THIRTEENTH REPORT

(*Seven annual, six biennial.*)

OF THE

BOARD OF TRUSTEES

OF THE

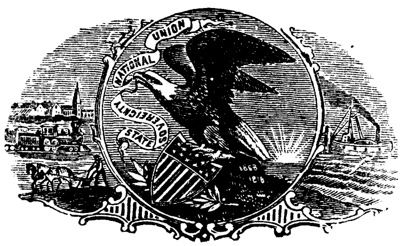
UNIVERSITY OF ILLINOIS

(ILLINOIS INDUSTRIAL UNIVERSITY.)

URBANA, CHAMPAIGN COUNTY, ILLINOIS.

For the Two Years ending September 30, 1886.

SPRINGFIELD, ILL.:
H. W. ROKKER, PRINTER AND BINDER.
1887.


NATIONAL UNION
STATE SOVEREIGNTY

MAIN BUILDING.

UNIVERSITY OF ILLINOIS,
URBANA, ILL., October 30, 1886.

To his Excellency RICHARD J. OGLESBY, *Governor of Illinois:*

I have the honor to submit herewith the Thirteenth Report of the Board of Trustees of the University of Illinois (formerly Illinois Industrial University) for the two years ending September 30, 1886. The equipment of the several departments, and an account of the instruction and other work performed in each, are given in the report of the Regent with the accompanying reports of the professors in the latter part of the volume. The succeeding papers by members of the Faculty give further illustration of the work done and results reached. The detailed transactions of the Board clearly exhibit the business affairs of the University.

Very respectfully and obediently, yours,

T. J. BURRILL,
Corresponding Secretary.

Now, although it may seem as if, in the present high state of our society, students were enabled to devote their time to the investigations of the facts and laws of nature, or to the contemplation of the mysteries of the world of thought, without any side-glance at the practical result of their labors, no science and no art have long prospered and flourished among us, unless they were in some way subservient to the practical interests of society. It is true that a Lyell collects and arranges, a Faraday weighs and analyses, an Owen dissects and compares, a Herschel observes and calculates, without any thought of the immediate marketable results of their labors. But there is a general interest which supports and enlivens their researches, and that interest depends on the practical advantages which society at large derives from their scientific studies.—*Max Müller.*

Now what have these successive discoveries in science done for the nation, in this single manufacture of matches, by an economy of time? If before 1833 we had made the same demand for light that we now do, when we daily consume eight matches per head of the population, the tinder box could have supplied the demand under the most favorable conditions by an expenditure of one quarter of an hour. The lucifer match supplies a light in fifteen seconds on each occasion, or in two minutes for the whole day. Putting these differences into a year the venerable ancient who still sticks to his tinder box would require to spend ninety hours yearly in the production of light, while the user of lucifer matches spends twelve hours; so that the latter has an economy of seventy-eight hours yearly, or about ten working days. Measured by cost of production, at one shilling sixpence daily, the economy of time represented in money to our population is *twenty-six millions of pounds annually*. This is a curious instance of the manner in which science leads to economy of time and wealth even in a small manufacture. In larger industries, the economy of time and labor produced by the application of scientific discoveries is beyond all measurement. —*Sir Lyon Playfair.*

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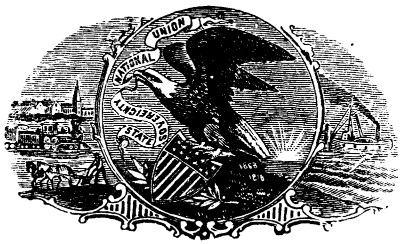
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Trevett & Green. The work was put in hand, but when completed was found to have very considerably exceeded the amount appropriated. The work has been well done, and as the needs of the case required. I ask that you will refer the matter to a committee, who shall make a just settlement with Trevett & Green. The payments have been delayed pending your action.

THE NEW BOILER AND FIRE PUMP,

authorized at the December meeting, have been procured and put in their places. Upon setting the pump it was found that the pipes leading to it from the well and cisterns, and from it to the different parts of the house, needed to be enlarged to adapt them to the capacity of the pump. The sum of $150 will be needed to complete this improvement.

THE NEW ORLEANS EXPOSITION.

Much labor has been expended upon this object by Profs. Burrill, Morrow and others, and I have just returned from New Orleans, where I went to see that the work done at the University was properly displayed. As directed by you, this exhibit has been made without any cost to the University for packing, transportation, cases, etc. Some expenses have been incurred in framing drawings, and in preparing some unfinished models and in other similar matters, which we can scarcely expect should be paid from the funds in the hands of the Commissioner of Illinois for this exposition. I ask that $150 be appropriated for this purpose.

The University has received a very prominent place in the exhibit representing the resources of the State of Illinois. It is likely to be in the end the recipient of much material of value to its collections, and at little cost. The State commissioner has a very limited sum of money to work upon, and he should not be asked to pay for expenses for preparation of University articles.

Prof. Morrow's annual report of the farms is herewith submitted.

Prof. Roos' report and requests are transmitted. He needs an assistant, and the nomination of Mr. Horace Taylor is approved.

Prof. Ricker asks for additional turning tools for the carpenter shop. Four sets are needed, at a cost of $40.

The school of Mechanical Engineering needs additional desks for its drawing room; $75 are asked for this purpose.

Prof. I. O. Baker's request for illustrative material is transmitted to you. Something of the kind will be greatly useful to his department. I also ask your attention to a request from Mr. A. B. Baker in regard to his apartments.

Authority is asked for the purchase of periodicals for the library to the amount of $300, and of books to the amount of $1,000.

Respectfully submitted,

S. H. PEABODY, *Regent.*

On motion, the report of the Regent was received for consideration.

The Regent then read the following report from Professor S. A. Forbes:

CHAMPAIGN, ILL., Dec. 12, 1884.

DR. S. H. PEABODY, *Regent of the University:*

DEAR SIR—As the time has nearly arrived at which I must assume charge of the department of zoölogy and entomology in the University, it seems proper t hat I should make some statement of the condition of that department with respect to appliances for its work, and put into formal shape my requests in that connection. As it has seemed expedient that I should, for the present at least, continue the work of the State Entomologist, I have asked that one of the rooms placed at my disposal (number six on the first door) be fitted up as an entomological office, and during your absence at New Orleans the furnishing of this room has been undertaken and partially completed Three book-cases have been moved down from the library for the accommodation of my entomological literature, and placed upon a table; two large work-tables have been made and placed before the windows, and a third table-case, containing drawers and cupboards of a height convenient for standing work, is now being made at the shops. The case formerly used for the storage of geological specimens in this room has been cleared and arranged for my entomological collection, and measures have been taken to place a sink in one corner of the room; a small office table has been bought, and storage cases for stationery and other supplies will be brought down from the store room. With the exception of a large office table, I believe these articles complete the necessary furnishing of the room. Room number eight, the tower-room of this floor, I prefer to use as a class-room, and would be glad to have the furniture rearranged for that purpose. For the further accommodation of the classes in zoölogy and entomology, the principal need, and a very pressing one, is that of a students' laboratory for the study of zoölogical specimens. As the basement of the west wing seems to be unoccupied, I would respectfully suggest that a part of this space be partitioned off for a zoölogical laboratory—preferably the northwest corner. An excellent laboratory room can be made here in a way not to interfere in any particular with the further subdivision of the main room for general natural history purposes (if this is found to be desirable), and could be furnished at no great expense. I have consequently arranged a plan for the division and furnishing of this part of the room, and have asked the Professor of Architecture to make working drawings and to submit them to the foreman of the carpenter shops for estimates of the cost.

I judge it will be quite essential to such a use of this room as is here proposed that the floor should be raised or otherwise protected from access of moisture beneath, as certain books, instruments and specimens must be habitually kept in this room, which, under present circumstances, would be liable to injury.

The partition dividing the proposed students' laboratory from the remainder of the room should be, in my opinion, a wainscoting about five feet high, and continued to the ceiling with glass.

For furniture, I propose that the room be supplied with eighteen small dissecting tables, 2 feet by 4½, each with two drawers, the tables to be arranged in three rows running lengthwise of the room, so that all students at them shall face the windows. In the northeast corner of the room a long sink will be required, in which fifteen or twenty students can wash their hands at once. This sink should be so constructed that it may be opened up in a way to permit the washing of large objects, such as may sometimes be required for dissection. Some high tables against the proposed east wall for standing work will be necessary, and it is also very desirable that an aquarium of medium size be provided in which living animals can be kept for observation and study. The possibility of maintaining such an aquarium, however, depends upon the constancy and character of the water supply, and should, perhaps, be left until the fitness of the University well water for the purpose may be tested experimentally.

Besides the above, a cupboard placed against the west wall will be needed for storage of microscopes and such other laboratory apparatus as may be issued to students, for which they are to be held personally responsible. This cupboard should be divided into numbered compartments, each with its separate door and lock, so that the property furnished each student may be separately secured. Details of the lighting and heating of the room will, of course, require attention, and a number of small fixtures, such as tube and bottle racks, drop lights and the like, can best be supplied, I presume, from time to time as the need of them becomes apparent.

I have next to ask your attention to a matter of some importance to the future of the natural history work in the institution, and of especial interest to me personally, as related to the work of the natural history survey of the State, which I have been for many years carrying forward. As you are doubtless aware, I have for some time held the position of Director of the State Laboratory of Natural History, located in the Normal University building at Normal, and, indeed, still remain in nominal charge of that establishment, having received from the State Board of Education a leave of absence, without pay, from January 1 to June 30, 1885, in order to enable me to enter upon my duties in the University here. If I believed that my acceptance of a chair in this University necessarily involved an interruption or serious modification of the work which I have organized as Director of the State Laboratory of Natural History, I should keenly regret it; and, indeed, I did not express my acceptance of that position until I had arranged a plan of readjustment which I thought adequate to prevent such a contingency. The location in the Normal University building of what is known as the State Laboratory of Natural History was purely accidental and historical in its origin, and it is a fact generally recognized by the friends of both institutions, that there is no organic connection between their fields of labor. The essentials of my original work and of the State natural history survey can be transferred from the Normal building to the basement of the University without detriment to any part of the work of the Normal School, and, indeed, with relief and improvement to some departments of that work. I believe, therefore, that it will be entirely legitimate and proper for the trustees of this institution to express, in whatever way to them seems fitting, their willingness to receive and care for the property of the State Laboratory of Natural History, on condition that the Board of Education at the Normal University and the legislature of the State are favorable to such transfer.

Very respectfully yours, S. A. FORBES.

On motion the report was referred to the Committee on Buildings and Grounds, with request that speedy action be taken.

On motion the Board adjourned for twenty minutes for the purpose of attending chapel exercises.

On reconvening the Regent submitted a report from Prof. Burrill, of the Horticultural Department. (On experiments, etc., to be found elsewhere in this report.) On motion it was referred to the Farm Committee.

The Regent then read the report of the Professor of Agriculture, as follows:

DR. S. H. PEABODY, *Regent, I. I. U.*:

SIR: I respectfully present the following report of the work on the University Farms for the year ending December 1st, 1884:

The receipts have been $6,360 52

They may be classified as follows: Cattle, $3,799.03; hogs, $726.95; butter and milk, $575.37; hay, $520.24; rye, $227.30; mare, $155.00; corn, $50.22; timothy seed, $79.50; pasture, $72.00; poultry, $57.30; wheat, $20.00; apples, $25.15; wood, $16.25; wool, $13.26; miscellaneous, $21.00.

The expenditures have been 4,749 54

Classified as follows: Labor, $2,676.04; machinery, $185.05; stock purchased, $1,030.70; feed purchased, $352.51; hardware, blacksmithing and repairing, $113.04; harness and repairs, $29.65; freight and express, $95.02; seeds, $51.08; painting barn, $119.64; tile, $38.50; sundries, $88.31.

In addition there was an expenditure of $303.96 for drainage of Griggs Farm, which farm was, during the year, separated in the matter of accounts from the University Farm proper.

The "saleable property" of the farms aggregate $12,060.00.

