing on one side, and passing to the other side of the field. Guard against a difference in the results, arising from a difference in the amount of moisture in root crops as well as others. It has been shown by some experiments made, that where turnips, for instance, have been manured, there was a great increase in the yield, but when the amount of water in the turnips was taken into account, it was found the amount of dry substance was precisely the same. The great increase arising from the manure, was simply water—nothing more—and here is something that should be looked at.

In feeding of animals, there are a great many difficulties in the way of satisfactory experiment. One of the first I will mention is that which may be termed individual peculiarities of animals. You may take animals of the same age, and the same size, or as we have fed, pigs of the same litter, and we find one pig will give a much larger return for feed than another. It is something we cannot get at, cannot measure, cannot detect, except by the experimental test of feeding.

Again, we find, as I mentioned this forenoon, when animals are first put up, they consume more feed in proportion to their weight than towards the close. We find they give a greater return for the feed consumed during the earlier stages of the feeding than afterwards.

What is the cause of the variation? I apprehend there are three causes, and two of them I have no doubt about The third, I am inclined to think, has an influence, yet it is an exceedingly difficult matter to determine. These peculiarities, or differences, are the age, the size and the ripeness. From the experiments we have already tried at the college, I have no doubt age has a very great influence on the result. The young animal seems to have an organization capable of deriving more nutritive material from the same feed, so that it gives a larger return for feed, other things being equal, than when it gets older. The ripeness of the animal has much to do with it. When the animal is in a moderate condition it will receive more nutrition from the food consumed than after it is excessively fat. The size of the animal perhaps has something to do with it. I am inclined to think it has, and you see we have a difficult problem to deal with to determine how much of this variation is owing to difference in age, how much to difference in size of the animals, and how much to this difference in ripeness. By ripeness, I mean the condition of the animal, as regards fat. The treatment of animals will have very much to do with the results. Animals that are carefully treated, and fed regularly, will give a larger return for food consumed, other things being equal, than those that are treated harshly, and kept in constant tumult from outside annoyances and interferences. The mental condition of the animal has undoubtedly very much to do with the progress it makes in feeding. We found when we were feeding sheep in the experimental pens in the sheep barns—this building being occupied by other sheep—they did not make as much progress as when fed by themselves, and they would fall away at once as soon as there was an unusual disturbance among the sheep, in the outside pens of the same building.

There is another matter that should be taken into consideration: that is the varying weights of animals, without apparent cause. If you weigh animals, at long intervals, you will undoubtedly find they are making very satisfactory progress from one weighing to another; but if you weigh them at short intervals, you will find they lose during one period, and gain the next. If you weigh them every day, you will find one day a loss, and the next day a gain, or perhaps two or three days of gain, and then a great loss. The progress made by the animal is an undulating line, and not a uniformly ascending line.

I do not know that I can give any satisfactory explanation of this variation in weights of animals, but I presume it is owing to a difference in the action of some of the secretory organs. It is probable their fluctuation in weight was owing to a loss of water in the animal rather than to a loss of dry substance, because where we find an animal has made a very great loss at one weighing, it will frequently make the least gain at the next weighing. If this loss in weight was owing to a defect in the animal, then we would suspect the animal was sick, or there was some derangement of the organs, and would not expect it to make such a rapid gain at the next weighing.

To obviate these difficulties and make our experiment satisfactory—that is, in order to accomplish the object of experimenting—it seems to me we should pay particular attention to several particulars, which I will enumerate. In the first place, the experiment should be as simple as possible. A large proportion of the experiments made thus far have been of no value, for the reason that too much was attempted. For instance, a person wishing to test the real value of potatoes of different sizes for seed, plants his small potatoes in drills two feet apart, and the large potatoes in rows three feet apart. Here, you see, is a double variation. There was no condition the same, and no chance to compare such experiments, and a very large proportion of experiments have been vitiated in this way. It arises from attempting to determine two things at once, that is, the effect of variation in size of the seed, and the effect of variation in the rows. You have two elements, and you may try experiments as long as you please without any valuable results. It would be better to try one experiment and settle the matter in regard to size, having all the conditions precisely the same, and then take as a separate experiment, one in which the different distances of the rows was the object of the investigation. In reference to this difficulty in regard to the variation of the soil, it would be necessary to have a large number of unmanured plats for comparison. The increase of the manured plats over the unmanured should be where the plats treated precisely alike.

I think it would be desirable also to put crops for two or three years in succession upon the same land before using it for experimental purposes. For instance, if you wish to test the value of manure as applied to soil, it would be better to mark out your plats accurately, and crop them for several years without any manure until you ascertain the peculiarities of this crop, and then continue the same crops with the addition of manure afterwards, but in this case at least one-half of the plats should be left unmanured for comparison, so that you may compare results alongside of the manured plats, and compare the plats with themselves, and also with the crops on the same plats the preceding years.

The question is often asked, what sized plats it is desirable to make in field experiments? That is a difficult question to answer. On some accounts it would be desirable to have the plats very small; on other accounts it would be desirable to have them of considerable size. Dr. Anderson states that he thinks the smaller plats are desirable; he would not have plats exceed 1-100 of an acre in area. Mr. J. B. Lawes, who is associated with Mr. Gilbert, in experiments conducted at Rothamstead, writes me he has no confidence in experiments made on plats of less than 1-20 of an acre. There are two high authorities. Dr. Anderson is an able chemist and a very successful experimenter. Lawes and Gilbert are perhaps the best agricultural experimenters we have had. Their experiments are not accurate, but taken on the whole, they are the best experiments that have been made. My own experience is, that a plat of from 1-100 to 1-20 of an acre should be the limits in size. The difficulties of the very small plats are, you are liable when you are manuring to have it extend its influence to the adjoining plats, and the roots of the plant will extend some distance into the soil, so that you are liable to be misled. When you come to weigh the produce of the plats, a very slight error will amount to considerable, when you make the calculation to ascertain the yield per acre; that is, the error in a single plat would be multiplied by 100 in getting the standard for an acre. In a small plat it requires very great accuracy in weighing, great accuracy in the division of the plat, and great care in the management of the experiment throughout. To obviate this objection that the roots run from one to another, I think it would be well to have space between the plats – a space of several feet left between these plats that are to be used for experimental purposes, and these spaces should be kept clean and free from weeds. But here comes another difficulty. Suppose you have plats laid out, and spaces of three feet between them, you must cultivate the spaces, and need to expend the same amount of cultivation on each one of the spaces, as on the other, so that the crop adjoining may be equally influenced. Again, the spaces should be weeded carefully at the same time, cultivated at the same time, and managed as carefully as the plats themselves, or you will vary the result in the plat.

The objection to the large plats I have already mentioned, but I will refer to it again. It is the difficulty of getting over a large area in a given time. If your plats are so large that it takes a whole day to go over them and perform the labor, you will be very liable to error from the variations mentioned.

Wires may be used for separating the plats, and that is a very convenient plan, and one we have practiced at the Agricultural College, but it does not obviate the objection that the roots pass from one to another. It enables you to make a fair division between two adjoining plats, which is exceedingly difficult—more so than a person would think who has had no experience in the matter of making exact divisions through a crop of growing grain.

In the feeding of animals, I would be particular, as I mentioned, to have but a single animal in a pen. If I was going to feed twenty animals on a given feed, I would place each one in a pen by itself, and then would confine them to a single article of food. It would be an important matter to test the nature of corn meal, and corn prepared in different ways, as food for swine. The natural mode that would be suggested, conducting the experiment, would be to put a number of swine in a pen, and give four or five of them corn unground, four or five more of them cooked corn meal, and four or five more uncooked corn meal. But I apprehend the results of the experiment would be very unsatisfactory, to say the least. I would not like to place any very great amount of reliance on it. I would prefer to take the same number of hogs and put them in pens separately, and feed them with unground corn, and follow that up until I got the range of variation between the animals. Then I would take the same number and feed them corn meal, and if your arrangements are of sufficient extent, you may have these experiments going on at the same time. We have been feeding swine for a number of years, and have from ten to fifteen pens. We have fed nothing but raw meal thus far. The question is often asked, "Why don't you feed cooked meal?" I have not yet got the standard of comparison with raw meal, by which I can compare results with the cooked meal. There is a great range of variation in the animals, and there would be made a serious error in the experiment. This error has arisen very much from the force of circumstances. We could not get animals of uniform size and uniform ages to fill our farms, and for that reason, the attempt to do the two things which I have mentioned, is objectionable. There has been so much variation in this matter, that we need to have more experiments with cooked meal, and I would hardly know what to compare them with so far as raw meal is concerned. Notwithstanding the great variation, the rule I laid down holds almost uniformly; the greater increase of food consumed during the early stage, and the dissemination in the amount of fat, as the animals fatten. The animals for feeding should not only be of the same age, but they should be as near as possible of the same size, and of the same degree of fatness when they are put into the pen, in order to get a fair opportunity for comparison.

I do not wish to take up too much time on this, because I would like to hear from others. I have but one other suggestion to make in regard to the methods of conducting experiments, and that is the method of obtaining manures. The term manure is a very indefinite term. We take manure from our barn-yards at different times, and it will vary very much in quality. The value of manure will depend on feed consumed; that is a fact well settled.

It is impossible to make a chemical analysis so as to get the value of it. A chemist may take a quantity and tell you what there is in the sample, but he cannot analyze each load that you use. The method I would adopt is this, to take the animals and put them into a pen—into a box-stall—and would have it constructed tight, so there is no chance of losing any of the liquid constituents, and I would feed to the animals a definite amount of food; then I would take the results of these articles of food as we have them furnished by chemists in tables, as the measure of the value. Then take the manure from the box, and put it on the plat. By pursuing this method, you may get a number of boxes of precisely the same strength for all practical purposes.

In regard to the experiments which it would be desirable to try, I have mentioned but a few. There are many more that suggest themselves to me, and I speak of these simply for the reason that they seem to me as important as any, and for the further reason that I think they would be as easily tried as any. It does not seem to me best to attempt very complicated experiments at any particular institution until a long experience has been had in experimenting—until the person experimenting becomes thoroughly familiar with all the difficulties in the way. For the feed experiments I would simply try to ascertain the value of Indian corn in its different forms. After this is accomplished we may then take other grain in the same manner. After that I would take the grasses elsewhere. In these experiments it would be desirable to have the same conditions observed by all the experimenters, otherwise the experiments cannot be compared. If I feed corn meal in a particular way in Michigan, and it is fed a different way in Illinois, Missouri or Pennsylvania, we cannot compare results at all. You are not assisted in the one place by the investigations made in the other. The experiments must be conducted in all places precisely in the same manner, then you can compare results, bearing in mind that certain conditions which cannot be controlled may influence the result.

The next class of experiments I will suggest would be to determine the best methods of applying manure—the application of manure on the surface, and the application so that it may be plowed under; and it would be desirable, likewise, to make experiments with reference to the application of these manures at different seasons; whether it would be best to apply manure in the spring on the surface, or in the fall.

This will be found to be a very complicated problem, and one that will require great caution. I would endeavor, likewise, to ascertain the value of commercial fertilizers as compared with barn-yard manures. You want to know the constituents of which the manure is composed and the fertilizer should be analyzed carefully. I have serious doubts of the propriety of farmers purchasing fertilizers. I have an idea they may be made cheaper by feeding animals. The barn-yard manure must be our staple manure for a long time. If we are to purchase other manure, we ought to have some means of knowing how it compares with this.

I would like to have experiments made showing the effects of change on the growing crops. In a system which has been tried, wheat has been grown for quite a number of years in succession, and a yield of from thirty to forty bushels obtained without any manure. The system is this: The field is divided into strips of three feet in width. The wheat is sowed on the alternate strips. The vacant strips are kept thoroughly pulverized during the season, and the next year the wheat is put on the strips left bare the year before.

It would be desirable likewise to ascertain the methods of seeding in corn, whether hills or drills would be desirable. These experiments all require a great deal of care and accuracy, and they will require a good deal of study in order to fix the conditions upon which they shall be tried by a large number of persons, so that the results may be compared.

Prof. Hamilton.—It seems to me that before we start out to experiment at all, we should understand one thing, and that is, that in this art of agriculture as it has been defined, aside from the science, no absolutely accurate result can be obtained from any experiment in the art of agriculture; that it is only by comparison—it is only relatively in their relation one to another, that they become of value. Crops may differ largely in weight, as to the times in which they are taken. It has been shown that after they have been considered perfectly dry, there is a difference in weight. This fact that they do differ in weight at different times, does not affect the experiment, because if they were weighed green, just as they were cut, and taken into the barn, it is the relation of these plats to one another, I think, that this would be found to be true in almost every case—as true as any portion of the experiment is. Every part of these experiments is attended with some error, and we wish to eliminate the error as far as possible, and in weighing of plants in that way—all of the plats at the same time or as soon as may be—we get a result that is almost correct; not absolutely correct, for no result we obtain is absolutely correct, and only correct results can be obtained by carrying on these experiments for a great number of years. The system of experimenting as it has been carried on, has been a failure, and is of no value inasmuch as they have been dropped after they have served a certain purpose; they have not been carried on persistently year after year, thereby developing a principle in agriculture, and not merely the curiosity of some person who is experimenting.

Now, in our experimenting for the Agricultural College in Pennsylvania, we have tried to avoid what the gentleman has clearly shown is an error we are apt to fall into, and become confused—that is, attempting two systems of culture, or putting in the same thing two objects. It cannot be done. We have failed on several plats for that very reason. The earlier experimenting was about a failure, just because we attempted to do too many things on the same grounds, and had more objects than one. There must be confined to each plat but a single object. If you have more you lose control of the experiment, and afterwards you have to experiment again to find out which of the two it is. Each plat, in any proposed plan, must be but a single experiment.

In regard to the size of these plats, it seems to me that the plan of having them so very small is one that probably is more liable to error than in having them large, although there are difficulties on the other hand; if your experiments are extended over a great deal of ground it is impossible, or almost impossible, to have them all carried along under the same conditions, but you can overcome that by going to extra expense. We try in all experiments to do this in one day, and in a portion of the day after the dew had gone from the earth, we try to get it as nearly in the same condition as possible, and if necessary hire extra help to insure this. There are accidents which happen—such as rains coming up—but those are things that no oversight can provide against. They do affect the experiment to some extent, but if these things are to be carried on for a succession of years, the probability is the next year one will be able to avoid this, and get such an average as will form a guide. The objection to the small plat has been stated: that if you make an error at all in weighing, or in the size of your plat, or in any particular, that is multiplied by just so many times as it is less than an acre, if you take that as a unit. If you take a larger piece, the multiplication of the error is not so great. We had some experience in the matter of small plats. One of our farms in Chester County, started before the one at the college, and before the one at the western part of the State, and they started some independent experimenting—sowing little plats of wheat of various varieties, and patches of one thing and another. It was found that these patches were very difficult to care for. Wherever we have small experiments the tendency is to increase the number, and it is scarcely possible to keep them all separate. The effect of that was that the superintendent, who was carrying on the experiments pretty much on his own hook, allowed his shocks of wheat of different varieties to stand in the field, and would thresh one and then another, taking several days in doing it, thereby occasioning greater error than would come in the having of large plats which were brought in and put in separate places in the barn, and not having so many of them. In regard to the way in which the plats should be laid out, I do not see exactly why the gentleman thinks it is necessary to cultivate between the plats. It seems to me, if the grass between the tiers of plats has an influence on one plat, it has that same influence on the other plat, and so the same influence goes on through the whole series of plats. There is the fact that we may use manure and we may not; inasmuch as this system of experiments is one that is only relatively compared, the same thing would be true if the plats were cultivated. It would not bring in any greater error, probably, than if the plats were cultivated. The keeping in mind of this one fact, that our results are only relative, I think clears up many of the objections. Also in the feeding of animals, this same thing holds good. I have only taken up the matters that have been suggested to me by the remarks of the gentlemen here, and given my views upon them, as I understand that it is the object. In this matter of feeding stock it seems to me if we could place equal weights of stock in different pens—pigs for instance —instead of having a single one in the pen, if we could place a number in one pen, and then a number in another, that would give a better result, because we divide up a greater amount of increase. When we come to show the effect the feeding has had upon the animals, we divide it up, having a greater number of pounds to go on, and we get a more correct result in the division.

I believe this is all I have noted, to reply to. I think there are three principles necessary to be kept in view, in instituting these experiments; that there are three grand divisions into which these experiments can be divided, one of which is to show the rotation of crops and method of culture. Those two are intimately united. They are things that are of practical value to farmers. They wish to know these things—the methods of culture and the proper rotation of crops. This, I think, is a proper subject for agricultural experiments.

Another is the experiment in different varieties of grains, seeds and vegetables, showing which are best adapted to certain soils, the ways of developing and the varieties that suit certain methods of cultivation. The next is in testing the qualities of different manures. These three things are the great question of the day in agriculture.

Professor Daniels—The remarks of Dr. Miles, I presume, are much more to the point, than any I shall make, as my experience has been mostly under Dr. Miles. I suppose you wish me to state something of what we are doing in regard to experiments.

The Chairman—The topic which is before us, recommended by the Committee, is the experiments which may be tried in common, by the several institutions in the country, and the methods of trying them.

Professor Daniels—I have been very much interested in hearing the remarks that have been made, and I am sorry that I did not understand exactly the points they were reaching, the experiments which may be tried in common. But I would agree with both the gentlemen who have spoken, in this: that experimentation is difficult to carry on, and definite conclusions are difficult to reach, on account of the great number of things that are brought in and the great number of elements involved in the experiment. The weather, the different characters of the season, different condition and different processes as applied to the soil—all these things render it exceedingly difficult, and no absolute results can be obtained. But they must be relative as it has been stated. The experiments which can be carried on, and best carried on generally with uniform action through the colleges, are, I should think, such as have been stated; the feeding of stock and the general results that may be obtained from feeding stock in different, definite, prescribed ways, and also in the methods of culture, and in regard to varieties. In regard to varieties of our crops, perhaps nothing so absolute can be obtained, on account of the difference in the climatic conditions in the different portions of the country, in which the experiments have been conducted. Our experiments mostly have been these, so far: The comparison of the different varieties—for instance, a comparison of all the varieties of oats that we have, and all those which we could obtain—a comparison of the different varieties of potatoes and so forth. The testing of some varieties of winter wheat and spring wheat and different methods of culture, and especially some of the simple matters. But under the circumstances in which we are placed, with an income which is small, we have not been able to do so much, and the Agricultural Department is simply one department of the University. We cannot apply all our energies in one direction. We look more to institutions that have devoted their energies more especially to these matters, having more money to expend than we have had; but any series of experiments, however, that the Convention would recommend, we should be glad to carry out to the furthest extent possible.

Dr. Miles—I would like to make a remark or two, to correct a misapprehension, and draw out some further information. I understood Prof. Hamilton to say that although an experiment might be conducted carelessly, and the result not accurate, that if an average is taken in large numbers, it would give satisfactory results.

Prof. Hamilton—I did not mean to say "carelessly"—not by any means; but after as great care as possible has been exerted, the result is not correct, and the only way to get accurate results is to compare, and in the end get some law that is general and as near accurate as may be.

Dr. Miles—I understood you to say the experiments might be tried in a certain way, and although they were not accurate, yet by reason of the large number of them, we might get at great results, which is the only means by which accuracy could be secured. It seems to me if that be the position, it is going to lead us astray at once. We must understand it is impossible to secure absolute accuracy; if it were otherwise, the matter of experiments would be an easy thing, and we could go right along with it. But if we cannot secure absolute accuracy, it seems to me we must avail ourselves of every means to reduce the error to the smallest possible amount, and even then we may find it difficult to draw satisfactory conclusions from the experiments. I apprehend we may have been misled in our attempts to draw conclusions from averages of a large number of experiments that have been made. I think we cannot get accurate results—we cannot get at any principle, at any law, by comparing experiments that are filled with errors, provided those errors are of any considerable amount. For that reason I would insist upon being exceedingly particular on every point in conducting experiments. I have made this subject a study for a great many years, and I have collected a large library upon this subject. All the agricultural experiments I have been able to lay hands on, I have brought together, and have examined and compared; and the more I study the published experiments, the more I am in the dark in regard to any underlying principle. I can see fallacies that are of very great consequence. I can see omissions in the statements which would lead me to suspect that proper precautions had not been taken.

In regard to cultivation between the plats, I, perhaps, might have stated the matter a little clearer. If you have spaces between the plats, they are there for the purpose of separating the plats, and if you have something growing there, it is not a fair separation. If weeds are allowed to grow, some of the spaces would contain more than others. What I mean by cultivation is, the spaces should be kept clean and free from weeds, and nothing be allowed to grow upon them, because if you leave plants to grow upon them they will extend their roots to the plats, and defraud the crops by drawing the nourishment from them.

In regard to putting up cattle and feeding. If the conclusions I have drawn from our experiments are correct, the putting of the same weights into pens would not answer the purpose. I might have in one pen 500 pounds of very small animals, and in another 500 pounds of animals considerably larger. But if you are taking the larger class of stock, there might be 1,000 pounds in one pen, consisting of five animals, and 1,900 pounds in another, consisting of one animal. You could not compare them if there was a difference in age, and a difference in condition. The matter of individual peculiarity of animals is a very important one. I found where I had two or three animals in a pen, there was no increase. In another pen adjoining, where there was the same number of animals, there was a remarkable increase. I said, "Why is this?" I weighed the animals separately, and found one animal was losing and another gaining. If you want to know the value of any feeding substance, it will not answer to take the averages of the animals. The amount of food required to produce a given increase is what we want, and I would have each animal's food by itself, so that when that animal made no return at all, I would know it was out of condition, and not a fit subject for experiment, and throw it aside. There is another reason why I would put animals in separate pens. They do much better. When the animal gets contented in the pen in which he is placed, with none to molest, he eats his food quietly and lies down. Where there are two or three together, perhaps one is quarrelsome, and is continually disturbing the others by not allowing them to eat or to lie down. It is with animals as it is with persons. One is restless, and another is inclined to be quiet. When you have a large number of persons together, you find it exceedingly difficult to keep the room still. It is so with animals. One animal gets nervous and keeps the others confused and unsettled.

Professor Hamilton—I would like to make one remark. I took it for granted, when I made the statement in regard to putting a number of pigs in the same pen, that the same care would be exercised as when there was but one animal in the pen.

Professor Prentiss—I have had enough experience and seen enough to convince me that the difficulty in the way of conducting experiments is even greater than has been set forth by the remarks this afternoon. The materials and the forces of nature are so varied, and life is everywhere so variable, in plants and in animals, that we cannot tell whether to attribute certain conditions to the plants or the animals. Dr. Miles refers to what he calls the individual peculiarities of animals. Botanists recognize very great peculiarities in plants, that they readily see and recognize but cannot describe; it is what Linnæus has termed "physiological peculiarities of plants," some hidden mystery about them, something that controls them, something that we see, but do not yet understand and probably never will. For instance, you take two seeds of an apple, apparently alike, and plant them. One develops into a tree, which bears a large, excellent fruit; a tree of vigorous growth and handsome appearance; the other develops into a small tree, producing a fruit of little or no value. Perhaps the condition of the soil and climate are precisely alike, and yet these differences are developed in the growth of the different seeds. The same truth applies, only perhaps to a less extent, to every plant that the farmer grows in a field, to every plant of grain in a field of wheat or corn. So when we take these plants and subject them to culture, to see what method is most valuable, we cannot tell whether it is a difference in culture that is productive of the different results, so much as individual differences in the plants themselves. So in every way in which we look at these experiments difficulties present themselves. I would not infer that all experiments are of no value, because I believe they are of great value; but the experience of a single year, I consider to be valueless. The experiment must be repeated time and again; and finally, notwithstanding the difficulties are pointed out, I believe a result would be obtained which, to a certain extent, would be considered as a general law. The proposition which has been made in reference to having the different agricultural colleges conduct the same experiments, I consider to be in the highest degree valuable; because the more experiments are tried, the more varying the conditions, and taking them year after year, the more sure would be the results. So as I look upon the matter, I believe that the value of experiments in this country has just been commenced, or rather the experiments that would prove of value are just commencing, and the step we are about to take I consider to be of the utmost value in this direction.

Dr. Detmers—We have just listened to very able remarks in reference to the conducting of these experiments, and I wish to add but a few words. There is one point I consider to be of very great importance, and that is the different agricultural colleges uniting in their efforts in this direction, to demonstrate and to find out what influences soil and climate in different localities have upon the development of our different domestic animals, and even upon the different breeds of domestic animals. It is well known that in one part of the country fine handsome horses are produced, but the cattle in that locality amount to but little. In another locality they raise excellent cattle, but the horses are inferior. In another they raise the finest kind of sheep, and in another the sheep do not succeed at all. We may know the cause, but not thoroughly enough; and this would be a very good object for the united efforts of these agricultural colleges. For instance, if you ask a dozen different men what is the best breed of cattle, you will receive as many different answers. Some will prefer one kind and some another; one prefers the Devonshire, another the Ayrshire, and so on; all are liked more or less. It would be of great importance to explain not only to the agricultural student what are these different conditions and varieties, but to the agricultural public what makes one breed thrive so much better in one locality than in another. We know it is almost impossible to raise sheep successfully in low, wet ground. We know that horses thrive better in a high and dry country than in a low and wet one, although they may get a great deal more weight in the latter. But there are many points which might be explained by proper and rational experiment.

A good deal has been said about feeding cattle; and I want to mention one simple point, established by empiricism. It has been found out that where we attempt to fatten animals, when kept separate, they never thrive as well as when two or more are kept together. It seems that two animals, or three or four kept together, eat better. They are somewhat jealous of each other, and each afraid the other will get more than its share, it seems; and they eat better, and consequently thrive better on that account.

President Denison in the chair.

Dr. Gregory—The committee have taken it for granted, I suppose, that all the agricultural colleges and institutions, or institutions that are teaching agriculture, are conducting experiments. It is of course understood that the agricultural colleges were organized, not for the purpose of experimenting first and foremost, but for the purpose of teaching agriculture, or the branches of learning relating to agriculture, and it has not been uniformly accepted that the agricultural colleges are to be experiment stations. They are not necessarily experiment stations. One of the questions for us to settle is, how far they can be made experiment stations, how far their forces and funds can be diverted for this purpose and used for this purpose. In Europe the agricultural experiment stations are sometimes connected with the institutions, but not always. If I am rightly informed, there are some thirty-three different agricultural experiment stations in Europe, under the charge of some agricultural chemists, besides other parties assisting them. These experiment stations, some of them at least, are found connected with the institutions. Those that I saw myself were always connected with them, because I did not turn aside to visit any of those that were not; but many of them, like the celebrated experiment station of Lawes and Gilbert, are not connected with any of the institutions of learning. We know this, that the country is demanding of the institutions that they shall conduct experiments. The agricultural public expects us to conduct experiments. They are constantly calling, through the agriculture press, at agricultural conventions and otherwise, upon these colleges to help them to settle questions relating to agriculture. Whatever might have been claimed at the outset to be the duty of these colleges, I trust we shall fulfill a public demand and duty by instituting experimentation. At least it seems to be the judgment, I think, of the gentlemen present here, and all I have known in connection with the agricultural colleges, that experiments shall be prosecuted. What has been already said here will perhaps, sufficiently, lead us to infer the great difficulty attending these experiments. But we have been told long ago that there is no excellence anywhere without great labor. The truth does not lie on the surface always. It hides itself in the depths. It is to be sought for with great patience and with great care, and great study. When it is found at last, be it after ever so long a search, and after ever so great expense, it will richly reward the seeker. Now in the solution of the problems in agriculture, the discovery of laws in agriculture—for I suppose that is the object of the experiment, and not merely to gratify the curiosity of the experimenter, not merely to get at some half-way results, like weighing a thing by taking it first in one hand and then in another, and then giving a guess—it is possible to determine, somewhere approximately at least, what are the facts, and ultimately to reach a law.

What are the laws and forces which enter into any agricultural product, animal or vegetable? What if they are many and complicated? Are they more so than the forces that have entered into the other results and deductions, that men ultimately have reached, and determined the laws of? We should remember this thing. If we can get one single element reduced to its law—if we can in one single case discover a law that is fixed and invariable and has the force of a law in a multiplicity of things—we have put, as it were, a streak of sunshine into it—we have got one fixed element in the problem, and everything else will be readily solved.

As far as Dr. Miles' experiments which he suggests, and very wisely in the matter of feeding, you can take simple corn in its various forms, and, by a series of experiments carried out, you can ultimately arrive at something like a law in regard to the effects of feeding an animal on this one article of diet. May you not ultimately reach a law of animal feeding and growth and fattening, which you will carry elsewhere? The multiplicity of forces that enter into these experiments, to my mind, only prove this: the necessity of combination and co-operation. Suppose, for instance, that the Agricultural College in this State would try certain experiments as carefully as we can. We are trying them under a careful experimenter, who is present, and we may ultimately in the course of years reach a conclusion, as we think. Somebody in Pennsylvania tries the same set of experiments and he reaches a different result, revealing to us what we alone should not have suspected perhaps, that there were climatic differences or something or another that modified the result, and which therefore vitiated our supposed law, and compelled us to start afresh before we dared to publish the results of our experiments to the world, as an established agricultural law. It seems to me the argument is sound in the matter of the proposed co-operation. How far this co-operation can go will be determined by the nature of the experiments. We shall see how far we are under different conditions, such as will compel us to make allowances for our own and other experiments. To me it is a very serious practical question, and I suppose it is to the gentlemen connected with these institutions. The public are expecting certain things of us, and demanding certain things rightly of us. They ask us to do perhaps what we cannot. They ask that we shall so experiment as to discover for them how they may cultivate corn to the best advantage in this and other States; or how to feed animals, or what varieties of corn are best worth cultivating. They ask us to enter upon a set of experiments to determine it. Suppose you in Pennsylvania, or in Wisconsin or Michigan, go and work isolated and alone, and the rest of us wait until you have accomplished your experimentation; you reach a result and you publish it to the world, and the first practical farmer that makes a trial of that supposed result and law, discovers that it won't hold in his community, and at once throws contempt upon your agricultural science, and convicts you, as he says, of not knowing what you are about, and of pretending to discover some things which are not true. If instead of conducting the experiment in isolated schools, and not helping each other at all, we are prepared to say that a set of precisely similar experiments, arranged by the same man, and conducted according to the same rules, and as far as possible in the same manner, produces such and such results, we defend ourselves against unjust criticisms at least, and put ourselves and the whole public with us on to vantage ground, for giving new investigations, if no more. We are at least all agreed in this one thing, in which Herbert Spencer says: "Scientists and religionists are all agreed in this, if not in anything else, that there is something to be known, there is something to be discovered" There are some questions to be asked, but I doubt whether you are prepared to state distinctly and fully just what the questions are that are to be settled. Strip them naked and set them before us, and see if we can determine precisely what is to be experimented upon. We want to experiment in order to learn how to experiment, and to know what road we want to travel and what results we ought to aim for. What we want ultimately to reach is a law—not a fact—but law. Ultimately truth; but what law, what truth? Who will tell us? Will Dr. Miles? I do not know of any body better prepared, but I do not know whether he can tell us to-day.

I wanted to call attention to a practical matter before us. I hope after this discussion shall have proceeded as far as the Convention shall choose, that the subject matter will be referred to a committee, with directions to report, if possible, before the close of the Convention, distinctly, some one, two or three experiments, perhaps one or more in each one of the three departments which Dr. Miles has given us, which the Convention recommends to the several institutions to try; that they may begin to work on common ground; and when we meet another year, we shall be able to compare notes, and then have reached our real point of starting.

I want to add one word here, if I am not already trespassing on your time. It seems to me we cannot too much insist upon the utmost care and precision, so that we may eliminate, as far as possible, every single source of error from these experiments, and reach some results that can be looked upon as derived from the causes suspected at least. Nothing struck me more impressively in agricultural experiments going on at the European stations than this: the great nicety and care with which these experiments were being performed. I remember at Munich I saw some plats, less than those recommended here, in which not only the seeds, even when they were grass seeds, were measured, but they were carefully weighed and counted, and at the head of every plat was placed the number of seed. The professor told me that every result that was obtained from that growth, was weighed, root, branch and fruit, hoping ultimately to reach more clear and distinct results. Now, we all know that science never began to make advances until it called mathematics to its aid. When it began to weigh and measure and count and number, then science began to make progress. Science in agriculture can make progress no better than in any other branch, unless it comes down to measure and weigh and count, and applies mathematics to get precise results, and measures and weighs, as far as possible, all the forces that enter into it. We see the difficulties, but we cannot help ourselves. We did not make them. We are to encounter them. If I heard to-day for the first time, the sentiments of Dr. Miles and Prof. Hamilton and Prof. Daniels, I should shut my eyes almost in perfect despair; saying, there is no use, the thing is so complicated. But when I remember that every other science was at the beginning just as much of a riddle as this, and only solved by long and patient study; when I remember that, I still hope there is something to be learned in agriculture by the same patience and the same processes.

Prof. Swallow—I think you will find there will be some difficulty in extending the experiments to all the colleges in the country—some of them, at least. As a general principle, when we are experimenting to discover new laws, we shouldn't override the laws that are well known and already discovered. I was reminded of this by some remarks made about putting animals in separate pens. I suppose there is no law so well established as this: that solitary confinement with many animals is very deleterious. It is as much so with animals as with men. I suppose if the giant in the old story had tried to fatten his men in solitary confinement, he might not have succeeded so well. I remember separating two horses that had been together a long time, and continuing one on the same feed; but he fell off all the time until his mate returned. I do not know how you will feed them so as to get accurate results. Sometimes, if you put animals together who do not agree, as will often be the case, there will be little parties of them that will naturally run together. If you could get those parties together and feed them, that would be better than if they were mixed with those for whom they have no affinity, as you may say. It would be difficult to manage this matter; I would rather regard the social principles, for we know it is a general law, than to disregard it.

I want to call attention to one thing—the question as to experiments in feeding. Experiments made in Maine and in Louisiana are almost worthless unless you take corn from Maine to Louisiana, and from Louisiana to Maine, so as to feed them on the same corn; for the corn in Maine is worth much more a pound than that raised in the south. They cannot raise the corn we do, and we cannot raise theirs; and the comparison of experiments made in such localities would be of little value, although not so much as those in Europe. They are almost valueless to us. What we want, and what our colleges want to do, is to each investigate the principles applicable to its own locality. You may prove, for instance, in Michigan that in your sandy soil a certain kind of manure is the best for corn and wheat, and we try it off in Missouri, and it would be a failure. We know it beforehand. We place your barn-yard manure on the ground for wheat, and it will injure it, but on the sandy soil in Michigan it will be of great value, but on some other soils animal manure will lessen the crop rather than increase it. There are certain things which you know, and that we don't know. It seems to me that we can do more by having a certain class of colleges, whose relations are very near to each other as to soil, take up one series of experiments; and another class of colleges, having another kind of soil and climate from those already related, take another class of experiments. That is, have each take up a certain class of experiments which would come within the range of its climate, soil and stock. I do not see, especially in the feeding of animals, that any experiments in Maine would be of much value to us in Missouri, the climate is so different. I do not see, on the other hand, that their feeding hay would benefit us much. We raise timothy and red clover as they do, but it is a different thing from theirs—as much as the corn is.

In regard to raising corn, for instance. You may try experiments with corn in Maine, and we try the same experiment in Missouri. The experiments are made with different varieties of corn, and we could scarcely compare them. They may raise less pounds, and yet more nourishment than we would. One kind of corn needs a little different nourishment from another.

I simply want to call attention to this point. I do not see how we are going to establish a series of experiments throughout the country on any point which has been spoken of, so as to make the comparison as valuable as it would be if they established, as I said before, a series of experiments with a few colleges whose conditions are about the same. Another thing, if you are going to conduct a few experiments by all the colleges, you and I will be dead before we know much about the results. People are in a hurry in these days, and if we can do a little something to aid those around us in such particular states, as we will have to do to avoid "going up the spout," that will be the much better way. They are not going to wait for us a great while. People are too much in a hurry, and if the agricultural colleges do not do something soon, I think they will ask in vain for much assistance or sympathy. I think that would be the result. I believe I am not mistaken that the idea in regard to whether we are compelled to have experiments is not correct. I think the law contemplates experiments as imperative on the subject. I will not be positive, but I know this, that in our reports we are required by law to give the results of experiments.

Prof. Daniels—I concur in the remarks made, as to the difficulty of experiments, and I believe it is true, as has been said, that nearly all the experiments that have been made are useless as such, that is, useless as giving us any general law, or any data from which we can draw any conclusions. But they have been of use in this, that they have taught us where we must begin. There is another thing that I think is true—lamentably true—that the very men from whom we must look for opposition, and who will be continually against us, are precisely those men for whom we are laboring. They are looking for some immediate results. They expect, as I heard a farmer say, the kind of education from the agricultural colleges, which will enable a man to take up a handful of soil and feel of it, and tell you all it is composed of. That is the kind of knowledge they are looking for, and those are the men from whom we are going to get opposition—the men for whom we are laboring. I do not believe that any man who has not been personally connected with careful and accurate experiments, has anything like an adequate idea of the difficulty there is in connection with carrying on experiments. It grows upon me every year as I am connected with it. I have lost faith in the results I have obtained every year, because I see how slight variations affect the experiment. So I have not a great deal of faith in the experiments that have been performed, I do not care by whom, or where. But I know we are getting nearer and nearer to what will be true, and what we shall find to be true, and the only way to get at it is by patient, earnest work, and although we get opposition from the farmers, as I know we shall, yet we can only work on earnestly and faithfully, and good will certainly result.

In regard to the remarks of Prof. Swallow, with reference to a series of experiments being prepared for one section of the country, I think I see the fallacy of his reasoning. Let us take the example of the corn culture in Maine and Louisiana. The experiment that is being conducted in Maine may not discover a law which will apply to Louisiana, but if we conduct the experiment in a certain way, and we find that certain results, if we carry on the experiment with any other variety of corn in Louisiana, follow relatively, it only follows that the law we have been trying to learn is a general law, and it applies not only to Maine, but to Louisiana as well. It seems to me this shows at once how important it is that these experiments should be carried on generally over the country—over a greater area, in order to get some data from which we can generalize—not laws that are local but general laws which agriculture may look to as settled and definite laws.

Professor Hilgard—I agree with the gentleman in this: that the more we employ experiments, the more apt we are to come to general laws instead of local experiences. The matter of experimenting has been "run into the ground." Experiments made by private individuals have been reported as general laws, or illustrating general laws, without any basis for the assumption. It is that which makes a great portion of the agricultural journals worthless, and a stumbling block to one who is trying to learn the truth. Each man tries to put forward his own experiences as the proper course to follow in all cases.

There is one point I would wish to call attention to, as demonstrating the importance of not relying entirely on the experiments made in the old country, for the reason, the soils have been cultivated a long time, and a great variety of manure is used on them, and their history is not known. It has been stated by one experimenter that it was impossible for them to obtain the average condition of the soils. In this country we are more favorably situated, and we have succeeded in separating our soils into certain classes, readily recognizable. For these soils we can establish certain rules, which, so far as I am aware, hold good. The use of fertilizers has not been very extensive in this country. In Europe, the use of bones, ground, has been practiced for a considerable length of time. We all know that it takes a very long time to disintegrate bones. The way it is ground is of such a character that it takes 25 or 30 years to disintegrate it all. When it comes to the use of mineral phosphates, such as have been used lavishly in Europe, there is no telling when the supply will become exhausted in the soil. In the soils of the prairies it is comparatively easy to get a soil of uniform character, but I do not think the experiments in Europe are applicable to this country. In Mississippi, we are able to class our soils under comparatively few heads, owing in a great measure, to the general geological formation. It is the same in Indiana, as far as I have seen, but in many sections the disintegration of the rocks influences the native soils, and causes the difference, which cannot be taken into account. I believe it is impossible to establish anything more than local laws. Great care should be exercised in the selection of the location of the experiments, and especially land that has been subject to long cultivation should not be selected for experiments, for it introduces an element which it is impossible to appreciate.

I confess I cannot agree with the strict separation that has been suggested between experiments of a practical nature and those of a scientific nature. One gentleman suggests we should come as soon as possible to the point, and do something which will tend to check the opposition we are apt to receive. I believe, with Professor Daniels, that we must face the music, and stand up and say we are not able to give general rules that will hold good for all parts. The practical men, so called, are really the most impractical men in the long run. We must educate the people, show them the difficulties in the way of immediate results, and the good we hope to accomplish by patient and continued effort. It takes time to do all this. An experiment of ten years is not a long experiment, and yet how frequently has it happened that, the eleventh year, that which seemed to be certain and fixed has failed. The Lois Weeden system, which has been so much praised for a dozen years, has finally failed, where it had been continued for a long time.

I am pleased with the views of Professor Hamilton. I think averages both in practice at one and the same time, and of a great number of things, is the only mode by which we can secure really practical results. But this opposition, I think, we must leave out of consideration, and if we wish to do good, we must face it bravely. This opposition I have encountered perhaps in as a great a degree as any gentleman present. Before the war I investigated the soil of Mississippi, to learn from what formation it was derived. The question that arose wherever I went, from practical men, was, "Do you pretend you can raise more than I can, or know better how to manage a plantation?" I do not think we ought to count these people in. We will have to fight them, and might as well make up our mind to it. Let us go forward in the true mode of inductive experimentation; that is the only security for the colleges. I think the difficulties can be overcome by experimentation; but do not let us have any putting forth of general principles, or what may be from local experiences. I will not detain the Convention any longer, but I am confident we must not look to anything like a compromise with those who would push us on to declarations as principles of things which we have not sufficiently tested.

Dr. Miles—As there is no one else to occupy the time, I would like to say a word or two more. The separation of animals in feeding experiments has been objected to on what seems to me to be purely theoretical grounds. It is easy to make an assumption, and from that reason to erroneous conclusions. We are all aware that solitary confinement is not profitable, yet from that fact it would hardly be safe to reason that we could not separate animals for experimentation. The question really is, how have we found it in our experience in the treatment of animals.

The facts are simply these, so far as my experience goes: that the animals in a pen by themselves are a great deal more quiet, and they thrive better, and do better every way, than where there are a number of them together. Take the case that Professor Swallow suggests, of animals that have been associated together for a long time, and then separated. Take a span of horses that have been together all their lives, and then separate them in the expectation of getting a good result in feeding them, and you will be very much disappointed. I have tried that—placing a number of animals together, and then separating them after they got acquainted with one another—and when they were separated they fell away at once, notwithstanding there was an increase in their feed. In selecting animals for experiments, it would be desirable to get those that have not these strong attachments. If there was two or three together, it would not be well to separate them at once, and commence experimenting, but they might be first separated for a sufficient time to form new habits. We keep a large number in pens by themselves and they do not come in contact with other animals except occasionally, yet they seem to be as contented as those where there are two or three or more in the same pen. Calves that we keep in box stalls, are better contented than those where there are two or three together; so that really this is not a question of theory, but is to be determined practically how we can best promote the growth of animals.

In regard to division of labor in experiments, it seems to me that the argument is carried a little too far. We know it is desirable at the present time to make a division of labor. It is impossible for one man to master the entire range of sciences, and become an adept in each. Great discoveries have been made by certain men confining their attention to certain objects, and working them out. It is desirable, of course, to repeat experiments, but the mere fact of repetition does not insure accuracy. If your experiments are defective, you may repeat them through all time and never get a satisfactory result. That is the point that should be kept in mind: repetition is absolutely necessary in experiments, but is not the only element. Accuracy is of the first importance, and then the repetition of an accurate experiment is essential. That is. when developing a law or principle from an experiment, we must do it with all the precautions that can be used. The progress of science has not been on account of the multiplication of observations, but the increased accuracy of them, and the employment of more perfect means of observation. Our senses become more acute, and we are able to detect slight changes; then the repetition of a nice observation has given us wonderful progress in science. I would seek a division of labor and the benefits of co-operation at the same time. In this division of labor, I insist in the first place, on the importance of confining our investigations to a single point. We should not try to mix science and art; we should not grow a crop of wheat and then send a chemist to examine the soil, and draw a conclusion as to the manner in which the plant has grown. We have had too much of such science and investigation. How has progress been made by the scientific men, and what are the scientific experiments to which I refer? the chemist and physiologist have wanted to know what particular elements were taken up from the soil by the plant, and in what particular form. How does he go at it? He takes distilled water and puts in certain definite substances, he shows what they are, and then grows his plants in that; he has certain accurate conditions in his experiments. The scientific man must control all of the experiments in his investigation ; he must control all of the conditions of the experiment in his investigation, or he will not be successful as a scientific man. It will not answer for him to have control of two or three conditions, and then guess at the rest. Here is the difference between investigation in science and art. In the investigation in art we cannot possibly control the conditions; we will control what we can, and then must compare observations for a long time, to get at the probable elements of error. Where we are drawing deductions as to the results of experiments, we must make allowances for the elements of error which underlie all our experiments. The distinction between the two lines of inquiry is very distinct. In art we want to get at certain rules of practice. An experiment that would be satisfactory so far as that is concerned, would amount to nothing so far as increasing our scientific knowledge is concerned. Scientific investigation must be made with more care; one great reason why such a change has taken place in our agricultural chemistry, has arisen from the fact that former experiments in chemistry did not control all the conditions; they had not apparatus sufficiently delicate to detect all the slight ch inges which took place. Just as long as we work in this direction we are going to meet with disappointment.

In regard to the quality of corn in Maine and St. Louis, I do not know there is such a difference in the feeding quality of this corn. I am not aware that the matter has been tested experimentally. I am aware there is a difference under certain circumstances; an analysis will show a difference in the quality, but it does not follow there is a difference in the feeding quality of the grain. We have been running along for a number of years with the theory that the composition of the grain was an index of its nutritive value. No one now will pretend to advance that doctrine who has examined the latest researches in physiology and chemistry. But, admitting there is a difference in the corn of Maine and St. Louis, what we want to get at is this: the result of feedlng in Louisiana or Missouri under the same conditions precisely, and the same care taken to secure accuracy. If the corn from Maine was taken to St. Louis, there would be a difference. There is an element of error underlying that we cannot get at. We may not reach it in our life time, but we must determine it before we can get at principles that are safe for us to follow in practice. If experiments must agree exactly in order to be of value, we may as well stop experimenting, for you will never get any two experiments to agree precisely, because you cannot control all the conditions. But we can get at the general principle, after eliminating the error. For instance, I wish to know what the effect or value of a certain commercial fertilizer is. Should I apply it to one plat? I should have to examine a large number of unmanured plats and find their variation, and then I may compare the unmanured with the manured plats. But in order to get at the value, I must deduct the variation of the unmanured plats. We can only make approximations toward accuracy, make the experiment as we will. If we have the experiments tried under the same conditions in different localities, we have the means of comparing them. I have been for years collecting different experiments for the purpose of comparing, in order to get some underlying principle, and my difficulty is here: Each one is tried in just a little different manner from the other, and there is no chance to compare them. I attempted a comparison of Lawes and Gilbert's in feeding experiments with my own. He took pigs nearly grown up and fed them for eight weeks; we took young pigs but an hour old and raised them, first feeding them milk and then corn meal. We got better results so far as the feed was concerned. When we took corn meal we did not try all the different kinds, but confined our attention to milk and corn meal. When I came to compare the results, they differed materially; yet, notwithstanding his experiments were tried in England and ours here, and he had corn meal that was imported, I found a very marked agreement. They differed, and yet they agreed in principle. They agreed in this: that the animals consumed more in proportion to their weight in the earlier stages of the experiment, and gave a greater return for the food consumed, than afterwards. They are experiments wide apart, and each taken by itself would be, perhaps, of little value, but together they corroborate one another.

There are many points I would like to bring up. It will not answer to experiment for the sake of our bread and butter. We must go at it as earnest scientific men seeking to develope the truth, and let it make no difference who is pleased or displeased with the result. We must get at it in this spirit, regardless of outside clamor. I know that farmers demand of the agricultural colleges impossibilities; I know they are expecting immediate results. A person said to me two years ago, "I do not think much of your agricultural colleges." I said, "I am not surprised." He said "Why?" I said, "Because you are expecting something impossible from it. You think we claim we can take a green boy out of the city, knowing nothing about it, and give him a little agricultural chemistry and physiology, and then turn him out qualified to instruct old farmers." He said that was about it. I told him we believed and claimed nothing of the kind. Agriculture must be studied, and our rules must be based upon experience.

Prof. Swallow—I wish to say one word. I seem to be unfortunate. The point I wish to make is this—I may be wrong, but I wish to show that twenty experiments with twenty elements of error in them are not so good as two with no elements of error. That is the idea. We have forty colleges in this country making the same experiments, and in one-half of them there is an element of error which we know must be there, and the result will not be so valuable as if ten of these colleges were making the experiments without this element of error. No man would accept it as conclusive. You may as well say you could feed one animal on wheat and one on corn, and the results would be the same. I want to get at results as soon as possible, and as men employed by the State, we are bound to do this. My idea was, we could get at some results more rapidly by having a sufficient number of colleges take up a certain class of experiments in which they could experiment without any necessary element of error, that we know of. I say you would get no more accurate results by having other colleges perform the same experiments. There is a popular idea that we must do something for the public, and I think we can do a great deal. I have been accustomed to say, for a great many years, there is something for agricultural colleges to teach even now. There is a vast amount of knowledge that our farmers do not possess, and which many of our men do know, and which the colleges ought to be prepared to give at once. I would not be misunderstood in this. I am for going ahead and finding out something else, while we are doing this. I suppose this is a meeting—a consultation as to how we may best do that. Although Prof. Miles thinks my ideas about the social qualities in animals is a theory, yet the world of naturalists have been laboring under that theory for these many years. I suppose by calling it a theory is meant that it is not a matter established in science. I do not know why it should rather be called a theory than a fact. My reason for making that remark was simply this, I wished to avoid in the experiments any element of error. The gentleman has told us how he provided against that element. He took the animals young and taught them to restrain their social qualities, the same as they do the monks and hermits. When they want to make a man a priest, they separate him from the women and keep him alone. It is doing what I saw he ought to do; be cautious about admitting elements of error into the experiments. I hope we shall come to some results which will be of great benefit to us as a whole. I came here because we are just trying to begin. I expect to be benefited more than the rest of you. Some of you have been at the work many years, and I will be able to learn by your experience, and in that way I expect to carry away more than I brought. Some of you, I hope, will carry as much.

The Chairman—The question has been raised, and is fundamental, whether these institutions are bound to experiment at all. The only reference in the law of Congress is in regard to the Annual Report. It defines in section 4 that the main object shall be to teach such branches of science as are related to agriculture and the mechanic arts.

Under section 4, article 3, it provides that an annual report shall be made, recording the progress of each college with regard to improvements and experiments made, with their cost and results, seeming to imply, but not necessarily, that they are to make experiments.

Dr. Detmers—Several remarks have been made in reference to the feeding of corn raised in Maine and Louisiana and the difference in the grain. I admit there is a difference, but that is not the only thing that causes a difference in the results. There is a great difference in the climate of the two places, and that affects the physiological condition of the animal. The dampness or the dryness of the climate, the temperature, and perhaps a great many other things, have to be considered in making the experiment.

Dr. Miles—I will make but a single remark. Prof. Swallow and myself are agreed that we are anxious to get at the result as soon as possible. We only differ slightly as to the way. One object I had in proposing the method of conducting the experiments was, that it would save time and get at the results sooner. I agreed with the Professor that it would be better to have one experiment without any error, than twenty with error. I will go further than that. I would rather have one without error than twenty containing error. The difficulty is this, however, and is one we must face: We cannot make a feed experiment, or an experiment in feeding, without it contains an error. But if we co-operate in trying the experiment we will sooner get at it, owing to the manner in which the experiment is conducted. I might experiment this year and get one result, and another next year. I do not know whether the variation is owing to differences in climate or not. If it had been tried at two different points under the same condition, it would be better than the same experiment tried two years in succession on the same ground. If the subject is assigned to me to settle, I might go on for fifteen or twenty years to do the same thing over again; but if twenty of us take hold of it we can go along four or five years, and when we get one thing disposed of we can take another.

Here is another point. Let each institution try as many of these experiments as it can, and just such as it chooses to try. If there are those that are strong enough, and have means to devote to the matter, so they can keep on with all of them at the same time, so much the better; but it is better to try some experiment than do nothing. We must not expect to get absolute accuracy, but to find the element of error, so that it can be eliminated. Even some of the most perfect instruments for philosophical investigation and observation are very imperfect—as the thermometer, the barometer, and many other instruments; but tables are constructed for the correction of these errors, after observation and trial, and results are reached which are practically accurate.

Prof. Swallow—There is this thing to be considered, that the experiments are to some extent limited to particular sections of the country. For instance, we want experiments in cotton; but you have to limit them. That will give the idea. We must have general experiments, and then special.

Mr. Flagg—I want to say a few words by way of preface to the offering of the following resolution. It is getting pretty well along in the day, and I suppose any conclusion that we may arrive at should come as speedily as may:

Resolved, That a committeee of five be appointed to report to this meeting a set of experiments recommended for trial at the agricultural colleges in the various States, with detailed statements of the methods of performing them, so as to insure all possible uniformity of conditions at each point.

The discussion before the meeting this afternoon has been as to what would be the proper experiments to be tried in common by the various agricultural colleges represented here, and the proper method of performing them. We have heard at considerable length from Dr. Miles, and there has been considerable discussion as to the practicability of doing it.

I should like to go back and consider to some extent the various subjects of experiments, which I think would properly come into the hands of the agricultural colleges of this country, and also consider to what extent we should take those up as a body, and endeavor to perform them in common with one another. I recognize the fact that there would be a large number of experiments which each class would have to try for itself—experiments which would be peculiar to their soil and their climate. Of course we do not expect to try experiments in growing sugar cane in Illinois, but there are such general crops as corn and wheat affording abundant scope for investigation. Many of the cereals can be cultivated to a greater or less extent nearly all over the country, and uniformity of condition can almost be secured. The corn of Maine may be planted in Louisiana, and at the same mean monthly temperature as in Maine, and the conditions in that case, it seems to me, would be perhaps nearly uniform—as near as may be—with the exception of soil and climate.

What I was going to say is this: there are a large class of observations and experiments that may be taken in hand by agricultural colleges. We have the meterological observations of the Smithsonian

Institute, and those which are now being made in behalf of the signal service, and they ought to be extended and made much more of than they have been in behalf of the agricultural interest. The agricultural interest is more important than the commercial. We have a large series of experiments of which no mention has been made. Take the experiments in light, heat and electricity, and their effects on vegetation. You will remember the experiments of Professor Stuart, which would tend to show that electricity may have an important bearing on the growth of plants. The different effects of heat, moisture and light have been but partially investigated, and there are a great many experiments of that kind throwing light on these various subjects. It is one of my ideals that ultimately, if not soon, we shall establish at each of our agricultural colleges an agricultural experiment station, similar to those of Europe. I think that is absolutely necessary to agricultural advancement. We know what Johnson intimates, in his preface to "How Crops Grow," that the agricultural stations have done more to advance agricultural science, and even agricultural practice, than all else together.

In regard to getting hold of experiments which are popular in their character, I have entire faith that science will do wonders for agriculture, although at the same time I recognize the fact that our agricultural colleges are dependent upon the money of the people for their support, and we must recognize the wants of the people in such a way as to secure their confidence and their aid; and looking at that, it has been my own feeling, to a great extent, to endeavor to popularize agricultural science. I am strongly in favor of the proposition which has been made here in reference to securing the performing of at least a few experiments in common. I am aware of the difficulties under which many of our institutions are laboring. Our own college in this State secured, at the last session of the Legislature, an appropriation of $3,000 a year, for two years at least, for the special purpose of making experiments. I know many institutions are not so well off in that respect. The Cornell University, of course, has an immense endowment and is practically independent. But recognizing the lack of means of others, I should hope these experiments will be simple in their nature, and carried on with as little draft on the treasuries of the various colleges as possible. I can see that it is possible to attain in one year, by the use of all the agricultural colleges, the same results that would need twenty years of the experience of one. Suppose, for instance, we try some experiment this coming year at twenty places, and suppose the result is the same in all or in three-fourths of them, then we might consider the point essentially settled. As we are doing now, an experiment is tried and results in a given way this year, and our farmers will nearly all say that settles the matter. One result would suffice them, but in the case of our agricultural colleges I do not think we would try it less than half a dozen years before making up our minds, and it might be unsafe to decide in that time; but when twenty or thirty institutions try the same experiment in the same way, we can settle a great many of the practical questions rapidly, and it seems to me, sasisfactorily, and I hope it will be the feeling of this Convention. We have represented here about a dozen States, having agricultural colleges, and I hope that we will take this great step for the advancement of the agricultural interests without any fear as to the results.

Mr. Murtfeldt—If I have anything to say it will not be as a scientific man. If you are going to make a distinction between the practical and the scientific, I want to use the word "practical" here. Supposing an Illinois farmer wants to stall-feed a hundred head of steers, will it be profitable for him to build a hundred pens, and confine each steer away from the others? Would it be practicable to confine two or three hundred hogs each in a separate pen? Supposing the experiment that Professor Miles speaks of, that he found out that the animal that is confined separate will do better—can it be reduced to practice on any scale that will be profitable to the men that practice that kind of stock-raising? So with regard to the feeding of corn. I believe, in his first remarks, Dr. Miles said that he fed corn meal successively. That may do for hogs, but I should not say it would do for steers or sheep.

Dr. Miles—I said we had fed corn meal successively, but would recommend experiments in feeding whole corn.

Mr. Murtfeldt—I will take him on the same ground. Supposing he feeds corn raised in Maine, Massachusetts or Vermont in the grain, and supposing the college in Missouri were to feed corn raised there, would there be a different result in experiments? As an unscientific man, but as a practical man, I should say there would be. Our corn is comparatively soft, while the corn of the East is very hard. With regard to manure, he says that it depends on the amount of the feed consumed.

Dr. Miles—The quality.

Mr. Murtfeldt—That is the word that I wanted to get in, because I know that there is a great difference, whether the cattle are fed on corn, or timothy, or clover. I think that the experiments should have a practical bearing. If I recollect right—and if I am not right I hope he will correct me—he commenced feeding young pigs with corn meal. I want to know what practical good we get from proving the fact, that animals from the very hour of their birth can be fed with corn meal. Supposing he had succeeded in that kind of experiment, what would the practical result be?

Dr. Miles—I am very unfortunate in being set up as a target here. In presenting a matter of this kind in a brief space, as we have to do, it is almost impossible to get in the details fully, and I have been misunderstood in every particular. Take the case that has been brought up by the gentleman from Missouri about feeding. Would it be profitable for an Illinois farmer to build a hundred pens to put in steers for fattening? I say no; it would not pay. That is just the reason why we are here. If we could do that and make it pay, we would not need agricultural experiments all over the country. What I would do is this: Ascertain the value of the corn fed in different ways, so that the Illinois farmer may ascertain whether he is getting the full value of the feed. But these accurate experiments show he is not getting one-half of the value of the corn meal, or is not getting one-half of the return he should have had. And he will say I am not pursuing the best practice, and this high standard set up before me will be an incentive to a better practice. The gentleman says, I fed young pigs with corn meal from the start. I have not referred to these particular pigs that he has in view in this discussion. I have not had time to take up our experiments in detail. The facts are these: We have taken the young pigs and fed them milk until of suitable age to live on meal. But we have never made the sudden change from milk to meal. I put some a little sooner on the meal, with a view of ascertaining the result. The result was that in treatment, which I considered unfair, to get at the physiological fact, the oil seemed to ooze out through the skins, but that has not been so except in that case. The mixing of this with other statements has tended to produce false impressions.

Mr. Murtfeldt—I did not mean to be unfair, but I wanted to put the point I wished to make as strongly as I could. I wanted to have the experiment being tried to have a practical bearing. I did not mean, in speaking of the building of a hundred pens for as many steers, that the farmer should try the experiment, but after these gentlemen have established the fact that an animal in confinement will do better than if it has company, it is still impracticable to go on and carry out that idea. It is not a practicable fact.

Dr. Miles—There is one point that has been admitted. In conducting these field and feeding experiments, we should pursue the same system, as far as possible, that is ordinarily practiced on a farm. But it is impossible to make your experiments exact and conform fully to all the practical usages.

Professor Hilgard—I am glad to see, from the remarks of Dr. Miles, that there is no difference between his views and my own, except he does not call science what I call it. The practical experiments are altogether scientific; that is, they are made on a scientific basis. What I wish to object to was making the experiments without controlling, as far as possible, the circumstances, and among these referring to positions, soil and so forth.

Dr. Miles—I must be allowed to make a few more remarks. I do not undervalue scientific investigation. I believe we should have in each of our colleges proper apparatus and a man to conduct experiments for the promotion of science. The distinction I would make between science and practice might be illustrated still further. In feeding stock, for instance, we want to get at the money value; we want to know what corn is worth in dollars and cents. In the scientific experiment, which has to do with the explanation of these results, we want to know the elements that enter into the constitution of these things and in what proportion they are combined. There are two lines of inquiry. We must conduct practical experiments with the accuracy of scientific experiments, applying the same methods. The scientific man, if he understands practical matters, is more capable of improving a practical experiment, than a man who does not understand scientific matters. But the scientific man who makes experiments in the art, is not familiar with the details in many cases, and he is looking at results, while in the act we want to get values in dollars and cents.

The meeting then adjourned to 7½ o'clock P. M.

7:30 O'CLOCK P. M.

Met pursuant to adjournment.

The Chairman—The discussion now in order is the question of the relation of the industrial school or scientific schools to each other, and the institutions of the country. The discussion is arranged to be opened by Professor Gilman, of the Sheffield Scientific School.

COMMITTEE ON EXPERIMENT.

I will announce, as the committee called for [as the Committee on Experiments] by the resolution adopted this afternoon, the mover of the resolution, Mr. Flagg, of Illinois, Professor Miles, of Michigan, Professor Hamilton, of Pennsylvania, and Professor Prentiss, of New York. The Chair desires to scatter the appointments pretty widely over the country, and would like to have added one name from the more extreme West, and one from a State further East.

Dr. Miles—I move the committee be increased by the addition of two names.

The amendment was adopted.

The Chairman—I add the names of President Denison, of Kansas, and Professor Peabody, of Massachusetts. The discussion fixed for this evening is now in order.

RELATIONS OF SCHOOLS OF APPLIED SCIENCE TO ONE ANOTHER AND TO OTHER INSTITUTIONS.

Professor Gilman—Mr. President and Gentlemen: The remarks I have to make this evening will be quite desultory, as I had no expectation of saying anything. I shall endeavor to shape them so as to draw out other gentlemen I see here, partly by stating some points upon which I am wanting information, and partly by suggesting some of the topics which seem to me of wide and lasting importance to the country.

I observe, by your remarks, that the sentiments which prevail here have very particular reference to the matter of Agricultural improvements. My interest in all this, and in the agricultural aspect, is very great; but by no means restricted to it. I believe there is going through our country, at the present time, a very great change in the notions of intelligent people, respecting the higher, middle and lower education. It seems to me desirable that, whenever an opportunity occurs like this, we should talk over among ourselves, in the most informal manner, the principles which should guide us. I am afraid that what I shall say will seem to most of you as of very *Eastern* character, and I am frank to admit that my knowledge of these institutions is largely based on observations made among those of the East. My object is, in coming to the West, to learn what you have learned here; for, so far as I can observe, you are much more free from routine, from the weights of precedent, and from long practiced usages, which may be good and may be bad. You are working out, with a good deal of liberality, a great many of the propositions which we look at from a distance, and we are very desirous of learning how you are getting along with a great many of these questions, and, therefore, what I have to say will, I trust, be of a kind to provoke comment and remark from you rather than with the expectation of adding much to your knowledge.

In the first place I suppose—among us it is more the case than among you—that there are growing up among these national endowments to schools of science, which receive the benefit of the Agricultural College grant so-called, a great many private institutions, founded many of them by individuals, and many of the most noteworthy character; and among them is the Bussey Agricultural School, which is connected with Harvard University. The fund has been accumulating, and now they are making announcements what they will do. Akin to that is the one at Worcester, a great school of Technology; another at Hoboken, a great school of Mechanical Engineering; at Dartmouth College they have two funds aside from their national college fund, and so I might go on. Some are of a lower grade and some higher. The question has arisen how far these endowments, national or private, shall be allowed to exert an influence over the common schools; how far it is necessary to have preparatory schools adapted to them. Many of these questions have arisen which are not yet settled. I see that some remarks were made in St. Louis of a severe and cutting character, bearing upon this matter. We are already discovering that public schools or high schools and academies are modifying their course of instruction. We have two schemes of study, one fitting boys for college, and the other for the scientific school. The change in the last two or three years has been very noteworthy. I merely throw this out to show you how completely I think this movement has taken hold of New England and the East, and how it is receiving recognition from State Legislatures, private individuals, teachers and parents. With us the matter is going forward. The first point is the spirit of entire friendliness to all sorts of learning. A few years ago all the movements of practical education, so-called, were in the direction of hostility to all classical training. So far as I can judge there is no such feeling now existing. I think those connected with classical colleges do not look with confidence on those schools. They do not feel quite certain that they are going to answer. They are a little afraid it is a sort of royal road to knowledge; and now and then I hear the phrase that this is a bread-and-butter knowledge that you are after, and they seem to think it is a college with the learning left out. On the other hand, we have the remnants of prejudice on the part of men who do not believe in book farming, and think that the teaching of mechanics in a school is putting learning in a workshop, where, they say, it does not belong. We have these two classes; on the one side a little suspicion on the part of classical men, and on the other a want of confidence on the part of practical men; but we are beginning to reach such results that both parties are satisfied, and I think the war of hostility at the East is over, and the friends of education are agreed that both are good; the question being what you want.

The next point I make is this: In all the New England States and New York, we have not been able to give a college endowed by national grant a special Agricultural character. In Massachusetts, as you all know, the grant is divided into two parts; one-third was given to one establishment and two-thirds to the other, and two schools are built up—one of Technology and one of Agriculture. In Rhode Island, it went to Brown University; in Vermont, to the Scientific School of the Burlington University; in New Hampshire, the founding of a school in connection with Dartmouth College; in New Haven, to the Sheffield School; in Maine they are building the Maine College, and in New York it is the Cornell University. In all these cases, I believe, while there is a decided leaning toward Science, theoretical and applied, in the structure of the colleges, there is also a very decided recognition of liberal culture. They are not, for the most part, to be in one specialty alone. With us they are not largely Agricultural, although all recognize the Agricultural element; all of them have Professors of Agriculture; all recognize a course of study in Agriculture, and all would be glad to have Agricultural students. But for the most part in New England, the tendency is to mechanics, civil engineering, to chemistry in its relation to industrial pursuits, and to the pursuit of science for its own sake, or as something which the world requires teachers in. So we are going forward, not in an Agricultural way, but in the general direction of applied science.