Cattle—68 Short Horns (7 unregistered)	$6,300 00	
10 Jerseys	1,100 00	
10 Grade cows	400 00	
12 Grade heifers, calves	300 00	
16 Yearling steers	560 00	
11 Steer calves	275 00	
Total..127 head	$8,935 00	
12 Sheep	300 00	
19 Hogs	220 00	
5 Colts	550 00	
Chickens	75 00	
Total live stock		$10,080 00
1,000 bushels of corn at 25c		
450 bushels of seed corn at 60c	$520 00	
900 bushels of oats at 20c	180 00	
180 tons of hay	940 00	
Straw and corn fodder	160 00	
		$1,800 00
Wheat seeding 35 acres	$100 00	
Fall plowing 45 acres	45 00	
Miscellaneous	35 00	
		$185 00

The saleable property December 1st, 1883, was	$12,366 00
Showing a decrease of	301 00
The teams now consist of 9 brood mares and 1 horse, valued at	1,350 00
Showing an increase in value of	75 00
The implements and machinery are valued at	1,850 00
Showing decrease for year of	50 00
This gives a total of	15,265 00
Showing a decrease for the year of	276 00
Deducting this from the balance of sales over expenditures, gives net balance for the year of	1,234 98
Deduct the outlay for tiling on Griggs farm	303 96
Gives net balance	931 02

Charges and credits against and in favor of other departments are not included. Settlement would show an increase of balance in favor of the farm. No charge is made for extra cost of experimental work, nor for work done in permanent improvement.

As a whole the season has been a favorable one. Excessive rains during July somewhat injured the corn and caused considerable loss in harvesting the oats crop. Aside from this we had good yields, good quality, and secured all crops in good condition. The live stock has done more than usually well; condition is better and the average quality better than it has ever been before. I have placed a very moderate valuation on the pure bred stock. Present prices for grain and hay are unusually low.

In general the farms are at least in as good condition as a year since.

While not now connected or belonging to the farms proper, I may say that the work of drainage on the "Griggs Farm" was completed in the early spring. As the work progressed, it was found advisable to do more drainage than was thought necessary when the plans were first made.

The old board fence on the east has been replaced by a wire fence, and a wire fence has been built on a part of the west line (60 rods) with an arrangement that the hedge which extends over nearly all the remaining 100 rods, shall be kept in condition by the owners of the land adjoining on the west. The half of the fence on the south has been repaired.

The farm was rented for the year to F. G. Jaques for $460 and half the hay on 40 acres of the land. The hay crop was either unusually light or much of it was lost by the rains, as the half crop is estimated at not over 15 tons. The good effects of the drainage done has been very readily seen.

G. E. MORROW.

On motion the report was received and referred to the Farm Committee.

Treasurer J. W. Bunn then submitted his quarterly report:

ILLINOIS INDUSTRIAL UNIVERSITY,
IN ACCOUNT WITH JOHN W. BUNN, *Treasurer*.

1884.	*Cr.*		
Sept. 10	By balance		$24,954 28
30	By amount received on account of university fees	$2,092 50	
	" " " tuition in prep. department	400 00	
	" " " chemical department	10 95	
	" " " fuel and light	2 50	
			2,505 95
Oct. 1	By interest on Douglas county school bonds		100 00
Nov. 29	By amount received on account of buildings and grounds	$35 00	
	" " " preparatory department	50 00	
	" " " university fees	996 25	
	" " " mechanical department	4 00	
	" " " architectural department	93 36	
	" " " horticultural department	113 19	
	" " " agricultural department	2,206 91	
			3,498 71
			$31,058 94
1884.	*Dr.*		
Nov. 29	To amount paid board expense	$103 25	
	" for salaries	1,816 57	
	" on account buildings and grounds	26 58	
	" " fuel and lights	260 53	
	" " stationery and printing	178 42	
	" " preparatory department	450 00	
	" " Nebraska lands	86 66	
	" " mechanical department	324 83	
	" " architectural department	410 12	
	" " agricultural department	1,436 91	
	" " horticultural department	304 06	
	" " chemical department	582 32	
	" " military department	28 69	
	" " library and apparatus	18 32	
	" " incidental expenses	50 49	
			6,077 75
	" " new pump and boiler	$874 53	
	" " Griggs farm	76 58	
	" " gymnasium	29 32	
	" " music fees	113 00	
			1,093 43
	State Appropriations—		
	To amount paid for buildings and grounds	$324 13	
	" " mechanical and architectural shops	225 00	
	" " books and publications	277 32	
	" " current expenses of instruction	6,049 83	
	" " blacksmith shops	39 19	
	" " machines and tools	205 42	
			7,120 89
	To balance on hand		16,766 87
			$31,058 94

Urbana, Ill., December 16, 1884.

J. W. BUNN, *Treasurer*.

On motion the report was referred to the Auditing Committee.

The Business Agent made his financial statement for the three months ending November 29th, 1884.

Statement of Current Appropriations and Expenditures for the three months ending November 29, 1884.

	Appropriated Sept. 1, 1883.	Receipt also approved.	Expended	Balance.
Board expense	$300 00	....	$103 25	$196 75
Current State	....	....	1,816 57	....
Salaries	17,360 00	....	6,047 83	9,495 60
Buildings and grounds	50 00	$35 00	26 58	58 42
Fuel and lights	1,500 00	2 50	260 53	1,241 97
Stationery and printing	400 00	....	178 42	221 58
Preparatory year	....	450 00	450 00	....
Nebraska lands	100 00	....	86 66	13 34
Mechanical department	500 00	4 00	324 83	179 17
Architectural department	546 23	93 36	410 12	229 47
Agricultural department	658 33	2,206 91	1,436 91	1,428 33
Horticultural department	500 00	113 19	304 06	309 13
Chemical department	379 77	10 95	582 32	....
Military department	50 00	....	28 69	21 31
Library and apparatus	150 00	....	18 32	131 68
Incidental expense	200 00	....	50 49	149 51
Sundries—Griggs farm	100 00	....	76 58	23 42
Physical laboratory	35 80	....	....	35 80
Cabinets	8 12	....	....	8 12
Gymnasium	81 75	....	29 32	52 43
Architectural department, desks	7 26	....	....	7 26
New pump, etc	850 00	....	874 53	....
Engraving, etc., for report	65 00	....	....	65 00
Music fees	....	113 00	113 00	....
University fees	....	3,088 75	....	....

State Appropriations for 1883-84, *to November* 29, 1884.

	Appropriated 1883.	Received.	Expended.	Balance.
Taxes on lands, ½ per annum	$5,000 00	$4,969 06	$4,969 06	....
Buildings and grounds, ½ per annum	6,000 00	6,000 00	4,734 49	$1,265 51
Laboratories, ½ per annum	3,000 00	3,000 00	1,467 68	1,532 32
Mechanical and Arch. shops, ½ per annum	3,000 00	3,000 00	1,825 00	1,175 00
Books and publications, ½ per annum	3,000 00	3,000 00	1,629 74	1,370 26
Cabinets, ½ per annum	2,000 00	2,000 00	201 47	1,798 53
Current expenses of instruction	28,000 00	28,000 00	24,049 71	3,950 29
Blacksmith shop	2,500 00	2,500 00	2,500 00	....
Machines and tools	2,000 00	2,000 00	1,969 45	30 55
	$54,500 00	$54,469 06	$43,346 60	$11,122 46

The committee having in charge the sales of the Nebraska lands reported as follows:

To the Board of Trustees Illinois Industrial University:

GENTLEMEN: Your committee charged with the sales of University lands in Nebraska, report their doings since your last meeting, as follows:

SALES OF LAND.

No. Sale.	Date.		Name of Purchaser.	Tract.	Acres.	Rate.	Price.	Cash Receiv'd
13	Aug.	15	H. J. Willis and A. W. Mills	N.W.27 3-8	160	$12 50	$2,000 00	$500 00
14	Sept.	5	W. S. Collins	N. E.31 3-8	160	12 50	2,000 00	500 00
15	"		W. T. Maxwell	S. W.31 3-8	153.11	15 00	2,296 85	574 21
16	"		R. S. Gumaer	N.W.10 2-8	160	12 50	2,000 00	500 00
17	"		R. S. Gumaer	N.W.11 2-8	160	10 00	1,600 00	400 00
18	"		S. G. Bryant	S. E. 2 2-8	160	10 00	1,600 00	400 00
19	Sept.	16	Lawrence Larson	N.W.35 5-8	160	15 00	2,400 00	600 00
20	"		Christian Anderson	S. W.35 5-8	160	15 00	2,400 00	600 00
21	Sept.	25	Dennis Magner	S. E. 6 2-8	160	12 50	2,000 00	500 00
22	Oct.	4	Henry H. Snyder and J.F.Martin	S. W.26 3-8	160	12 50	2,000 00	500 00
23	"		James Lowe	N.W.13 3-8	160	12 50	2,000 00	500 00
24	"		John Higgin	S. W. 5 2-8	160	14 00	2,240 00	560 00
25	"		John Higgin	S. E. 5 2-8	160	14 00	2,240 00	560 00
26	Oct.	11	Maurice R. O'Brien	N. E 6 2-8	151.67	12 50	1,895 88	473 97
27	"	20	Amos L. Wright	S. E.14 3-8	160	12 50	2,000 00	500 00
28	"		Amos L. Wright	S. W.14 3-8	160	12 50	2,000 00	500 00
29	"		Spencer G. Bryant	N. E.11 2-8	160	10 00	1,600 00	400 00
30	Nov.	12	James A. Huston	N. E.24 3-8	160	12 50	2,000 00	500 00
			Totals from August 15th to November 12th inclusive		2,864.78	......	$36,272 73	$9,068 18
			Previously sold		1,893.58	......	26.789 84	6,697 46
			Total sold		4,758.36	......	$63,062 57	$15,765 64

The lands which have been sold include those upon which trespass appeared to have been committed by parties occupying or using the lands. Further action in regard to trespassers appears to be unnecessary.

Your committee reports further, that the sum of $128.52 should be paid to Messrs. Burnham, Trevett & Mattis for expenses in sale of lands to December 1.

Respectfully submitted,

CHARLES BENNETT.
S. H. PEABODY.

On motion the report was received and placed on file for further reference.

On motion the sum of $128.52, recommended to be paid to Burnham, Trevett & Mattis for services in connection with the sales of Nebraska lands, was ordered to be paid.

The Auditing Committee submitted the following report:

To the Board of Trustees of the I. I. U.

The undersigned Auditing Committee would respectfully report that they have examined the Business Agent's report, and accompanying vouchers Nos. 756 to 795 and Nos. 1 to 150 inclusive, and find them correct, in due form and properly receipted, and recommend that said report be approved.

CHARLES BENNETT,
PHILIP H. POSTEL,
ALEX. McLEAN,
Committee.

On motion the report was received and placed on file.

The committee on recommending a new system of bookkeeping made the following report:

To the Trustees of the Illinois Industrial University:

SIRS—Your committee appointed to consider the method of keeping the accounts of the University find that they have not been able to give the subject the consideration it demands, and respectfully ask for leave to report at the next meeting of the board.

S. M. MILLARD, *Chairman.*

On motion the extension of time was granted.

The Committee on Buildings and Grounds, to whom was referred the communication from Professor Forbes, made the following report:

To the Board of Trustees of the Illinois Industrial University:

SIRS—The undersigned, your committee to whom was referred the communication from Professor Forbes, would respectfully report as follows:

1. We would recommend the approval of the action of Professor Forbes in fitting up room No. 6 on first floor, and obtaining tables, desks, etc., as set forth in said report, and that appropriations be made by this board to complete the same.

2. We also recommend that room No. 8 be fitted up and used as a class-room, as desired by Professor Forbes.

3. We would also recommend that the basement of the west wing of the main building be fitted and partitioned as requested by the Professor, and that an appropriation of $500 be made, based on the estimates submitted with said report, for the purpose of fitting room as desired.

4. We recommend that Professor Forbes be authorized to obtain eighteen dissecting tables of size and form as set forth in his report, and that the expense of the same be paid out of proper funds.