In the third place, I would say that our tendency is largely to the giving of a general education, as well as a special technical one. I mean, by that, while Civil Engineering, Chemistry, Agriculture and Mining is taught, all of them are marked specialties, and there is a strong desire that the men thus trained shall be well fitted for any station in life; and a good deal of prominence is given to the modern languages, to German and French and especially to the English tongue, so that these men may know how to speak and write when called upon. There is, as far as time allows, a recognition of other subjects, like Political Economy, History, Moral Science and things of that kind. These, however, are subordinate to the main special studies.

I would say, in the next place, our great want in the direction of the colleges, is good preparatory schools. There are, in New England, a few famous schools, like those at Exeter and Andover, for instance, which are admirable training schools for the ordinary colleges; but thus far we have hardly anything to prepare for the scientific schools. We want to strengthen our introductory schools. We all feel that the college proper, the Scientific School and the University, will not flourish among us until we have a very much larger number of these preparatory schools and of a much better quality; and most of us who are interested in these matters, at the East, are working hard for the general education of the community, and for the improvement of the public schools, the high schools, the academies, and doing everything that will quicken the community into an appreciation of the importance of these things. We are obliged to go around the State in old-settled communities, to lecture, take part in teachers' institutes, call meetings of farmers, to arouse an interest in these important educational movements. I do not believe this new education, as it has been called, will achieve its proper work until a great deal of that enlightenment is done far and wide. These are a few points which we are wanting light upon, and I am glad to tell you what we are trying to do.

Coming to some other matters, I would mention first the question of how far manual labor in the Scientific School is important, and how far it is unimportant. At New Haven we have felt that we could not urge it upon the young men; that if any one chose to work and could find time from his studies, we would favor it. Many of our young men do work in vacation, and some in term time, but we think the time is so crowded with study, they would have very little opportunity for work. I do not know how we should feel if we were so fortunate as to possess a fund for the maintenance of a shop for discipline in mechanics, or having a farm given to us, or having a large amount of money. We have kept the time occupied with hard work. At the Worcester Institute of Technology, every young man is required to spend a certain portion of his time in the shop, and becomes there familiar with the use of tools, and learns to manufacture certain things, under the charge of the Superintendent, which are sold in the market. The shop takes the place of a regular manufacturing establishment, and is known in the trade for the manufacture, among other things, of lathes, which are supplied at business rates for profit. In the Massachusetts Agricultural College, every boy is required to work Wednesday and Saturday afternoons, for three hours each, and he is paid for that work, according to its value, from twelve to twenty cents an hour, and he may work more if he is inclined, as some are.

Another point, that interests us a good deal, is whether or not it is desirable to have a farm. I see how much is thought of it in the West, and I see how important it is, and I enjoy very much the things I have heard to-day respecting your plans for the future. I can only say of New Haven, thus far there has not been a call for it, and those interested in Agriculture have rather avoided encouraging anything in that direction, because they have felt that with us the number of persons to be trained in Agriculture is very small indeed, and that the cost and expense of taking care of a farm, in proportion to our means, would be very great, and therefore, perhaps, to be avoided.

The Military matter interests all of us connected with the national grant. For the most part in our neighborhood the military clause of the bill is regarded with no particular favor, and many would be very glad to have it entirely abolished. At Amherst they recognize it, and the head of the school was a volunteer officer, and he enters into it with the greatest spirit, and has an admirably trained company, and would be glad if all the rest of the States of the Union would do as he has done. He is quite enthusiastic about it. You know in this manner occurred the remarkable fact that the Agricultural College boys at Amherst—who are looked down upon, to put it mild, with a lack of appreciation—won in the University boat race. Yale did not row this year in consequence of some misunderstanding, and the Agricultural College bore off the prize by such long odds that one of the spectators watching the boat coming in so far ahead would not believe it was the winning boat, thinking they had not started fairly.

The Agricultural College folks are proud of it, as well they may be. I was curious to inquire the reason of it—whether it meant brain or muscle—and I learned that the winning crew were the best scholars on the list; also that they were young men, most of them from poor and needy families, who had toiled with their arms all their days, and who worked a great deal at farm labor, and in various other ways had strengthened themselves, although they had only ten days of drill to win the prize. If they should succeed in doing it three or four years, they would not need any better advertisement, and the boys will leave the other colleges and come there. It has a bearing I think on this matter of manual labor and physical development.

We are very curious to learn what the experience of the West is in a dmitting women to the Universities, Colleges and Schools of Science. The question has come up in New England this autumn, at two universities, at Middlebury, Vermont, and Amherst College, and we are all of us looking with a great deal of interest to the experience of the West; though none of the New England Colleges have thus far admitted women to the privileges of instruction in any definite way.

These are some of the points which are interesting to us, and I think we should like to hear the views of various persons here assembled. I should sum all up by saying that there is going forward throughout the country a very great educational change; that side by side with the study of letters, and the classics, and the old, recognized branches of learning, other new branches of learning are coming up; that this study is pursued with us without hostility to other branches, and that science is studied partly for its own sake, partly for the sake of its uses, and partly for its means of disciplining the mind; that these colleges, as they are established, ought to have in every section of the country a peculiar and definite character; that the school in New Haven should be different from the one in Lansing—the one in Amherst different from the one at Urbana. It is desirable each region of the country should have that kind of scientific school best adapted to its wants, and it is desirable to confer with one another on all these minor points, in order to learn the best ways of arriving at the best results. I can say that at New Haven, where there are two colleges side by side, that the scientific has exerted a strong influence on the classical. We are able to do away with a great many traditional customs; the separation of the pupil from the teacher, and many other customs of the past. There grows up with us a much greater confidence on the part of the young men in their teachers, a familiarity with the young men on the part of the instructors, and out of it all has come a far greater love of study. The young men become enthusiastic and are delighted with their progress and the freedom from the petty annoyances of college discipline, which in the old-fashioned colleges have heretofore given so much trouble. I think the whole matter is one that ought to be encouraged. The question is put to us, "What are the results? What becomes of those boys?" There have been some statements made in reference to the results at Amherst College, which, I was informed there, are erroneous; but it is not the question what the boys there are going to do. It is a question which cannot be determined for several years. They must be out of college, and eight, ten or fifteen years elapse before we can tell what their work is. Time will decide. I think that is the only test that can be applied to these institutions as to what sort of men they will train up. When we have young men who have been that length of time in service, the world will know what they are.

At the Sheffield School, the character of the young men sent out is the best advertisement we have. A gentleman came from one of the neighboring towns a few weeks ago, and says. "I have brought my son to the Scientific School because I have seen boys attending the classical and the scientific schools side by side, and that is the reason I bring him here." Others take the opposite course. They may have a strong tendency in the direction of letters. There is our hope: that the results of this training will be good, and such as not only to reward us, but justify the country in these large expenses and very important modifications of the educational system.

Perhaps I have talked too long, but there is one further remark. There are some people who do not believe in these movements and sneer at them as the "new education"—that is the phrase used by many, as if that was a novelty. The best way to answer them is to tell them that 300 years ago the phrase, "new education," was used in England and in Germany, to indicate instruction in Greek and Latin, which met with the same opposition that we find now. They said it was heretical, and would take men away from the church; but in process of time they saw in Greek and Latin there were great elements of culture, and now they have entirely superseded the old metaphysical courses. As the world has grown, science has become a great department of human learning, and there are a multitude of things to be learned they had no suspicion of two or three hundred years ago.

President Welch, being called on by the chairman, spoke as follows:

THE IOWA STATE AGRICULTURAL COLLEGE

Was opened in the spring of 1868. Its income, amounting to $36,000 a year, is derived from the leasing of the lands donated by Congress. The college building, which is 168 feet by 110, was erected by the State, and cost $170,000. The building, which holds 160 students, has been filled to its utmost from the beginning, and the surrounding country, though sparsely settled, furnishes homes for about fifty more, so that the entire number in attendance is two hundred.

The applications for admissions each year have more than doubled the attendance, and if the facilities for board equalled the demand, I judge we should have five hundred instead of two hundred.

The first year there were two classes, being a Preparatory and Freshman class—about equal in number. Last fall the preparatory class was discontinued, except a few who failed of quite entering the Freshman class. We have now a Freshman class of one hundred, a Sophomore and a Junior class, thirty-five each, and some thirty who are preparing for college in branches in which they showed a deficiency last spring.

The courses of study occupy four years. They are largely scientific and industrial, balanced and relieved by such instruction in the German language, and in the English language and literature, as the time of students may warrant, and their tastes demand.

They rest upon the fundamental principles of chemistry, natural history and mathematics, which are strongly taught, and aim to present plainly the practical applications of those sciences to farming, gardening and engineering in its various branches, and to the other arts and professions of life. While principles are taught in the class room, they are carefully illustrated in the field and the workshop.

Two departments of study are organized, viz.: the agricultural and the mechanical, as required by the act of Congress making the land grant for the support of these colleges.

In the Agricultural department, four courses of special study are arranged — that of agriculture, horticulture, pomology and stock-breeding.

In the Mechanical department, likewise, four courses—that of civil engineering, mechanical engineering, mining engineering, and architecture, respectively.

For the first year and a half the several courses are identical, consisting of those studies which are preparatory to all alike, viz : Algebra, geometry, trigonometry and surveying; in mathematics, book-keeping, freehand drawing, rhetoric and English literature, human physiology, general chemistry, and something of natural philosophy and botany.

From the middle of Sophomore year the courses divide, students in engineering putting their main strength into mathematics, mechanics and drawing, with practice in the field and workshop; while students of agriculture work more in the laboratory and the museum, making chemistry and natural history, including botany, their principal studies, with work upon the farm and in the garden.

To all alike are taught military tactics, and in their senior year the principles of intellectual and moral philosophy, logic, political economy and constitutional law.

Throughout the course the object is, on the one hand, to teach the arts—first in their scientific principle, and secondly in their practice, so as to make both learned and skilled workmen; and, on the other hand, to make good men and useful citizens, able to take their places in society, and perform their duties as such.

The students consist of both sexes. About one-fourth of them are girls and young ladies, who occupy rooms in a wing of the building.

The question has been frequently asked if, in schools where the sexes are educated together, young women show a capacity for study equal to that of young men.

From an experience of twenty-five years in conducting such schools, I can say confidently that the two sexes are of an average equality in their capacity for scholarship.

Some of our best students are young ladies.

One of our best manipulators in analytical chemistry is a girl of seventeen. Variation in natural ability is shown in different families, not in sexes. Our young women recite in the same classes with the young men and retain an average rank there.

Then, further, the presence of both sexes, under the proper system, makes the government less difficult and more wholesome.

Sexual isolation for the purpose of culture, is contrary to nature; it makes boys rough and girls silly. Of course we have had occasional troubles in government. What college does not? But such troubles are far less, as I verily believe, both in number and seriousness, than occur under the old plan of separating the sexes.

I am unqualifiedly in favor of co-education.

In the college building we have been trying a new experiment in government with entire success. Soon after the college was opened, I said to the students that the maintenance of order in rooms and halls was mainly their affair. I then proposed to them a plan of self-government, which was adopted, and at once carried out. There are several sections in the building, a section being composed of a single hall and its adjacent rooms.

The students of each section choose a captain and lieutenant, to take charge of the order and see that the study hours are kept.

A member of a council or court was also selected by each section, and this court meets twice a week to try all offenses reported by the captains, and if guilty, to assign certain demerit marks, which are reported to the faculty.

This simple plan for self-government has been pretty uniformly successful. It has saved the faculty all the petty annoyances which arise from the maintenance of police regulations, and its influence on the students themselves is very salutary.

I do not think, however, that it could be sustained without the aid of an enlightened public opinion on the part of the students.

We require all students to spend three hours a day in manual labor, and to meet this requirement we have a farm of 900 acres, 400 under cultivation; a garden of ten acres, an orchard of small and large fruits of equal area, a workshop, and a park of 190 acres.

We do not call this work compulsory, though all engage in some departments of it.

The daily labor is no more compulsory than the daily recitations, and the students come to both with equal cheerfulness, and have an equal freedom of choice as to what kind of work they shall do. We are striving to make, as soon as may be, all the work strictly educational. The student of pomology, for example, goes into the orchard and vineyard; the student in stock-breeding has the care of stock; the botanist works in the garden, and the mechanic in the workshop; and the young ladies, under a competent superintendent, do nearly all the labor of the kitchen, the dining-room and the bakery.

The clerks, librarians, fire-builders, bell-ringer and the cleaners of the public rooms and halls are all students, and the whole matter of manual labor, complicated as it is, seems, somehow, to get on with a good degree of regularity.

Of course it cannot be permanently successful without careful and constant watching, but we have never for a moment thought of abandoning so salutary an element in higher education. I am happy to say that though we are not quite three years old, so far we have realized our hopes, in numbers, and in the quality of students, in uniform manual labor, and in the co-education of the sexes.

Mr. Flagg—I want to ask the gentleman in regard to the price paid for labor.

Pres. Welch—The highest is nine cents an hour. If the labor is of that kind requiring skill and instruction—one of the nicer processes of the garden, for instance—we pay seven cents, but what is called the dead work is remunerated at the rate of nine cents an hour.

Mr. Murtfeldt—I believe Dr. Denison has some experience in regard to having both sexes in colleges, and I should be glad to have him say something about it. I will say, while on my feet, that the daughter of Prof. ———, at the University of Missouri, took off the prize as the best Greek scholar in her class, and she was at least one of the three best in the higher mathematics in a class of 30.

President Denison—I am pleased to know the question was settled in Iowa before President Welch went there. Previous to that time it was not quite settled. In Kansas the trustees were divided on the question of admitting ladies, and we frankly asked what right they had to exclude them, as the endowment was not given to any particular portion of the citizens. I agree with President Welch in his statements and reference to that matter. It is true that it requires care in government, but I believe, with him, that government on the whole is easier where the sexes are together, than it is where they are in separate schools. The system of education in Kansas is based on the idea that ladies should enjoy equal privileges with gentlemen, not only in the common schools, but the higher institutions. Our experience in reference to the ability of ladies to compete with the gentlemen, accords with the statement made by President Welch, and some of our best scholars have been ladies. We graduated this year four ladies and one gentleman, and in 1867 we graduated three ladies and two gentlemen. The ladies are interested in fruit culture, in horticulture—in fact, a portion of our ladies have been through Waring's Elements of Agriculture, in the agricultural class, and attended to it with interest. I believe this is the true course for the West, and I think the East is working into it. I have had inquiries from Amherst College with reference to the subject, and I doubt not these places will admit ladies before long. The single lady that appeared in the Michigan University, and was not excluded, won her way by her character, and obtained not only a standing for herself, but for others, and now there are thirty there.

Mr. Flagg—What is your experience with the labor question ?

President Denison—I am sorry to say it is not the experience of President Welsh, and I congratulate Iowa on her success in this matter. We are working at it, and accomplishing something. They had a great deal the advantage of us. The State gave them a building costing $130,000, making, in all its appointments, really about $200,000, and placing things in such a shape as to not only invite, but encourage labor. We began at the beginning; we were poor and had to work up; we now have a farm of 415 acres and are getting things into shape; so I trust our report on the labor question will be more favorable in the future than it has been. We have proposed to pay students for their labor.

The Chairman—We should be glad to hear from President Folwell.

IN MINNESOTA.

President Folwell—In my State there has never been any legislation on the subject of admitting women to the University. There is no such thing as sex known in the charter, or act of incorporation. They came there in the beginning and have been there ever since. It has been with us entirely successful. There have been some difficulties, but small ones; they do not begin to compare with those turning up every day in the old colleges, as President Welch has remarked.

The two sexes are mingled as they are in the family; we could make no separation owing to the structure of the building. Thus far we do not find the male students get the start of the young ladies. I have no doubt of the result of the experiment. The young ladies can take care of themselves up to that point; whether they can hold their own in abstract studies, remains to be seen. I think they will.

The manual labor question has not vexed us as yet. It strikes me it can be settled on general principles. Each institution must settle that for itself. In some places it cannot be practiced with success, and in some places not at all. President Fairchild, of Oberlin, wrote me that after an experiment of some years, they were obliged to give it up, because the expense of maintaining it was overwhelming. They could not afford to provide the material for the students to labor. Our farm is a mile from the building, and only a few of our students live in the University Building. The farm is so far away students are unwilling to go to it. The Agricultural College was attached to the University, and buildings have been erected in the meantime. It was not practicable to purchase a farm in the immediate vicinity, but we intend to build there one of these days. It seems to me it will be troublesome to provide labor for a large body of students. I do not commit myself on the question, whether it ought to be done. Some can do it, and some cannot. In principle it seems to me it is not necessary. I do not know we need a farm any more than we need a model cotton mill or machine shop to carry on the corresponding work in the arts; still it is convenient, and if it is possible, we shall endeavor to conduct experiments in various departments of agriculture. It may not be possible to co-operate thoroughly in all the experiments proposed here. We are rather far North. Corn, for instance, is not a safe crop in Minnesota. If the frost holds off two weeks we shall have an excellent crop this year, but last year it was small. We do not want to do much in winter wheat; it is not a safe crop and is raised very little. Each one must conduct experiments suited to his latitude and people.

I would remark that in Minnesota we recognize the fact that this grant of land for these schools was not given exclusively for agriculture, but the agricultural and mechanical arts and all industrial professions. Our University is located at what is to be very soon a great manufacturing center. There is water power enough running to waste to supply all the cotton mills in the country, and they are beginning to avail themselves of it. For that reason we shall be obliged to develop our department of mechanical arts somewhat in advance of the agricultural. We have in Minnesota sixty thousand square miles of as good land as there is out of doors, which needs no manure for years, and there is not that need of scientific farming in Minnesota for crop-raising that exists in many other localities.

I will allude to the military matter. When I went there two years ago, I found holding the position of Professor of Military Science, a retired officer who had been a Major-General of the volunteers. He remained with us but a year, and then left to go into some business, but during that period he conducted the military matter quite vigorously. He was a popular and successful instructor. Since then nothing has been done, and whether we do anything further will depend upon whether we can get a successful instructor. I cannot give the time to it myself to conduct the exercises, and we have no one else to do it. The practical proposition is this: That we bring the matter forward in a proper way, and ask Congress to legislate that the military exercises shall not be obligatory except when the Secretary of War shall detail an officer to give the instruction. When this is done I think we ought to be obliged to give the instruction; otherwise to do it or not, as we please. I have no doubt the intention of Congress was to make the military exercises obligatory, and I am fully disposed to comply with the letter and the spirit of the law. What we ought to do depends on what we can do, and that is what we shall do in Minnesota if we get an officer that will carry it out; if not we shall wait awhile.

I want to make one remark on the matter of secondary education I think this is the great want of the country just now, and we are doing in Minnesota what we hope will stimulate the development of the secondary schools. I think we make a mistake in organizing the agricultural colleges as academic institutions with a little seasoning of technical studies. I do not believe in inviting our farmers to receive a farmer's education as such. The farmer, if he is to be educated, will need the same kind of education as others; he wants to be a man as well as a workman.

We, therefore, propose this to the educational men in Minnesota: that they develop the high schools of the State as rapidly as possible to do all the work up in the end of the Sophomore year. President Angell proposed, in his address at Ann Arbor, that the high schools do all the Freshman work very soon. We have proposed that to the high schools of our State. When this is done, the University will be delivered from a great deal of work which belongs to the secondary schools. We propose to start our Agricultural College from this common basis to secondary schools, and make it a technical school of agriculture and the mechanical arts, and not simply higher academic. In the meantime what we shall do is what we can do. I propose, as a practical thing, to assemble this fall a class of any number who want instruction in agriculture, for the purpose of practicing it. We shall give no degree to a student in that department unless he has a good general education. I should be glad to answer any questions.

President Denison—Let me ask in reference to training in your secondary schools. So far as I see this can be apcomplished in your chief cities and principal towns, but when you get out into the country towns, which need the benefit of the agricultural department, they cannot have the benefit of the schools, and unless the institution adapts itself to them, they go unbenefited.

Professor Folwell—That is quite right; we recognize that fact, and are maintaining a preparatory department intended to meet the wants of such schools. Our rule is this: that the University begin almost where the high schools leave off; we intend to work in harmony with them. We have this advantage, that we have rather a clean sweep in no competing institutions; we propose to leave the secondary work to the public high schools and the denominations. I have long been of the opinion that the division under the last grant was unfair. It was made in 1862 on the basis of the thin population. Since then Minnesota has doubled in population, and has acquired one additional representative, but we have got no more land for the college. It seems to me such a basis of division never could be fair. I have no plan just now to propose, but certainly a better one might be devised. The State of New York has 46,000 square miles of land, and she gets 990,000 acres of land. What does Illinois get? 480,000 acres, and she has 55,000 square miles; Minnesota has 83,000 square miles, and gets 120,000 acres. It seems to me the opposition which might arise in changing this matter can be met. They do not like to have scrip located in the States.

MISSISSIPPI.

Professor Hilgard—Our scrip was only issued a short time ago, and has just been sold. The scrip has been divided between the white and colored universities. The University of Mississippi, which is to be continued, has been allowed two-fifths of the agricultural fund, while three fifths is to go to the Colored University. I was requested to learn as much as possible by the Board of Trustees, and especially in regard to the labor question, about which we have been a good deal exercised—I think unnecessarily. I think at the present time it would not be at all difficult at the South to get as much labor as would be desirable for the purpose of illustrating the principal portion of the course in which the student may be at the time. There is one difficulty, however, which I perceive is not very much insisted upon by the gentleman who first spoke; that is, that of government. Most of the gentlemen have spoken on the supposition that the students were located in dormitories. We have about come to the conclusion that the dormitory system was impracticable, and intend to abolish dormitories, or introduce military discipline. It is proposed by our trustees to have the agricultural students remain in the dormitories while the other students are free to go where they please. I would inquire whether any such separation of the two classes has been introduced anywhere else, and especially in the University of Michigan, which has had the largest experience? It seems to me injudicious, but it is likely to prevail, and I should be happy to have any suggestion on the subject. I believe any such distinction between the students would be injudicious and unnecessary, to say the least.

ILLINOIS INDUSTRIAL UNIVERSITY.

The Chairman—In regard to the questions that have come up, they have all been interesting to us because we have had the experience that has touched on them. We have recognized the fact that the grant itself is designed not for agriculture alone, but for all scientific education, and especially scientific as applied to all the arts. So we proposed the organization from the outset, not only of an agricultural college, but a mechanical college, and we have now several distinct courses, all of them looking to certain recognized professions and pursuits in life. We have two courses in the Agricultural College, a course of Agriculture and a course of Horticulture: the Agriculture embracing two branches, plant husbandry and animal husbandry; and Horticulture, embracing not only ordinary garden culture, but nursery work, orchard work, forest planting or the care of green houses. We have all of these departments, indeed, in successful operation in a small way. We have a market garden and a nursery, and a large fruit plantation—perhaps as large a variety in our orchard as will be found in any one orchard in the country. There are about 3,000 trees and about 1,400 varieties in apples. We have several hundred varieties of pears, and a considerable collection of the small and other fruits. We have the trees there in nursery, or already in field, and have a forest plantation to experiment with, and some thirty sorts of timber trees, selected by the best authorities as being promising for timber groves on the prairies. We have also green houses which are now particularly under the care of the young ladies. We have also a course in mechanical engineering, a course in civil engineering, and some who have begun the elementary parts in a course of mining engineering. We have a course in architecture, and two or three students have entered, and we are making provision for a full development of the course. We have a course of applied chemistry besides the analytical course, and we have also a commercial course. The teacher is a gentleman who was for some time a teacher in one of the commercial colleges, but of more liberal culture than many of them, and gives instruction in the branches suitable to fit a man for commercial life. We have, in addition to that, a military course partly developed. The students in the military course have simply been in some text books in tactics. I should have said at the outset that we adopted the voluntary plan as to study; that is, we threw the whole field as far as we could open, and allowed students to select their own courses and their own studies in the course. We have several recommended courses that we put in the hands of the students, and say to them if they have no choice of their own they had better take that, and they have largely followed the course advised They are most of them four year courses. We do not confer degrees. The members of the Legislature visited us during the last winter, and asked the question whether we wished to have our law of organization modified so as to give us the power to confer degrees. I told them I had no care in the matter; that for a year or two, until our reputation was perhaps wider, it might be a little benefit to us; in the long run we hoped to make the certificate we gave of equal value, and did not care to confer honorary degrees. We have a sort of diploma which states that the student holding it has pursued a partial, or full course, in the different departments he has chosen, and attained a certain percentage of scholarship in the studies mentioned, and there is enumerated in his diploma everything he has studied. So every boy's diploma will certify as much as he makes it and no more.

We have dormitories. I wish we had none, but they were given to us, and we use them, of course. We could not use the building very well for anything else. In the management of the students who occupy the building—about 150—we have adopted the same plan that President Welch has adopted. I said to the students, after one year of governing the institution by the Faculty, "You are young Americans; you expect to govern yourselves and will be governors of the country by-and-by; why not begin now?" We offered them at their option the privilege of undertaking their own government in the Institution. They had a meeting and unanimously voted to undertake the government. We have a semi-military organization as we have had from the outset. Every corridor has its Hall Sergeant, whose business it is to assemble the men, lead them to the chapel, etc. I suggested that they should appoint a council, and a council of five or six men was appointed with a president, who act as a court, the Adjutant of the building being the chief executive officer. The Hall Sergeant in each hall reports any offenses to the Adjutant, and they are then tried by the court. They have appealed to me but two cases only in the whole time. Shortly after the opening of their government, they said they had caught in one of the rooms a number of boys, with some one fiddling, having a dance, and it was against their rules, and asked what they should do in the case. I said to them, "Is it a violation of the rules?" They said, "Yes." "Can you prove the guilt of the parties?" "Yes." Said I, "Then there is no option; you must enforce the law." I never heard anything farther about the matter. The other case that came before me was that of a young man who declined to pay his fine. They didn't tell me what his offense was, and I did not ask, but told him he must obey the rules, or leave the school. They have written out their constitution and by-laws, and put them up in the library, and govern matters their own way. I must say it is well governed, and better than I could govern it with the whole Faculty.

I want to say there has been in the State thus far a pretty good feeling—much better than I could have anticipated—between this and the other institutions, and I do not think there is very much danger of any rupture of the harmony. I have said, whenever I meet gentlemen of the other institutions, the only difficulty, I suppose, that would occur, would be a little feeling of jealousy for fear one institution would get more than its share of patronage. But there is a plenty of material to fill every college of the State. We want more educated men everywhere, and would not have enough if every college in this State was crowded to the utmost, and there is no room for jealousy.

The first two years of the history of the Institution we had no young ladies; they were not admitted. We were not provided with conveniences for them, as we are not very well now. Although the arguments *pro* and *con* seem to be so equally balanced that I did not think it was a matter of much consequence either way, my own private conviction had been that while I believed in the entire capacity of young ladies for a college education, I do not recognize any great difference, for I have had young ladies go through calculus and other departments with as much success as others, and as to their need of education, I do not see any difference between the sexes; if anything, I would rather give education to the women than the men, and as to their right to education nobody can question that. Still I have always felt disposed to say this: if you are too poor or too mean to give to women equal institutions, then let her be admitted to the best you have; but my own impression was, if the nineteenth century would do what it ought to do, it would endow its woman's university with as broad a basis as that provided for young men, but if you cannot do it, give woman the best education you have. When it came to a vote, the committee who had it in charge being equally divided, I gave my voice in favor of their admission. I have some daughters of my own I love too well not to wish to give them all the advantages possible. I knew before hand there were great advantages in the way of government. The influence on each other of the sexes is certainly good. We have several ladies in the chemical laboratory doing themselves and the studies good justice. Several of them are interested more or less in some of the practical studies. I suggested to our gardener that the young ladies go into his green-house under his supervision, and they are doing in term time a large portion of the work. There is not much done in New England by ladies in farming, but I recollect meeting, on one of our excursions, a New England school teacher who had come here and bought ten acres of land, and I found her out with big mittens on, with her hired man, at work raising fruits and garden vegetables, and making money. She had not had the benefit, even, of an agricultural education, but was working out her destiny because she had worn out her health in the school rooms of the East.

The question of labor, our friends all agree, is a difficult one. One might come in here and ask us the question, "Why are you troubled thus about it? Why don't you give it up if it costs so much trouble?" At the outset I gave you our history. We undertook the labor system;

I believed in it. We went on to the ground and helped the boys with a great deal of work. We graded our grounds, laid out our walks, plants, trees, built fences, put down walks, and did a hundred things, and are still doing many things; but we found that it was impracticable to furnish labor for the great number of students that were coming to us. We paid them for their labor; twelve and a-half cents was the maximum, and from that to nothing, according to their skill. We finally abolished the compulsory system, and at the opening of the term, after organization, we said to them, "All who wish can join the labor classes—and we emphasize the matter a little of joining the classes, and throw the influence as far as we can in favor of labor—please to hand in your names to the proper officer, with the work which you have been accustomed to do, or which you wish to do, and the hours of the day at which you will be at liberty." Then we organize three labor classes to labor two hours each—one from ten to twelve, another from one till three, and another from two to four. We leave the house between four and five for general lectures, drilling and other exercises. Then we take the labor class of the morning, and distribute them to the garden, to the ornamental grounds, to the shops—to wherever we may have labor for them; and we do so with the afternoon classes. They report to the Superintendent in charge, and are expected at the proper hours to appear on the grounds. In the Mechanical Shops we work under the same system, except in some parts of the work we allow piece-work—that is, giving them a piece of work to do, and the Professor says, "That is worth so much," allowing them to take their own time about it. In the Mechanical Course, I would say, inasmuch as it requires a great deal of instruction at the outset, from skilled men, they are required, for three terms of their course, to take shop practice, just as a student in chemistry takes laboratory practice, for which he gets no compensation.

Why should we keep up this? To my mind, these are the real reasons. In the first place, the labor system with us has an advantage in allowing poor young men to help pay their way. A great many young men come to us absolutely penniless, and actually pay all their expenses during the whole course. It may be true that we have more of that class of students out West, and yet Professor Felton told me—I think it was he—that the glory of Harvard was in educating so many poor young men; but there they have scholarships, and many advantages in doing this. We cannot afford to carry it on simply for that alone, although we ought to tax our patience urgently and funds a little, to help young men get an education. We do not expect, of course, that a man who has spent four years in scientific study, will go out as a day laborer on the farm. They will work with their brains, but after all it is necessary they should know practically, and they never can do it except by labor. We find this—that a practical application in any of the exercises as well as in any of the arts gives a practical and correct judgment of the value of the facts in this science. To illustrate what I mean : To the student, the principles and the facts of the science of the facts in the books are on a dead level, and it takes as many lines of the book to describe a fact, as it does a controlling principle ; the teacher may distinguish the difference, but the pupil does not. When he sees the practical application of it, he knows it at once. There we have another objection. In the study of natural history and the sciences of observation and experiment, we make a mistake in setting them to learn that from books. When he studies natural history, he studies what cannot be put into a book, but is outside of it. I recollect with what eagerness, when I had been poring over Latin or Greek for so long, I commenced the study of Geology and Botany, and the interest with which I went about it ; but this zeal evaporated in nine out of ten before we had been three weeks in the class, simply because we were studying not Botany, but descriptions of Botany, and in these schools you will be obliged to show these applications not simply with the eyes, but with the hand, and failure will result unless they receive that training that comes alone from the practical adaptation of means to ends. If I take a theorem in a book, and my pupils learn it, I am never quite certain that their judgment has been precisely correct, but when a man makes a judgment in regard to the direction of forces to split a stick of wood, for instance, the next blow tells him whether his judgment was right. The men who are leaders or forces in this country—I do not care in what department—are, in nine cases out of ten, men who some time in their life, probably before they went to college, knew how to work, and were trained to work. I am solicitous for one, as I suppose you are, that our Industrial Universities shall send out characteristic men without titles or degrees, but with education, to take their place in the ranks. I have an idea what I want them to be—not mere fluent talkers ; I would like to have them speak respectably if they have anything to say, and know enough to keep still when they have not—not merely men who can chatter about science, but, with intelligent and practical minds, can do whatever they are required to do, wherever it is—intelligent, able, working men, who do not feel above labor, but regard it as one of the incidents of life, and one of the necessary results. A great many of the students do not work, but there is no man among them that does not honor work, and no one hesitates to put on his old clothes and march out with his spade or hoe and work. They know all of us honor labor as the means by which the vast millions of the family of man must be sustained with daily bread.

I think I have touched all the points called out by the speech of my friend, with this exception: there has been the most enthusiasm in the Institution in the studies, of any school I ever knew, and there have been the fewest laggards, and the least disposition to shirk work. They said to me: "If you make the studies all free, you will have the boys come in and take the things that are easy, and leave the things that are hard." They take the things that their good common sense tells them are the things that will be the best for their future power in the world. They will take that thing which tends most directly to the end, if they have to stand on their heads to study. There is no danger in throwing up the whole field of labor, and saying to young men: "Take what you want, what you have time for, what you need." The result has been a very rapid growth of the institution. I ought to say perhaps, here, we have not felt ourselves compelled to follow New England, much as we honor her, but we have felt ourselves at entire liberty to build up an institution for Illinois. We have not asked ourselves the question, what they require for admission, but what the young men are prepared to do, and what they will do, and what we can do for them. They may not travel over a four years' course, and they may not begin as I did, or end as I did, but the education will not be determined by the point they stop at, but the distance they can climb afterwards. If you will give us time, I think we will successfully compete in the ultimate standing our young men will take—at least, I have no fear of them, and am ready to take the young men as the schools of the State will furnish them to us.

In regard to the military education, I do not know what was the intention of the law makers. We are taught not to go behind the statutes but take them as they are. The law says, we must not omit military tactics. We organized, and were fortunate in having for our teacher, Professor Snyder, who was here to-day, but has now gone—a gentleman who was in the Polish army, and afterwards in the Austrian army, at the great battle of Solferino, and afterwards in the service of this government. He organized a university battalion and four companies, and successfully drilled them. We took this ground, and I am glad to take this occasion to say we have held on patiently, hoping for something. I know that the military drill, after the novelty has worn off, becomes a little tiresome, and it requires effort, enthusiasm and ability on the part of the instructor to keep it up, but it can be kept up. All our students drill. These companies are under the immediate command of the students who take military tactics as a study. We shall open on the 13th of September a drill hall, 60 feet by 120, with a large platform, giving space for 300 spectators, and also a lower story devoted to large machine shops. I am delighted with the success we have met with in the teaching of mechanical engineering, in a practical way. I inquired of the schools I saw abroad, as to that point, and found they had tried shops, and in most cases abandoned them, but the difficulty they had was this: their students never expect to be laborers like ours; they simply expect to be mechanical engineers, and have charge, in the way of superintendence, of large manufacturing interests, maybe. But this matter of labor is of great consequence. I said to our Professor, "We have $2,000 to buy books and apparatus to illustrate mechanics." He said to me: "Let me make the apparatus we want." I said, "Very well, if you think you can make it as quick as you can buy it, do so." There were several applicants for the course of mechanical engineering. He went into a vacant shop that he got, bought some tools, and made patterns of a steam engine. He wanted one of peculiar construction for illustration. When he got it at work, he wrote to Mr. Corliss, the proprietor of the well known Corliss engine, for the privilege of making the valve gear, of the Corliss pattern. Permission was given, and he sat down to make his drawings of the valve gear adapted in size to his own engine. He invented a better one, and obtained a patent on it—better than the Corliss invention, because it does better work and is cheaper; the whole engine can be made as cheap as the Corliss cut off. They made our apparatus of various kinds, put steam heating into the building, and various other things. They are making castings for a 20 horse-power engine that they say shall run so smooth that standing with your back to it, you cannot tell whether it is running or not. The beauty of it is, that it has inspired such intense zeal, that every old book of mechanics in the library has been rumaged, and we have been obliged to send abroad for books. They have taken out patents, and one of the students has rented a shop, and is making a patent windmill. I am delighted with the result of this shop practice.

LABOR FOR STUDENTS.

Mr. Roberts—Mr. Chairman, I have been quite interested in your description of the working of your Institution, and I wish to say that we have succeeded in nearly the same way. I have been connected with the institution only about a year, but have had much to do with the students on the farm, running a large farm almost exclusively by their aid. Last year we tile-drained considerable, and much of that has been done by the fathers of these students when they have returned home and explained its benefits. The result abroad, also, has been similar with regard to deep plowing. And I claim that these are the influences, to a very great extent, that are to go out from these colleges. We are not only to continue to send them out, but they are to be teachers, and they are doing it, to my knowledge. I have received quite a number of applications from the boys, for some of the wheat which they helped to raise. In these, and many other ways, they will scatter the information they have received at our colleges, and in that way help to inspire a proper appreciation of our efforts.

Pres. Folwell—We find difficulty in furnishing work. I should like to know what kind of trade or manufacturing business I could start, to employ the young men. If I had an employment for 100 young men, at which they could earn their living, it would be of great service to those whose means are limited. The practical question is, what we shall do.

Mr. Roberts—In my experience during the last year, our boys have constructed fence. I let it to them by the job. We make all our fences in that way. Our students milk forty odd cows, and they take care of the cows; and, in addition to that, take care of quite a number of head of blooded stock, in connection with their lectures on stock-breeding. You can tell the students the difference between the harsh and soft feeling of an animal, but he cannot understand it without the examples before him. We plant all our corn by the help of students. I can get more work out of a squad of forty students, for two hours and a half, than from hired men. In some kinds of work there is a profit; others result in loss. Certain kinds of work can be done—cutting corn, for instance. We cut corn two cents a shock cheaper than we could by outside help. We shall have this year some 5,000 or 6,000 bushels of corn, in all probability. Our churning is done by the students; in fact, we use them in almost every place. As I came away, almost the last thing was to give some direction about hauling wood for the bakery, and the students cut the wood at so much a cord. Sometimes the students want to work half a day. They come in the morning, and are ready to start at seven o'clock; instead of having a dread of work, they are anxious to do extra jobs. Most of them are limited somewhat in their means, and when at the first of the month they are able to reduce their expenses for the past month, by six, or eight or ten dollars earned, it aids them very much.

Dr. Miles—I think that in the practical departments, labor cannot well be dispensed with. Students who are at work on the farm take a greater interest in the study of agriculture. There are many topics which are difficult to teach in a satisfactory manner without actual illustration before you. Take, for instance, some processes in the laying of tile drains, putting it down in quicksand, etc. You may lecture by the hour, and still the student does not appreciate the importance of the directions given. Put him in the ditch and he sees at once how it is, and he takes a greater interest in the lectures. So, in regard to stock. We look upon our farm stock as the means of illustration, as much as anything in the apparatus. Lectures on the different breeds of stock cannot be appreciated unless they have the animals before them. There are certain peculiarities you cannot well describe, but you can point them out. Our students do not object to any kind of labor. We do not set the students at work that they understand, but at work that they do not understand. We do not in this labor have reference to the gaining of manual dexterity merely, but we want the student to continue at the particular kind of work until he understands the manner in which it should be done. This season we have put up a large building; the students laid the foundation, cut the timber, took it to the saw-mill, and put it up, and they feel proud of it. Although we may never work at the carpenter's trade, yet when we have buildings to put up, we shall know whether they are properly constructed.

The Chairman—The question that Pres. Folwell suggests, is a practical one—what to provide. I can see the time will come when all the fences will be put up that we want—all the buildings required will be finished, and when, for instance, all our underdraining, which we have used largely, will be done—when there will be no work of that kind. The question, I think, ultimately, will come down to this. We will be obliged to resort to work whatever we have on the grounds available for the students in that apartment. That is, the agricultural students will have whatever work we have on the farm, the horticultural students work in the garden, and the mechanical students, the work of the shops. I think all of us will be obliged to relinquish the labor system, except the ordinary work. In Kentucky they have a large wagon manufactory connected with their Institution. The trouble is, the mechanics of the State will find just the same fault with your attempting manufacturing, that they do now with reference to its being done at the Penitentiary. It is going to be very difficult, ultimately, to manage the work.

Dr. Miles—Before adjourning, the Committee on Programme would make their report for the order of the day (to-morrow), as follows: At 9, A. M., "Experiments on the Pennsylvania Experimental Farm." Discussion to be opened by Professor Hamilton, of the Pennsylvania Agricultural College. At 2 P. M., a paper by C. W. Murtfeldt, on the "Agricultural Colleges of Europe and the United States."

At the suggestion of Mr. Murtfeldt, the reading of his paper was changed to 9 A. M., instead of 2 P. M.

The Convention then adjourned to Friday, August 25th, 1871, at 9 o'clock A. M.

FRIDAY, AUGUST 25, 1871.

The Convention met pursuant to adjournment, at 9 o'clock A. M., President Gregory in the chair.

The President read the following communication from M. C. Fernald, acting President of the Maine State College:

GENTLEMEN: I regret very much that our college cannot be represented in the Convention to be held at Chicago, commencing the 24th inst. Its object I recognize as of signal importance. I had hoped to be present, but find I shall not be able. Shall learn of its proceedings with interest. Most truly yours, M. C. FERNALD,

Acting President Maine State College.

The Secretary stated that the first thing in order, according to the order of business, would be the reading of a paper by Mr. Murtfeldt, on the "Relationship between the Agricultural Colleges of Europe and those of America."

The President—While we are waiting for the gentlemen to arrive, I would say to the Convention that we have, in addition to the invitation to visit Riverside—which I laid before the Convention yesterday afternoon—an invitation which has been brought in this morning by the Commissioners of the Land Department of the Illinois Central Railroad, for the members of the Convention, or as many as may find it convenient, to take a trip along their road. They offer to put at the service of the Convention one or more sleeping cars, or a special train, if it is necessary, to take us down any distance, and on any part of their road, stopping where we please, and connecting with such trains as we may please.

We all know that the Illinois Central Railroad Company, in addition to being a railroad incorporation, has had a very large share in the work of increasing the agricultural population of the State. They hold a large amount of the farming lands of the State. They have, through their labors, succeeded in settling a large portion of the State, and they have still some hundreds of thousands of acres of the best land in the State in their care, and are interested very greatly in the agricultural prosperity of the State. There are a great many points of interest along the road. The State Fair at Du Quoin and at Champaign could be taken in on the route. We who are from that place, would be very glad, indeed, if the gentlemen of the Convention would accept this invitation and stop over and see us.

The consideration of the invitation was postponed, to permit Mr. Murtfeldt to read his paper.

Mr. Murtfeldt then read his paper, as follows:

AGRICULTURAL COLLEGES IN EUROPE AND THE UNITED STATES.

The precise time when agricultural schools were first introduced in Europe I have not been able to learn, but with the primary object of their establishment I am sufficiently familiar to venture an assertion. It seems to have been clearly understood, however, by those, who inaugurated training schools for farmers, that the educated agriculturist has in every respect the advantage over the man who has no clearly defined purpose in his labors, who does not believe in rotation of crops, who has no accurate knowledge of the adaptation and capacity of the soil he cultivates, or of any of the known laws of the climate in which he lives—in brief, whose whole business is carried on hap-hazard. If these facts are admitted in America I answer, possibly in theory but not in fact, without stopping here to argue the point. Now as to the assertion.

In Europe, Kings, Princes and Barons hold many landed estates. Some petty Princes, the whole of whose territory is not as large as that of a single county in Illinois, own a hundred estates, varying in extent from four hundred to a thousand acres each. Now, to have these domains as productive and to make them yield as large a revenue as possible, these Princes needed stewards, or as the Germans say "*Verwalters*," which term implies, not only a skillful agriculturist, but also a man of considerable executive and administrative ability. These Princes being able to control the schools, they wisely concluded to educate a class of men whom they could appoint over their estates. Such positions, being entirely dependent upon the good will of the appointee, remunerative withal, and not very wearisome to the flesh, are much sought after, and are of themselves stimulants to the incumbent to make as good an exhibit and as large returns as possible. That the best of these schools, or perhaps all of them, are now established upon a broader and more cosmopolitan basis, may be taken as an index of general national progress.

The act passed by the Congress of the United States donating public lands to the several States and Territories, which would provide colleges for the benefit of agriculture and the mechanic arts, approved July 2d, 1862, has called into existence quite a number of institutions, most frequently termed Industrial Universities, some of which are represented here to-day. Prior to that day there were in the United States no institutions of this character, of any note. With the creation of schools of agriculture came the demand for Presidents or Regents of these Universities, and also for Professors of Agriculture. There being no normal university of agriculture in the United States, where men could be trained for the teaching of this science and art, men who were favorably known as Presidents of colleges, or educators, were pressed into service, or where the industrial schools were united with colleges already in existence, the Presidents of these became *ipso facto* Presidents of the industrial universities. Doubtless every one of these gentlemen have all the executive ability and literary attainment desirable in a college President, and yet we look for something more in this connection, something more in sympathy with the agriculturist and the mechanic, or in fact with all the laboring classes. So with the Professors of agriculture; there are yet but few, even of these, who studied agriculture with a view to be able practically to teach the science and art. There are perhaps plenty of men well qualified to teach agricultural chemistry, or botany, or horticulture as a branch of agriculture, and many of these have already been incorporated into the Faculty of industrial universities. Thus a corps of Professors have been created out of material not originally designed for such a purpose. It is not the intention of this present paper to question the ability of any one of these gentlemen. All that is desired is to bring out the fact that many of the gentlemen who compose the Faculties of our industrial universities, had no intention to labor in this particular field ten or even five years ago. Furthermore, to show in the sequel that men especially trained for other pursuits frequently adopt that of agriculture or horticulture from an innate love of the calling, and that such, because of their scientific training and powers of observation, stand at the very head of the agricultural profession, need I refer to the doctors of medicine, law or theology, (some of whom are here today), who have abandoned their first love to follow *Ceres*, *Pomona* and *Flora* through the more enchanting fields and gardens where they reign?

The government military school at West Point and the naval school at Annapolis, demand of each and all the cadets and scholars conformity to *all* the rules and regulations of these institutions respectively. At West Point studies adapted to the various branches of the service are taught, whether of infantry, cavalry or artillery. Nevertheless, the graduates of West Point are not all found in the service; some are civil engineers, others presidents or land agents of railroad companies, and some, even, are plain farmers. In any emergency, however, each and all of these graduates of military schools can readily go back to the calling for which they received a special training—can even lead armies and become Presidents of the United States.

I have referred to this matter here to answer an objection not unfrequently made to our industrial universities, namely: there are but few students in these institutions who intend to follow agriculture as a life business, and that therefore they need not be taught to labor while at college. I maintain the opposite. They, like the cadets in our military academies, ought to be made to conform to all the rules; they ought not only to study the theory of agriculture but the art also, and that *practically*. After that, let them choose any other field or profession if they desire. The advantage and influence of their practical training will prove no loss, either to themselves or the community at large.

The labor question, therefore, should be answered affirmatively. Most men labor for money; they strive to attain wealth (even more than a competency) because with money as a means, men can accomplish much; if this be trite it is also true. But a man may possess all the wealth of the Californias, and not be able to tunnel the Chicago river or bridge the Mississippi; it takes knowledge to do this. "A fool and his money are soon parted," whether he attempts to bridge the Mississippi or carry on a farm. In the West we have thousands of illustrations, where sagacious, skillful farmers have made fortunes in the same special pursuit where others, without the requisite knowledge and skill, have utterly failed. Few men succeed in any calling which they do not like. There may be some young men in these industrial universities, who enter there at the wish of their parents, without any desire to become farmers; but most *men* at the age at which they enter a university should and do have a definite idea of what they intend to follow as a life pursuit, and therefore it is presumable that those who take the agricultural course do so *con amore*, and intend to become farmers. But there are some men who are easily influenced by others, especially by men whom they esteem or to whom they look up, and therefore the Presidents or Regents of agricultural colleges, and all the Professors, should be wholly in sympathy with the industrial classes, especially the students, so that these may have set before them the proper motives, which shall establish in them the firm conviction that they can succeed in life as agriculturists better (or at least full as well) as in the so-called professions, which are already overcrowded, and which men, whose special training has fitted them for these professions, are charged to especially favor. We claim then the industrial universities primarily for the industrial classes, because there are plenty of other colleges and universities where men can be trained for the profession; and entertain the hope, that all who are called to preside over or teach in them, will use all their power and influence to hold the trust committed to them SACRED TO THIS PURPOSE.

PRACTICE AND SCIENCE.

Mr. Murtfeldt—I will say that a good many of the points that I have endeavored to bring out, have already been traversed in the discussions of this Convention; the Labor question, and several others. I did not know exactly what form this Convention was to take. I knew that part of the object of the Convention was to concert action with regard to experiments to be tried. I had hoped that I should be seconded—if we are going to allow any division between the scientific and the practical men in this connection. I had hoped that I should be seconded by such men as Mr. Flagg, and others. Mr. Flagg, I believe, is a college graduate. I want to impress upon this Convention this idea in regard to these industrial classes, and the money given to them by the United States, and which is held in trust for them. And that is the point I want to bring out especially. It is the money that is given by Uncle Sam to industrial classes, and the attempt to divert this money in favor of the so-called "classical" institutions, solely to bring them up to that standard—if it is up—which I do not exactly agree to—to bring them up to that standard that they will watch you very jealously; and when attacked that way will call pretty loudly, from the press first, and then from the farmers themselves.

I have been very much pleased with the spirit that has been exhibited by the gentlemen here, and if I could have intruded myself upon the Convention after the very pleasant, agreeable and sensible talk that we had last night, I should have called attention to this fact then.

In the New England States, according to Prof. Gilman, the most of the benefits and emoluments received from the land grant are already diverted. He says we draw upon the farmers for our students, but we do not return many to them. We have few agricultural professors in our institutions, and half as many students.

I simply want to call the attention of this Convention to the fact that the farmers are jealously watching these grants, every single one of them.

And perhaps there has never been, in one sense, a more important Convention called in the United States, than this very one. A great deal depends upon the experiments that are being tried at the experimental stations—for in the end our Agricultural Colleges will amount to nothing but that they will be experimental stations.

Mr. Flagg—I wish simply to refer to the gentleman's allusion to me. I heard my name mentioned, but I did not hear what was said. I do not know but that he misrepresented me. I am very anxious to have my record clear.

Mr. Murtfeldt—I will inform the gentleman that I want him to take the stand at the unscientific side of this Convention, or I will find myself alone. He being a graduate, went over to the college side of the question.

Mr. Flagg—I want to be, and I think I am a more practical man than Mr. Murtfeldt. I think I always have been. While he has been theorizing here with regard to the encroachments of the classical, or college-bred men, if you please, upon the domain of practical life, as they claim, I, who am but a representative of a great many other men who have the same opportunities, have been working I think perhaps fully as much as he has, and I believe a little more, to the practical ends of agricultural education.

Now the statement that was made here last night, I believe, by Prof. Gilman, (if he did not make it here he made it elsewhere,) in regard to the small number of agricultural students who are graduating from Sheffield Scientific School, is in itself no proof of failure. I think Mr. Murtfeldt himself will admit—if he will not, certainly a large portion of the men in this room will—that Prof. Johnson, in his "How Crops Grow," and "How Crops Feed," is doing more to advance agricultural interests than any man in the United States.

That is my solemn belief, and I don't care in what way this work is done; whether it is done by taking students into the school and sending them out as graduates, or whether it is done in the way in which Prof. Johnson has done it; so the work is accomplished, I think we ought to be fully satisfied. I think there has been nothing more practical or more valuable for getting our general agricultural practice upon a scientific basis, than those works by Prof. Johnson. I think this country owes a great debt to Sheffield Scientific School, and I think Mr. Murtfeldt himself will take that view of it. But I don't think it is right to attack Yale College or any other institution that is doing as much in a different way towards agricultural science, with the plea that it is unpractical.

Mr. Murtfeldt—I did not mean to be so understood, sir. I simply quoted Prof. Gilman.

Mr. Flagg—I am a Yale man, and I sympathize with young Yale, too. I believe that Yale is all right, and so is Harvard. I believe, although those are classical schools, so-called, that they are doing their work, and doing it well for the practical men in this country.

Mr. Denison—The law of Congress places the matter in this form. These Institutions are endowed to teach (not excluding other scientific and other classical learning), such branches of learning as relate to the Agricultural and Mechanical Arts, in order to promote a liberal, practical education in the industry of life. I suppose that Mr. Murtfeldt will not exclude the classics?

Mr. Murtfeldt—Certainly not, sir.

Mr. Welch—I am a little befogged in regard to the exact distinction drawn between the scientific and the practical. I think I have never been able to see it. I think that the usual distinction (which I do not believe is well founded), is about thus: There are a class of men who have no knowledge of abstract science, who have become, by long experience, skillful in the manipulations of the farm, and they call these practical, and they have knowledge, no doubt, of an exceedingly important part of farming. Then there are men, on the other hand, who work in the laboratory, who are skillful botanists, and who have accumulated, by life-long industry, great knowledge in these departments. Now, I hold that those men that determine the principles that can be applied on the farm, and that indeed form the basis of all genuine progress on the farm, are just as practical as the other class. [Applause.] So I have long doubted the wisdom of giving to one class, viz: the workers—I mean the muscular workers—all the credit of having the only practical men, and on the other hand, I have doubted the justice of giving the intensely earnest workers in the laboratory and in science, the credit or discredit of being the only theoretical men. Of course, the so-called practical men—the muscular workers—cannot do without the scientific workers, because there would not be any great or genuine progress without the application of scientific discovery to the work on the farm, in the garden, or in the work-shop. Indeed, there could not be any real progress without these scientific, practical men. And, on the other hand, the scientific, practical men never could reduce their experiments, their discoveries, to practice on the farm without the muscular workers. So I believe that all these men are practical men, all of them.

I heard yesterday a sentiment that I (and I speak with all deference to the speaker) did not like. I have forgotten who the speaker was, but the sentiment was in derogation or deprecation of the idea that a school should have a sprinkling of agriculture.

If I may not be too egotistical in reference to our own laboratory, I would say that we have there a two and a-half years' course in analytical chemistry—in experimental chemistry, at any rate. Well, I might call that a "sprinkling of agriculture," and a pretty large sprinkling, too. It is true that the analyses do not always point right to the farm, but they always have a bearing upon it, and the truths of science are intimately connected together. You cannot teach a boy one experiment in the laboratory, or any manipulation of the laboratory that is not related, more or less, indirectly to the work on the farm.

Now, if I should stand at the head of an institution of learning wherein the whole scope of the work was simply out-door experiments, or wherein art was taught simply, the manipulations of the farm and the nicer processes of the garden, with science left out and the laboratory left out, I should resign in utter disgust. I could not run such an institution. Nor do I believe that those institutions can ever be successful, or that they can ever be practical in the widest sense of the term, unless they are founded upon genuine attainments in science. And then the practice, as it is called, or the art, which is better, comes in, and no man can be a genuine *artiste* in agriculture, or in the garden, or in pomology, or in anything else, unless his labors are founded upon large attainments in science.

Mr. Hilgard—There is one point made by Mr. Murtfeldt which I desire to notice, and it is this: He says that after all, the main object, or what is meant, is experiments and experiment stations. This would seem to imply that we really have made no genuine progress in agriculture, or rather that we have nothing to teach that would benefit the farmer. I do not think that Agricultural science deserves that imputation; nor do I think that experiments are at present our primary object. It is the popular prejudice that they are to be so. I do not think we ought to encourage this popular prejudice. I think that while experiments properly carried out, are of great importance, yet at the same time we must teach the principles, and, with the principles, sufficient practice—that is, sufficient practical instruction to teach the application of those principles. How the work ought to be done is the main object of these colleges. After all, our experiments can only lead to general results, and only by experiments continued for a number of years, and by a large number of colleges, can be secured the recognition of general laws. Now, if we announce that it is by this slow process alone that we can benefit the agricultural community, I think we lay a trap for ourselves. I think we should stand just on the ground that we have a great many things in practical agriculture, to teach which are exceedingly valuable—that it is more practice, more handicraft that we wish to teach, and that we have very valuable principles which we wish to inculcate, and that without experiments our colleges are not worth anything. We are to place ourselves then on that ground and let experiments be considered as a very important point.

Mr. Folwell—The main point is that this benefaction of the general government is for the benefit of the industrial classes. No matter about whether our institutions are scientific. The main point is the benefit of the industrial classes—for the liberal and practical education of the industrial classes.

I think I know something about what the wants of the industrial classes are, for I belong to that class. I labored on a farm for the first twenty years of my life, and I think I know just exactly what the wants of that class are. We farmers would not be content with an education inferior to that of other men. That led me to say here last night that the farmer wants an education to make a man of him, not merely to make a working man of him. It is therefore that I made the remark that Mr. Welch has so kindly alluded to, (for it was I who made the remark.) The gentleman misunderstood me. I had not the idea to which he refers, in my mind at the time. I ought to have said then that in the University of Minnesota, our plan is to make our agricultural college, a college or university which shall be a technical school of agriculture. We don't intend to build large houses in which we shall teach academic branches, because we are already teaching them in our institutions there. We organized as a university long before we got our agricultural college. We got our academic work organized, and we did not need to take up time in the agricultural school to teach the boys algebra, geometry, or even the elements of chemistry, and so on. That is a point in which we make a saving. We intend to bring this system up to the beginning of the Sophomore year, and not to the beginning of the Freshman year, as the newspapers have me down as saying yesterday.

Mr. Miles—I do not wish to travel over the ground I went over yesterday, but I cannot pass this subject without saying a word or two in regard to the differences between science and art. It seems to me that as soon as we confound these two terms, we throw aside all opportunity for improvement. The great drawback in agriculture has been, that we have been claiming for the last twenty-five years that it is practically based upon science. Now, if any gentleman will point out to me a single move or principle in agriculture that is founded on or is derived from scientific experience, I will own that I am mistaken. I do not know of one. Agriculture is an art. It is had with practice. Now the rules governing that practice are derived from experience. What scientific men have attempted to do, is to explain why these rules were successful. Attempts have been made heretofore to explain these rules. Scientific men have said the explanation is so and so, and hence they infer that we should modify our practice so and so. The practical men who are thus sneered at, found that this was not true. The scientific men have re-examined the case and found out that they were mistaken.

Now, I claim, that if we place science first, and practice afterwards, we cannot make progress. The art must always precede the science. You cannot build up your science until the art has made certain progress.

Why is it that the sister industrial arts are making progress then ? Simply because in the investigation of them the various experiments could be tried. A calico printer wants to know how he can fix a certain color in the cloth. He goes to the chemist with a certain question; the chemist answers that question, and thus he has been directly benefited by the investigations of the chemist. But when the farmer comes to the chemist to ask a question, it is a vague, indefinite, uncertain question that he asks, and the scientific man cannot answer.

Now these two leading objects, or these two lines of inquiry, are of equal importance. I do not underrate or undervalue the importance of scientific instruction. There is no man who gives it a higher place than myself.

And I claim further, that an experimenter, in the practical department, cannot succeed unless he has a thorough scientific knowledge as a basis of his action.

In this matter of experiments we have been groping in the dark to a great extent. I apprehend that a large proportion of the experiments that have been inaugurated, have been attempted under mistaken notions—the idea that there is nothing known about farming at the present time, that the accumulated experience of the past has been of no use to the practical men of to day.

Now I am well satisfied that the principles of the practice of the art of agriculture are well settled, and they have been settled entirely from observation and experience. Look at the history of agriculture in colleges. You find that two hundred years ago certain rules of practice were arrived at by trial and observation; they were reached *materia.* These were printed, but they were not widely disseminated. Very few saw them. You come down a little later and you find men who had never seen the writing of their predecessors, who have by the same process arrived at the same conclusion. We find them to-day arriving at the same conclusion. We have presented at the present time as original (as they no doubt are with the persons who present them,) discoveries that they have originated of great practical importance, which have been discovered before repeatedly, time and again.

What is the object of experiments, then, if these principles of agriculture are well understood? It is simply to give us a little more practical knowledge. The farmer knows very well, and you cannot impress it any more strongly upon him by any scientific exposition of the matter, that the best mode of disposing of his corn is to feed it upon the farm, and return the manure upon the farm; that it is for his interest to feed his corn to his stock and get the return in money.

Now the question would come up in regard to the exact amount of money that he would make for a certain amount of corn. These experiments that we are inaugurating here, that we are attempting to carry on, are, or should be, made for the sole purpose of giving him a little more exact knowledge in the art. If these experiments are carried on with the understanding that you are going to revolutionize the art, they are carried on upon a strong basis. You cannot revolutionize his principles, for they are well fixed.

Now, these rules of practice have something to do with the art of agriculture, and a man can learn those principles—those principles can be taught. The making of these rules should be a question of ways and means. It is equally important that the man of science should interrogate nature, and ascertain the changes which are taking place in the economy of nature.

We would like to have him explain these processes—these rules of art. We know that the one man cannot accomplish very much in both directions. It is only by this division of labor that the whole work can be accomplished. The scientific man, in explaining the rules of practice, suggests a new line of inquiry, and then we have to go to experimenting to modify our rules of practice.

Now, it seems to me that this confusion of terms—using the term science to mean practice, and practice to mean science—mixing them all up—only retards our progress. Let the farmer perfect, by means of experiments, the rules of his art, so that he has some good *data*, and then he can put a more pertinent question to the scientific men for the purpose of getting an explanation of the why and wherefore he proceeds. It seems that this distinction is a broad one; it is a distinction that we must make, if we would have progress in the art we are seeking to cultivate.

Mr. Welch—I appreciate the truth of those remarks in general, sir; but agriculture is a very complex term. It covers a large period of operations; and while the gentleman's remarks are true in some of their branches, it seems to me that their truth may be questioned as to others.

For instance, as in stock-breeding. Now, all knowledge of stock-breeding, as studied by the student, is, or ought to be, founded upon progress in physiology and anatomy; and a knowledge of zoology is very important as a foundation for progress in stock-breeding. It is true, the art was in advance of science, and that the science has been established by the constant observation of different experimenters in stock-breeding; but when a fact is fairly set down and agreed upon by the various experimenters, it becomes a fact in science.

There is now, therefore, a science which has to be studied carefully by those who intend, or want, to be scholars in stock-breeding. Antecedent is necessary to practice in stock-breeding; and it seems to me that the progress in the subject has been largely due to the gentleman's well known progress in the science of zoology.

Now, there is another branch in farming. It is well known that the farmer has now many enemies to encounter. One of these is the innumerable hosts of destructive insects that help themselves to his products; and it is utterly impossible that he should intelligibly engage in the extermination of these enemies, unless he knows their habits; and the only way under Heaven by which he can know their habits, is by a full and perfect understanding of the science that gives those habits. And the gentleman has been engaged in the study of that science for a great many years. But I verily believe, after having inquired particularly into his whole practice, that he has given exceedingly valuable instruction before he gave any sort of practice in it. I venture that he will recommend to all of us to give instruction to our students in the principles of zoology, and in the principles of physiology even, before we proceed to instructing them in the science, or the art of stock-breeding, and stock-managing, and so on, and so on.

No doubt agriculture is an art that is largely based upon experiment, and that a progress in the sciences upon which it is based, actually has been made subsequent to a large progress in the art, and I am sure the gentleman won't assert that every operation on the farm is actually based upon the principles, whether known or not, which, if understood fairly, would belong to science. And I am sure he will say also that any scientific knowledge of these principles, whether we have that now or not, would be vastly important to the progress of the science.

Mr. Miles—I will go as far as any gentleman in my admiration of science, and its uses. A man is a better observer who is a thorough scientific man. But the idea that I am proceeding against is this: that our art is based upon science—that the rules of our art are based upon science; and that we call the art the science of agriculture. Now take the illustration of stock-breeding; it is a very good one. If I were going to teach a class stock-breeding, I would like to have them understand physiology and zoology, and all of those other natural sciences, because I could bring illustrations to fix the principles that I inculcated; and they would be illustrations that they would appreciate. That is all true. A knowledge of science in the student is desirable.

But the question arises : Have we made any progress in stock-breeding through scientific investigation? I say no; not one step. Go back to two or three hundred years and take those old writers, and you will find just as pertinent rules laid down for the breeding of stock as you will find in any modern writer. What the scientific man has done, or is attempting to do, is to explain these rules of breeding. Take the first work on Agriculture published in Germany, and you will find the rules for breeding, for the selection of the male, for the selection of the female, and the relations of the one to the other, and so on. Come down to later times, and take the writings of John Mill, and the writings of some of the old English farmers, and they get at this matter of experiment, as a matter of observation, that certain forms and colors were adapted to coupling with certain other forms or colors.

The scientific man has settled very many things; there are many points in which he has succeeded. It is true that in zoology and in physiology we have a great many illustrations which we cannot expect to understand when teaching the principles of stock-breeding.

Mr. Detmers—Since when has breeding made progress? Not before anatomy, physiology, and those sciences were cultivated as sciences. It is but a few hundred years—and I say very much when I say two hundred years—that which we may call breeding, has really made progress; that better breeds have been developed. I will not claim that those celebrated breeders in England, for instance, have been graduates of colleges. No, they have not; but they have been true observers of nature; they have listened to the workings of nature, and found out the rule by which nature governs, and they have applied those rules; they studied physiology from nature. It makes but little difference in the end, whether we study directly from nature, by our own observation, or whether it is taught us in colleges or schools. We have breeders in our own land—breeders who excel—who are not graduates of colleges, but are true observers of nature; others who have money enough, and who commence stock-breeding and think all that is necessary is experimenting; and as experimenters only will they succeed; but those men who follow certain rules—rules which have been gathered from observation of nature—are the only ones that can, and that will succeed.

Professor Daniels—A science is only classified knowledge; and when we speak of science, or speak of applying these rules of science, we are simply applying those rules by which a certain kind of knowledge—by which accumulated knowledge, or that kind of knowledge by which we accumulate enough, or a sufficient number of facts to state that a certain theory is true—and we call that a law—that is, scientific law. Now it is immaterial whether science comes first, or practice comes first. That is true, and I know it is true of Dr. Miles. He does not teach his zoology, he does not teach his stock-breeding, until he teaches physiology; when he teaches stock-breeding, and applies the laws of physiology to it. I know that he does not teach practical agriculture—that is the higher and better course—until the student has had botany and chemistry, and he applies those principles right along—he claims that they are practical agriculture, as he teaches them; but he applies those principles right along that the student has been learning for two years before. It is practical agriculture when he teaches it; that is when he shows them how those peculiar laws they have learned apply. If the students know it, it is science; and he nor any other man, who has had any experience in this matter, would attempt to teach agriculture arbitrarily; but he would teach those facts as far as he knew them, and show how far science explains them, and that is science, just so far it goes. Everything cannot be explained by those laws, and just so as we can explain them it is science. But I know that whatever Dr. Miles says, he teaches those facts as scientific facts.