5. As to estimates submitted for raising and reflooring the basement room to be occupied for laboratory purposes, we would recommend that the same be done in accordance with the statement of cost of the same, as mentioned in the report; provided, however, that the board has sufficient funds on hand to complete the same.

6. We approve the recommendation of Professor Forbes relative to obtaining an aquarium, when convenient and proper.

7. We would refer the matter of obtaining boxes and fitting the same in laboratory room, to preserve such instruments as the students may have in use, to the Regent and Executive Committee, with power to act.

8. We heartily recommend to the board that the proper steps be taken and suitable rooms prepared for the purpose of having the State Laboratory removed to the buildings of this University, as recommended by Professor Forbes.

Respectfully submitted.

ALEX. McLEAN,
PHILIP H. POSTEL,
G. A. FOLLANSBEE,
Committee.

The report was received and placed on file for further action.

The Farm Committee made the following report:

To the Board of Trustees of the Illinois Industrial University:

SIRS—Your committee, to whom was referred the report of Professor Morrow on University farms for 1884, recommend that said report be approved and filed.

J. T. PEARMAN,
CHAS. BENNETT,
Committee.

The recommendation was adopted.

The committee to whom was referred the report from Prof. Burrill submitted the following:

To the Board of Trustees of the Illinois Industrial University:

SIRS: Your Farm Committee, to whom was referred Prof. Burrill's report of the department of Horticulture for the year ending December 1, 1884, would respectfully recommend that so much of said report as refers to scientific investigations and experiments be referred to the Regent and Prof. Burrill for publication in the biennial University reports. Your committee asks further time for the consideration of the remainder of said report.

J. T. PEARMAN,
CHAS. BENNETT,
Committee.

On motion the recommendation and request were concurred in.

Trustee Pearman offered the following resolution:

WHEREAS, We have learned that the name of the Hon. James R. Scott, of Champaign, Ill., will be presented to the incoming President of the United States for appointment to the office of Commissioner of Agriculture; and,

WHEREAS, We recognize that this difficult and most important office requires ability and integrity of the highest order; therefore,

Resolved, That we, the Board of Trustees of the Illinois Industrial University, of which Mr. Scott is an ex-member, do most heartily approve of and recommend such appointment. We regard him most eminently fitted for the duties of such office by his long experience and earnest devotion to the agricultural interests of the country, coupled with his sound judgment and unwavering fidelity. We do therefore most earnestly urge that such appointment be made.

Resolved, That these resolutions be spread upon our record, and that a certified copy of the same be furnished to Mr. Scott.

The resolution was adopted.

The committee on legislative action made the following report:

To the Trustees of the Illinois Industrial University:

GENTLEMEN: Your committee appointed to consider legislation needed by this University, and to report from time to time, respectfully present the following report:

For reasons so often set forth in the reports of the Regent, and in accordance with the numerous requests of the alumni, the students, and the patrons of the University, your committee advises that the General Assembly at its next session be asked to change the name of the University and give it the name of "The University of Illinois."

By order of the Committee on Legislation.

S. H. PEABODY, *Chairman.*

The report was adopted.

On motion the meeting adjourned until 2 P. M.

AFTERNOON SESSION.

The Board convened at 2:30 P. M.

Present: Trustees Bennett, Follansbee, McLean, Millard, Pearman and Postel.

The Committee on Legislation submitted the following further report:

To the Board of Trustees of the Illinois Industrial University:

GENTLEMEN: Your committee appointed to consider what legislation in behalf of this University should be asked of the next General Assembly of the State of Illinois, have carefully considered the financial condition of the University, and respectfully report that appropriations be asked for the maintenance of the University for the two years to come as follows:

1—For taxes on lands in Nebraska and Minnesota	$2,000 00	per annum.
2—For repairs and improvements in buildings and grounds	3,000 00	" "
3—For instruction in the mechanical shops	1,500 00	" "
4—For the chemical, physical and botanical laboratories	1,500 00	" "
5—For the purchase of books and periodicals	1,500 00	" "
6—For collecting, preparing and preserving specimens of natural history	1,000 00	" "
7—For current expenses of instruction	12,000 00	" "
8—For additional machines for shops	2,000 00	" "
9—For building fire walls in the main building and for completing the ventilation of the same	4,500 00	" "

All of which is respectfully submitted. By order of the committee,

S. H. PEABODY, *Chairman.*

On motion the action was concurred in.

Trustee Bennett offered the following resolution:

Resolved, That the committee on legislation are hereby instructed to take such steps as in their judgment may be necessary to present to the Legislature of this State the needs of the University for the next two years, and to ask the necessary appropriations for that purpose.

The resolution was carried.

The Board then proceeded to the consideration of requests from professors and departments, as contained in the Regent's report.

The request of Prof. Burrill concerning the needs of the horticultural department, was referred to the Executive Committee with power to act.

The request of Prof. Roos, for an assistant in drawing and certain fittings needed in the drawing room, was also referred to the Executive Committee with power to act.

It was moved and carried, that an appropriation not to exceed $125 be granted (from the State appropriation for physical apparatus) for models, etc., to be expended under the direction of the Regent and Prof. Baker.

On motion an appropriation of $40 (from State appropriation for shops) was made for the purchase of tools for the architectural department.

From the same fund a further amount of $75 was appropriated for drawing tables for the mechanical department.

A communication from Janitor A. B. Baker, concerning his apartments, was referred to the committee on buildings and grounds for report.

A communication concerning the leasing of the Griggs farm, from Mr. F. G. Jaques, was referred to the Executive Committee.

It was moved and carried that an additional appropriation of $150 from current funds be made for the completion of boiler and pump.

The employment of a teacher of elocution was, on motion, referred to the Regent and Executive Committee with power to act.

The Executive Committee asked for further time to report on purchase of Rush lot, which was granted.

On motion the Regent was requested to furnish to the Board a full financial statement as to the condition of the university at the ensuing March meeting.

The report of the Committee on Buildings and Grounds concerning requests of Prof. Forbes, was taken up.

It was moved that a sum not to exceed $500 be appropriated from current funds for the purpose of repairing and fitting the basement room for service as a biological laboratory; and further, that a sum not to exceed $600 be appropriated from State appropriations for cabinets for the purpose of furnishing models, materials for dissection and contingent expenses for the zoölogical laboratory. Carried.

On motion a sum not to exceed $150 was appropriated from current funds to meet expenses of the university exhibit at the New Orleans Exposition.

The balance of the State appropriation for books and publications of $13.70 was directed to be expended by a committee consisting of the Regent, Librarian and Business Agent.

The Auditing Committee reported orally that they have found the Treasurer's report correct, and recommend that it be received and filed.

The report of the committee was adopted.

The following resolution of Trustee Follansbee was adopted:

Resolved, That the regular quarterly meetings of this Board be held on the second Tuesdays of March, September and December respectively, and on the Tuesday of June immediately preceding commencement day.

On motion of Trustee Pearman, the Regent and Executive Committee were authorized to publish the Regent's biennial report to the State Superintendent of Public Instruction, and a sum not to exceed $50 was appropriated for the purpose.

On motion of Trustee Follansbee, the bill of Messrs. Trevett & Green for plumbing, amounting to $618.33, was referred to the Executive Committee, with power to act.

The Committee on Buildings and Grounds asked that the request of Janitor A. B. Baker concerning his lodgings, which had been referred to them, may be turned over to the Executive Committee and Regent, because of lack of time to duly consider the matter.

Their request was granted and the communication so referred.

The following resolution was offered by Trustee Bennett and adopted:

Resolved, That the Business Agent be required to make out and present to the Board at each quarterly meeting an estimate of the resources and expenditures of the University for the remainder of the then current year; being as to current expenses and receipts the year ending September 1.

Trustee Follansbee offered the following resolution, which was carried:

Resolved, That the Secretary be directed to cause the transactions of each meeting of the Board to be printed within one month after the date thereof, and send a copy to each member of said Board until further ordered.

Adjourned until 8 o'clock P. M.

EVENING SESSION.

The Board met at 8:30 P. M. Members present as before.

The following resolution was offered by Trustee Follansbee, and passed:

Resolved, That the Secretary of this Board be and he is hereby directed to embrace in the minutes of its meetings, as spread upon its books of record, all the proceedings, resolutions and reports which are had and considered, *in extenso*.

Trustee Follansbee offered the following resolution:

Resolved, That the Treasurer and the Committee on Nebraska Lands are hereby directed not to receive moneys upon contracts for the sale of said lands until such time as the same become due and payable by the terms thereof.

Carried.

The following resolutions, offered by Trustee McLean, were adopted:

Resolved, That the Trustees of the Illinois Industrial University have heard with great satisfaction the suggestion that the State Laboratory of Natural History may be united with the University under their charge.

Resolved, That in case such a union shall be accomplished they will, to the extent of the means intrusted to them, aid in carrying forward the valuable work of the laboratory, by assigning to it suitable apartments in the building of the University, and by providing such conveniences as the nature of the work may require, to the end that it may enjoy a commodious and perpetual home within, and the generous coöperation of, an institution founded and maintained for the promotion of scientific research and the dissemination of practical knowledge.

Adjourned.

S. M. Millard, *President*.

E. Snyder, *Secretary*.

STANDING COMMITTEES.

Executive—Miller, Pearman and Bennett.
Farm—Pearman, Earle and Bennett.
Buildings and Grounds—McLean, Follansbee and Postel.
Auditing—Paden, Postel and Bennett.
Finance—Bennett, Follansbee and Paden.

PROCEEDING OF THE BOARD OF TRUSTEES, MARCH, 1885.

The Board met at the University parlor at 4 o'clock P. M., March 10th, 1885.

Present—Trustees Cobb, McLean, Millard, Pearman and Paden.

Absent—Governor Oglesby, Trustees Bennett, Earle, Follansbee, Landrigan and Postel.

The minutes of the last meeting were adopted as printed and revised.

The election of officers was postponed until March 11, 1885, at 10 o'clock A. M.

Trustees Cobb and Pearman were appointed by the chair to serve on the Auditing Committee, vice Bennett and Postel absent.

Regent Peabody read the following report, which was received for further consideration.

To the Trustees of the Illinois Industrial University:

GENTLEMEN: The present occasion marks the close of the second term of my service as Regent of this University, and brings me nearly to the end of five years since the duties were first undertaken. It may not be amiss to look back over this period and see what progress, if any, has been made by the University under your supervision.

No substantial change in the organization of the University has been designed or attempted. The effort to maintain the integrity of existing outlines under severe financial embarrassment has required the full strength of those in authority. It is earnestly hoped that the time has nearly come when some steps in progress may be safely taken, particularly in the establishment in the College of Engineering of a well organized school of Mining Engineering.

The School of Chemistry in the College of Natural Science, has, in the last two and one-half years, been thoroughly renovated. Its courses in Assaying, Agricultural Chemistry, Pharmacy and General Analysis are thorough and efficient. Except at a time when a temporary interest was awakened by the discovery of a new method of manufacturing sugar from sorghum, a discovery whose benefits, if any existed, were of right the property of the State, as having been developed in its University, at public cost—the number of chemical students, and especially the grade of the chemical work, in all its departments has never been greater or higher than now. While performing with success the duties of this chair, the Professor of Chemistry has conducted, at the request of the Agricultural Department at Washington, an elaborate and exhaustive examination and discussion of the fineness elasticity and strength of wools from many localities and of a great variety of breeds. The investigation has been aided by new and delicate mechanism of the professor's own invention. The results, as collated and tabulated, ready for publication, are most remarkable and valuable. They reach to the core of the subject, showing what wools are best adapted for various purposes, and why and what breeds are most serviceable and profitable to the breeders of sheep. It is expected that these results will be published under government auspices, or it would be desirable that the University itself should assist in bringing them before the public.