Mr. Flagg—I don't know as it is worth while to differ much on this matter; it is merely to look at different sides of the same shield. But practically, there is certainly a good deal of force in what Dr. Miles said. We have a great deal of farming based upon experiments, which is good farming so far as our practical life goes; and yet, when you come to explain these processes, and give a theory for them, you will find the men will differ immensely in their theories, and perhaps none of those theories will be right. For instance, in the little matter we were talking about this morning: that is in regard to our wheat soils. Our experience in Southern Illinois and that of Dr. Miles in Michigan, and I presume it is getting to be very nearly the general rule, is that it is highly important to compact soils after plowing for wheat; and yet when you come to explain why that is to be done—what the advantage is that makes the wheat come better, and grow better, and remain through the winter better—you will find there is an immense difference of opinion. And that is only an illustration of a very large class of facts of husbandry that have not yet been explained or settled on any scientific principles, so that there is any general agreement upon them; and so long as that class of facts exist I suppose we must draw a kind of line between practical agriculture and scientific agriculture. I do not think that it necessitates any quarrel at all; it is simply because we know the facts, and cannot explain them.

INVITATIONS.

The President—I will interrupt for a moment to say that I hold in my hand a letter, which is a duplicate of what was sent me yesterday, but unfortunately I mislaid it. I interrupt the discussion a moment to communicate the letter, as it will need perhaps an earlier answer than it would receive if I did not read it now. It is a communication sent by the Secretary of the Riverside Improvement Company, addressed to George S. Bowen, and is as follows:

"Will you please extend to the gentlemen now visiting at Chicago, representing the agricultural interests of the several States, an invitation to visit Riverside at any time they may elect. Inclosed please find the time table of the Riverside trains. By leaving at three o'clock it will afford them sufficient time to take an extended drive around our improvements and return on the 5:50 train. I will perfect arrangements there for their convenience if you will give me a short notice of their acceptance."

I will repeat also, in connection with this, an invitation that was brought in personally by one of the officers of the Illinois Central Railroad Company, and this morning tendered to the Convention.

Mr. Flagg—I move that we suspend the discussion, in order to take up these invitations. I suppose the question ought to be settled this forenoon.

The motion was adopted.

Mr. Gilman—I move that the Convention accept the invitation to visit Riverside.

The motion was adopted.

The invitation from the Illinois Central Railroad Company was taken up.

Mr. Welch—I move that it be declined, with the thanks of the Convention, and an expression of the appreciation of the kindness of the company in extending it.

The motion was adopted.

PERMANENT ORGANIZATION.

Mr. Hilgard presented the report of the Committee on a Permanent Organization.

The report was read by the Secretary, as follows:

Your Committee on Permanent Organization, after a consideration of the general subject committed to them, respectfully submit that in their opinion such an organization would at the present time be premature.

(1.) They therefore recommend that this meeting adjourn, subject to the call of an Executive Committee to be composed of the officers.

(2.) That the same committee be charged with the duty of drafting each article of association, as may in their judgment seem best adapted to secure the objects in view.

(3.) That, in order that said Committee may the better appreciate the demands of the case, a time be given at this meeting for a general discussion upon the character of the Association to be formed—its constitution, its memberships, its objects, etc.

Mr. Flagg—I should like the report be amended so as to read that the Committee recommend that when we adjourn, we adjourn subject to the call of the officers; otherwise the adoption of the report might be construed to adjourn the meeting.

The amendment was made by the Secretary, there being no objection.

Mr. Flagg—I would state that the important matter in this report is the consideration of the kind of organization which ought to be effected; and I should hope that the hour which is to be devoted to the discussion will be taken now while we have the report before us.

The President—The report is before us, and may be made the subject of discussion. The discussion, however, should properly come upon a motion to adopt or to amend, or to do something with the report.

The report was made the special order for eleven o'clock.

The President—The hour has come for the consideration of the special order, which is the report of the Committee on Permanent Organization.

The report was received and adopted.

Mr. Folwell—I move that the discussion contemplated by the report take place now.

The motion was adopted.

Mr. Folwell—I do not wish it to be thought that I had any special proposition to bring forward here. I would remark, if you please, sir, that coming here quite unexpectedly, I did not know what I was to find here or whom I was to meet here exactly. And when it was proposed here, to form a permanent organization, the question immediately arose in my mind, of whom shall this Association be composed, what shall be its constitution, and what shall its object be? And as a member of the committee to which that matter was referred, I did not feel willing to begin to draw the articles of our association until I should know something about it from a discussion of a kind that may now take place—what has taken place and what is wanted. I will say very briefly, that for my own part, if there shall be a permanent organization, I would wish that it would be a practical one, and a broad one; that it should exclude nobody; that it should not be confined to agricultural nor mechanical matters exclusively, but to embrace all subjects which may properly be brought within the scope of institutions as founded by the land grant of Congress. I suppose we can do no business in the matter now. As we do not come here as delegates from our various institutions, we cannot do anything which will commit them.

Mr. Flagg—I suppose, in holding this meeting, we are exercising that inalienable right of American citizens of forming an organization for any purpose we choose. Of course we cannot commit anybody but ourselves. We are simply here as individuals. While what we may do here will not bind anybody, it still may have very considerable effect at home. It is not in our power to bind anybody except so far as we are concerned as individuals.

In regard to the calling of this meeting, with which I had something to do, I can only state my own views and leave others to do the same. This organization arose primarily from a consultation that Dr. Miles and myself were having at Lansing in reference to agricultural experimentation. It is very clear to any one who has considered the subject at all that very great advantages could be derived by co-operation in experimentation—a subject which both of us had a good deal at heart. Having gone that far, the further consideration arose that this experimentation is to be done largely by the agricultural colleges, probably, and involve the agricultural colleges generally, and they again would involve pretty much all, or a large share of those institutions, founded on the national grant for the advancement of agricultural and mechanical arts, and they would include again a very large portion, perhaps nearly all of the institutions that are seeking the new education —I believe that is the term—so that there is quite a bond of unity running through all this, which would make it desirable in many respects not only to have those who are engaged in agricultural experimentation in the various agricultural colleges interested in this matter, but all interested in the institutions, perhaps, from the community of sentiment and community of interest and the possibility of our needing a defense. There are a good many reasons for forming a permanent organization which should be tolerably broad in its character. Primarily, the gentlemen who first called this meeting were seeking to carry out these agricultural experiments in common to get our whole country at work, if possible, in the matter of improving the scientific basis of our agriculture. That in itself is a great work and one which will involve a great deal of time, and might, perhaps, fully occupy any convention that we should be able to hold. At the same time, in view of the fact that there has, I believe, no convention whatever, ever been held of the Presidents of our Agricultural Colleges, and of those who are specially interested in their management, and inasmuch as they are new institutions, striking out a new path, in which co-operation, mutual advice and mutual experience will be eminently beneficial, it seems to me that there are pretty strong reasons for making this organization very general and broad in its character.

I merely throw out these general considerations now, Mr. President, with the hope that those who have considered the interests of the agricultural educators will speak further upon it.

Mr. Miles—It seems to me this question narrows itself down to the proposition whether it is desirable to continue an organization here which has been called for an especial purpose. The persons here in this Convention represent to a large extent the subordinate officers of the colleges which are engaged in this particular work. The primary object of their being called here, as stated by Mr. Flagg, was to get them to co-operate. It seems to me that they have a right to organize for their mutual improvement and benefit for the promotion of the object they have in view. If the proposition is to have an organization uniting or bringing together the industrial institutions that have been organized under the Congressional grant, for the purpose of comparison of views in regard to the manner in which these institutions shall be conducted—the course sought to be pursued—then this Convention should have a very different object. The faculty of the colleges, and the persons in control of the colleges should be consulted and allowed to send delegates to the Convention, which is to form an organization upon that basis.

It seems to me that we can do nothing in regard to organizing a Convention of Agricultural Colleges any farther than this: that we might express our opinion in regard to the matter, and leave it for the faculties, and the parties in charge of the colleges, for the purpose of making the organization. If we choose to organize as individuals who are engaged in a common object, we can go right along and make a common organization.

The President—A year ago I had some conference with President White, of Cornell College, with reference to an organization, or at least to be called, looking to an organization of gentlemen connected with the industrial and technological schools—scientific schools of the country. And some discussion was held also in our own State. Mr. Flagg and myself held some conversation on the matter; and a good deal of interest was felt and manifested and consulted at the time. But it has occurred to them that there is already in existence a National Convention, very broad in its character and aims, looking to the discussion of all questions relating to education in all their departments and interests whatever; a Convention that has just closed its annual session at St. Louis, and which is willing to admit as many additional sections, I suppose, as are necessary to organize under it, to meet the special points and interests of any class of educators. That Convention, very many of the men connected with the institutions of learning, will want to attend, as several gentlemen present have come, perhaps, to this Convention. If an organization is made of the industrial institutions, for the discussion of all questions relating to industrial education, or the management of those institutions, I do not know why it could not be made there, and save us the trifling expenses and the time involved in making two or three annual trips; and thus the gentlemen who hold middle ground between the two associations, would feel that they would leave that and come and attend this. It seems to me that this form of organization is needed that is composed of all the men interested in agricultural education, where we can discuss when we meet, as we discuss here, all these questions. But, on the other hand, the specific object for which this Convention is called, is a proper object, and a sufficient object probably for an organization by itself. I know that the experimental stations in Europe have an annual meeting of all the experimenters and chemists—those interested, and the rest of the institution is not represented, nor are its interests represented. They meet in the annual Convention to report upon their experiments, and to discuss conditions of experimentation, and to arrange for experiments; and they meet for that purpose alone, and it is a matter which fully occupies their time and attention. The difficulty in an organization which should embrace all the interests that are represented in an industrial institution, would be this: that we would be as we are now—crowded for time. Some of us are interested in all the questions concerning these institutions, and they press upon us; they are practical questions—they are meeting us in the face as soon as we get at home. We have got to battle our way through with them some way or other, and with that light or information, and with that comparison of views and relation of experience; and we cannot have these unless sufficient time could be given.

Now, it remains with the Convention, it seems to me, to determine whether the organization that is proposed to be made, should be an organization like that of the European, for discussion for experiments, reporting experiments, and arranging experiments; or whether it shall be a Convention of educators in these schools who will meet to discuss the general management of schools, experiments included. I think it will strike you at once as a practical difficulty with the experiments themselves constituting so leading an interest, whether that object itself would not call us together, and when we get together we could not discuss the other questions.

Mr. Flagg—I wish to ask for information, in order to bring out another fact, to what extent our educators from the agricultural colleges find that the questions they desire to consider, are considered in the National Convention of Education.

The Chairman—My impression is, that they have but little place there; that the discussions do not come upon our ground except incidentally; and that our topics at present have no very warm welcome in that Convention; and that there is a radical divergence of views between us and the leading men who are leading this National Educational Convention. And so as between the two, not feeling able to go to both, I came to this, as I shall probably do in every case.

Mr. Welch—I harmonize with the views expressed generally, with regard to the object that such a Convention as this could react if it should become permanent. I do not fall into the idea of making this Association that is to be, a branch of a National Association of Education. The questions that we want to discuss, it seems to me, are peculiar, and arise from the newness of the enterprise. These immensely important subjects that are discussed by the convention of teachers—the National Convention—have been before them for years and years. Most of us have reached our conclusions with regard to them. But with these new institutions we are facing some new problems that are intensely interesting, and that are portentious in their importance. Hence we might be trammeled by any connection of the National Association. At any rate, our attention would be more or less distracted by the multiplicity of subjects that are discussed by that body.

And then again, it might not be convenient for us to meet at the same place that they meet. And for my own part, I have not time for attending more than one or two conventions in a year. These are reasons, however, which may not appeal to most of you.

What I want to know is not whether languages are more efficient in giving general mental discipline than science; not how to conduct primary education, or to get at the exact value of object lessons, or how to teach geography; but I want particularly to know how to manage in the solution of the new problems that we have to face the moment we organize an industrial institution, as to the admission of the sexes; as to the labor question; as to the exact relation to the sciences and their practice in the field, and as to the new problems that, in the organization of these new institutions, come before us in regard to college government. Such things I come to get light on. The old subjects that have been discussed, from time immemorial, and which you and I have hammered away at for twenty-five years, I have laid aside.

Now, there is another point that suggested itself to me this moment. For my part, I am sure that if we, who are present here from our institutions, give our assent to this Convention, it will be heartily acquiesced in by those we left at home. And though we were not actually elected as delegates to this Convention, yet we are considered as representing these institutions, and institutions will be bound by our actions; and I am confident that will be the case with all the faculties of the new industrial colleges that are not present in the Convention. And I believe, sir, that this meeting can reach, or leave matters in such a hape that we shall become a permanent organization, with definite objects; one of which shall be experimentation; and another, the course of study best adapted to accomplish our purposes in the new organization, and the manual labor, etc., etc. I don't want any one question, or any one specific individual purpose, however important, to absorb the energies of the association; but I want it to gather within its compass all the important topics that must occupy the attention of men who have these institutions in their charge.

Mr. Denison—The remarks made by President Welch, in reference to representing the Institution of Iowa—the fact that the faculty of that Institution, and probably that that Board of Regents, will approve what is here done—will also apply to the Institutions that we represent. The Secretary of our Board is present, and I presume that any determination of this Assembly, in reference to any permanent organization, will be approved by them.

I wish, however, to say that while the objects which we aim at are distinct and separate from the objects at which the National Teachers' Association aim, it is true that we hold a relation to that Association. We are American citizens. I believe that it is true that an officer of the government to which we stand related, is recognized as one of the important officers in that Institution. I refer to Mr. Eaton, the Commissioner of the Bureau of Education, and who, by direction of the government, has special oversight of the endowment granted to us, and of what we are doing in relation to that endowment.

I do not know but it may be best for us at first to be distinct from them until we require an organization that shall be an individuality; until we to some extent initiate a progress more or less in the working out of the special problems, committed to our trust. But I believe the day may come, and perhaps will, when this organization will be considered a section of the National Teachers' Association; that association allowing us the utmost freedom in the expression of our opinions, and in the working out of the special problems committed to our care.

Mr. Murtfeldt—The call issued for this Convention is sufficiently broad to admit a person of my standing, to this Convention, I believe. I hope that when an organization of this kind is completed that the lines will be very clearly defined. Now we have a particular Institution in the State of Missouri that is a little different from most of the States by which it is surrounded; and a very few minutes will suffice to explain just how that is. Our industrial university, or the University of the State of Missouri, has twenty-two curators; and the State Board of Agriculture is composed of twelve persons that are self-perpetuating — elected by the presidents of the agricultural societies throughout the State. The Governor and the State Superintendent of Public Schools, are ex-officio members of the State Board of Agriculture; and, by the organic law of the State, fixing the location of the Industrial University of Missouri at Columbia, there are seven of the State Board of Agriculture incorporated in the State Board of Curators of that Institution. You will therefore see that these curators have, in the managing of the Institution, something more than the mere care of the fund. You can readily see the intimate connection that there is between the State Board of Agriculture, as such, and the Board of Curators, and the Institution itself.

As I stated before, I think that the call was broad enough to admit me to a seat upon this floor, at this time, and I want this Convention to clearly define the line as to who shall be entitled to a seat upon this floor, and who shall not. If you say that no one but the professors or members of the faculties of the several universities, in the United States, shall be entitled to seats, all right. If you are going to make it broad enough to admit the Presidents or the Secretaries of the several Agricultural Societies, or the State Board of Agriculture to seats, it is all right also. Only do this for me: clearly define what you want.

Mr. Parker—I think the questions coming before the Association that is contemplated, are peculiar, and in some degree differing from those that are discussed at the National Association; and it appears to me that it is very essential that we have such an association.

The Regents of the Industrial College, (or the curators, as they are called in Missouri) in Kansas, meet frequently, and have long and patient discussions, sitting some times all night; going into session at half-past six in the evening, and not adjourning until half-past six in the morning. You can judge, by that, something of the interest that is taken. The questions are new, and of the greatest importance, just how to launch forth these new institutions. We have to lay the track before we can run the engine; every mile of the track must be laid first. The old institutions—the former organizations of colleges—know what they are going to do and what they are aiming at; but we have to combine labor in the new sense with the new education, and the form of education is to be determined.

Now, as a Regent, as one feeling this responsibility resting upon me, to know how to advance our own institution, it is a great privilege to come into an association of those similarly situated, and who have had larger experience, and who can give information upon those points that we need information upon, and I feel as though it would be just the thing in years to come, if we can come together and compare our work, and see what progress we have made; and so go on together with the experience of each, and all inuring to the benefit of all, so that we shall be able to judge from a larger induction.

Mr. Folwell—I sympathize very much with those gentlemen who favor the union with the National Educational Convention; as I favor it for the same reason, as a matter of economy to myself, I shall probably attend the meetings of that association, and should want, also, to come here; and would not like to take my choice. There is some hostility between the persons who compose that association, and those of us who are likely to meet here; but I think that is not necessary any more than there is a necessary hostility between the scientific and classical system which we have discussed. We have brought the matter down until it is merely a question of methods and means. We are substantially agreed; and I do not believe that we should lose in uniting with the National Educational Convention, or that we should find ourselves out of place there, or out of sympathy with the men we should meet there. We can go on with these very troublesome questions, and I cheerfully agree with the last gentleman that they are some of them troublesome questions. There are, perhaps, some in that convention who are jealous and doubtful of this new experiment that we are making. I would like to discuss these matters right in the presence of the backers of the old education.

I would add one further word about the organization to be formed here. I must confess that I did not so carefully read the call as I ought to have done; otherwise my own action in the case, as a member of that committee, might have been somewhat different.

I will say, also, that I favor a broader organization; one which will include experimentation and a great many other things; still, at the same time, I would not throw anything in the way of gentlemen who may wish to form an organization simply for that one purpose. At the same time, my advice to them and to all would be, that we should make the organization much broader than that.

The President—I suggested joining the National Association, not because I felt myself attracted that way, but I was aware that several of our institutions are affiliating more nearly with institutions represented there than the rest of us. Some of us are seedlings, and some of us were grafted on to old institutions. The Wisconsin school was grafted on to the university; the same is true of Minnesota, and perhaps in one or two other States; and the Sheffield Scientific School is intimately related as a branch of Yale College, and the new school of Harvard will be united with the Harvard College. As to the School of Technology, it is singularly associated, I think. I don't know how that is; but the Scientific School there, at any rate, is a branch. And I suppose that I threw out the suggestion simply because it might aid myself and the other officers of the association to act in the matter of permanent organization, to have the point drawn out in discussion. It is possible it might be well for the Convention to go on a missionary up to the old National Association.

Mr. Folwell—There seems to be an understanding that there is a concession on our part, that we have interests that are adverse to other educators. We have no such interests.

The President—I do not understand it that way, nor do I think the others understand it so.

Mr. McAffee—It seems to me there is a very great call for an organization in the direction of the call that we have heard read here, and that we all have seen before. There is certainly a special call for an organization in the direction of unity of experiment among the institutions. There are, no doubt, great interests involved in respect to the institutions, aside from that; but here is the special matter—the matter of experimentation. We are seeking for knowledge by experiment; we are trying to make agriculture, which is accumulative science now, accumulation of distinct facts. To organize these facts, which we can do faster and better by these experiments, it seems to me eminently proper, and eminently fit that we should organize those who are connected in any way, remote or direct, with those experiments—organize them in such a way that there may be a community of the work. I think it is possible; and I think we can come together on that subject, and after that question has been decided, we can organize an association for experiment there. Then, if it should become necessary to go further and organize for the purpose of meeting to discuss questions of the land grant, school management, etc., it might be well to include that in the organization. There is this one point that seems to have peculiar force and a peculiar meaning to my mind, perhaps because I am intimately connected with experiments—that there should be an organization in the direction of a community of experiments.

Mr. Flagg—I assent very heartily to the remarks of the gentleman who has just sat down. I think as he does, that while the primary object of this organization should be the accumulation of agricultural knowledge particularly, that it ought to be the feeling of us who are engaged more particularly in that work, and that we very earnestly desire to have the co-operation and aid and suggestions of men who are generally interested workers, as the Presidents of our colleges, founded on the national grant, all are.

In making this call, and sending it out, for instance, we found a great many cases of this kind where a university—as is the case I believe with the one in Minnesota—had not yet been sufficiently developed to have any representative of the peculiar agricultural interest n it. There are a good many cases of that kind. Now, where no such organization exists with these colleges, we still want their co-operation and aid; and if we can furnish them any advice ourselves, and give them any suggestions to suit their peculiar wants, it is eminently proper that we should do so; and if they can give us any suggestions in regard to their experience, it is eminently proper that we should have them.

It seems to me that practically we ought to make an organization which should be broad enough to interest all who are engaged in the general work. I think the Secretaries of our State Agricultural Societies, for instance, are men that we particularly wish to get in. They are certainly as much interested as any one here can be in the dissemination of agricultural knowledge. That is true of our Presidents of these various Institutions founded on the national grant. It is true of our technological Professors, I presume, quite generally; and I should favor, myself, certainly, a tolerably broad organization of all interested. There are not so many of them, as yet, that they would stand in one another's way. The time may come when it will be necessary to go either into separate sections in the same convention, or else to form a separate convention of experimenters. That time has certainly not yet arrived, and in order to bring this matter up, I would ask leave to introduce the following resolution:

Resolved, That the object of the organization to be formed by this meeting shall be the advancement of the interests of industrial education, by assembling together persons engaged in agricultural and mechanical experiments and education, and with a view of disseminating industrial knowledge.

I do not know whether that will cover the views of others at this meeting or not.

Mr. Miles—I think, myself, it would be desirable to have an organization of the officers of the different industrial institutions, for the purpose of discussing methods of instruction, the labor question, the endowment question, and all of these other questions. That I give as my own opinion. I have no right to represent the Michigan Agricultural College on that subject, but I come here as a private individual, and do not know what the wishes of the college would be as regards this organization. I have no doubt, however, that they would co-operate with the other institutions, and be glad to in this general organization.

I would be very glad, however, to have a separate organization for the purpose of promoting experimentation, for this reason: that it seems to me that if connected with any other interest, the time will be so occupied by delegates at the convention, that we cannot get the full benefit of consultation in regard to the matter of experimentation.

Now this matter of conducting experiments for the promotion of the science of agriculture is valuable, and we can only make progress in it by discussion of the subject in detail.

It seems to me that we can decide upon a certain number of experiments that we can try in common; then we can come here a year from now, with the results of those experiments, to compare notes, and endeavor by discussion to get at the cause of those results. We shall then be much better fitted for the trial of experiments in the future.

It seems to me that this organization, for the promotion of experiments, for the purpose of improvement in the art and science of agriculture, would not stand in the way of this other organization, which is quite desirable—perhaps, equally desirable.

Mr. Parker—It seems to me, that while that question of experimentation is of great importance, and it would be an excellent plan for the Superintendents of the farm and the Professors of agriculture to meet and compare notes; it is of equal, and perhaps greater importance, that the officers of the colleges, who have in charge this general department, and have the appointment of these Professors of Agriculture, and Farm Superintendents, and who need to know if they are working upon the right plans—that those who represent the people in the control of these institutions should have their place of organization and of consultation, because they need to have a general view of the whole subject. It appears to me that it would be extremely beneficial if they could all come together, in one convention, where they could compare the work that they have done. I feel that we need just such an organization.

Professor Detmers—I think it is highly necessary that those who are considered practical men, should come to this meeting and find out that they are, after all, to some extent, scientific men themselves; and which is very important, particularly, that we should avail ourselves of the opportunity afforded by these meetings, to disseminate, if we can, among as large an audience as possible, correct views as to agricultural education. In the management of our colleges we have to combat a prejudice; and the most we can desire, is to have a very large audience at those meetings. We want not only States, but counties, represented.

Mr. Miles—It seems to me almost impossible for any one to discuss this subject of experimentation, unless they are actually engaged in it; they cannot see the force of the arguments; they do not understand them. It seems to me it would be better to limit it to those who are engaged in experimenting.

Mr. Denison—Would not the objection be met by making the experimenters a section? They can be sections of the meeting, and discuss the matter to the fullest possible extent.

Mr. Miles—There is the difficulty. This would be included in a larger organization, and be subject, to a certain extent, to that wider organization. The difficulty that the gentlemen are trying to obviate, can be got over with in this way: Make the larger organization an independent one; and then arrange to have the meetings at the same time and place. I think the work of the Experimental Convention could be carried on more successfully and more satisfactorily, if it was placed entirely in their control.

Mr. Hamilton—I do not know whether I understand the intention of Dr. Miles in regard to this matter; whether he includes in experimenters, all persons who are interested in experiments, directly and indirectly; that is, the Professors of Agriculture, who are carrying on these experiments, and the Presidents of colleges who control them. Now, it seems to me very necessary that if the Professors of Agriculture meet together, and wish to do any effective work, in which they can engage their own colleges, they will have to have some other representative from the colleges, who have general control of the interests of their colleges. They will have to be in every convention at which these experimenters meet. The experimenters are not acting independently of these colleges; they are a part of these colleges—but a department; and the funds that they get for the purpose of carrying on their experiments, and all the assistance they receive, they receive from these colleges; and the Presidents of these colleges should be consulted in regard to any enterprise which they enter upon. It seems to me that our convention could be broad enough, at least, to include the Presidents of our colleges, or some representative from the Board of Trustees—let the President be the representative, if you will; the Secretary of our State Agricultural Society, the Commissioner of Agriculture, and other persons who are interested in this thing. And by interest, I mean those who are actual experimenters—carrying them on with a view to develop some theory—and who are willing to co-operate in this system of experiments which we intend to carry out.

Professor Hilgard—I think the difficulty raised by Dr. Miles, as to our organization becoming too numerous, can be settled upon a practical basis. The American Association for the Advancement of Science —I beg pardon for referring to it—but I think it has a good plan for obviating such a difficulty; which is by dividing the different subjects into sections and sub-sections; we have had sub-sections whenever it became necessary. Sections A and B are generally found to be quite sufficient, however, for the transaction of business; and I am sure that a good many of us who have had discussions in those sections, instead of complaining of having too large an audience, have been troubled with the opposite difficulty, that is, too small an audience. The detailing of experiments is a matter in which people will not be very generally interested. The result of the experiments is what they want and not the details. And I think that the section of the Association by which a discussion of this subject is particularly committed, would not be likely to be burdened with too large an audience.

Mr. Miles—It seems to me that if we should carry out the suggestion that has been offered here that we should get the Presidents and officers of our colleges into the business, that they would be glad to throw the load off from their shoulders. Now if it is supposed that these officers are to follow each squad of men around to see what they are doing, and where they go to, suppose you have your geologists —are they to go around and tend to all this work, for the purpose of promoting the study of geology—for mutual improvement? Must you call in the Presidents of the colleges, to stand over there and see what they are doing all the while? There you have other Professors, and the Engineer; are they too to join in this work for the purpose of mutual improvement? It seems to me that the Presidents of these colleges and these other officers would be glad to be relieved of it.

If this experimental organization is made a section of the other organization, we shall then need sub-sections, and we will have a very complex arrangement. It would necessitate sub-sections for chemistry, mechanics, and experiments in physics, and that soon. It seems to me the wider you make the organization, the more complicated it is going to be.

Mr. McAffee—I have frequently seen where an object that has been held in view has been defeated by widening that object out and extending it in too many channels. We used to think that an agricultural society embraced all husbandry. How is it? We have found that it is necessary that there should be sub-divisions in husbandry and that different interests should be cared for by different independent associations. You find that your breeders find an association with profit to themselves and with profit to the country. You find that horticulturists have organized an association, independent of agriculture, which is doing a great and good work, and people in general will look carefully at this system of experimentation for the purpose of elementary knowledge, science with agriculture, and will find that it is so vast, and so grand, that they will unite with it and make it a broad and a great organization. It is necessary that the subject should be carefully considered in the convention. It is necessary to take all the time and all the attention that the members of such a convention can devote to it. It is a larger subject, perhaps, than many consider it to be, until they have actually got into it and found what it is enlarging to. And I would therefore insist that there is enough to do for an organization which has this specifically for its object; there is enough to do in the way of organization and experimentation, in these different institutions organized under the land grant, to carry on the organization and make it very interesting and very profitable in a very scientific point of view.

There is another question that I wish to call your attention to. The manner in which this convention has been called, and the words of the call, have not been the means of bringing together representatives of the governing powers—the trustee power which governs these land grant institutions. It has brought together the representatives of the Presidents of the colleges, representatives from the chairs of agriculture, and it has brought some others—some experimental farmers, etc. Now it seems to me eminently unfit and improper that this convention should take the responsibility of organizing a body such as has been spoken of here, which would have under consideration all things connected with this new education. Such a body is needed; such a body is eminently proper and eminently necessary in the United States. Such an organization has never been formed and it is a wonder to me that it has not been formed; but that this Convention could take steps to form it, it seems to me hardly possible under the call. We can take steps here which are eminently proper to form an organization such as I have spoken of, for the purpose of organizing experiments.

Mr. Welch—I perceive that we have departed largely from the spirit of this call, in the discussion of the various interests outside of experimental work. I would ask our friends who would advocate the organization of a society for experimenting, whether that is not ungermane to the purpose to which we have met; and whether we have not wandered from their intentions in getting up the Convention.

Mr. Miles—I would make a very brief expression in regard to the origin of this Convention. In the conversation that occurred between myself and Mr. Flagg at Lansing, we talked of the necessity of getting together those interested in this matter. Several of the colleges were mentioned; and I said that the Presidents should be written to, where we did not know any one interested in experiments. We did not wish to limit the matter very closely at the present meeting.

I have been very glad that the discussions have taken this wide range. I am glad we have not cut down to the strict limits of that call; but for organization it seems to me desirable to limit it somewhat.

Mr. Welch—I certainly am in hearty sympathy with the object that Professor Miles advocates, and I appreciate the immense importance of a series of experiments conducted by the various colleges in common. But I confess that I did not come here expecting that an association would be formed. I am not selfish about it; but if it would reckon the Presidents all out, as certainly this proposed association would, because it has been expressed definitely. If I am wrong, Professor Miles can correct me.

Mr. Miles—I did not assume to reckon the Presidents out, or anybody out, but simply to bring in those who are engaged in experimenting, so that all would engage in it in common. We do not want to rule out any class of men. We would like to have the Presidents here every time.

Mr. Welch—I must agree with some gentleman who has inquired whether the proposed object could not be well reached by sections. I do not think that the parent society, which should have such a section, would trammel it in the least; because it would have no other control over it than to fix the time and place of its meeting. Then the experimenters in that section would have the whole weight of influence, and the whole sympathy of their co-workers in the colleges; whereas they would lack, it seems to me, that influence and sympathy, and would lack the help that comes from general attendance.

One of the Professors has said that only those who are actually engaged in experimentations, can take part in the exercises of a meeting of experimenters. I cannot think that that is exactly and strictly true; but I know there is a good deal of truth in it; because, though I do not myself take part in actual experimentation, I keep myself posted on the experiments that are going on to a large extent upon our own farm. Now I am willing, so far as I am concerned, that this subject of experimentation should be the prominent subject to be considered in these meetings; but there are a great many exceedingly intricate and troublesome questions, in this new organization, to permit one single one, though it is of paramount importance even, to engage all the attention of the Association.

One thing about what the gentleman says as to the representation of Trustees here. The Presidents of these Agricultural Colleges, so far as they are here, are Presidents of the Boards of Trustees, I think. If that is not entirely true, it is true in most cases.

Mr. Hamilton—He is not of our Board.

Mr. Welch—He is not?

Mr. Hamilton—No sir.

Mr. Welch—The Presidents generally represent the Trustees; and if they are not on the Board of Trustees, as of our Board, they are the preceding officers.

Mr. Murtfeldt—It is not so in Missouri.

Mr. Welch—It is not so there?

Mr. Murtfeldt—No sir.

Mr. Welch—I simply spoke of cases like my own, from which I came as an individual.

Mr. Flagg—I would like to say one or two words more in reference to this resolution. I have offered it in order to arrive at some basis of agreement. I shall be entirely willing, myself, to take up either theory; the one that Dr. Miles is in favor of, or the other one.

I think there is a good deal of force in what Dr. Miles says in reference to the benefits which would be gained from concentration on one point. At the same time, recognizing the fact that we are but few as yet, we speak of ourselves now as interested in Agricultural Colleges and agricultural experimenters—men who are in the general interests of agriculture. We are so few as yet that I do not see any great disadvantage that will arise from our all coming together and consulting. I do not know what the experience of other men may have been, but my observation is that when we get the most we can together who are interested on all points—I do not care how broad you make it in reference to agiculture—that we still lack very much of intelligent appreciation, understanding and knowledge of the conditions we are laboring under. I do not see any present danger of our being overcome with a redundance of wisdom. And I think the more we can get in of these men, the better off we will be.