The unsuccessful effort of three years ago to secure for the University the presence and aid of Prof. S. A. Forbes for the organization of the instruction of Zoölogy was renewed last year, and has been crowned with better fortune. Since the opening of the new year the Zoölogical laboratory has become an active agency in this department of physical science, and its success is well assured. A new interest has been aroused in this science. The office of the State Entomologist has found a home, it is to be hoped permanent, where it naturally belongs. The governing board of the Normal University has unanimously resolved that the State Laboratory of Natural History should find its proper abode here at the State University, and has consented that the property peculiar to the work of that labortoary may be transferred hither. This change requires only legislative action before it can legally go, as it has practically gone into effect, and there appears to be little doubt that such action will be taken during the present session. When that action is law, your attention will be asked to plans for arranging quarters suitable for this new and important department.

The schools of Mechanical Engineering and of Architecture have shown large progress during the past four years. In each the number of students has increased about threefold. The courses of shop instruction in the freshman year have been changed from one short term in the spring to the occupation of the entire year, while we would yet be glad to secure more time for shop teaching, if it could be spared from other studies. As it is, the mechanical shop is occupied during the entire day, and any material increase in numbers—such an increase as our late experience may well lead us to expect—will make it necessary to add one or two competent assistants to our force of shop teachers. The Legislature has been asked to furnish the means to purchase more machine tools for second year's students, an aid which is certainly imperatively required. The projected increase of shop-room for the architectural shops should not be postponed beyond the coming summer vacation, even if the artillery should be required to stand in the yard without shelter.

The drift of the instruction at the University may be best understood from the following table, prepared for insertion in the last report of the Regent to the State Superintendent of Public Instruction:

Percentages of Students in the Different Courses of Study.

	1868-1881.		1881-1882.		1882-1883.		1883-1884.		1884-1885.	
	Courses.	Colleges.	Courses.	Colleges.	Courses.	Colleges.	Courses.	Colleges.	Courses.	Colleges.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
School of Agriculture	18		6		7		7		6	
College of Agriculture		18		6		7		7		6
School of Mechan'l Engineering	10		12		10		14		17	
School of Civil Engineering	10		12		14		15		13	
School of Mining Engineering	1		1		1		1		1	
School of Architecture	3		4		5		6		6	
College of Engineers		24		29		30		36		37
School of Chemistry	7		12		10		8		8	
School of Natural History	2		4		3		5		5	
School of Domestic Science	1									
College of Natural Sciences		10		16		13		13		13
School of Art and Design									2	3
Elective Scientific		13		11		12		10		7
Total Technical		60		62		64		68		66
College of Literature and Science		32		35		34		31		32
Commercial		3								
Special		3		1						
Special Military		1								
Resident Graduates		1		2		2		1		2
Grand Total		100		100		100		100		100

An examination of the foregoing table should forever set at rest any question which may have arisen as to the intent or effort of the present management to change the character of the University in such a way as to lessen by the least fraction its technical and scientific superiority, or, as it is sometimes averred, to convert it into a "mere literary and classical college."

Still it must not be forgotten that literature and language have a lawful and legitimate place here which must not be denied nor abridged, nor hidden beneath a bushel.

The material and visible improvements made during the last four years at the University are not unworthy of notice. The most notable, perhaps, is the building of the boiler-house with the removal of boilers from the basement of the main building and their replacement by two of much larger capacity than that of the first set. As a result of this improvement may be cited the fact that since the change was made, and particularly during the phenomenally inclement season from which we are just emerging, the main building has been regularly and constantly warmed, and the old days of frozen pipes and enforced holidays have entirely passed away.

The latest improvement in the boiler-house is the setting of a new boiler for pumping uses, with a duplex pump and attachments which command every floor and the roof of the main building, and give added security against fire. But this leads me to say that a matter which will require attention at an early day will be some method of securing a more abundant supply of water.

Lesser items of improvement are the building of the blacksmith's shop, with its cupola for melting iron, and its sixteen fires and forges; the enlargement of the pattern shops and of the machine shops; the building of the dairy-house; the building of the farm cottage; thorough repairs of both the north and the south barns; the painting of the main building; the shelters at the basement doors of the main building; the construction of a sewer from main and chemical buildings to the creek; the neat fences on either side of Green street; the fitting up of the observatory for the reception of the new twelve-inch theodolite; the fitting up of the botanical laboratory; the fitting up of the zoölogical laboratory; the renewal of the ceiling of the upper story of the west wing of the main building, and the occupation of the room as a museum of industrial art, whose fitting centre-piece is the beautiful and unique Gay model; the receiling of a part of the art gallery, and renovation of the same; the construction of new cases in and the the rearrangement of the library, by which its capacity for books was duplicated; the opening of new rooms for mathematical and engineering drawing, and the addition to the equipment of all other drawing rooms. To this may be added the constant accumulation of books, apparatus, models, and other means of instruction and illustration, as fast as the needs for them have been found and the funds found.

In this hasty enumeration of improvements made will be seen the reasons for the regular increase of students in the technical studies. Much as has been done, there is yet need for farther improvements in many directions.

Nor should we forget the removal of the old dormitory building—unsightly, unhealthy, and a constant menace to good morals and good government. Without doubt the ground on which the building stood should be sold whenever an advantageous sale can be made, and the proceeds be either added to endowment or invested in some useful and necessary buildings. So long, however, as there is no present market for this property and its holding costs the University nothing, it should be kept until it shall be sought after for more important uses. The time will come when the University will wish to hold no property north of Springfield avenue, if, indeed, it shall not prefer to retire quite south of the horse railway. Meanwhile, the acquisition of the Chase lots has straightened your lines in a serviceable manner, which will be completed, possibly to your entire satisfaction, in a way to be referred to later.

The financial affairs of the University have been greatly aided during the past four years. The legislature has twice recognized the claims of the University for assistance in view of the diminished rates of interest earned by its endowment. The lapsed indebtedness of Kankakee county has been satisfactorily settled, without expense and vexatious litigation, and the University has been secured from loss. Indeed, it may be a matter of congratulation that the State of Illinois has never been called to replace any of the endowment of this University, because lost in unfortunate investments, as in such case the law of Congress requires. The same good fortune has not attended all our Western States.

The sale of Nebraska lands has been well organized, and has so far progressed that there seems little doubt but all will be taken at the prices fixed, adding $120,000 to our endowment, and raising our total to more than $450,000. Without presuming to question the wisdom of those who in an early day managed the financial interests of the University, in the light of present facts we may well wish that she were the fortunate investor of 100,000 acres of land scrip in Nebraska instead of the 9,000 acres that she did locate there. So often it is in the history of colleges, as of persons, that a great future welfare is sacrificed for a paltry present gain. That the University, as the assignee of the State, had a lawful right to make such investments there can be no shadow of a doubt, or that it has an indefeasible title to the lands so entered, which it now holds under patents duly issued to it by the government of the United States.

Meanwhile the University is constantly gaining in favor with the people of the State, from the knowledge of it disseminated through its students, through its faculty, through the press of the State, which has of late uttered no unkind words concerning it, and through the troops of visitors of every shade of opinion and sentiment, who frequently come to scoff, but who uniformly go away to praise. Among its late visitors may be named committees from the State Grange and the Legislature, the State Horticultural Society, the State Dairymen's Association, the State Press Association, a large concourse of the Masonic order, with smaller groups innumerable. Both the agricultural and secular press have adopted a kinder and more appreciative tone than was always their habit in the earlier days of our history.

It is well thus to look over the history of the years and count up the results of our labors, if for no other good than that we may take heart to go forward. We must not, we do not, imagine that the University has achieved any more than elementary successes. There is much to be done which time and progress will make known. There are many things which are yet needed before the institution will have taken its true position. We need now a name which is a true and broad index of the scope and quality of our work. We need the active sympathy and aid of a large and influential body of educated and cultivated men and women in the State, who from force of habit and circumstance have never even yet discovered how grand is the enterprise here in action, nor how far assured is its success. While we enter into no competition with other collegiate institutions within the borders of the State—there is room enough for us and for them to march ever out of sight of each other's banners—we do want that a large part of the thousand students who annually leave the State for no greater privileges on the Eastern slope than they could find here, should stay at home for their education.

We need, what we may not soon obtain, a larger endowment. A senator asked me when this institution would be self sustaining. I answered, not while we give $150 worth of tuition for $22.50. The more business we do at these figures the more aid we must ask of the State. We need more men to carry forward our work.

We need, and must maintain, a constant, vigorous, and healthy growth. Having thus hastily glanced at the retrospect, I beg to call your attention to other matters of more immediate interest.

THE HALF WAY HOUSE.

The Half Way House, so called, on the line of the horse railway, and the land adjacent, near the northwest corner of the arboretum, has been before brought to your attention, and some negotiations were had for the purchase of the building and the ground it was supposed to occupy. Since your last meeting the house has been burned. From some investigations I had before made, it had seemed to me that the building really stood on the University property, and that the builder was in error as to the lot which he supposed he had purchased. The deed by which the University holds the west half of the west half of the northeast quarter of section 18, &c., that is the ground of the aboretum, college campus, etc., has been examined by competent legal counsel, and I am advised that the corner lot, being the southeast corner of Wright street and the right of way of the horse-railway, is the property of the University, and that the lot bought by Mr. Rush lies next east of the corner lot. This lot he has sold to the horse-railway company, and I have a communication from Mr. F. G. Jaques, its secretary, offering it to the University, upon terms specified. The University should certainly have the lot if it can be obtained at reasonable terms. If secured, the line of lots south of the horse railway will all be included in the arboretum.

ELECTRICAL APPARATUS.

The purchase of a dynamo electrical generator for the joint use of the chemical and physical laboratories has long been desired, but has been postponed from time to time for sufficient reasons. With a view to this purchase, the State appropriation for the laboratories for the current year has been drawn upon sparingly, and the time seems to have come when we can safely make this outlay. The machine is wanted primarily for experiments in the physical laboratory, both for lighting and measurement, and in the chemical laboratory for electro-metallurgy. When not in use in these ways it may be used to a moderate degree for illumination. From investigations made I believe that a machine suitable for our purposes, with the necessary attachments to an engine, line, and fittings, will cost about $500. I ask authority to use that sum for the purpose.

I would advise that authority be given to expend the balance of the appropriation for such apparatus as may seem most needed.

THE GYMNASIUM.

The attention of the students to this work is increasing. The money appropriated a year since has been usefully expended. I ask a farther appropriation of $100 for this purpose with authority to use a portion of it in causing the floor of the platform in the drill hall to be reduced to one level, instead of being raised in steps as now. In this way room may be made for primary apparatus not in the way of the drill and not requiring, as now, to be constantly removed. The change is a simple one and should not cost more than $20.

Prof. Burrill asks that he may be permitted to fit up that part of the east basement once used for taxidermy, but now no longer needed for that purpose, and use it for micrographic photography. I concur in his request.

I recommend that W. H. Garman, assistant to Prof. Forbes, be appointed assistant in zoölogy without salary, for the remainder of the current year.

With great regret I present to you the resignation of Prof. F. W. Prentice to take effect at the end of the current collegiate year. Dr. Prentice has occupied the chair of veterinary science and physiology for a long term of years, with great fidelity and success. It will be no easy matter to supply properly the vacancy.

Authority is ask to publish 4,000 copies of the annual catalogue at an expense not to exceed $300.

The usual report of classes taught by instructors and the inventory of personal property of the University are presented.

I respectfully ask the following appropriations, including those named before:

From the State Appropriations for Laboratories—

For a dynamo and adjuncts	$500 00
For chemical apparatus	250 00
For the botanical laboratory	100 00

From State Appropriations for Cabinets—

For labor on the herbarium, etc	$16 50
For bird skins for museum	50 00
For apparatus for making microscopic sections	60 00

From Current Expense Account—

For collection of photographs, etc., for school of architecture	$50 00
For outfit of stamps, etc., for schools of engineering and architecture	20 00
For gymnasium	100 00
For new case for card catalogue in library	30 00

FINANCES.

The following part of this report is in answer to your request for a statement of the results of the transaction of those departments of the University which have business accounts.

The preliminary explanations made last year will not be needed now and are omitted.

THE DEPARTMENT OF AGRICULTURE.

The lands belonging to the University may be classed thus: Lands used for agricultural purposes.

The experimental farm, acres	90	
The stock farm	410	
		500
Lands used for horticulture, etc		53
Lands used for public grounds		38
Roads, external and internal, plats for yards, etc		34
Total for University purposes		610
The Griggs farm		160
Total land in Champaign county, acres		770

The agricultural lands have been used thus:

In pasture	235	
Meadow	95	
Tillage—Corn, 67; oats, 66; rye, 27; wheat, 3½; miscellaneous, 6½	170	
		500

Of this land about twenty acres are used specially for experimental purposes.

The products of tillage were in 1884:

Corn, bushels		2,750	
Oats, "	1,400		
Rye, "	450		
Wheat, "	70		
		1,920	4,670
Hay, tons			200

The usual line of experimental work has been continued in testing varieties of corn and small grains, effects of rotation of crops, continuous cultivation of same crops, use of fertilizers, feeding of stock, etc.

The dairy-house has used the milk of about sixteen cows, except that required for the raising of the calves.

There has been sold of butter 2,600 pounds	$550 00
" " " milk and cream	20 87
Total	$570 87

Fences—These are as follows:

	Miles.
Hedge fence, osage	5
Board and board and wire	1.5
Wire	1.25
Rail	.25
Total	8

The hedges have been trimmed, and one-fourth of a mile of old rail fence has been rebuilt as wire fence.

The following balance sheet sets forth the financial condition of the farm, in which its educational services cannot be included, as they cannot be measured in money units:

Balance Sheet of Agricultural Department, Dec. 1, 1884.

Cr.			
Inventory Dec. 1, 1884:			
Live stock	$10,080 00		
Farm products	1,980 00		
Teams	1,350 00		
Machinery and tools	1,850 00		
		$15,260 00	
Sales—Live stock	$4,788 00		
Butter and milk	575 87		
		5,313 65	
Grain and hay	....	897 26	
Miscellaneous	....	147 61	
			$21,620 52
Dr.			
Inventory Dec. 1, 1883:			
Live stock	$10,301 00		
Farm products	2.065 00		
Teams	1,275 00		
Machinery and tools	1,900 00		
		$15,541 00	
Paid—For labor	$2,676 04		
Stock purchased	1,030 70		
Special food for stock	352 51		
Machines, tools and repairs	214 70		
Ordinary repairs	173 99		
Seeds, freight and advertising	135 10		
Miscellaneous	167 50		
		4,750 54	
			20,291 54
Profits from year's work	....	....	$1,329 98

The Griggs Farm.

It was ordered last year that the accounts of this piece of property should be kept separately from those of the University farm. The fencing and drainage required has been completed, and the account of this farm stands as follows:

Cr.		
Rent	$460 00	
Hay	80 00	
Old lumber	7 00	
		$547 00
Dr.		
Tile and ditching	$376 15	
Fencing	75 92	
		452 07
Profits for the year	......	$94 93

It should be remarked, however, that the whole outlay upon this property is of the nature of permament improvement, which is already yielding return in the way of increased rental.

THE HORTICULTURAL DEPARTMENT.

The lands used by this department are divided thus:

Orchard, acres	30
Forest plantation	15
Small fruits and grapes	6
Garden and nursery	2

This department is also charged with the care and ornamentation of the public grounds the arboretum and the University campus. The old college campus has paid in hay for the cost of its care. The culture of strawberries has yielded a profit. The blackberries and grapes paid nothing. The attempt to grow vegetables for the canning factory was not profitable. The chief item of expense in the nursery was caused by clearing up ground which had been previously in use.

The expense of the green-house, including the wages of the gardener, exceeds the income by $516 43. Against this item may be offset the value of more than 13,000 plants furnished by the green-house for the decoration of the public grounds. These plants would have cost fully that sum if bought at the wholesale market rates.

The balance sheet of this department is as follows:

Balance Sheet of the Horticultural Department.

Credits.			
Receipts from—			
Orchard	$34 95		
Small fruit	513 17		
Nursery	49 10		
Forest and arboretum	55 80		
		$653 42	
Green-house, sales	$533 44		
" plants for grounds, estimated	500 00		
		1,033 44	
State appropriations, buildings and grounds	....	483 55	
			$2,170 41
Debits.			
Payments for—			
Orchard, labor	....	$45 00	
Small fruits, labor	$491 62		
" material	74 80		
		566 42	
Nursery, labor	$55 00		
" material	20 42		
		75 42	
Forest and arboretum	....	24 00	
Green-house, labor	$152 00		
" gardener	600 00		
" repairs	52 01		
" fuel	114 26		
" materials	131 60		
		1,049 87	
University campus, labor	$441 55		
" " material	42 00		
" " plants from green-house	500 00		
		983 55	
			$2,744 26
Balance, payments above receipts	....	....	$573 85

Balance Sheet Chemical Department, March 1, 1885.

Credits.		
State appropriations	$30 99	
Receipts for students	890 29	
Material sold	16 60	
Balance of last year, re-appropriated	99 99	
Material supplied other departments	15 05	
		$1,052 92
Debits.		
Apparatus and chemicals	$714 64	
Gas	156 00	
Repairs	77 93	
Sundries	48 14	
		986 81
Balance to credit	....	$66 11

Balance Sheet Machine and Carpenter Shops, March 1, 1885.

	Carpenter Shop.		Machine Shop.	
Credits.				
Work for University	$2,198 02		$829 49	
Work for other parties	416 74		33 35	
State appropriations	500 00		1,000 00	
		$3,114 76		$1,862 84
Debits.				
Materials and tools	$1,162 88		$536 07	
Labor	1,034 69		740 93	
Power	116 54		116 54	
Teacher and foreman	960 00		1,200 00	
		3,274 11		2,593 54
Balance against General fund	....	$159 35		$730 70
Number students taught during year	....	23		56
Inventory of stock on hand	....	$650 00		$1,044 36

General Balance Sheet.

Department.	Loss.	Gain.
Agricultural Department	....	$1,329 98
Horticultural Department	$573 85	
Chemical Department	....	66 11
Mechanical shops	890 05	
Balance	....	67 81
	$1,463 90	$1,463 90

Respectfully submitted,

S. H. PEABODY, *Regent.*

The following report from the Professor of Agriculture was read, and on motion of Trustee McLean was received and ordered filed:

CHAMPAIGN, March 7, 1885.

Dr. S. H. Peabody, Regent:

During the last three months the extreme cold weather and the deep snow have prevented about all farm labor except the care of live stock. With a very few exceptions these have done well. More than the usual quantity of food has been required. We have been able to give comfortable shelter to all the stock.

During the three months the sales have amounted to $496.58. The chief items are: Hay, $153.35; butter and milk, $122.50; cattle, $139; old horse, $60.

The payments for the quarter have been $1,044.41. Of this sum $558.50 were for stock purchased and on hand, including steers and calves for experimental feeding, twelve Cotswold ewes, and steers for ordinary feeding.

We have now pure bred or grade Ayrshire, Hereford, Holstein and Short Horn steers, near one year old, for feeding in comparative test of these breeds.

We have a number of young Short Horn bull calves for sale, and can now also spare Short Horn and grade cows and heifers. We can sell hay, but shall need grain.

On the whole, I think we are in good condition.

Respectfully,

G. E. MORROW,

Professor of Agriculture.

On motion of Trustee Pearman, the request of Prof. Burrill for an assistant in the Horticultural Department was referred to the Committee on Buildings and Grounds.

The President appointed Trustees Cobb and McLean to fill vacancies on the Farm Committee, and Regent Peabody and Trustee Paden on the Committee on Buildings and Grounds.

Voted, that if the Board adjourn it be to meet at the Doane House, in Champaign, at 8 o'clock P. M.

The Business Agent then submitted the following statements, which were read and referred to the Auditing Committee:

State Appropriations.

July, 1883.	Appropriated.	Received.	Expended.	Balance.
Taxes on lands, ½ per annum	$5,000 00	$4,969 06	$4,969 06	....
Buildings and grounds, ½ per annum	6,000 00	6,000 00	5,292 89	$707 11
Laboratories, ½ per annum	3,000 00	3,000 00	2,000 96	999 04
Mechanical and arch'l shops, ½ per annum	3,000 00	3,000 00	2,431 82	568 18
Books and publications, ½ per annum	3,000 00	3,000 00	1,868 77	1,131 23
Cabinets, ½ per annum	2,000 00	2,000 00	517 12	1,482 88
Current expenses of instruction, ½ per annum	28,000 00	28,000 00	28,000 00	....
Blacksmith shop	2,500 00	2,500 00	2,500 00	....
Machines and tools	2,000 00	2,000 00	2,000 00	....
Total	$54,500 00	$54,469 06	$49,580 62	$4,888 44

Current Appropriations.

September 1, 1884.	Appropriated.	Receipt also approved. Approp'ted.	Expended.	Balance.
Board expense	$300 00	....	$201 76	$98 24
	....	Cur'nt State	6,335 08	....
Salaries	17,360 00	....	10,000 12	1,024 80
Buildings and grounds	50 00	82 00	105 93	26 07
Fuel and lights	1,500 00	97 33	1,840 91	243 58
Stationery and printing	450 00	....	333 03	66 97
Preparatory year	....	782 50	900 00	117 50
Nebraska lands	228 52	....	163 30	65 22
Mechanical department	500 00	558 42	790 23	268 19
Architectural department	546 23	1,555 96	1,231 44	870 75
Agricultural department	658 33	2,763 49	2,545 51	876 31
Horticultural department	500 00	155 89	825 69	169 80
Chemical department	379 77	467 76	691 96	155 57
Military department	50 00	....	49 74	26
Library and apparatus	300 00	....	222 34	77 66
Incidental expenses	200 00	1 45	156 43	45 02
Sundries—Griggs farm	100 00	547 00	148 11	498 89
Physical laboratory	35 80	....	2 60	33 20
Cabinets	8 12	....	1 37	6 75
Gymnasium	81 75	....	41 20	40 55
Architectural dep't (desks)	7 26	....	....	7 26
New pump and boiler	1,000 00	....	1,021 09	21 09
Engraving, etc., for report	65 00	....	....	65 00
New Orleans exposition	150 00	....	53 24	96 76
Natural History laboratory	500 00	....	596 34	96 34
Civil engineering instruments	25 00	....	25 00	....
Music fees	....	113 00	113 00	....
University fees	....	4,991 50	....	....

Dr. Peabody read the following report from Committee on Sale of Nebraska Lands:

To the Board of Trustees of the Illinois Industrial University:

GENTLEMEN—Your committee upon the sale of the Nebraska lands reports as follows:

The sales since your last meeting have been:

No.	Name.	Tract.	Price.	Cash.
31	John H. Hanson	N.E. 35 5 8	$2,000 00	$500 00
	Total sales		65,061 36	16,265 34
	Proposals have been accepted and contracts are drawn for—			
32	Patrick C. O'Brien	N.E. 5 2 8	2,054 00	514 50
33	Christian Hesse	S.E. 30 3 8	2,244 00	560 00
34	Joseph Swoboda and H. John Swoboda	S.E. 35 5 8	2,000 00	500 00

When these sales are completed the total sales will be $71,359.36.

Inquiries are more abundant and more sales may be made soon.

One purchaser has completed his purchase in accordance with the terms of his contract, and is entitled to his deed. This fact has led your committee to ask your further attention to the character of the deeds which should be given to the purchasers of these lands. due consideration being had both to the rights of the buyers and to the influence which the deed will have upon the sales hereafter to be made. Your committee respectfully recommends the passage of a resolution substantially as follows, and that the resolution be incorporated in the deed:

Resolved, That the President of the Board of Trustees of the Illinois Industrial University be and hereby is authorized and directed to execute, in the name and under the seal of the said Board, deeds in fee simple of lands belonging to said University in Gage county, Nebraska. to purchasers who have paid the full purchase price thereof, said deeds to be countersigned by the Recording Secretary of said Board of Trustees.

Your committee further recommends that deeds be prepared substantially in accordanc with a form herewith presented.