—30

Mr. Roberts—The matter of experiments President Welch and I have been engaged in a good deal this summer; and I conceive that there is two much stress laid upon experiments as a group, or as bringing the result of the different experiments together for comparison. For instance, I find it very difficult in experimenting on our farm. Let me go back a little. Having lived in Henry county, I found that the climate was wonderfully different. It is so in our own State with experiments, frequently. The experiments of crops that we tried would not produce the same results as in my own county at home. And now I conceive that on our farm there, the soil is so very much different from the soil of Illinois there, where the college is situated—I mean taking the two farms, not the two different States in general—the soil of them is so different, and that soil is so very much different from the soil of Maine—the climate, and all things considered, will have such a different effect—that you do not learn much, you do not gain much.

Now the experiments that are made on our farm there, will not apply to the whole State; much less to Illinois and Maine. And so, to a very great extent, each college has got to be an experimental college for its own State, or as much of it as possible.

Now I find one great difficulty. I take a field and lay it off in plats for wheat, of two acres each. I find great difficulty in getting those different plats to operate alike, so that the results will amount to anything. One part of the field will do much better than the other part.

There are certain things that can be learned, but it is my opinion that those experiments cannot be relied upon to give us a very wide range of certain knowledge.

Besides this, there are a great many other things that may exercise an influence to make the crops different. There is the amount of the rainfall, the backwardness or forwardness of the spring, the temperature, etc. A storm this year spoiled our oatfield, and knocked our experiments almost all to pieces; blew the oats all over. So we have all these things to contend with. And it seems to me that it would be doing a wonderful work, if we could succeed in applying our experiments to our own States. Our agricultural papers, it seems to me, are the best, and perhaps the only means by which we can reach the end we want to reach. Professor Miles and I can be in weekly communication as to any experiments we are carrying on.

Mr. Miles—The object of this resolution was to call out discussion, and get an expression of opinion. I now move to lay the resolution upon the table. The effect of this will be to leave the matter for a committee of the officers of the society to consult and plan.

I must say, that, although I expressed my own opinion very positively and decidedly, yet I have no very strong preference either way in regard to this matter. I expressed my opinion strongly for the purpose of bringing out discussion. I have no strong preference either way. Therefore, I move to lay this resolution upon the table. That will leave the officers of the society free to consult one another, and act as for the best interests of the whole.

The motion was adopted.

Mr. McAffee—In what position does that leave the matter for consideration?

The President—It leaves it where the report left it—in the hands of the officers, who are made an Executive Committee, for the purpose of making an organization.

Mr. Flagg, as Chairman of the Committee on Experiments, submitted a report.

Mr. Flagg—I would state, in explanation of this report, which I now make, that we could get but a portion of our committee together; but we got as many together as we could, and with what unanimity we could. In case there should be any fault found with what is reported, I hope that members of the Convention will feel entirely free to differ from us. The report is as follows:

REPORT OF COMMITTEE ON EXPERIMENTS.

The Committee have taken the subject assigned them under consideration, so far as possible in the press of other business, and would report as follows:

The field of experiment in its widest sense, in relation to our colleges founded on the national grant, is large and crowded with work. We want—

I. Meteorological observations.
   1. Scientific, after the Smithsonian plan.
   2. Practical, like those of the Signal Sense.

II. Mechanical experiments.
   1. In strength of materialts.
   2. In native powers.
   3. In trials of agricultural and other industrial implements.

III. Experiments in physics, especially in the effects of different degrees of light, heat and electricity and moisture on vegetable life.

IV. Experiments in industrial chemistry, such as analysis of soils, of clays and other earths used in the arts; of coal, lime, and building rocks, minerals, manures, plants and their products, and of animal products.

V. Experiments and observations in mining and metallurgy.

VI. Experiments with soils in their drainage, pulverization by different implements and their compaction; the application of different fertilizers; the variation of soils in adjoining plots, then continuous cropping without manure and other irrigation.

VII. Experiments in special culture with different varieties of grasses, grains, roots, plants, trees, etc., with variations in the time, distance and depth of planting, modes of cultivation, harvesting, manuring, modes of propagation; and with insects and diseases affecting plants.

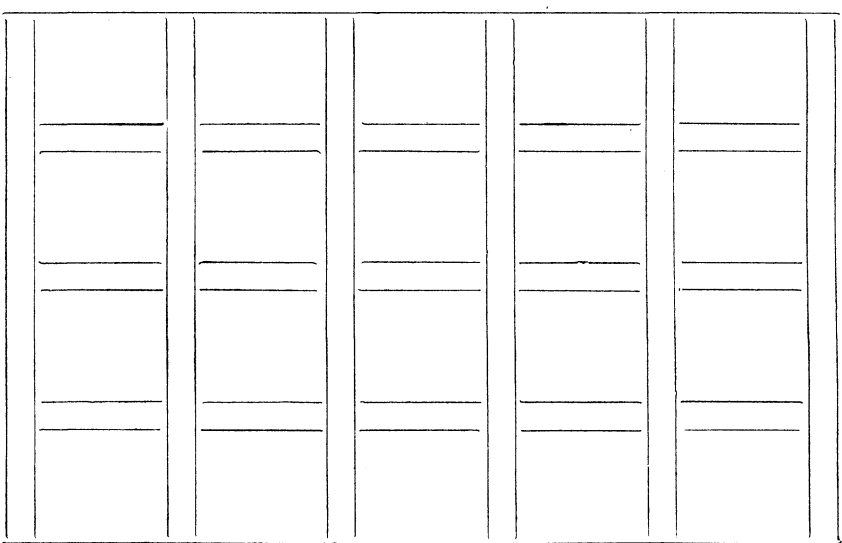
VIII. Experiments in the breeding and fattening of domestic animals, comparing difference, breeds and species, then diseases, etc.

We enumerate these to give those who have not given the subject special attention, some idea of the immensity of the labor to be performed. To a large extent, of course, these experiments must be tried by each State, for its own people, according to its peculiar wants and capabilities. To a considerable extent, however, experiments may be tried in common or repeated all over the country. Especially this is true of the culture of certain widely grown plants, such as corn, wheat and other cereals.

Accordingly, we submit herewith two or three simple experiments of primary importance and inexpensive character, which we hope to have begun next year at a large number of our agricultural colleges, and prosecuted to final results.

EXPERIMENT No. 1.—1 Acre Plats, 2 Rods by 4—4 feet between Plats.

Experiment to Test the Variation of Soil on Adjacent Plats.



The plats should be situated on a soil as uniform throughout as possible, and which has not been manured, at least for a number of years. If possible, the soil should be tile-drained thoroughly. The aspect of the whole should be the same, and the slope uniform if possible. In case of lack of tile-drainage, the soil should be naturally well drained; and where there is lack of uniformity in the slope, the differences between different plats should be carefully noted. A separate analysis is desirable of the soils on each plat.

The plats should be plowed and otherwise cultivated uniformly at the same depths, at the same time and under the same conditions.

These plats should be planted to corn in 1872, in drills, at such distance between rows as each experimenter may prefer, one stalk in a place. The same number of plants should be grown upon each plat.

No manure should be applied in 1872, and the experiment should be repeated in 1873 and 1874, also without the addition of manures.

The corn should be cut up at a proper stage of ripeness, weighed green, each plat separately, and cured in small stooks, and when thoroughly dried, should be weighed again, stalks and all. The ears should then be husked and weighed separately first, when first husked, and again when the cobs seem thoroughly dried. The pounds each of soft and hard corn should be noted.

The time occupied in planting, in going through each process of cultivation, harvesting, etc., should be accurately noted and performed, each in the dry part of the same day.

This experiment is intended to ascertain the relative differences in the natural productiveness of adjacent plats, with the view of thereafter applying manures to the soils thus proved.

EXPERIMENT No. 2.—Planting of Corn in Hills and Drills.

The fields planted in hills and drills should consist of a little more than one acre each, divided as in the preceding experiment, into twenty plats, each four by two rods. Each of these fields should be as nearly as possible identical in soil, aspect and slope. In one field the corn should be planted in hills, in the other in drills, at the same distance apart between rows, with the stalks placed equi-distant in the rows, so that the number of plants to the square rod shall be the same in each case. The different fields should receive the same amount of cultivation, and the crops should be cut up and weighed, the ears weighed separately, and the amount of soft and hard corn compared in either case, as in Experiment No. 1.

EXPERIMENT No. 3.—Uniform Application of Manures on Adjacent Plats.

The object of this experiment is to test the variation of soils on adjoining plats, both manured and unmanured, the conditions being more complex than in the first experiment.

Great care should be taken to obtain as uniform conditions of soil and of the manures applied to it as possible.

The plats should be planted with corn, and cultivated and harvested as prescribed in experiment No. 1.

We recommend, as in the previous cases, the choice of uniform fields under uniform conditions, divided into plats separated by strips of four feet. The same weight of the same manure should be applied on adjoining diagonal plats, leaving the alternate plats without manure for purposes of comparison—thus:

Manure.		Manure.	
	Manure.		Manure.
Manure.		Manure.	
	Manure.		Manure.
Manure.		Manure.	

Mr. McAffee—I do not understand one point there, Mr. Committee-man, that says the corn shall be planted at such distances in the drill as decided best by each party.

Mr. Flagg—Such distances between rows and in drills both—as the particular experimenters might desire.

Mr. McAffee—Then there is another point. Is it provided that all experimenters that are trying that experiment, shall use the same variety of corn or such as they choose? I would remark, if that is the case, that there are some varieties of corn which may vary in small plats, and do not stand so uniform in the field as other varieties, and I should wish to have one certain variety, or some certain variety fixed upon, that are more constant in their characteristics than some are.

Mr. Flagg—I will ask leave to explain here. As the gentleman will perceive, the point is this: to get at a field which shall either be uniform in its natural productiveness, or if it be not uniform, to notice the differences, plat by plat, so that we can apply the manure to it after we have got through with our first series of experiments, and see pretty definitely what the effect of that manure will be. If you should have one plat, or one-twentieth of an acre, which would produce one bushel of corn more per year than the one adjoining it, and were to put on your manure before you had ascertained that fact, your experiment as to the manures, or comparison of manures, would be entirely vitiated, or partially so. The object, therefore, is to plant, year after year, as far as may be thought best, these different plats without manure, and ascertain their relative productiveness. If they prove equal in productiveness, all well and good, or if they do not prove equal in productiveness, we want to know it, and to what extent they are unequal. Having ascertained that fact, your committee then suppose we are ready to go on and apply manure, and by the results to decide to what extent it has been affected by those manures.

The President—In these preliminary experiments, you do not design any comparison between the plats of one institution and those of another.

Mr. Flagg—We thought not. I would call the attention of the gentleman from Wisconsin to this fact, that while it may be desirable on many accounts to use certain particular varieties of corn over the whole extent of country over which we hope to range, yet it would be practically impossible, because the corn growing in different latitudes varies so much in its characteristics and its wants.

The comparison that we wish to make is simply to ascertain the fact in the first place, whether this variation of soils adjoining one another is found throughout the country that we have under experiment, and whether they all vary in this way.

Mr. Miles—It makes no difference in regard to the distance apart, provided it is uniform. It matters not about the variety of corn. What might be a certain variety in one State might be different in another State. Let each one select the kind that will grow best. We can ascertain then whether the soils in one locality are more local to those varieties than those in other localities.

Mr. Welch—I move we now adjourn to half-past one o'clock.

The motion was adopted, and the Convention adjourned.

AFTERNOON SESSION.

The Convention was called to order at two o'clock P. M., by Vice-President Miles.

The President *pro tem*—The question before the Convention is the adoption of the report of the Committee on Experiments.

Mr. Flagg—The report, I will explain, is given, but not in sufficient detail as far as the last two experiments are concerned.

The Committee recommended as experiment number two, the planting of corn in hills and drills; and specifying details, which they will add to hereafter.

Experiment number three is in relation to the uniform application of manures on adjacent plats; which needs to be set forth in detail also before it is finally acted upon. Otherwise, the report of the committee is complete.

I would add, that should this report be adopted, I should then move the appointment of a sub-committee to perfect details, and to correspond, and as far as the colleges will co-operate, to carry it out—to endeavor to have these experiments tried in as many institutions as possible during the coming year.

Mr. Daniels —I move the adoption of the report.

The President, *pro tem*—That is the question that is before the Convention.

The report was adopted.

Mr. Flagg—In order to close up this business, I will move the appointment of a sub-committee, whose duty it shall be to perfect the details of this report, and to correspond with the various agricultural colleges, and with other persons that may be deemed fit, and endeavor to secure the carrying out of these experiments in the various parts of the country.

Mr. Hamilton—Does it not seem premature for us to appoint a committee of this sort, before we have a permanent organization? Will it not be well for us to wait until we have agreed upon some form of organization, before presenting a report like this for the action of all the colleges? It might modify their action in some respect.

The President—I would state for the information of the gentlemen, that the matter of permanent organization is already disposed of. This particular business is now before the present Convention. The matter of permanent organization was referred to a committee consisting of the officers of the present Convention, for them to correspond and perfect it. If we await their action, we will not get any business done.

Mr. Hamilton—I am very anxious it should be accomplished before we leave; but I do not understand the present situation of things.

Mr. Flagg—I would add in explanation, that the very reason of my making this motion, was the fact that we have no permanent organization; that is, a continuous one fully officered; and I wanted to secure immediate action in obtaining these experiments, although our organization is not perfected. Otherwise it would properly go into the hands of the Executive Committee.

The motion was adopted.

Mr. Daniels—I move that Mr. Flagg, Mr. Miles and Mr. McAffee, constitute that committee.

Mr. Flagg—I hope I will be excused from serving on that committee, in order to have some gentleman from further East put on in my place. I think it would be well to have these gentlemen distributed as much as possible. I would nominate Mr. Hamilton.

Mr. Hamilton—I am very certain that Mr. Flagg will fill that position much better than I could, although I feel very much interested in it; but he has had probably more experience than I have, in this matter. I am willing, however, to act on the committee if it is thought desirable, but I would not like to take the place of so good a man as Mr. Flagg.

Mr. Flagg—I would move an addition of two members to the committee.

The Chairman—That would make it too cumbersome.

Mr. Flagg—I should like to have a representation from Pennsylvania. I hope Mr. Hamilton will consent to act.

Mr. Hamilton—I think if there were probably more members on the committee, it would enable us to act probably more intelligently than when we are so few. It might be better to have the experience of men in different sections of the country, so that gentlemen from the South, and those from the extreme North, can have a voice in this matter, it seems to me, to take into account and regulate the characteristics of their countries. I will make a motion that two persons be added to this committee, which shall consist of five instead of three.

The motion was adopted.

Mr. Flagg—I nominate Prof. Hamilton, of Pennsylvania.

Prof. Hamilton was elected.

Mr. Miles—I nominate Prof. Prentiss, of New York.

Prof. Prentiss—I would nominate Prof. Caldwell. He would probably be able to serve the committee much better than I would be able to do.

On motion, the Assembly adjourned to 7:30 this evening.

EVENING SESSION.

Met, pursuant to adjournment, at 7:30 P. M.

REPORT.

Mr. Flagg suggested that some action should be taken to remunerate the publishers of "The Prairie Farmer," who have secured a short-hand report of the proceedings of the Convention, at a considerable expense, either by ordering a large number of the papers containing the report, or by having the report printed in pamphlet form.

After discussion, on motion of Mr. Flagg, the matter was referred to a committee, consisting of the officers of the Society, with power to act.

Mr. Flagg was requested by the Convention to attend to the revision of the copy before publishing.

The order of business for the evening was then taken up, being

EXPERIMENTS AT THE PENNSYLVANIA AGRICULTURAL COLLEGE.

Mr. Hamilton—The Agricultural College of Pennsylvania, Mr. Chairman, was opened for students in 1859—among the first of the colleges of the country to throw open its doors for the admission of young men whose object in coming there was to get a better knowledge of the principles of agriculture. The gentlemen who conceived this idea had for a long time before been thinking of the matter, but it had not taken proper shape until about 1856, when the question was agitated as to the probability of the States being able to get land to endow colleges such as these. It was seven years after this time that these States did get the land, the first bill being defeated by Congress, as you know. The college began right in the woods. It was not, as the gentleman stated here the other day, in a state of nature; it was a sort of unnatural state. The ground upon which the college was built, and its farm, was full of roots—of what we call grubs in our country—of land that has been cut off repeatedly for timber and for ore furnaces; so that they had to go to work right in the woods. It cost us $25 an acre to clear our land. It was, in addition to that, very stony, and we had all these difficulties to contend against. The college started without an endowment. When the students first entered the college, about one-half of the building was up, but it was considered unadvisable to defer longer the opening of the college. Dr. Pugh was its first President. He, as you all know, was a gentleman eminently qualified for this position—for the position of President of an agricultural college. He had a peculiar knowledge; he had a special training for this business. He had gone to Europe and studied there. He had taken his degree of Doctor of Philosophy in Germany. He came to England and was conected with Lawes and Gilbert in their experiments. He was a first class chemist, an extraordinary man, versed in pretty much all of the sciences with which we are acquainted. He was not a literary man in the sense that we mean when we speak of a man who has an intimate acquaintance with the ancient languages, but he had an acquaintance with the modern languages, and was a very well educated man; and besides this he was what we call practical, that is, he had good common sense, and he knew how to apply it. I know that the term has become rather offensive here, but it expresses the idea. During his administration the college was filled with students. They turned a great many young men away. They took but the best young men, who seemed to have ability. They made a mistake, however, in putting their terms entirely too low—only $100 a year. This put the college in debt; it could not run at that rate. They hoped, with the great number of students and the amount of income that they would derive from them, to pay all their expenses.

The corner stone of this college was educated labor. Dr. Pugh objected, when he took charge of the college, to this principle of labor that the Trustees had impressed upon it. They told him that the labor question must go with this college; that it was the distinctive feature; that it was in this that they differed from other colleges, in making labor honorable and respectable, and they told Dr. Pugh plainly that if he did not wish to take the college on these terms, then somebody else would have to take it; that if there was any distinctive feature in their college, if they had any idea of what an agricultural college was, it was that labor must be connected with it. This labor was carried to a greater extent, probably, than in any other college in this land. The students did everything. When I say that I mean that they did everything. They went to the kitchen and did the cooking. They waited on the table; they washed the dishes. They did all the work that was done on the farm and in the garden, and in the nursery, in the workshops, in the college—cleaning out halls, cleaning out privies: all the work was done by the students. Each student was required to work. This was carried on during Dr. Pugh's administration, until about 1864. The college was successful up until about that time, when he died. I may say that about 1863, a good many of the students went to the war. This was its first stroke. The building was completed, and when it was completed it had a load of debt of some $80,000 upon it. This was in the shape of bonds, and the interest on these bonds had to be met. The students that left this college at that time did not come back. They got into the army and then came home and went into business. Dr. Pugh in the meantime died, and the college for almost a year was in a state bordering on chaos. The Professors of the college attended to the finances, and also to the administration of affairs. The students were discouraged to some extent by this want of organization.

At the beginning of the year 1865, Dr. Allen, of Philadelphia, who was formerly President of Girard College, was elected President—a very able man, and one eminently fitted for this position, a farmer himself and a thoroughly practical man. He brought a good number of students with him, but at the end of two years, owing to some difficulties which I will not explain, he was desirous, compelled by his circumstances, to leave the college; there was no inharmonious feeling between him and the officers of the college, however. It was entirely a matter of his private affairs. This was unfortunate; students went with him. General Fraser then came in. Dr. Allen, I may say, tried to modify this labor system. He told the Trustees that if they would do away with this labor system he would fill the college inside of two years; and an effort was made in the Faculty to do away with this system of labor, and it was abolished to a great extent. The students at that time were not required to do these offices in the kitchen, and dining-room, and to work about the buildings so much. Dr. Allen left us and the college began to deline.

Gen. Fraser, who was at Canonsburg, came there and took the Presidency of the college. He drew up a paper that was signed by the Faculty, protesting against this matter of labor—an able paper, which I wish would be read by the members of this Convention, each of them —giving the reasons why the labor system was not practicable, why it was not profitable. I will not give an opinion as to the value of this paper. I have some views that differ from it to some extent, yet there are many suggestions in it that are valuable. He gave the matter a thorough investigation. The consequence was that the Board of Trustees, who had established a college in which they laid the corner stone of labor, changed their views and said that they would allow the President of the college to carry on that institution without labor; did not require the students to work, but allowed them to work, and a compensaton was given to all such as desired this opportunity. This was carried on until the latter part of 1868, when General Fraser left, having been elected to one of these Western universities, in Lawrence, Kansas. He took charge of that University as President, and has succeeded, I understand, very well. Our college by this time had become so depressed that it had run down to about twenty students, although we had a Faculty that would compare with any college in this land. They were gentlemen eminent in their deparments. In zoology, Professor Clark, who is, probably, second to none in the country, and in chemistry was Dr. Caldwell, now of Ithica; and gentlemen of like stamp in all these departments; and each department was divided up, presenting every opportunity for a student who desired to gain a first-rate education.

I go into these details for the purpose of introducing this thing, to show our condition at the time when we inaugurated this Experimental Farm; partly to show you the progress of this labor system in our college, where it was, as you see, tried from one extreme to the other, and afterwards, if time will allow, I will give you our present status in this respect, of labor, and maybe a little bit of military history.

But at this time, the fall of 1867, or the spring of 1868, the Trustees became alarmed about the college. They thought that we were certainly now broken up; that all the money that had been expended and all the trouble that they had gone to, and it was not a little, had been in vain. The Trustees met at Harrisburg, to consider the state of the college; what they should do in order to resuscitate it; what they should do in order to commend it to the public. It seemed to have lost the confidence of the public, and in the course of their deliberations, they resolved, as they had not sufficient time themselves to determine the matter in their session there, to appoint a committee who should take this matter into consideration, to see what should be done. They had done everything that they knew. They had established a curriculum that was an honor to any college, and now they cast about to see what else they should do. All of these things had failed. They appointed this committee, and they immediately went to work. They began asking people what this college ought to be. They wrote to people; they consulted their friends; they consulted men everywhere—other colleges in regard to their success—to see wherein we did not meet the public wants; why it was that we had lost confidence, and why it was that we could not get students. We had this endowment; the land scrip had been given to us entire. Now what we wanted was students. We had all the material, all the apparatus that was necessary. And the consequence of the whole thing was that this committee, after a great deal of exertion, came to the conclusion that they found two things that the people seemed to need. They seemed to think that the sort of education they wanted was an accurate knowledge of the process of agriculture by actual experiment. They had tired of theories. We had been theorizing on agriculture and doing our best to give the theories in connection with it, and these gentlemen had failed to see that they were of any value. Our experiments that we did carry on—and those we had were carried on by a gentleman who is a chemist, and who is a very careful man—our experiments amounted to nothing; owing to their transient character, they elicited from nature very vague replies.

The committee found out another thing: that our best farmers thought we ought to carry on a series of experiments at the college to demonstrate these points in agriculture; that there should be something practical, something that would show to the people where this money that we received did go, that they would get some direct return; that all the citizens of the State should receive benefit from this grant, and not only the boys that came there, but that men everywhere that agriculture men, who had experience in agriculture, could learn from an agricultural college; that it should not only teach boys, but it should teach men; that it should not only teach theories, but it should teach principles in agriculture that had been developed from theory by practice; that these were the things they wished. They were tired of these theories advanced in books—a multitude of which are fruitless—and men of means had experimented until they had given the matter up in disgust. Some men, too, felt that there was a necessity for these experiments being carried on at the college, because the college received money for this purpose, and that private individuals could not afford to carry on a series of experiments from which people could derive much benefit, owing to the cost of the experiment.

Another thing was that they could not hope to carry them on for any great length of time, and another matter that affected them was that their farms, changing hands by the death of persons, these things might go for nothing, and nobody would profit by their experience. And so the committee reported to the Board that there seemed to be a demand for some plan by which this scientific agriculture could be reduced to practice, by which people could be made to feel that we were working in their interests. The Board of Trustees seemed to see the force of the argument of these gentlemen, and the result of the matter was that they placed the whole subject in the hands of a new committee, and gave this committee the injunction to draw up some plan for the working out of their ideas, and it resulted in this: that they considered that a series of experiments should be carried on at the College Farm; that a portion of our College Farm should be put aside or the purpose of making these experiments; but in considering the whole matter, and in attempting to draw up a line of procedure, some system by which they should be governed, they found that the difference in soil and the difference in climate must be considered, and that in order to give the widest scope, and that our experiments might produce the greatest benefits, they thought that it was necessary to test these experiments in differents parts of the States—similar experiments under different conditions, as isolated elevation, temperature, and so on. They then reported to the Board this much: that they thought some plan should be devised by which the college could distribute its experiments to different parts of the State. The matter was concurred in by the Board; they saw the force of the argument, but they did not see how it could be accomplished. The college was too poor to buy; it could not buy these farms and it could not rent them, because it was inconvenient; they could not rent them for any considerable length of time, and nobody would give them to them; so they did not see what could be done. After a good deal of consultation it was determined to go before our State Legislature and just present the matter to them. We were a little afraid of the Legislature, that they would partake of the same prejudice that had existed against the college through the State.

The Chairman—Allow me to state that there are some gentlemen who will be obliged to leave by the trains, who would like to hear of your experiments, and the historical part ought to be omitted for their benefit.

Mr. Hamilton—I will go over the matter briefly. The three farms were instituted by the Legislature appropriating one-tenth part of the principal of the college scrip for that purpose, and the farms were located by a committee of the Board, after a great deal of trouble, one in Chester county, one in Indiana county, and one at the college in Center county, one hundred acres each. About thirty-five acres of these farms was set apart as experimental farms. The other was farmed as a model farm. The programme of experiments, I may say, was drawn up by the committee of the Board of Trustees and other gentlemen from different parts of the State, who were interested in agricultural experiments. This programme, as it was drawn up, was made irrevocable. No matter if a Professor of Agriculture in the Agricultural College, or the President of the Agricultural College should leave, no matter what should take place, this system shall be carried out; it is the action of the Board. It was got up by the Board of Trustees, and these experiments were imprinted here by the Board of Trustees themselves. They are irrevocable; they expect to carry them out as they are, allowing those plats that have received any error to go through, and noting their errors, counting them of no value, but not changing the system because some of the plats have been found to be erroneous.

The committee, who drew up the plan, considered that there were three points upon which men desired information. One object of the experiments was to demonstrate the rotation of crops and the methods of culture. Another was the difierent applications of manures and their effect upon soils. Another, the different sorts of grain; trying experiments as to the comparative value of the different sorts of grains, seeds and vegetables. These were the three ideas that they intended to develop, and all their experiments were made to tend to this end; the object was to have them tend in this direction.

The matter of rotation of crops was tried very cautiously. They saw the difficulties that were in the way, and they agreed that the common system of rotation of crops was probably the safest one to take at first, so they took what we call a five years' rotation of crops. The first would be corn, the next would be in barley, or in oats, or in potatoes; and the next would be in clover, and the next year in clover, making a five years' rotation of crops. This is the rotation of crops that is common there.

A few of the experiments go to show the effect of a change from barley to oats, or from barley to fallow, but these are the only experiments in the rotation of crops that we have.

The next object was in the methods of culture, and in these methods of culture they used different sorts of plowing, for one thing—the difference between shallow and deep plowing—to continue these experiments year after year, and see the relative value of shallow and deep plowing in our soils. These are matters that are of great importance to us, for if we have to subsoil our land it involves almost a double expense. To be profitable, subsoiling must effect great results, both in produce and the improvement of our land.

They form a comparison between two plats. They found that it was necessary, in order to demonstrate anything in this matter, to make but one experiment upon one plat.

I think I have gone a little too fast in telling you of this rotation of crops. There are five tiers of plats, running up to 44, making five times 44—220 plats altogether. An experiment is tried in the five years rotation, on five plats right through. Plat 1 would be in corn one year; next year 101, receiving the same treatment that 1 did, would be in corn, and 1, instead of being in corn, would be in barley; and the next year 201 would be, we may say, in corn, and the one before that, 101, would be in barley; the one before that, No. 1, would be in wheat. So on; 301, in the fourth tier of plats, the fourth year, would be in clover; the one before that would be in wheat; the one before that would be in barley, and the one before that would be in clover, and so on, continuing these experiments through these five years rotation, and giving to each of these five plats the same method of culture.

We have, then, another principle besides this matter of methods of culture, which is, to test the different ways of planting seeds. Take corn, for instance, to see which is the best, to plant end grains, to plant butt grains, or to plant center grains; to plant grains one foot apart in a row, six inches apart in drills, or to plant them three feet apart in hills, with three in a hill, or two feet apart in hills, with two in a hill, and various other experiments in regard to different ways of planting corn.

Then they tried the effects of fertilizers. Notice each of these experiments has a distinct system of plats to itself. And so in the matter of manures. We have lime, twenty-five bushels to the acre; lime, fifty bushels to the acre; lime, one hundred bushels to the acre; lime, two hundred bushels to the acre; applied in different ways, to show its relative merits, its effects upon the land, and to see how long those effects continue. All these are compared with land that is not limed, that never has been limed, and the plats lie as nearly in the same condition as possible. They are in the same slopes, if possible the same sort of ground, not going from a clay to a slate, or to any other sort of ground, but retaining the clay for the same experiment.

Different sorts of seeds are used; the advantage of sowing half a bushel of wheat to the acre, a bushel of wheat to the acre, a bushel and a half, two bushels, three bushels. The same way with timothy seed or clover seed, giving the different ways in which these things shall be sowed, and see by comparison, by weighing the result and accurate observation what the relative differences are between these series of experiments.

There were gentlemen, too, in our State and in other States, who were anxious to compete in the matter of artificial manures. A series of plats were set apart for them, and they furnished artificial manure, different compositions, giving certain statements of their composition. We bought in the market, without the knowledge of these men, certain other quantities of these manures, so as to test the fact as to whether they were genuine articles or not; whether they were a fair sample on not. These manures were applied and their virtues are expected to be determined to some extent by these experiments.

We have, besides that, another tier of plats for experimenting in grains, different varieties of grain, seeds and vegetables. These are set apart entirely to this purpose, and seeds are put on those plats and acclimated, brought into such condition that although they might not succeed the first year, yet they are tried again and again, and attempts are made to acclimate these seeds; and one of the objects of this whole matter of experimenting in these different seeds is to find out what seeds are adapted to one sort of climate, and find what seeds are adapted to our own State, and then when we have found out a number of varieties that seem to do well, and tried them on our model farm, and thoroughly tested their virtues, then distribute them to the farmers over the State, at the regular prices of wheat, not charging the fancy prices that men charge who keep wheat for sale and make a business of experimenting for profit, but to give them at ordinary prices. The idea is to disseminate these seeds through the State, that farmers may get the benefit.

This, gentlemen, is, in brief, an outliue of our series of experiments. We publish these experiments in pamphlet form. They are only what you see; we do not as yet attempt to draw any conclusion whatever, from them. It is done exactly as the programme has prescribed; that is followed out to the letter. Wherever, through accident or neglect, any discrepancy does exist, that is noted on the books, and will be considered in any general collection of these things, or any report that may be made of them when it is attempted to draw conclusions. We think that if these experiments are carried on for a number of years, and are then compared one with another, probably some light will be thrown upon these three objects which we have attempted to experiment upon, namely: the rotation of crops, and methods of culture;

the relative value of different sorts of artificial manures and fertilizers, and different values of seeds, grains, vegetables, etc., that are cultivated by farmers.

We have a system of bookkeeping, which I will not present to you, as it would take up more time than would probably be desirable.

The Chairman—I would like to inquire of Professor Hamilton whether you have any guesses.

Mr. Hamilton—We give exactly what we get. Our report is just exactly what we have received. We make no comment on it one way or the other. It is in exact accordance with the programme that has been prescribed by the Board of Trustees and carried out to the letter. These things are weighed exactly, weighed at different times, under different circumstances. This does not give all that we have in connection with the matter. It is given merely as a sort of synopsis of the experiments. We have in our books a more complete account. There is no guess at anything.

The Chairman—My point is this: You say you don't publish the result. My question is whether among yourselves you didn't have some hypothesis—didn't have ground for some shrewd guesses as to what the result would be in some respects.

Mr. Hamilton—There has not yet been anything sufficiently developed to give us ground for anything of that sort. One curious thing that we have this year—it is a curious thing; it may not do it again; we don't know, and that is the reason we want to try it if we can—was that our fallow went ahead of all our land; that we raised forty-two bushels of wheat to the acre off of fallow, and these plats are one eighth of an acre plats. That surpassed our others very much. It could be told by anybody looking at it; but whether even that is profitable, whether it is profitable to allow the land to lie and go to fallow, is another question. All these things come in when the result is made up. That is all we pretend to give, just the things as they are there. They are in accordance with this programme that has been prescribed, and we don't pretend to draw any results as yet, thinking that it will be premature, and that no man can draw results from single experiments. Two years this has been in operation; this is the third year.

Mr. Flagg—Do I understand you to say that the fallow is a part of your common system of rotation?

Mr. Hamilton—It is in some instances.

Mr. Flagg—You mentioned that you had adopted this system that was common in Pennsylvania of the rotation of five courses, of which a fallow, I understood you, was one.

Mr. Hamilton—A fallow is sometimes used. If land is weedy we use a fallow oftentimes, to kill the weeds; or if it is disposed to go to certain sorts of grass, we use it for the purpose of killing the grass; or if land is rather poor, use a fallow, feeling that it eases the land, and gives it the benefit of the action of the elements during the summer. The best farmers farm every acre of their farms each year; no waste land at all; every acre must produce.