Your committee presents the account of Burnham, Trevett & Mattis, of Beatrice, Nebraska, amounting to $130 08, for service to the committee during the year ending Dec. 31, 1884, and ask that it may be audited and paid, after making due account of sums already authorized by you to be paid to the same firm on current account during the year.

Respectfully submitted,

S. H. PEABODY, *for Committee.*

The report was received and referred to the Executive Committee and the Regent for report at this meeting.

Adjourned.

EVENING SESSION.

The Board met at 8 o'clock P. M. Present: Trustees Cobb, McLean, Millard, Pearman, and Paden.

The resignation of Dr. F. W. Prentice, Professor of Veterinary Science, was received and placed on file.

The committee to whom was referred the request of Janitor A. B. Baker, asked for further time to report, which was granted.

Treasurer J. W. Bunn read his report, which was received and referred to the Auditing Committee.

ILLINOIS INDUSTRIAL UNIVERSITY, *To John W. Bunn, Treasurer. Dr.*

1885.			
Feb. 28	To amount paid for Board expense	$98 51	
	" " " Salaries	4,518 51	
	" " " Buildings and grounds	79 35	
	" " " Fuel and light	1,580 38	
	" " " Stationery and printing	204 61	
	" " " Preparatory department	450 00	
	" " " Nebraska lands	76 64	
	" " " Mechanical department	465 40	
	" " " Architectural department	821 32	
	" " " Agricultural department	1,108 60	
	" " " Horticultural department	521 63	
	" " " Chemical department	109 64	
	" " " Military department	21 05	
	" " " Library and apparatus	204 02	
	" " " Incidentals	105 94	
			$10,365 60
	" " " Griggs farm	$71 53	
	" " " Physical laboratory	2 60	
	" " " Cabinets	1 37	
	" " " Gymnasium	11 88	
	" " " New pump and boiler	146 56	
	" " " Civil Engineering instruments	25 00	
	" " " Natural History laboratory	596 34	
	" " " New Orleans Exposition	53 24	
			908 52
	STATE APPROPRIATIONS:		
Feb. 28	To amount paid for Buildings and grounds	$558 40	
	" " " Laboratories	533 28	
	" " " Mechanical and architectural shops	606 82	
	" " " Books and publications	239 03	
	" " " Cabinets	315 65	
	" " " Current expenses for instruction	3,950 29	
	" " " Machinists' tools	37 98	
			6,241 45
	To balance		9,458 94
			$26,974 51

ILLINOIS INDUSTRIAL UNIVERSITY, *To John W. Bunn, Treasurer, Cr.*

1884.			
Dec. 16	By balance		$16,766 87
1885.			
Jan. 1	By interest on Chicago water bonds	$875 00	
	" " Pittsfield school bonds	600 00	
	" " $24,000.00	960 00	
			$2,435 00
	" " Champaign school bonds		180 00
Jan. 15	" " Land contract No. 1, A. Hubka	$121 87	
	" " " " No. 2, J. T. Applegate	110 31	
	" " " " No. 3, "	120 39	
	" " " " No. 4, "	115 62	
	" " " " No. 5, S. C. Miller and D. C. Bashor	80 50	
	" " " " No. 7, August Zahlten	69 00	
	" " " " No. 8, C. E. Baker	79 74	
	" " " " No. 9, Chester M. Dawson	62 00	
	" " " " No. 10, John W. Herbert	62 00	
	" " " " No. 11, David Richardson	50 00	
	" " " " No. 12, Herman C. Kluders	50 00	
	" " " " No. 13, H.T. Willis and A.W. Miller	45 20	
	" " " " No. 14, W.L. Collins	38 33	
	" " " " No. 15, W.T. Maxwell	44 00	
	" " " " No. 16, Robert L. Gumaer	30 66	
	" " " " No. 17, Robert L. Gumaer	38 33	
	" " " " No. 18, Spencer G. Bryant	30 66	
	" " " " No. 19, Lawrence Larsen	42 00	
	" " " " No. 20, Christian Andersen	42 00	
	" " " " No. 21, Dennis Magner	31 67	
	" " " " No. 22, H.H. Snyder and J.H. Martin	28 33	
	" " " " No. 23, James Lowe	28 33	
	" " " " No. 24, John Higgins	31 73	
	" " " " No. 25, John Higgins	31 73	
	" " " " No. 26, M.R. O'Brien	25 28	

Jan. 15	By interest on land contract	No. 27, Amos L. Wright	$23 33	
	" " " "	No. 28, Amos L. Wright	23 33	
	" " " "	No. 29, Spencer G. Bryant	18 66	
	" " " "	No. 30, John A. Huston	16 00	
				$1,491 00
Feb. 28	By amount received on account	Mechanical department	$554 42	
	" " " "	Architectural department	1,462 60	
	" " " "	Agricultural department	556 58	
	" " " "	Horticultural department	42 70	
	" " " "	Chemical department	456 81	
	" " " "	Fuel and lights	94 83	
	" " " "	Buildings and grounds	47 00	
	" " " "	Griggs' farm	547 00	
	" " " "	Incidentals	1 45	
	" " " "	University fees	1,892 75	
	" " " "	Tuition in preparatory departm't	332 50	
	" " " "	Music fees	113 00	
				6,101 64
				$26,974 51

URBANA, March 10, 1885. JOHN W. BUNN, *Treasurer.*

The Committee on Buildings and Grounds submitted the following report:

To the Trustees of the Illinois Industrial University:

The undersigned, Committee on Buildings and Grounds, to whom was referred the report of Prof. T. J. Burrill, would report that after a careful consideration of the matter of engaging the services of a foreman of horticultural department, we would recommend that George W. McClure be appointed to that position at a salary of six hundred and sixty dollars per annum. And we would also recommend that an assistant be appointed, preference being given to a woman of some experience in horticulture, whose duty it shall be to attend to the sale department and to have in charge the office and other matters pertaining to the indoor work of the department, at a suitable salary, to be determined by the Board hereafter.

Respectfully submitted,

ALEX. McLEAN,
EMORY COBB,
R. N. PADEN,
Committee.

The report was received and its recommendations adopted.

The Executive Committee reported that the request of Prof. Burrill concerning the needs of the horticultural department, referred to them at the last meeting, has required no action on their part.

The Executive Committee further reported that they have, on recommendation of the Regent, employed Mr. Horace Taylor at a salary of $25 per month, as assistant to Prof. Roos, and asked further time for a report on fittings and furniture in the drawing room.

The appointment was concurred in and further time granted.

The matter of leasing or putting under cultivation the Griggs farm was referred to the Executive Committee with power to act.

The following appropriations were made from State funds in accordance with requests found in Regent's report:

For dynamo engine	$500 00
For apparatus for chemical department	125 00
For apparatus for botanical laboratory	100 00
For cabinets for botanical collections	16 50
For cabinets for zoölogical collections	110 00

Further appropriations were made from current funds as follows:

For chemicals	$400 00
For card cabinets for library	30 00
For photos of drawings for architectural department	50 00
For rubber type and stamps for engineering and architectural departments	20 00
For gymnasium apparatus, etc	140 00

Authority was granted to the Regent and Faculty to publish the annual catalogue, in 4,000 copies, at an expense not to exceed $350.

W. H. Garman was appointed assistant in Zoölogy for the remainder of the academic year (without salary).

Trustee McLean offered the following resolution, which was adopted:

Resolved, That the Treasurer of this University be and he is hereby requested to have placed upon the records of Gage County, Nebraska, the fifty-nine patents issued by the United States to the Illinois Industrial University to tracts of land in said county; that the Treasurer be authorized to pay the fees for same from the funds of this University, and that he report his action at the next meeting of the Board.

Adjourned to meet at 8 o'clock A. M.

SECOND DAY'S SESSION.

The Board convened at 8 o'clock A. M.

Present: Trustees Cobb, McLean, Millard, Paden, and Pearman.

The Committee on system of Bookkeeping submitted the following report:

REPORT OF COMMITTEE ON ACCOUNTS.

To the Trustees of the Illinois Industrial University:

GENTLEMEN: Your committee to whom has been referred the revision of the system of accounts used in the business of the University, has carefully considered the subject referred to it, and reports and recommends as follows:

1. The accounts have been kept from the beginning of the University in an accurate and methodical manner, and with great fidelity. Such changes as may be recommended will be rather in detail than in principle, and are not to be construed as reflecting upon former methods or accounts. It has been thought better to restate a system than to describe amendments to one which already exists.

2. All accounts should be closed and a balance struck at the end of each year, on the first day of September, and the balance sheet be reported to the Trustees on the regular meeting held in that month.

3. The leading accounts will be those of current expenses and State appropriations. The account of State appropriations will be charged with all sums paid out from this fund by order of the Trustees, and credited with all sums received on this account from the State Treasurer. When closed, the balance, if any exists, will be carried forward to a new account.

The account of current expenses will have subordinated to it such and so many others as may be found desirable for convenience of classification, as Board expenses, salaries for instruction, fuel and lights, buildings and grounds, the several departments, the laboratories, students' fees, etc., etc. Each of these subordinate accounts will be charged with the moneys paid out on its account, and credited with the funds received for its use. For example:

Salaries for instruction—	*Dr.*	*Cr.*
To monthly vouchers for salaries, say	$15,000	
By interest from endowment	......	$11,000
By State appropriation	......	3,000
Balance to current expenses	......	1,000
	$15,000	$15,000

Chemical laboratory—	*Dr.*	*Cr.*
To paid for chemicals and apparatus	$1,000	
By receipts from students	......	$600
By State appropriation, laboratory	......	500
Balance to current expenses	100	......
	$1,100	$1,100

Agricultural department—	*Dr.*	*Cr.*
By sums received from sales, etc	......	$17,000
To sums paid for labor, etc	$15,000	......
Balance to current expenses	2,000	......
	$17,000	$17,000

Buildings and grounds—	*Dr.*	*Cr.*
To sums paid out for sundry purposes	$3,500	......
By State appropriation	......	$3,000
Balance to current expenses	......	500
	$3,500	$3,500

When these accounts are closed to current expenses that account will stand thus:

Current expenses:	*Dr.*	*Cr.*
By balance from last year (say)	......	$7,000
By balance account chemical laboratory	......	100
By balance account agricultural department	......	2,000
To balance account salaries for instruction	$1,000	......
To balance account buildings and grounds	500	......
Balance to new account	7,500	......
	$9,100	$9,100

The corresponding account of State appropriations will stand thus:

State appropriations:	*Dr.*	*Cr.*
By sums received from the State Treasurer (say)	......	$7,000
To paid account salaries for instruction	$3,000	......
To paid account buildings and grounds	3,000	......
Balance to new account	1,000	......
	$7,000	$7,000

The balances found in this and the preceding account will, when added, equal the cash in the Treasurer's hands, exclusive of that belonging to the endowment fund, to be separately provided for.

An interest account will be kept thus:	*Dr.*	*Cr.*
Interest from endowment:		
By interest —— county bonds	......	$1,000
By interest —— county bonds	......	11,000
Balance to account salaries for instruction	$12,000	......
	$12,000	$12,000

This account is closed to salaries for instruction in order that it may appear that the interest from endowment is all used for this purpose, as the law requires. But if at the end of any year a balance should remain, then so much as has been paid out should be transferred to that account, and the account of interest should be closed by balance to a new account, so that none of the interest may find its way into the account of current expenses.

An endowment account may be kept thus:

Endowment account:	*Dr.*	*Cr.*
By sums received for bonds redeemed	......	$20,000
To paid for new bonds (face)	$10,000	......
To paid premium on bonds	200	......
Carried to new account	10,000	......
Balance to current expenses	......	200
	$20,200	$20,200

The cash ($10,000) will be separately reported.

4. At the beginning of each half year, and at such other times as may be needful, the necessary appropriations will be made to each of the separate departments. These appropriations will carry no money into accounts. They will be listed in a suitable memorandum, and will be the authority for using so much money from a specified source, if such an expenditure should be found needful. In any case the balances carried to the general account of current expenses will never exceed the corresponding appropriations.

The memorandum of appropriations will show, as now:

Sums appropriated.	Expended.	Balances.

The warrant book will continue to be used, as now.

5. The drawing of credit warrants, so called, by which one department is enabled to pay another department for labor, material, etc., by a transfer on the books of the Treasurer, seems to be a useful and necessary aid in keeping the accounts of any department which is transacting miscellaneous business.

An example may be found in the repair or refitting of an apartment, to be paid out of the State appropriation for buildings and grounds. If the work were done by a carpenter not belonging to the University, he would bring in his vouchers in duplicate, be paid, and the sum would be charged in the proper account. If, instead, the work were done in the University shop, as all persons would prefer, why should not the vouchers of the department be received, as in the other case, and be charged in the same account? The receipts will be credited in the accounts of the architectural department, which employs the labor and pays for the material used.

Otherwise the shop would fail to get pay for the material, etc., charged to it, or the University would be prevented from using its own facilities for its own benefit.

The purpose of this report has been to give an outline of a method, with such illustrations as will show the consistency of its parts. Further details will readily arrange themselves.

Respectfully submitted,
S. H. PEABODY,
JOHN W. BUNN,
S. M. MILLARD,
Committee.

URBANA, ILL., March 10, 1885.

On motion of Trustee Cobb, it was resolved that the report of the Committee on Bookkeeping be received and adopted, and that the Regent and Treasurer put the same into operation as soon as the business of the University will permit.

The Executive Committee reported back the report of the committee on Nebraska lands, with the recommendation that the resolution contained therein, as well as the form of conveyance proposed, be adopted.

On motion of Trustee Paden the resolution (incorporated in the deed) was adopted and the following form of deed approved:

Contract No...... Deed No......

KNOW ALL MEN BY THESE PRESENTS, That in pursuance of a resolution of the Board of Trustees of the Illinois Industrial University, passed March 11th, 1885. as follows:

Resolved, That the President of the Board of Trustees of the Illinois Industrial University is hereby authorized and directed to execute, in the name and under the seal of said Board, deeds in fee simple of lands belonging to said University in the county of Gage, and the State of Nebraska, to purchasers who have paid the full purchase price thereof, said deeds to be countersigned by the recording secretary of said Board.

THE BOARD OF TRUSTEES OF THE ILLINOIS INDUSTRIAL UNIVERSITY, in consideration of the sum of............dollars, to it paid by............of............and............of............ the receipt of which is hereby acknowledged, doth grant, bargain, sell and convey to the said ....and............the following described real estate situated in the county of Gage, and State of Nebraska, to-wit:

The......quarter of Section......Township......North, Range......East of the Sixth Principal Meridian, containing, according to the United States survey........acres, subject to taxes of A. D. 188.. and subsequent years, intending hereby to grant and convey all the interest of the parties of the first part and of the Illinois Industrial University, acquired by virtue of a patent to the above described premises from the government of the United States, said patent being numbered......

In Testimony Whereof, the Board of Trustees of the Illinois Industrial University has hereunto set its seal and caused these presents to be signed by its president and countersigned by its secretary. this........day of........A. D. 188..

THE BOARD OF TRUSTEES OF THE ILLINOIS INDUSTRIAL UNIVERSITY.

[L. S.] By.......................................President.
Contersigned by............................Recording Secretary.

STATE OF ILLINOIS, }
...............County, } ss. I, ...do hereby certify that on this day personally appeared before me............who is personally known to me to be the president of the Board of Trustees of the Illinois Industrial University, described in the foregoing instrument, and acknowledged that he executed said instrument as his free act and deed, as such president, and as the free and voluntary act of the Board of Trustees of the Illinois Industrial University,

In witness whereof I have hereunto set my hand and seal this....day of......A. D. 188..

[L. S.] ....

On motion of Trustee McLean, the opinion of Judge Cunningham relating to the ownership of corner lot on street car track was received and placed on file.

On motion of Trustee Cobb, the subject of maintaining a waiting room, in accordance with the request of Mr. F. G. Jaques, on the above mentioned lot, was referred to the Executive Committee and Regent with power to act.

On motion of Trustee Cobb the following resolution was adopted:

WHEREAS, For the past year there has been a gradual shrinkage in the value of all kinds of produce in the markets of the country, thereby decreasing the income from the farms of this institution, and from the indications of the future there seems to be no certainty of a speedy rise in the market for farm products; therefore be it

Resolved, That the farm committee and heads of the agricultural and horticultural departments be and are hereby requested to make a proportionate reduction in the price of labor which may be necessary to properly carry on their several departments.

Resolved, That all matters of expenditure on the farms of this institution be and is hereby declared to be subject to the supervision and control of the farm committee.

The appointed time having arrived the Board proceeded to the election of officers. The following were elected for one year:

S. M. Millard, President of the Board; Prof. E. Snyder, Recording Secretary; Prof. T. J. Burrill, Corresponding Secretary.

The following were elected for two years:

S. H. Peabody, Regent; J. W. Bunn, Treasurer.

The President appointed the following standing committees:

Executive Committee—Millard, Cobb, Pearman.
Farm Committee—Pearman, Bennett, Cobb.
Buildings and Grounds—McLean, Follansbee, Earle.
Finance Committee—Bennett, Follansbee, Paden.
Auditing Committee—Paden, Bennett, Earle.

It was moved and carried that the bond of the Treasurer be $100,000, to be approved by the Executive Committee and reported to the Board at the next meeting.

The following report of the Auditing Committee was read, and on motion adopted:

To the Board of Trustees of the Illinois Industrial University:

Your Auditing Committee would respectfully report that so much of the Business Agent's report covering the vouchers from No. 151 to 383, both inclusive, has been duly examined and found correct.

R. N. PADEN,
E. COBB,
J. T. PEARMAN,
Committee.

The following appropriations from current funds were made for the six months ending September 1, 1885:

CURRENT APPROPRIATIONS.

Board expense	$325 30
Salaries—	
Instruction	16,010 00
Services	1,210 00
Buildings and grounds	50 00
Fuel and lights	1,000 00
Stationery and printing	650 00
Nebraska lands	100 00
Library and apparatus	150 00
Incidental expenses	200 00
Mechanical department	500 00
Architectural department	800 00
Agricultural department	800 00
Horticultural department	500 00
Chemical department	400 00
Military department	50 00
Sundries—	
Griggs farm	100 00
Physical laboratory	25 00
Cabinets	25 00
Gymnasium	140 00
Engraving, etc., for report	65 00
Library case for card catalogue	30 00
Drawing and photos architectural department	50 00
Rubber stamps engineering department	20 00
	$23,200 30

The Executive Committee submitted the following report on appointment of teacher of elocution referred to them last meeting:

To the Board of Trustees Illinois Industrial University:

Your Executive Committee have appointed Prof. Wm. Carnes to be instructor in elocution for the current term at a salary of $25 per week. Some arrangement will need to be made for the next term, and the authority for further action be continued in the committee.

Respectfully submitted,

S. M. MILLARD,
J. T. PEARMAN,
Committee.

The report was received and approved, and authority given to the committee to re-engage Prof. Wm. Carnes for the next term.

On motion of Trustee McLean $50 was appropriated to make sidewalk of cinders to front gate, as recommended by the Regent.

On motion, the account of the Regent for expenses to Springfield, in attendance on appropriation committees of the Legislature, amounting to $25.30, was allowed.

The request of the Regent relating to the return of goods exhibited at the New Orleans exposition, was referred to the Executive Committee, with power to act.

The following report from the Executive Committee was read and, on motion, adopted:

To the Board of Trustees of the Illinois Industrial University:

Your Executive Committee, to whom was referred the report of the Committee on Nebraska Lands in relation to the account of Burnham, Trevitt & Mattis, would recommend that the report be received and its recommendation approved.

S. M. MILLARD,
EMORY COBB,
J. T. PEARMAN,
Committee.

On motion, the inventory referred to in the Regent's report, and now submitted, was approved and ordered filed:

Department.	Articles enumerated.	Articles estimated.	Total.
Physical Laboratory	$5,441 72	$100 00	$5,541 72
Art Gallery	3,084 10	....	3,084 10
Botanical	2,145 85	2,700 00	4,845 85
Natural History Museum	6,430 00	1,600 00	8,030 00
Mechanical Engineering	9,685 79	1,044 36	10,730 15
Military and Gymnasium	7,748 25	251 75	8,000 00
Agricultural	2,170 80	15,260 00	17,430 80
Architectural	2,759 50	650 00	3,409 50
Civil Engineering	2,689 50	100 00	2,789 50
Chemical	737 85	15,000 00	15,737 85
Art and Design	586 06	....	586 06
Library	28,520 90	....	28,520 90
Blue Printing Laboratory	....	100 00	100 00
Furniture	....	3,500 00	3,500 00
Heating apparatus	....	23,000 00	23,000 00
Total inventory	....	....	$135,306 43
Belonging to the United States	....	....	7,748 25
Total belonging to University	....	....	$127,658 18

The Auditing Committee submitted the following report:

To the Board of Trustees of the Illinois Industrial University:

Your Auditing Committee, to whom was referred the report of the Treasurer and Business Agent, beg leave to report that we have examined said reports and find the same correct. We have also examined and compared the books of the Treasurer with the warrants drawn upon him for the past two years, beginning March, 1883, with Nos. 348 to 667 to September 1, and Nos. 1 to 795 up to September 1, 1884, and Nos. 1 to 383 up to March 1, 1885, and found all to be in order and correct. The warrants have been cancelled and left in the hands of the Treasurer.

R. N. PADEN,
J. T. PEARMAN,
EMORY COBB,
Committee.

On motion of Trustee McLean, the Board then adjourned.

S. M. MILLARD,
President.

E. SNYDER,
Secretary.

PROCEEDINGS OF THE BOARD OF TRUSTEES—JUNE, 1885.

The Board met at the University parlor at 3 o'clock P. M., June 9, 1885.

Present—Trustees Bennett, Eisenmayer, Follansbee, McLean, Millard, Paden and Pearman.

Absent—Governor Oglesby, Trustees Cobb, Earle and Landrigan.

The oath of office was administered to Trustees Bennett, Millard and Eisenmayer.

The minutes of the last meeting were read and approved as revised.

The Regent then submitted the following report:

To the Board of Trustees of the Illinois Industrial University:

GENTLEMEN—The bill before the legislature making appropriations for the support of this University yet lacks action by the House of Representatives before it can become a law, and it will seem to be necessary to postpone much of the business which usually comes before you at this season until an adjourned meeting may convene.

I have, however, to ask your approval of the list herewith presented, as recommended by the Faculty, for degrees, as follows:

With Degree of B. S. in the College of Agriculture:

Fred K. Vial.

With Degree of B. S. in the College of Engineering:

James M. Kent, Hugh L. Ronalds, William. F. Kendall, Theodore H. Schleder, Judson Latten, William H. Stockham, E. Leland Morse, Henry L. Reynolds, Simeon C. Colton, Alfred C. Schrader.

With Degree of B. S. in the College of Natural Science:

George H. Ellis, Kate F. Clark, John Müller, Albert G. Manns, Mary T. Earle, Chas. W. Woodworth, John A. Miller, Milo P. Lantz.

With Degree of B. L. in the College of Literature and Science:

George L. Hicks, Emma T. Jones, Sherman L. Marshall.

With Degree of Civil Engineer in the College of Engineering:

Arthur N. Talbot.

With full Certificates:

Alfred N. Abbott, Harry L. Carter, Charles F. Hopper, Charles H. Rankin, John E. Wright, L. Estelle Paulin, Abbie Weston, Minnie S. Wright, Judson F. Ayres, T. Edward Cole, Arthur T. North, William H. Smith, Louisa Merboth, Bessie G. Plank, Etta C. Wills, Josephine M. Zeller, William B. Braucher, Robert L. Dunlap, George R. Petty, William C. Swern, Bessie W. Owens, Charlotte Switzer, Lizzie M. Wright.