The Chairman—Any remarks will be in order upon the report made by Professor Hamilton.

Mr. Flagg—We have not heard from Wisconsin much in this agricultural experiment matter.

Mr. McAffee—I wouldn't like to trespass upon the time. If this military matter is a matter of considerable interest, I don't wish to take time.

The Chairman—Everything is of interest.

Mr. McAffee—I can give a short history of our experimentation, but it is for so short a time that perhaps it would not be of any great advantage. Only this year is all I know about it.

WISCONSIN EXPERIMENTAL FARM.

Our experimental farm is located upon the Huronian drift. The soil is mixed, composed of a detritis of a drift which has come from the North, mostly derived from granite and trap rocks, and is somewhat sandy. It is of such a nature that you cannot tell by an analysis of the soil on one square yard what may lie on the next square yard; but as it was mentioned here, to-day or yesterday, that the analyses of soils are not to be relied upon, I think there is a plain case where they are not to be. There is also an admixture among this drift of the older formation, some of the latter, fine stone and sand. This lies on the shore of Lake Mendota and is perfectly level. Some of it needs underdraining; it has not had it. We have only 33 acres under the plow. As I have 146 experiments running this season, they were necessarily divided up into small plats of ground.

The first thing that was taken into consideration this spring, in laying out a series of experiments, and the thing of the most importance, was a line of experiments in which we can reach results soonest, and communicate these results to the agricultural classes who are looking to these colleges soonest, and with the best results; that is, the testing of a variety of different crops. We all know that seedsmen and these private experimenters that are spoken of are very busy in pushing their commodities before the public, and there is a great deal of swindling and humbugging, naturally, and if any institution, with the dignity and with the reputation that one of these industrial institutions has, can be brought to test varieties as soon as possible, no matter what the seed costs, test them just as quick as possible, and let the results that follow —the actual results, without very much comment—go out among the people, there is no doubt that a great deal of money can be saved to the agricultural classes, and that some knowledge can be disseminated in that way. Therefore, we have tested, so far as we could get varieties, varieties of different kinds of grain. We tested some eleven or twelve varieties of oats and a number of varieties of wheat. I did not bring my books along, and I cannot tell you exactly how many, and a number of varieties of corn and barley. Our experiments have been generally what I call successful experiments, for the reason that we commenced in the spring and we have not as yet detected any errors. That is what I call a successful experiment. I don't care if you don't raise a crop; if everything fails, it may be a successful experiment; if you succeed in trying an experiment right straight through, and don't find any errors in it, and have reason to believe there is no error.

In this connection I wish to say one word, with all deference to higher authorities, about something that Prof. Miles said, I believe it was yesterday. He was telling us about elements of error. I don't like the use of that word "error." There are conditions which prevent certainty of results; there is no doubt about that, but why are they errors? I can't see it. I think that if a person tries an experiment, and in their measurements and in their weights they are just as accurate as circumstances will allow them to be, it is reasonable and proper to say that there was no element of error. There is an element of uncertainty running all through it, because we cannot control the elements. We cannot bring the rain when we want it, or the clouds when we want them. We cannot control the constitution of the atmosphere. There are thousands of things that we cannot control. These are elements of uncertainty, but why are they elements of error? If we try an experiment on a tract, and try it carefully and fully, and don't get our ideas wrought up to such a high pitch, that we are going to fix results from that one experiment, there is no error about it. If we think we are going to discover the laws of nature and understand the science of agriculture right off, we are in error in the beginning, and the error is not in the experiment. The science of agriculture is an accumulative science, and never will be all known in all human probability.

We next tried a series of experiments in reference to the durability of wood, for the reason that the fencing problem is a very large problem in the West, and we wished to try experiments upon the durability of wood, by using artificial agents. We tried a number of these experiments, and of course the results cannot be known for a number of years. Whenever wood rots that we have tried to preserve, why we know that that experiment is completed as far as that wood is concerned. If some of them last forever, we will never complete the experiment. We have not as yet tested but one piece of European larch, which is said to last pretty nearly forever, and of course we will have to wait a long time for that.

Mr. Flagg—I want to ask you how many sticks or posts, or whatever you use, do you put under the same conditions?

Mr. McAffee—From 25 to 150.

Mr. Hamilton—What size?

Mr. McAffee—They vary from two inches in diameter to four. One of the experiments is testing them top downwards, with medication. Another experiment is testing them top upwards with medication, and then a lot not medicated at all, put top downwards and top upwards.

Then another experiment is in regard to the amount per acre to be sown of small grains, wheat and oats. We did not test it as to barley. We took the amount of wheat from three pecks to the acre, broadcast, up to two bushels to the acre. We ran the experiment with oats, from a bushel and a half to the acre to three bushels to the acre, varying half a bushel each time.

We organized a series of experiments with deep and shallow plowing, and subsoil plowing. This tract was planted with corn.

Another small series of experiments was to test as to the yield of small grain to the weight of the grain as depending upon the kind of grain sown, whether well cleaned, the heaviest grains taken in just as it is ordinarily taken out of the bin. For instance, sow a quarter of an acre of oats just as they are taken from the bin. Another quarter of an acre alongside, under the same conditions exactly, with the exception that we blew the fanning mill as hard as we could blow it, and got all the heaviest grains; blew out more than half.

Then we tested top dressing after the grain was planted, partly to show whether there would be any good results in retaining moisture by mulching, and also by the use of peat, which is black, or nearly black on the surface, as our land is a light gray, almost white, for the purpose of finding whether the color had much influence.

Another series of experiments was with planting corn. We planted corn one grain to the hill, 13 inches apart, and were very careful in getting the distance, and the rows four feet apart. Then some right alongside of it, two grains in the hill, 26 inches apart, and the rows four feet apart. And then some four grains in the hill, 52 inches apart, each time multiplying by two, multiplying the number of grains in a hill by two, so that the same number of grains is on the same area; the only difference is in the distance apart.

Another experiment with corn was, with the hills three feet and a half apart each way, and three grains to the hill, tested alongside of corn with the hills four feet apart each way, and three grains in a hill.

These are a few of the experiments. We have a number of others, and I must say, in closing the account of the experiments, that I feel very much more encouraged about the actual results that may flow from experimentation, than most of the speakers who spoke here, especially yesterday, and some to-day. The difficulties I do not believe I am disposed to underrate. I know they are immense. There are difficulties that can scarcely be surmounted by human wisdom and human contrivance, but for all that, it seems to me there is just about as promising a field for investigation from which to derive instruction in this line of actual experimentation in farm operations as there is in any direction. I believe that it is just exactly as easy for us to find out important facts in agriculture as it is to take the chemistry of to-day, and find out important facts in organic chemistry.

Mr. Miles—In this experiment with a different number of kernels of corn in a hill, how many plats of each had you?

Mr. McAffee—One plat of each only.

Mr. Flagg—How large?

Mr. McAffee—I could not give you the area of each.

Mr. Flagg—About, could you?

Mr. McAffee—I should judge it was, at the least calculation, ten square rods—one-sixteenth of an acre, I should think it was.

Mr. Miles—How many times has this experiment been tried?

Mr. McAffee—This is the first; I can say that I find no records that are satisfactory of former experiments, so I cannot tell what has happened before this year. I had nothing to do with it.

Mr. Miles—Of the different kinds of grain that you have been testing, this is the first time?

Mr. McAffee—No; they were tested last year, and I found them in the bins, with the record of the weights per bushel, and the yield.

Mr. Miles—I will inquire if the same results were obtained last year, as are obtained this year?

Mr. McAffee—this year's results are not completed. So far as the threshing is done, the result seems to be very similar indeed.

One more remark, that is this: I feel a great deal of interest in this question of student labor. We had student labor in our institution when I went there, and I did all I could to encourage it, and I believe that good results, followed, results probably, that may be more apparent years hence than they are now; but, from some cause or other, I understand that our governing power, the Board of Regents, as they are called, decided not to continue the student labor, so I suppose we will be without student labor in our institution. I suppose that difficult question has been eliminated.

Mr. Flagg—What has been your experience with student labor?

Mr. McAffee—I found, very much to my surprise, that, taking the average of student labor, under the rule that I was working under, that the twelve and a half cents an hour that we paid for student labor, I thought was well expended as if I had gone out and hired laborers at that price. I could have hired laborers at a higher price that would have done more work, but I think that the average of the student labor that we had on the farm was worth twelve and a half cents an hour, as the market price of labor ran. I will say, though, that I think it would not have been if it had not been that I had the power of dockage, and I exercised that power carefully. I docked time. I classified the students. I notified them at the beginning of the work that I should exercise the power of dockage if I found, from any cause, either inability to perform the work they were given, inattention to rules and regulations and instructions, and the way the work should be done; or idling, such as conversation without any results, conversing and stopping to converse. If I found any of these that I should classify them and dock them according as my judgment would dictate, during the month; and I classified them into A, B and C classes. A class had full time, B time was docked ten per cent., C time was docked twenty per cent. I had occasion to dock one student twenty per cent. and out of fifty-four, I had occasion, during the month, to dock only eleven ten per cent. The next month there was no need of any dockage at all. Everything went on first rate, and I believe there was not one of the students but what acknowledged to me personally that they believed the dockage was just and correct, and they thought it was the proper thing to do, and it did work all right. I had some little doubt about it at first.

Mr. Hamilton—Do you pay for disposition, or do you pay for work—the amount that is done, or for the disposition to do it?

Mr. McAffee—It is a pecuniary matter, and we pay for work, not disposition. If a student has not the power or constitution to do the work that he is set to do, we don't pay him the full price.

Mr. Miles—In regard to these plats of corn, with a different number of kernels in the hill, what shape are the plats? You say they are about ten rods.

Mr. McAffee—They are 32 rods long and very narrow. They are in rows. I run a four foot marker through, and then I had to invent a machine to mark it.

Mr. Miles—Mr. President, I wish to make a few remarks. I don't propose to follow Mr. McAffee in regard to rows of corn. I care not whether he calls it uncertainty or error. There is something that causes variation that we cannot measure. I am very glad to see that they have commenced so large a number of experiments, and I am very much pleased with the spirit with which he enters into it. I am not at all surprised, however, that the gentleman is very much encouraged in regard to results that may be derived from it, and if the experiments are continued in the present method, I have no doubt that he will continue to be pleased with the results; it will be very satisfactory, indeed. But if he adopt a slight modification, I apprehend some difficulty might arise. If you take these plats, one in a place, then two in a place, then three in a place, and so on through, and when you get through only one plat of a kind, you will be very much pleased with the result; but if you cut these strips up, and I would recommend it now, you can make accurate measurements, and draw lines across and cut those strips up into 20 or 30 pieces, and then compare No. 1, No. 2, Nos. 3, 4, 5, and so on, precisely the same character of experiment. You will find the result varying so you will hardly know what is the matter; and besides, if you have, right alongside of these same experiments, a number of plats treated in the same way, you will find as much difference between those all alike as you will find between the corn with the different number of grains. There is the difficulty.

Now in regard to this matter of different kinds of grain. I have had perhaps a dozen applications this summer for the best kind of oats. We have raised quite a large number of varieties, and have raised them for a number of years, and I cannot tell which is the best. I don't know. What was the best three years ago was the poorest last year. The crops are not all threshed this year, so I don't know. I can judge somewhat from appearance; what was the best last year I apprehend will not be found to be the best this year—so that it becomes really complicated. The first experiments are easy, and the results are all satisfactory, until you come to duplicate them. When you duplicate plats, and begin to compare between plats exactly alike and between those under different conditions, you then find the difficulty in getting at exact results.

Mr. McAffee—That matter had occurred to me, and I can easily conceive of what the Professor has said, being exactly so; but for all that it seems to me that here is a point in regard to these larger plats, and I am in favor of the larger plats I must say, even if we have to hire extra help to harvest. All you can ever get in this thing is not absolute certainty on account of these circumstances that render things doubtful, but you want to get a general average, as large as possible, stricken with as much accuracy as possible. We don't know how many people are going to die in a year to the thousand of a population, but the Life Insurance Companies come very close to it, because they have had the general average so many years they know about how the thing runs. They know the laws of chance, as you might call it; perhaps it is an unfortunate expression. They know about how the thing will run. Now, we can go so far by a great many experiments as to get a general average. The idea has suggested itself to me, frequently, that it would be a very good thing to divide off a lot of plats, and raise A, B and C on those plats one year, and then change, something on the system that they have in Pennsylvania, and in that way get at the actual characteristics of the actual areas; but it seems to me by subdividing areas into small plats, taking twenty to the acre for instance, we are making our labor much greater. Let us get the general average of that acre as a grain producer. For instance, we take the general average of that acre as compared with other acres of corn; the general average of that acre as compared with other acres of oats and wheat, and it is valuable so far as it goes. Now we consider that acre as either better or poorer than other acres, and go on with it. It seems to me of no use to divide the acre up into twenty plats, for if the argument is good that it should be divided up into plats of a foot square, even, or an inch square, I don't see where you are going to stop if you argue in that way—that because the land gives different results on different areas you must make the areas small. Let us have the result from the whole acre. I know from the appearance of that corn experiment that what the Professor said is correct. If I cut that piece up into strips and harvest it, I know some places will be poorer than others, and I believe I know the reason, but that is a guess of course;

but that don't prove that the general average is not correct, as a general average.

Mr. Miles—No; but let me explain that. Divide those up, and take the general average of those. You find a certain range of variation, and then you find, on comparison of this with another, a certain result. You must deduct from that this variation, that is, you don't get as much grain as you think for, unless you take into account the variation. If the argument, as presented here to-night by Mr. McAffee, is the one that I have presented, I have been very unfortunate, indeed, that these plats should be subdivided because of those variations, but in order to diminish the chances of variation. It is understood by everyone that the slope of the plats should be the same. Now take the plat of an acre, and it is exceedingly difficult, in many places, to get another plat of an acre of precisely the same slope; but if you cut that acre up into three or four pieces, you can get three or four pieces of about the same inclination. Now an illustration: Take forty plats, and let the manure be applied in this way: the first series of four plats is unmanured, the next is manured, the next series unmanured, the next manured, and so on alternately through, so if I take any one of these rows through in this direction, and compare them, one-half will be manured and the other half will not. Now if I take the same series in this direction, it will be treated precisely alike. Now, I found by some of my experiments, taking one of these series of plats through, that there was a variation of 66 pounds in the quantity of corn. Taking the plats right down in this direction, no apparent reason for their variation whatever, and the variation is 79 pounds. Now, if I had had a single plat manured and a single plat unmanured, the experiment would have been very satisfactory, but when we come to subdivide it and multiply it, this element of uncertainty comes in. I will not call it an element of error, if that is an objectionable term.

Mr. McAffee—I would like to ask Prof. Miles in regard to this question. I regarded his suggestion yesterday in regard to dividing off pieces, with a piece of ground between on which there was no crop raised, as very timely and very valuable. I have seen the want of it this year. Because I did not know any better, I planted adjoining, but I believe I will never do it again if I can help it; and the question has been a matter of serious consideration as to the best way to get along with it in future, and this idea occurred to me: if I just plant so far apart and leave that ground, of course we know what the result would be: it would be full of weeds. I don't want the weeds on the ground. I don't want the piece of ground injured in its mechanical texture by the growth of weeds. Suppose I cultivate it, I don't think that that is exactly the fair thing either. Suppose I put it in timothy and clover There is a plant growing there and running its roots out and injuring the plat of ground. The idea occurred to me to make it into beds. I would back furrow, and make a dead furrow between them; just take the soil that plants will grow readily in, right out and throw out the beds. Down to the bottom of an ordinary furrow plants do not start so readily.

Mr. Miles—I have thought of that plan, but it seems to me objectionable. We plow our plats so as to leave the lines between one a dead furrow, and the other a ridge, each series of plats with a dead furrow on one side and ridge on the other. When you come to dig down and remove the soil below, if you get an unfair proportion of that upon either side, you are going to influence the result in that way. Then again, the cultivation of this piece excavated will have some influence on your crops, for if you examine carefully you will find the roots running into the sub-strata. It seems to me the only way to obviate this difficulty is to cultivate through and give the same amount of cultivation to each band as far as possible. Then you treat them all alike. Now, when the weeds spring up, with some crops the weeds will get a considerable start before the crop is started. We could go through and pull those up by hand, although they might be numerous. Then, at other times, we have practiced going through with a hoe and just cutting the weeds off, disturbing below the surface as little as possible. These are all difficult things to manage, and require a great deal of thought.

Mr. Hamilton—Let me understand what you mean by weeds. A plant out of place ?

Mr. Miles—Any plant out of place is a weed.

Mr. Hamilton—We have what is called grass.

Mr. Miles—Grass we call a weed. I don't care what it is, whether clover or corn.

The Chairman—A stool of wheat in a corn field is a weed.

Mr. Miles—Yes, sir.

Mr. Parker—These dead furrows in our section would not do at all, on account of the drainage. What I was always accustomed to do in Michigan, in raising a bed for onions or beets, or anything of that kind in the garden, I used to raise it from two to four or six inches above the surface, by ditches around it. Do that in Kansas and you will lose your crop.

The Chairman—What is the cause?

Mr. Parker—The rain fall is sudden. The rain does not come down in showers, but comes down in water spouts, frequently.

Mr. Flagg—You have to do your *level best* in that country.

Mr. Parker—Yes, sir. You have to do your level best.

The Chairman—There are one or two topics I suppose we must consider a little.

Mr. Flagg—Mr. Chairman, I want to make one suggestion in reference to this matter of the succession of crops, planting one crop after another. It is this: Plant your crop one year, this year say, in strips, corn first, oats next, wheat in the next, and grass in the last. Then next year turn around and plant across these the same crops. In that way you would have every crop in succession to every other that has been planted; corn after corn, corn after oats, corn after wheat, and corn after grass. It is an easy way of trying the experiment of succession, and is suggested by an experimenter at Munich.

FUTURE MEETINGS.

The Chairman—I find myself under some difficulty. If I may be allowed to interrupt the discussion, for I fear that we may at last get in a hurry and adjourn without having time to think of it. I say I find myself (if it is expected that I act as chairman of the executive committee, made so by the officers of the society,) under some difficulty and embarrassment to meet the other members of the committee, to compare with them upon some of the points that would necessarily come before the committee, if they provide for future meetings. It seems to me a little desirable to secure some understanding with members of the Convention before they all disperse, where and when shall the next meeting be held, if a meeting is called. I will say that it has been suggested as a thing desirable that the meeting of the Convention, if it continues to hold something of the character that it now seems to have, shall be held at the seat of the several institutions in turn; that we give the gentlemen, as they come together at the Convention, an opportunity to make a personal inspection of one of these institutions, of its experimental fields and general condition.

Mr. Miles—It seems to me, if we are to continue the meetings, it would be very desirable to meet at the different colleges, and we could look over the different methods.

Mr. Flagg—There is another suggestion, and that is that we secure more quiet, uninterrupted work, perhaps, at the institutions themselves than we can in any city.

Mr. Hamilton—I think if we do meet, we should meet during the vacations of those institutions, so as to not interrupt the officers of the institutions in their regular duties. I would extend an invitation to the gentlemen to have it at our college in Pennsylvania, if I did not think that in another year probably—in two years from now—we may be able to have a railroad that will take the gentlemen right there; and we have twelve miles of rough roads to go over, and it might be inconvenient. I am very anxious that the system of experiments which we have at that college, should have a thorough examination. I believe that they are important. We in Pennsylvania believe that they are important, that they are worthy of some consideration, and the gentlemen who got them up are certainly not numbskulls. They are gentlemen who have had some experience in experimenting. They are gentlemen in Bucks county, in Chester county, in Cumberland county; and better farms do not exist in this country than those to be found there.

Mr. McAffee—I have no doubt that the management of the University of Wisconsin would be most happy to welcome this body to meet at Madison at any time, if they should see fit. I think I may say there is no doubt of it. I am not authorized, of course, to extend the invitation, because it was not known that this body would continue its organization, but I can state in almost confident terms to that effect; and I like the idea of the next meeting, if we have a meeting, being held at some one of the industrial universities.

The Chairman—I will say that I shall also be glad, the next time, if it is due to Illinois to have the next meeting in our midst, to have them meet at the Industrial University at Champaign. We have railroads north and south, and east and west, and you can meet us quite readily.

Mr. Parker—Would it be possible to meet and not interfere with the terms, as in the Iowa institution it runs all summer, and the others run all winter. We shall have to meet while some of the colleges are in session. But our latch-string hangs out, and we welcome our friends, whether they come on an excursion, or stop on their way to the mountains, or at any other time; we shall be very glad to meet this association. I believe I am authorized, as a resident there, to invite the association to come whenever it sees fit. What is the order of business now?

VOTE OF THANKS.

The Chairman—The general order.

Mr. Parker—I would like to introduce a resolution.

The resolutions were read, as follows:

Resolved, That the thanks of this meeting are hereby tendered to "The Prairie Farmer" Company for the very liberal courtesy extended to this convention in procuring the use of the rooms in which we have met, and in other kind attentions extended to us during our stay in this city.

Resolved, That we also heartily thank the agricultural and daily press of this city for their reports of our proceedings; and the officers of the Riverside Improvement Company and of the Illinois Central Railway for their invitations to visit their respective grounds and railway lines.

Resolved, That our thanks are heartily tendered to the President and Secretary for the official discharge of their respective duties.

The resolutions were unanimously adopted.

EXPERIMENT STATIONS.

Mr. Flagg offered the following resolutions:

Resolved, That the very strong commendation that the agricultural experiment stations of Europe have received from such persons as Johnson and Liebig as a source of a large amount of agricultural science and practical progress, as well as our own examinations into the subject, make us believe the establishment of not less than one such station in each of the several States of the Union, would be eminently beneficial to the agricultural interests of the country.

Resolved, That a committee, consisting of one from each of the several States in which an institution founded on the national grant has been organized, be appointed by the President, whose duty it shall be to memorialize Congress and the several State Legislatures for the speedy establishment of such stations throughout the country.

The resolutions were adopted.

Mr. McAffee—There is one matter that a gentleman who was present here wished to present to the Convention, but he saw that the time was passing, and he had so much to do that he refrained from doing it. It is a matter of great importance, and a matter that I wish simply to announce here as food for reflection, and if we meet again in this capacity, or any persons representing these institutions, it is worthy of being considered. It is this: how best to get a knowledge of the work of these industrial institutions, and of what they are trying to accomplish, and what they do accomplish, before the people. It is a great thing. We well know that the class of the community who are expected to be benefited by the exertions of the officers connected with this institution are the most inert in attending to information about them. They won't even take the trouble frequently to send for the published reports, and it is worthy of consideration whether there is not some other way of getting the information about them—everything about them—all that we can get before the people and make the matter as public as need be. If there is any possibility of distributing printer's ink among them, it seems to me it ought to be done. The simple fact of getting out the reports, and presenting them, and having them printed, and distributing them as well as you can, don't seem to go far enough. They do good, of course, but it don't go far enough. It seems to me eminently proper that this institute should consider this point.

Mr. Flagg—I think there might be some useful hints gained from the experience of our institution in this State in this respect. I don't know but Mr. McAffee is as well acquainted with the facts, though, in that connection, as I am; he was formerly a resident here. My impression is that a good way to advertise these institutions is to do what we are doing—that is, to go out and advertise ourselves by holding farmers' meetings. We have held them for three years, and while the results have not been as good as I could wish, they have still done an important work in advertising the institution. I think another very efficient thing has been done by our Regent this summer, in publishing a circular—publishing our catalogue, in the form of an illustrated circular, which has been distributed to the amount of 20,000 copies, and nearly paid for by the advertisements on the covers. It was a good financial operation, and I think spread the name of the institution broadcast throughout the State, and to some extent in other States. I think that is another good way of bringing the institution before the people.

AGRICULTURAL LECTURES.

Mr. Parker—In regard to these meetings, that is a matter that we have not discussed in the society. We feel a great deal of interest in it, and have held some meetings—but one or two questions in regard to it: One is, whether, in the employment of those who are specialists, bringing them from abroad is necessary, or merely using the faculty and board of control of the College—that is, the material out of which the institute is made up; whether it is your faculty—those who naturally associate with you, or whether you procure from abroad lecturers—specialists.

The Chairman—Use the faculty to some extent.

Mr. Flagg—I believe we have had now three courses of these lectures in different sections. The first winter a two weeks' course at the institution itself, at the Industrial University. The second year one of one week, I think at the Institution; one at Rockford, in the north part of the State; and one at Centralia, in the south part of the State. Last winter, I think, we had four—one of two weeks at the University; one at South Pass, pretty well toward the southern end of the State; one at Pekin; and another at Springfield, or rather a few lectures were held there without any attempt at a regular institute.

Mr. Parker—Did these follow each other close together?

Mr. Flagg—That was according as it was convenient to those participating as lecturers. In those cases we have used the professors of the University to a considerable extent, and particularly outside of the institution, where they were carried among the people, not desiring them to lecture so much at home as they did abroad. On the other hand, as far as the institution itself is concerned, it has been rather a policy to bring outsiders in, to bring the practical minds, as they are called, into the institution. The policy of that, in part, was to bring our teachers and our people into closer relations to one another. The two first years, I believe, the teaching was mostly by single lecturers—by one person; that is, each professor delivered but one, or perhaps two lectures. During the last winter, and to some extent the winter before, there has been considerable done by one person. For instance, Dr. Hull, who was here yesterday, and Dr. Miles went to several places and delivered two and three lectures at each. There were some advantages in that, but one of the more special features, perhaps, was in getting in—although they may know less about it—the practical men who are not ordinarily engaged in teaching, and are not entirely *au fait* in the matter of communicating knowledge. We find in these cases some advantages and some disadvantages; they throw some new light on a great many matters. They aid our professors in thinking, and they waken them up, I think, to a considerable extent, giving them some new views of things, and they, perhaps, draw out the opinions and discussions of practical men which are valuable, better, perhaps, than regular teachers would do. The results of these meetings I take to be two-fold—they instruct the teacher as to the wants—the professors who go out, at least, and who are present at the meetings—they instruct them to a considerable extent as to what the people want the subjects in which they are specially interested, and on which they want information, and I think they are valuable to the people in bringing them more in relation to men who have a more scientific method thanour ordinary farmers have. I think if agriculture is going to gain anything in this century, especially it is to be in the getting hold, as our farmers are seeming to do, of a scientific method—that is, a careful induction of facts—and coming in contact with men who are scientific in their character, as most of these professors who go out to give lectures are. I think they learn a great deal in that direction. They get hold of the reason of a great many facts, too, which they knew as facts, but did not know the wherefore of them. Upon the whole, I am inclined to believe that that is one of the most valuable features of a popular agricultural education. It has not succeeded as well as I could

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wish, still I think there is every reason to be encouraged that we can make a great deal of it.

MILITARY TACTICS.

The Chairman—Before we close, and I suppose the hour of closing is nearly reached, if not quite, I want to add a word or two. We have done a great deal of talking; we have taken a very wide range of discussion. We have gone pretty generally over the field, if we have not pretty thoroughly touched all the points in it. There are many points, however, that will suggest themselves to us doubtless, when we are away, that we shall wish had been discussed, and some of us have, perhaps, now in mind, that it would have been desirable to have discussed while we were together. It is evident to every one, that it was impracticable for us, within so limited a time, to meet all these questions. I shall not detain you by attempting to discuss any additional questions to those that have been before you. I want simply to make an announcement—that in this matter of military education, to which I have alluded once or twice, and hoped that we should get time for a discussion—in this matter of military education, which is a very practical one to be met, and is a somewhat difficult one to be met—I have come to the conclusion that at our institution, military education is not in our way, is on the whole an advantage to us, though it costs an expenditure of funds, and will cost also a considerable expenditure of effort. We have no objection to continuing it, and, indeed, have gone so far in our preparation for continuing it, as to ask and secure the means to build a large drill hall for the future drilling of our students in military tactics. On much reflection, I finally reached what seemed to me a feasible plan for occasional military education in connection with these schools, and after consulting with the Senators of this State, and the Governor, and some gentlemen from other States, I prepared a draft of a plan, at the request of the Chairman of the Committee on Military Affairs in the House of Representatives, and submitted it to him, and it has by him been laid, as I understand, before the committee in Congress. It has also been submitted to gentlemen connected with some of the institutions in the East, who have expressed an interest in it. It is too late to detail it, because it would occupy considerable time. It is too late to discuss the question. I only wished to say this by way of announcement, that I propose at an early day to take this plan—of which I failed to bring a copy with me; I have a copy in manuscript—to take this plan and get it printed, and to send copies to you, at the several institutions interested, and ask of you your criticisms, and, if possible, your concurrence, and when we shall concur in a plan that shall suit us all, then your co-operation and assistance in securing the aid of your several members in Congress, to give us the means, as institutions, for this work that is imposed upon us. I should have been glad, if the time had permitted, but it has been better occupied, probably, to have detailed before the Convention the plan that has been devised. I only wished to night, before we separate, to express the conviction that I have come to, that the general interests of the nation, and of our States under the nation, demand military education in a more extended form, and equally complete type to that of West Point, through all the States, and it seems to me that by a very slight expenditure, comparatively, an expenditure of less than the cost of the annual maintenance of a single regiment of soldiers, that we may secure in every State of the Union an institution equal in its power as a place of instruction to West Point, with great incidental advantages to the institutions concerned, sufficient to compensate them for whatever additional trouble may come to them. I say so much in explanation of it now, that I may get you interested in it, your curiosity at least provoked about it.

Mr. Miles—I move that we now adjourn.

Mr. Hamilton—There is one thing that I think we ought to attend to: that before the next meeting there should be some programme of business made out, so that gentlemen could understand some time beforehand what would probably be the order of business.

Mr. Folwell—That matter is in charge of the committee, I suppose.

Mr. Hamilton—Yes, sir. I merely call attention to the fact, so that it may not be forgotten.

Mr. Flagg—There is one thing more that possibly the committee would like suggestions on, and that is in reference to the extent of time which will be occupied by another meeting. I don't know but the committee will be willing to take the responsibility, but I think when we meet again—I will express my opinion, and would like to hear from others—that when we meet again, we ought to meet for a longer time.

Mr. Parker—It appears to me, if we met one day at least, earlier in the week—many wish to get home, that is, they have no place to stay over the Sabbath—and if we could meet Wednesday or Tuesday evening, it might bring almost any of us, perhaps, from our homes together at any place.

Mr. Folwell—I think we should always quit before everybody is tired out.

The Convention adjourned.

EXTRACTS FROM CORRESPONDENCE OF GENTLEMEN UNABLE TO ATTEND.

"The objects of the proposed Convention are such as to command my hearty approval, and such co-operation as the facilities of my position may admit."

FRED WATTS,
Commissioner of Agriculture.

"Both the Commissioners and myself are pleased to have our names associated with your scheme for the promotion of Agricultural Education."

GEORGE BUCKLAND,
Sec'y Bureau of Agriculture and Arts, Ontario.

"I can only express my regret, and hope for better luck next time."

HUNTER NICHOLS,
Professor of Agriculture, East Tennessee University.

"Could I be with you, I would like very much to have a talk over many matters relating to Agricultural schools. I would like to hear the ideas of the various persons at work on this important problem, particularly what grade (as an educational establishment above the common or high school) the institution he is with aimed at, and also what principle of instruction is the leading one in its management. To explain my meaning: they are all called "colleges" or "universities." Both colleges and universities are, or should be, schools much above both the common school and the high school; institutions aiming at much culture, and, indeed, usually professing to have the discipline of the mind (whatever that may mean) and culture the leading objects, rather than the direct imparting of immediately useful knowledge. Now, how far is this the real aim of the various "agricultural," "technical," "scientific," and other schools springing up in all the States, mostly under the stimulus of the congressional land grant for such institutions?

"And this brings me to what I mean by the second question: what *principle of instruction* is the *leading* one in its plan. It seems to me that in many there is *no* fixed principle or definite idea as to this matter. There is a wide-spread outside demand, (a newspaper demand; or young America demand, I might say) for only knowledge that is of immediate or direct practical application. There are two distinct theories held, as unlike as day is unlike night—one, that in colleges, mental discipline and culture are the main things to be aimed at, and the acquisition of direct practical knowledge only the secondary item; the other that the acquisition of useful knowledge is of the first importance, and that mental discipline and culture are to be but secondary or incidental. Now, it seems to me that most of our Agricultural Colleges are trying to ride both horses, and are in danger of falling between. I hear a good deal of vague talk about a "healthy combination" of the two, and I am free to say that of much of the most common talk on this matter, I fail to understand its exact meaning.

"While each and every successful school must arrive at ultimate success by a process of growth, yet it seems to me that each must have a tolerably definite plan or ideal toward which it is striving, rather than a vague desire for *something* higher, but uncertain as to what that something is. It is certain that in all professional schools an important part of the instruction *must be* of technical branches, of useful knowledge, to be used directly in that profession, and presupposes the previous acquisition of not only certain rudimental branches of study, but also a certain (and usually considerable) amount of mental discipline. Now our Agricultural Colleges are, in one sense, *professional schools*, but made up of camparatively undisciplined pupils. In some cases I am tolerably well informed on, the attempted compromise is unsuccessful, whether considered in the light of an institution making cultivated scholars or making practical farmers. That the pupils are better off for attending such an institute than if they had attended none, I do not deny; but was the *system* which left them where they were left a healthy or sound one?

"No one exact type of schools can be expected to be the best for the interest of each State, but this is a matter of detail, of grade, of special studies, etc.; but there are principles of education which are as broad as humanity, tried and proven by the experience of generations, which we, in our intense desire for progress, too often wish to overthrow, or at least ignore, apparently simply because they are old.

"I will state that I believe that *Agricultural* Schools may be made successful, which will aim at high mental discipline and culture, although I do not think there is much actual and practical demand for such, yet I believe they may be made *successful*, in the truest sense of this word. And I also believe that other schools may be successful, reaching vastly larger numbers of immediate pupils, which schools may not aim at such high culture nor mental discipline, and where the imparting of useful knowledge is the leading idea in instruction—schools truly *professional*. But it seems to me that such a school should be conducted on this avowed principle, relying on its merits, without claiming for it a grade or position it does not truly hold, or pretending to do what it does not do—that is, to give a thorough education. Such a school may be not high, yet a center of great influence—greater because it honestly does what it professes. I say, after spinning out more than I intended, I would like to talk with the various presidents or managers of each schools, and see what the aims of each was, how many were trying to ride one horse, and how many two."

Yours, truly, W. H. BREWER,
Prof. of Agriculture, Sheffield Scientific School.

"Although I could not be present, I am exceedingly interested in the objects of the Convention, and trust it will be the beginning of better things than we have been obliged to be content with heretofore."

PROF. S. W. JOHNSON,
Of Sheffield Scientific School, of Yale College.

"I fully agree with you as to the importance of such a meeting, as proposed. Will gladly co-operate in any way I can."

J. B. BOWMAN,
Regent Kentucky University.

[Editorial from "New York Tribune," September 6, 1871.]

EDUCATIONAL EXPERIMENTS.

At a convention of representatives of Agricultural Colleges, held recently in Chicago, for the purpose of discussing the progress and prospects of those institutions, many facts were stated respecting their methods of conducting education, which indicate extensive innovations upon all previous systems, and may prove the forerunners of an entire change in the management of schools and colleges throughout the country. It should be observed that the agricultural colleges are not only of the branch which is designated, to distinguish it from the usual classical course, the "New Education," and which embraces sciences and modern languages; they are—especially at the West—of the most extreme portion of that division. They regard the study of the classics much as that of monastic lore and scholastic metaphysics might be regarded. In the new communities where they are situated, it is the fashion to scoff at all that is old, and the "New Education" is popular because it is new; all the methods of the old institutions are viewed with doubt and disrespect, and startling novelties are frequently substituted for them, not, it must be admitted, without success.

With many things in common, there are numerous particulars in which the "New Education" of the East differs from that of the West. In both sections of country great attention is paid by the colleges to analytical chemistry and civil engineering; but while in New England the general direction of the curriculum is chiefly toward technological studies and least toward agriculture, just the reverse is true of the Western States; yet it is obvious that there is more immediate need of the science of agriculture in cultivating the well-worn Eastern fields than in raising crops on the comparatively fresh soil of the prairies. It is noticeable that even the technological studies of the West include more of matters relating to pioneer life than those of the East; the former especially exercising the students in actual ditching and draining, and the construction of fences, farm buildings, and dwellings; the latter in the arts of the workshop rather than of the field. In general, there are many poor students who would be unable to obtain education were they not paid, at least in part, for labor; but the problem of making such labor sufficiently profitable to the colleges to keep them from running behindhand in finances, has not been solved in more than one or two instances, if at all. In the Eastern States the preparatory schools are insufficient in training pupils for the colleges, and between the State institutions and technological schools not fostered by State aid there is a direct and somewhat embarrassing competition; but in the Western States the common and high schools of the State are perfectly adequate in preparing for the universities, and in Minnesota at least, there is no rivalry whatever between private educational institutions and those of the State.

It is therefore at the West that the most remarkable results have thus far been reached. At the East it is yet believed that students' time is too much crowded for careful attention to agriculture, notwithstanding the success of the Amherst "Aggies" at the boat-race, of which the agricultural professors are very proud as the winning crew were the best scholars in their class, and were also among the hardest workers of the labor students. But at the West it is found that the students who do the most manual labor invariably accomplish the most study, and the best workmen are the best scholars. This is probably in part because the work at the West is not made compulsory, and the single exception to success with labor, in Oberlin, Ohio, may have relation to this feature. Where the students are paid extra for their labor, as in Wisconsin, a system of "docking" the pay where the work was not assiduously performed, had the effect of greatly increasing its efficiency.

But the indirect effects are as remarkable as those which lie on the surface. The students at Champaign, Illinois, "are not only not ashamed of labor," says Prof. Gregory—"they love it." They are brought by it into greater intimacy with their teachers, resulting in a better appreciation of the wants of the student, less trouble as to his discipline, extraordinary efforts on his part, and a personal improvement that is manifest in the high moral character of the graduates. All this has a correlative effect also upon the teachers, who go with the students into the field and the workshop and take hold themselves: an excellent effect, physical as well as moral. Dr. Welch of Iowa declares that it benefits him far more than the gymnasium. Prof. Miles of Michigan tells of the delight which he and his boys experienced on completing a school building, every part of which was the work of their own hands. Dr. Gregory asks how could he help a joyful sympathy when his students, having constructed a 40-horse-power steam engine, asked him to sit down with his back to it and say, if he could, when it was in action and when not, its movements were so noiseless.

There are young women in large numbers in those Western colleges, and in one of them at least there is but one staircase to the building and no more division made in the domestic arrangements than in any large family. From each College that reports on this subject the testimony is that the presence of the young women has an excellent effect upon the young men, making them more mannerly, tractable, and ambitious. Dr. Welch, at whose institution in Ames, Iowa, there are fifty young women, declares that they are a most valuable adjunct in the management, with which he would not willingly dispense. Testimony is unanimous that there are fewer scandals of any sort in these colleges than in those where either sex is domiciled alone. And as to capacity for scientific learning, and also for many branches of actual work in the orchards, forests, green-houses, nurseries, and market-gardens, the young women everywhere equal and rival the young men. The *experimentum crucis* in college affairs, and one worthy of the great West, has, however, been made in Illinois and Iowa. The entire government of the College in each instance has been relegated by the Faculty to the students. The result has been that the colleges were never better governed. The students arrange for themselves a sort of semi-military organization, with a court somewhat like a court-martial, which tries offenders and pronounces the penalties for infraction of the laws of the organization. The Faculty has only to applaud the judgment thus far evinced in such trials and sentences, and the occasions for any trials at all have of late become very rare. But one fact need be added to complete the conspicuous novelty of this system of college government. The "court" in the Iowa College consists of five young men and two young women.

LAYING OF CORNER STONE OF NEW UNIVERSITY BUILDING,

AND DEDICATION OF NEW MECHANICAL SHOPS.

At a few minutes past 3 o'clock, September 13, 1872, commenced the exercises connected with the opening of the new Drill Hall and Mechanical Shops, and the laying of the corner-stone of the new University building. The procession formed in front of the University, in the following order: First, the old students, uniformed and armed; second, the new students, about one hundred and twenty-five in number; then the faculty, the trustees, and State officers; and, finally, the citizens who had come to witness the ceremonies of the occasion.

The procession then marched to the new building, where the entire audience present cannot have fallen far short of twelve hundred. There, the Regent stated that he had just received a telegram from Governor Palmer, stating that he and his staff had been left by the cars, so that, much to his regret, it was impossible for him to be present as he had hoped.

After the University band had beautifully executed Schubert's *Parade March*, the corner stone was laid by Prof. J. B. Turner. The Rev. Mr. Frame then followed, in a short but impressive prayer; and, after a statement by the Regent of the dimensions of the new building, the procession reformed and marched to the new Mechanical Shops, the band playing *Hail Columbia.*

At the hall the Regent stated that we were then standing in what was probably the first building of its kind in America, a building dedicated to the mechanic arts, which are to do so much to develop the resources of the country, and to military science, which shall defend the product of those arts if need be. After detailing the intended uses of the different portions of the Mechanical Building, details with which our readers are already familiar, the doctor stated that the building would not only be completed, but entirely furnished with machinery, etc., at a cost not exceeding the appropriation for the building alone. This success, he said, was due to the faithfulness of the trustees, of the architect, and of the contractor, Mr. Gehlman, who, though he had taken the contract for several hundred dollars less than any one else thought the building could be erected for, was still doing more than his contract bound him to—putting in better material, in some instances, than he had agreed to. After these deserved encomiums, the Regent introduced Prof. J. B. Turner, by saying that he needed no introduction, since "his name, if not so long as the State, is as broad as the Continent."

After explaining that, owing to the detention of Governor Palmer, he had been unexpectedly called upon to deliver the leading address, Prof. J. B. Turner, of Jacksonville, spoke as follows:

ADDRESS OF PROF. J. B. TURNER.

Fellow-Citizens:

It gives me joy to meet you on this interesting occasion. For more than twenty years a little band of brothers, in this State, labored as well and as faithfully as we could for the promotion of Industrial education, in this great Republic of ours. In this labor, no one of my comrades ever received one cent of public funds in payment for either time or expenses. We sought and accepted no offices or perquisites whatever, in connection with the enterprise; and not one single man, of that original band of brothers, holds any such relation to-day, or ever has held it, or to my knowledge ever sought to hold it. If, then, our hands are not clean, let those whose hands are clean, wash us, and make us clean.

At one time, as you all know, the whole enterprise seemed to us to stumble and fall: to come to nought so far as our day and generation were concerned. I say it so seemed to us; and however mistaken, we were honest in our view. Under the same conditions, we should still think the expenditure of funds here an entire waste to the State, which we could not approve. That was a sad and a dark day to us—to me one of the saddest and darkest days of my life. But we all decided not to attack the Institution: to let it live amid its new surroundings if it could, even though we had no faith that it could. Then came the criticisms of its friends, who were supposed to know of its surroundings, deepening both our gloom and our despair, and intensifying all our natural prepossessions, prejudices and fears. We shut our mouths, bit our lips, and bitterly hoped for some better resurrection of our idolized principles, after we were in our graves.

But all this is now changed; and it is not only our duty but our great joy to change to meet the new conditions; doubly so when we reflect that the present board of trust and of instruction were, in no sense, responsible for any of those untoward conditions. For the first time I came to this University last winter to see for myself. I did not find any one of the Professors and Teachers either omniscient or omnipotent; nor yet angels walking the earth with sublime grandeur, with wings at their shoulders, all plumed and ready for the skies. From the newspaper accounts I had previously read of them, I hardly expected this. But I found (or at least I fancied that I found) good, honest-hearted, intelligent men, prosecuting a great, arduous, and difficult public work—new in its ends and aims, and untried in its modes and methods—with a patience, a zeal, and a self-devotion worthy of their great cause; and when I have said that, I have said enough in praise of any set of mortal men that ever lived. I found, also, a corps of most courteous and well-behaved pupils, well worthy of their teachers. They frankly told me (what it is easy to see in any similar Institution under the sun) that they had made mistakes, and were striving to correct them; and expected to make more and correct them, too. What more or better did any man expect, who knew anything about the newness, the difficulties, and the natural and artificial obstacles of the great enterprise in which they are engaged. It will probably take a thousand years for a single one of these great free States to learn to endow and manage these Industrial Universities, in the best possible.manner. But what of that ? Shall we never attempt to learn the greatest of all possible arts, the preparing of our American youth for a true American life, because our art is difficult and our lesson a long one ? I shall soon die; you will soon die; we shall all soon die; but these Institutions will live—live still to learn their art and their duty, and to bless their race, long after the oaks have grown and fallen again, and rotted over our graves. Here, then, is my tripple joy. I come here again to-day to cast off and abjure all my former prejudices and prepossessions—if prejudices and prepossessions they were—and to bury them beneath the corner stone of this new and beautiful edifice, now rising to our view. What greater joy can any man have than when he finds things better even than he had dared to hope ? Such, in kind, is the joy of the angels when it becomes "meet that they should make merry and be glad, for this their brother was dead and is alive again—was lost and is found;" in this case, a resurrection a half century sooner than I, for one, dared to hope for it, only a few short years ago. Why, then, should I not this day rejoice ?

This Institution will still need, in the future as in the past, a magnanimous patience within, and a magnanimous forbearance from without its walls; our little and censorious criticisms can neither destroy nor aid it. Thank God, it has already, even though beyond our former hope, become two big for any such result.

It must now live ! It ought to live ! and it will live ! The fly that can annoy the elephant cannot devour him, even though he may continue to keep him in an unseemly wagging of his tail. Do the best it can, this Institution will not and cannot do all we desire, for at least a round hundred years to come; though it may, and it can, and it will, do a good work to-day, and to-morrow, and forever.

Some lament because that only a small per cent. of the youth educated in our Agricultural Colleges remain, in after life, in industrial pursuits; and therefore deem these institutions a failure. Now, several, if not most of our older colleges were founded for the special and avowed purpose of training up the youth for the ministry of the Gospel. And yet it is doubtful whether five per cent. of their graduates ever in fact enter the ministry at all; and do we hear their trustees and guardians and patrons talk of abandoning these colleges because such is the result ? Not at all: they have better sense than all that. They well know that after a young man has been educated by their methods, he will and must, to a greater or less extent, imbibe their spirit, become possessed of their animus, and tend to diffuse it over the whole surface of human society, in whatever profession he may be engaged. "Verily the children of this world are in their generation wiser than the children of light." If then these sons of our farmers and our friends are educated in our Industrial institutions—which are in no sense conventional, partisan or sectarian, but in all their methods, ends and aims, truly, grandly and broadly industrial, natural, scientific and American, and therefore christian—I care not into what particular professions they may choose to go in after life ! This is a free country, and they have a right to go where they please: but wherever they may go, or in whatever they may engage, they must and they will carry the broad, scientific, catholic, American and truly christian spirit of their *Alma Mater* along with them, instead of the narrow and scholastic spirit of caste and sect. We may trust them as our men. true sons of the Republic, and true sons of God, whatever profession they may elect, wherever they may rest, or wherever they may roam, the whole world around.

I know there are good and true men in our State and in all the States, who still differ from you and from me, in their views of American education. Some, and quite a large class, think that the State, as such, should confine its whole effort to perfecting the common schools, and leave the higher form of knowledge to take care of itself. But no State ever did, or ever will, keep up a full and vigorous supply of either knowledge or goods, at retail, which did not at the same time take care that its great wholesale supplies should be ever open and near at hand. The whole thing is absurd. Others say that political States cannot successfully endow and manage our higher universities; and that, too, in spite of the fact that no institution, worthy of the name of an university, was ever founded or endowed without State aid and patronage, on the face of the earth, or probably ever will be. It would be quite as becoming for a great State like Illinois to run abroad for all her goods and merchandise, as to do it for all her higher forms of knowledge; and what it is clearly impossible that individuals should do, in this regard, it is wise and proper that the State should do.

It is said that there is also in our State still a small class of seven-by-nine politicians, who occasionally sneer at the great cause of industrial education, and begrudge it the crumbs it gathers. Let them sneer. To all such in this State, and in all our States, I have but one answer to give in behalf of the farmers and working men of the Republic. We intend to keep on asking for endowments for each and all of these institutions throughout the land, until we have made each one of them, in some good degree, in all needful buildings, apparatus, perquisites and endowments, what they ought to be; and when they shed the full radiance of their united glory and light over every state and every hamlet on this continent, from sea to sea, we intend to point to them and say to these carpers, "these are all our stealings from the treasuries of the Republic. We obtained every dollar of them by the honest vote of a proud, a patriotic, and a grateful people; and now, where are yours ? Can you, dare you show them to us ?" And whenever their dishonest stealings—which they cannot and dare not show—do not in fact amount to ten times as much as our honest ones, which we can show with great pleasure and pride, we intend to suspend all further applications, and give them a chance to get even with us again.

The mass of our people pay the taxes and fight the battles of the country, and whichever party is in power, they do none of the stealing out of the public treasury, and I, for one, am tired of the groaning and whining of the few who do it all, whenever these masses ask for a few dollars out of the general or the State treasury, for some great agricultural or industrial interest of their own. I have no doubt that the majority of our people and our legislators, who are not thieves, will continue to give us all we may need in this regard, and that in despite of all these croakers, these institutions will at last achieve a great and glorious success. Let, then, these beautiful walls rise, as the monument of our past endeavor and the memorial of our plighted faith, if not *where* we preferred, still to become *what* we preferred; if not as our feeble forecast prescribed, still in that better way which He who alone can truly forecaste and overrule all events, may prescribe and elect. Let them rise till the myriads who dwell upon these rich plains shall throng around to uphold, to endow, and to bless them, till their rising light shall shine far abroad over this great green sea of prairie lands, with its woodland isles and dales, to gladden every household, to bless every farm, and to enlighten and exalt every soul: till ministering angels shall come to greet and to bless their inmates with every morning sun, and bid them rest and sleep in peace with every evening shade.

The band then played Prof. Colberg's "Industrial University March," and then the audience listened to the

ADDRESS OF HON. N. BATEMAN, LL.D.

On the 11th day of March, 1868, just three and a half years ago, the Illinois Industrial University was formally inaugurated, with appropriate ceremonies. In the presence of a large concourse of citizens, gathered from every part of the State, words of gratitude and of hope were spoken—glad songs were sung—and the benedictions of Almighty God were solemnly invoked upon this new child of humanity and of civilization, as, in weakness, yet in faith, it stepped into line, and entered upon its work.

It was my privilege to participate in the services of that great day—to sketch the history of that long series of efforts which had culminated in the great act of Congress of July 2, 1862, and in the acts of our General Assembly of January, February and March, 1867, locating and organizing this University—to indicate the principles upon which it was proposed to conduct the Institution—to point out the elements wherein it was to be and to remain radically separate and distinct from all other existing State Institutions, and to invite to it the support and confidence of the public.

Three years and a-half have come and gone—years of arduous toil, of struggle and trial and peril, of the most painful vicissitudes of hope and fear—and to-day we meet again. And for what do we meet? To acknowledge the failure of another experiment in behalf of the higher education of the industrial classes? To mourn over abandoned plans and perished hopes? To put the Illinois Industrial University into bankruptcy, inventory and sell its assets, and dissolve forever this grand partnership of labor and learning?

Nay, verily, but to lay the corner-stone of a new University building, the best adapted and planned edifice of its class on the continent, with class-room accommodations for over one thousand students; and to celebrate the opening of a new Mechanic and Military Hall, of corresponding proportions. These are the objects for which we meet—these the auspices under which we assemble to-day.

I am not unacquainted with the history and progress of all the Agricultural Colleges established on the foundation of the public lands granted by the act of Congress of July 2, 1862, and I affirm that no other has accomplished so much within the same period from the opening of its doors for the admission of students, as has ours. And if reference be had to the number and nature and continuance of the obstacles and difficulties encountered, the progress of this Institution is altogether remarkable.

In a little more than three years of actual working time, order has been evoked from confusion; the departments have been defined and organized; the landed estates have been pushed rapidly towards a symmetrical development; the old building has been made to seem even more unsightly by contrast with the orderly beauty of the grounds in which it now stands; specimens of philosophical and other apparatus of finished workmanship and improved construction have attested the efficiency of the mechanical department; series of experiments of great practical value to farmers, horticulturists and stock-raisers, have been inaugurated; attention has been widely drawn to the courses of public lectures on practical subjects, given at the University, and elsewhere under its auspices; the libraries have been enriched by rare works, carefully selected by the Regent and Faculty, from the treasures of both Europe and America; the department of chemistry already challenges the attention of recognized masters in that most splendid of the natural sciences; similar institutions in Europe have been visited and studied, and such improved methods and principles as were found to be applicable here, have been introduced to enrich and perfect our own system; the number of students has more than quadrupled, while the average attainments of applicants has advanced in nearly an equal ratio, thus supplying better material for the forces of the University to work upon; the atmosphere of the Institution is wholesome and bracing, producing an earnest and manly average tone of student life; through all the departments and classes of the University the freshest and most inspiring breezes come from the fields and meadows, from the facts and objects of the outer world, and not from books, and the *trend* of the Institution is already very powerful in the direction of those pursuits and ends for which it was established; and, finally, the current of public sentiment now sets, strong and steady, *towards* the University, and the people of the State, through their representatives, have recently put the seal of their approbation and confidence upon it, by appropriating the funds wherewith these structures are now rising to completion.

Are not these hopeful results to be achieved in forty-two months? and do they not prophesy a great future? Who that stood with us in March, 1868, dared even to hope for what is reality to-day?

And now the inquiry arises, what has brought about these results, this refluent wave of public sentiment, these converging and centripetal forces, these auspicious events and well founded anticipations of greater things in the near future?

Not to under-estimate other contributing factors, I believe that prominence is due the following:

1. To the sound and well considered principles promulgated by the trustees in their first published circular. Truly comprehending and firmly grasping the outlines of the problem set before them, they boldly declared at the very outset, what they believed to be the true character of the Institution which they were to found, and the essential conditions of success. They uplifted a banner that was *fit* to be borne at the head of the columns of modern civilization. Rejecting the wood, hay and stubble of those who would build for to-day, they chose granite and iron, gold and precious stones, for their temple of ages. Denying the imputation that farmers and artizans needed *less* culture than others, they proclaimed the truth that no other classes needed more careful training, and that only by learning equally varied and profound, would it be possible for the industrial classes to break down the barriers in their way, and protect themselves against the formidable aristocracy that was growing up under the name of the professional classes.

The scheme which they presented did not escape criticism. To some it was a stumbling block, to others foolishness. Though drawn up with the laws of Congress and of Illinois open before them, and with fidelity to their spirit and intent, a lower and narrower interpretation was tenaciously urged, and the weapons of irony and ridicule were mingled with the graver imputation of a perversion of the funds from their legitimate purpose. But the trustees, with patient endurance, steadfastly looking into the future, stood quietly yet firmly by their convictions, and in accordance therewith the University, in due time, was launched.

The good effects of the high ground thus assumed at the outset have been incalculable. It led to an earnest and widely extended discussion of the whole question of higher education, of State and national Universities, and especially of the problem of how to marshal the forces of science and culture in the interest and to the support of the children of toil. The press teemed with arguments and theories, with essays and strictures, on one side or the other, while editorial lightnings flashed and thunders rolled continually. By all this the *people* were mightily stirred, instructed and *educated.* It is safe to say that the liberal views on which the University was founded, have three friends and supporters to-day, where they had one, when the controversy began. The fact that the Regent is at this moment at his wit's end to provide room for the students already here and known to be coming, is proof on this point. By uplifting this worthy standard, we have all the time had something worth contending for, while upon the lower plane proposed by some, success would have itself been a defeat.

2. But a true philosophy of education, broad and comprehensive plans, have in themselves no self-acting, self-developing power. Be these never so wise and good, success must still depend in a large measure upon the fidelity and capacity of the agents to whom the execution is intrusted. I am here as the blind eulogist of none, but a sense of what is justly due to good and faithful servants, will not allow me to withhold an expression of the belief I entertain, that to the Regent and Faculty is also due much of the success and prestige achieved.

Had the first Regent and Professors of the University been men of less breadth and discernment; less honest and catholic in their views; less ready and willing to seize and utilize every legitimate element of success, every sound principle, whether old or new—had they been less conscientious and devoted, as well as capable and scholarly, and less patient and prudent withal, we might not have been summoned hither to-day on this glad errand; these nascent walls might not have been grandly rising about us.

Few appreciate the environment of difficulties attending the opening of a great institution of learning, even under the most favorable circumstances—the unlooked-for emergencies and perplexities, the adjustment and arrangements and re-arrangements, till all is made to run smoothly, each force acting without noise or friction, each body moving in its own appropriate orbit. But how formidably and painfully enhanced are the embarrassments when the enterprise itself is largely experimental, with no beaten paths to follow, no sure lights to guide—the past almost a blank, the future little better than darkness.

Not only was this the problem with which our Regent and his associates had to grapple, but there were other and special elements of difficulty. A then recent contest for the location of the University had left the usual harvest of irritations and alienations; the friends of industrial education were not a unit in support of the Institution, nor even in their views of the general principles and policy in accordance with which it should be organized and conducted. Amid the clashing of opinions and theories, the public mind became for a time bewildered and confused, and many students delayed entering the Institution till it should clearly appear what the excitement signified or portended, and what the end thereof might be. Added to all this, the buildings were unsuitable and insufficient, the appliances of instruction were meagre in the extreme, the number of teachers inadequate, and the available funds wholly unequal to the necessities of the case.

Into the midst of this unpromising conflict, environed by this tangled web of difficulties, these strong, brave men entered, doing the best they could, pressing steadily on, each bearing a double burden of labor and responsibility, patient, uncomplaining, hopeful; waiting till the morning should break, and relief and recognition come. They have, indeed, settled convictions as to the fundamental truths of education and educational philosophy, but they were wedded to no pet theories in collateral matters, and committed to no stereotyped methods and measures of reaching the desired end. Ever seeking light, and willing to walk therein when found, they have not disappointed the confidence reposed in them. While resisting every attempt to overthrow the broad foundations on which they believed that the temple must be reared, if at all, they have ever been ready to modify the details of the superstructure in accordance with the unfoldings of events and the teachings of experience.

3. But the most potential cause of the triumphant success of the Illinois Industrial University, and of the noble future which we are to-day permitted to believe lies before it, is without doubt the fact, becoming daily more apparent, that its work is in harmony with and demanded by the *pressing needs of the living present;* that it is moving in the line of the ocean-currents of modern thought—in the direction of the paramount interests and necessities of humanity.

But for this, in vain would be the excellence of its curriculum, the learning and heroism of its Regent and Faculty, the magnificence of its buildings and the abundance of its resources. The cry of the disappointed and tired world is: "Give us the true bread and water of life—we are starving upon husks and fleshless bones. If there is balm in the Gilead of science, bring it down to us, for we are sick unto death. If there is blessing and power in philosophy and learning, dispense them to the toiling millions. We would not know less of the world to come, but more of these visible heavens and this solid earth."

In response to this long and bitter cry of the ages, we have at last a *new departure* in education. Its impressive motto is: "The invisible things of God from the creation of the world are clearly seen, being understood by the *things that are made.*"

The movement is from the few toward the many—through the abstract to the concrete—from books to nature—from sect and caste and party, to humanity. Welcoming *all* knowledge, the whole unbroken circle of the sciences, and joyfully recognizing the right of every man to devote himself to any chosen study and to any pursuit in life—making war upon no existing institutions and courses of study—its special province is to *utilize* education in the interest of productive industry, to *deploy* the shining battalions of science out upon the open plains of life, and bring them to the support of the ubiquitous and gigantic activities of the age.

Bowing to the truth that by the sweat of his face shall man eat bread, it seeks to lessen the sweat and increase the quantity of bread. It sees the great bulk of mankind engaged in tilling the soil, and wearily fighting the myriad foes to which every plant and cereal and esculent is exposed, and seeks to help them in the unequal encounter. To that man, vainly endeavoring to raise wheat in a soil destitute of the essential elements demanded by that grain, it whispers a word of counsel—he changes the crop, or supplies the needed ingredients, and success is the result. It sees the scanty results of husbandry everywhere, compared with the possibilities of the soil, and invites desponding farmers to the cheering revelations of vegetable physiology.

It looks out upon this marvelous land of ours, so full of exhaustless treasures, above and beneath the surface—upon the infinite variety and magnificence of its natural scenery—its lakes and rivers, its Niagaras and Yo Semites, its ocean-girdled shores, its stupendous mountain ranges, its boundless capacities for manufactures, and for domestic and foreign commerce —upon its amazing national and corporate enterprises, its screaming locomotives, pushing north, south, east and west, like the beast of apocalyptic vision, while tunnels open and bridges rise to receive them as they thunder along. It beholds the rising towns and cities, the tidal waves of emigration setting towards the occidental ocean, while State is added to State, and territory after territory is organized out of the imperial domains of the far West, affording illimitable opportunities and boundless fields for the display of enterprise, with swift and sure rewards for the energetic and industrious.

It contemplates one form of government, so wise and free, with every avenue of preferment open to honorable competition—no fetters on limb or conscience, on press or tongue—no tyranny of priest or king, of oligarchy or caste. And our people, keen, shrewd, alert—full of the spirit of enterprise, adventure, enthusiasm and dash ; the most aggressive and self-reliant on earth. And marking all these things it asks, what should be the education of such a people, in such an age and country ? Was ever a people so environed by such tremendous incentives to a brave and heroic manhood ? Its high challenge is: Go into these battle-fields; cut and hew and delve; dig down these mountains, fill up these valleys, bridge these rivers, push on the highways of commerce; lay the iron rails, stretch the telegraphic wire, down with the forests, up with the homestead, on with the stalwart hosts of industry; let the anvils ring, the forges blaze, the shuttles fly, the spindles hum; speed the plow, the loom, the ship and the buzzing wheels; explore the mine, bring up the shining ores, stuff the black diamonds into the red hot throats of furnaces, and let the molten iron and steel pour forth; peer into the mysteries of soils, of animal and vegetable life and growth, bend upon them the apocalyptic light of the solar ray, clap on them the vise and thumb-screw of chemical analysis, and wrench and torture their secrets frcm them ; and you, ye Titans who wield and whirl the mechanical forces, marshal the omnipotence of your dynamics and statics to relieve the strained and aching sinews of man, to reduplicate his power, add to his comfort and ennoble his life; ye landscape gardeners, and rural engineers, subsidize the hillsides and slopes, the wild rocks and glens, the majestic forests and tangled thickets; fling over them all the spell of your enchantments, and make them minister to beauty and adornment. With trees and shrubs in clumps and groups, at artistic points, with clambering vine and rose-clad trellis—with the cheap and simple magic of light and shade, foreground and perspective, *beautify* the homes of the toiling poor, for it is the will of God that *earth*, as well as heaven, shall be filled with brightness and glory.

These are the trumpet voices that seem to ring out from these rising walls and foundation stones, sounding upwards to God and grandly echoing onwards into the stillness and silence of the waiting future. This is the *new departure* in education—not differing so much from the old in essence and purpose, because these are generically and immutably the same, but calling upon the children of men to give a *new direction*, *new uses*, to their powers when trained and polished by culture—uplifting the gorgeous banner of Nature, written all over with symbols of matchless wisdom, and flashing with the ineffable glory of God, and seeking to attract to it and to gather about it the devotion and love and joyful service of those whom philosophy and learning have made keen-sighted strong. It declares that in the problems of husbandry and mechanics; of mining, engineering and architecture; of animal and vegetable physiology and hybridization, and a thousand others arising out of the practice of the industrial arts, there is scope for the loftiest powers and the profoundest learning, while their pursuit opens up the fountains of intense, ever-varying and perennial enjoyment.

It is because I believe that this building which we to-day inaugurate, and that statelier one whose corner-stone we have now laid, and the University to which they both belong, are all linked with the future well-being and glory of Illinois, and with these brighter hopes for the on-coming ages of culture and of humanity, that I have left my work and come hither to-day. God grant that the dawn of a long career of great usefulness and prosperity; of liberal provision and fostering care; of public respect, confidence and affection, which to-day seems breaking along the horizon of this Institution, may shine on, brighter and brighter, until the perfect day.

Prayer was then offered by the Rev. Mr. Riley.

Upon the platform were the Hons. Messrs. Miller, Williams, Sheldon, Langley, Wright, Flagg, Griggs, Cunningham, Dunlap, and perhaps others; also, members of the Board of Supervisors of the county. Several of these were called upon for speeches, and made short but appropriate remarks, all of them indorsing fully the course pursued by the University, and promising it their heartiest support.

Mr. Bailey, of the Board of Supervisors, being called upon as a representative of the people of Champaign county, expressed himself, and the people in general, as well satisfied that the University had been a benefit to them in the past, and would be still more in the future.

Music by the band followed, and the audience adjourned, to meet next year, Providence permitting, to dedicate the main building.

And now a few

CLOSING WORDS.

Germs are prophecies. The germ of the acorn is a prophecy of the wide-spreading oak. The past is the germ of the future. The histories of the coming centuries will be but an outgrowth of the events of the present, as the history of the present is but an outgrowth of that of the past.

Seeds grow, produce and die, and by culture their fruits are improved, new species are created and take the place of the old. New prophecies are written in the hidden recesses of the seed. There the eye of the skilled botanist may detect them, but the multitude see them not, read them not; *they* must wait until the germ has become a plant, perhaps until it has produced its first fruits, until the prophecy has become history.

In the history of education it is evident that the education of the present is but an outgrowth of that of the past; but cultured by experience, the old education has "sported," as horticulturists say, and a new seedling produced. The men of experience and thought, the skillful botanists in educational matters, read long ago in this plant of *industrial education* the prophecy of its future. Would-be sages said it was but a seed of the old plant, and that hence it would produce the same fruit as the plant from which it sprung. Prophets of evil foretold its speedy withering, and did all in their power to prove their prognostications true. But those to whom the seed had been entrusted, dug broad and deep the ground which was to receive it, and the germ, in spite of adverse storms, has grown and prospered. Its first fruits have been produced, and the vote of the Illinois Legislature last winter, granting such magnificent appropriations to the Industrial University, was the verdict of impartial judgment pronouncing them good.

But the fruit of a plant is also its seed; if the present is the accomplishment of the past, it is also the prophecy of the future.

If now we look upon the present of the University as we should, as a germ, a prophecy of its future and of the future of the education which it represents, their common strength and grandeur in years yet to come may better be imagined than described.

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