The following named persons, on recommendation of the faculty, have received from his excellency, Governor Oglesby, commissions as captains, by brevet, in the Illinois National Guard:

Alfred N. Abbott, Milo F. Lantz, Judson Lattin, Sherman L. Marshall, E. Leland Morse, George W. Richards, William H. Stockham.

I present the report from the professor of agriculture.

I respectfully suggest that a meeting be arranged with Mr. Jaques in behalf of the Champaign and Urbana railroad company, with reference to the construction of a half way house and other subjects connected therewith.

Also Mr. Pleasant Vance desires to communicate with you concerning his proposition to prospect for a gas well.

I ask leave to extend this report at your future meeting.

Respectfully submitted,

Urbana, June 9, 1885. S. H. PEABODY, Regent.

The following report from the agricultural department was submitted:

CHAMPAIGN, June 6, 1885.

Dr. S. H. Peabody, Regent:

SIR: The sales from the University farm for the last three months aggregate $1,066 10. The expenses were $1,077 41.

The extreme cold weather of last winter caused greater consumption of grain by the farm stock than was anticipated, making purchase of food necessary. It is believed that a profitable return has been made for all food fed.

The farm work is in fair state of advancement, the season being a late one.

The wheat of which we had thirty-five to thirty-seven acres, was so badly injured during the winter that the ground was sown to oats this spring except about two acres.

Of oats we have about seventy acres, promising a good crop. Except two or three acres all the land in oats was also sown with timothy and clover.

Of corn we have planted 105 acres. On the greater part we have secured a good stand, but some replanting has been necessary. We were fortunate in having good seed for the larger part of the ground. We have sold a considerable quantity of corn for seed, most of it giving good satisfaction. A part, although having sufficient vitality to grow when tested in the green-house, failed under less favorable conditions in the field.

Grass, both in meadows and pastures is now doing well, although somewhat shortened by lack of rain until recently.

In general the live stock is in good condition. We have seven fine colts and fillies dropped this spring. The cattle are doing well with very few exceptions.

We have sold nearly all of our young bulls at moderate prices. There has been less than usual inquiry for cattle. We can now supply either pure bred or high grade short-horn cows and heifers.

Respectfully submitted,

G. E. MORROW, Professor of Agriculture.

On motion the report was referred to the Farm committee.

The committee on Nebraska lands submitted the following report, which was adopted:

To the Trustee of the Illinois Industrial University:

GENTLEMEN: Your committee on the sale of Nebraska lands report as follows:

The sales since your last meeting have been:

No.	Name.	Tract.			Price.	Cash.
32	Patrick C. O'Brien	NE. 5	2	8	$2,054 00	$514 50
33	Christian Hesse	SE. 30	3	8	2,240 00	560 00
34	Joseph Swoboda and H. John Swoboda	SE. 35	5	8	2,000 00	500 00
35	John and William Losey	NE. 34	3	8	2,000 00	500 00
36	E. & C. O. Fothergill	SW. 27	3	8	2,000 00	500 00
37	Wm. H. Gibler	NE. 10	2	8	2,000 00	500 00
	Sales before reported				$65,062 57	$16,265 64
	Total sales				77,356 57	18,840 14
	Proposals have been accepted for—					
38	David W. Gilmore	NW. 26	3	8	$2,000 00	$500 00

When this sale is complete the total sales will be $79,356 57.

Seven quarter sections have been leased for the summer for $175 00. They will be used for grazing.

Respectfully submitted,

S. H. PEABODY.
CHAS. BENNETT.

Urbana, June 9, 1885.

The committee on purchase of Jaques' lot made a verbal report and the Board decided to hear Mr. Jaques to-morrow at 3 P. M.

The Business Agent then presented the following statement of the receipts and expenditures from State and current funds for the past three months, with vouchers:

Current Appropriations.

March 11, 1885.	Appropriated.	Receipts also Appropriat'd.	Expended	Balance.
Board expense	$325 30	....	$159 57	$165 73
Salaries instruction	16,010 00	....	8,282 31	7,727 69
Salaries services	1,210 00	....	793 04	416 96
Buildings and grounds	50 00	$39 33	25 23	64 10
Fuel and lights	1,000 00	6 79	417 80	588 99
Stationery and printing	650 00	1 10	370 42	280 68
Nebraska lands	100 00	130 08	135 58	94 50
Library and apparatus	150 00	....	11 08	138 92
Incidental expenses	200 00	....	79 05	120 95
Mechanical department	500 00	50 85	256 87	293 98
Architectural department	800 00	59 23	360 56	498 67
Agricultural department	800 00	1,066 10	1,077 41	788 69
Horticultural department	500 00	333 40	456 08	377 32
Chemical department	400 00	....	111 10	288 90
Military department	50 00	....	42 80	7 20
SUNDRIES.				
Griggs farm	100 00	....	40 40	59 60
Physical laboratory	25 00	....	....	25 00
Cabinets	25 00	....	....	25 00
Gymnasium	140 00	....	12 88	127 12
Engraving, etc., for report	65 00	....	....	65 00
Library case for card catalogue	30 00	....	3 60	26 40
Drawings architectural department	50 00	....	....	50 00
Rubber stamps engineering department	20 00	....	19 98	02
Elocution fees	....	143 00	....	....
Music fees	....	58 00	58 00	....
Preparatory year fees	....	220 00	350 00	....
University fees	....	2,428 75	....	....
Illinois Central freight donation	....	1,050 75	....	....

State Appropriations.

July, 1883.	Appropriated.	Received.	Expended	Balance.
Taxes on lands, ½ per annum	$5,000 00	$4,969 06	$4,969 06	....
Buildings and grounds, ½ per annum	6,000 00	6,000 00	5,576 52	$423 48
Laboratories, ½ per annum	3,000 00	3,000 00	2,112 21	887 79
Mechanical and arch. shops, ½ per annum	3,000 00	3,000 00	2,793 56	206 44
Books and publications, ½ per annum	3,000 00	3,000 00	2,437 77	562 23
Cabinets, ½ per annum	2,000 00	2,000 00	641 37	1,358 63
Current expense of instruction, ½ per annum	28,000 00	28,000 00	28,000 00	....
Blacksmith shop	2,500 00	2,500 00	2,500 00	....
Machines and tools	2,000 00	2,000 00	2,000 00	....
Total	$54,500 00	$54,469 06	$51,030 49	$3,438 57

On motion the report was received, and the statements of receipts and expenditures were referred to the Finance Committee, and the vouchers to the Auditing Committee.

A communication from Mr. Foster North was received and read. On motion it was referred to the Committee of the Whole, and made the special order of business for to-morrow, 4 P. M.

On motion of Trustee Pearman, the regular order of business was suspended, and it was resolved that the students recommended by the faculty (see Regent's report) be granted degrees and certificates.

The Board then adjourned to meet at 9 o'clock P. M.

EVENING SESSION.

The Board met according to adjournment.

Present: Trustees Bennett, Eisenmayer, Follansbee, McLean, Millard, Paden and Pearman.

A communication from Mr. Klingenspor was read and referred to the Committee on Buildings and Grounds.

On motion of Trustee Pearman, it was voted to hear Mr. Vance on the subject of boring for a gas well on the University farm, at 4:30 P. M., to-morrow.

The resignation of Prof. F. W. Prentice was accepted, and the following resolution, introduced by Trustee McLean, was passed unanimously:

WHEREAS, Frederick W. Prentice, M. D., V. S., Professor of Veterinary Science in the Illinois Industrial University for the past thirteen years, has seen fit to resign his position, for the purpose of entering into the practice of medicine; and,

WHEREAS, Professor Prentice has worked earnestly and faithfully in his department, bringing so successfully this important branch of education before the public as to merit the commendation of the Board; therefore, be it

Resolved, That the Board of Trustees, while regretting the loss of Prof. F. W. Prentice to our institution, heartily recommend him to the public generally as a gentleman of eminent ability, full worthy of the confidence of those with whom he may have professional relations. That he may succeed in his future career is the earnest desire of this Board.

Resolved, That a copy of these resolutions be transmitted to Prof. F. W. Prentice.

Treasurer J. W. Bunn read his report, as follows:

ILLINOIS INDUSTRIAL UNIVERSITY,

To John W Bunn, Treasurer, Dr.

1885.			
March 10	To balance		$9,458 94
	" amount received on account Ill. Central R. R. donation		1,050 75
March 31	" " " " University fees	$1,196 25	
	" " " " Preparatory Department	115 00	
	" " " " Mechanical Department	8 40	
	" " " " Architectural Department	3 00	
			1,322 65
April 15	" interest on land contract No. 6, T. A. Woodward		71 56
May 30	" amount received on account Buildings and grounds	$39 33	
	" " " " Fuel and lights	6 79	
	" " " " Stationery and printing	1 10	
	" " " " Nebraska lands	130 08	
	" " " " Mechanical Department	42 45	
	" " " " Architectural Department	56 23	
	" " " " Agricultural Department	1,066 10	
	" " " " Horticultural Department	333 40	
	" " " " Elocution fees	143 00	
	" " " " Music fees	58 00	
	" " " " Preparatory year	105 00	
	" " " " University fees	1,232 50	
			3,213 98
	Total		$15,117 88

ILLINOIS INDUSTRIAL UNIVERSITY, *To John W Bunn, Treasurer, Cr.*

May 31	By amount paid for Board expense	$159 57	
	" " " Salaries	9,075 35	
	" " " Buildings and grounds	25 23	
	" " " Fuel and lights	417 80	
	" " " Stationery and printing	370 42	
	" " " Preparatory Department	350 00	
	" " " Nebraska lands	135 58	
	" " " Mechanical Department	256 87	
	" " " Architectural Department	360 56	
	" " " Agricultural Department	1,077 41	
	" " " Horticultural Department	456 08	
	" " " Chemical Department	111 10	
	" " " Military Department	42 80	
	" " " Library and apparatus	11 08	
	" " " Incidental expenses	79 05	
			$12,928 90
	State Appropriations:		
	By amount paid for Buildings and grounds	$283 63	
	" " " Laboratories	111 25	
	" " " Mechanical and Architectural shops	361 74	
	" " " Books and publications	569 00	
	" " " Cabinets	124 25	
			1,449 87
	Sundries:		
	By amount paid for Griggs farm	$40 40	
	" " " Gymnasium	12 88	
	" " " Library catalogue case	3 60	
	" " " Rubber stamps	19 98	
	" " " Music fees	58 00	
			134 86
	Balance		604 25
			$15,117 88

JOHN W. BUNN, *Treasurer.*

URBANA, June 9, 1885.

The report was received, and, on motion, referred to the Finance Committee.

Adjourned to meet Wednesday, June 10, 1885, at 9 A. M.

SECOND DAY'S SESSION.

The Board assembled as by adjournment.

Present—Trustees Bennett, Eisenmayer, Follansbee, McLean, Millard, Paden and Pearman.

The Executive Committee submitted the following report:

To the Board of Trustees of the Illinois Industrial University:

SIRS—Your committee, to whom was referred the matter of leasing the Griggs farm, would respectfully report that they have leased to Messrs. Baird and Sewell, for the term of one year from March 10, 1885, the entire quarter section, as follows:

The forty acres now in meadow to be cut and put in stack on said farm on the halves; forty acres to be sown to oats, the rental for which is to be one-third the grain, to be delivered at any place in Urbana that we may elect, and the remaining eighty acres to be planted in corn, of which crop the University is to have two-fifths, delivered in crib on said farm.

We would further report that we have caused to be seeded to timothy grass the forty acres sown to oats at an expense of $18.50 for seed.

We would further report that an effort was made to rent for cash, but receiving no offer, the leasing was the best that could be made, and is the customary rental for such lands in this section.

J. T. PEARMAN.
S. M. MILLARD.

On motion of Trustee Bennett, the report was received and the action of the committee approved.

The Executive Committee submitted the following report:

To the Board of Trustees of the Illinois Industrial University:

SIRS—Your committee, to whom was referred the Treasurer's bond, would report that they have examined the same and find it correct in form, the security ample and according to law, and recommend that it be approved.

S. M. MILLARD.
J. T. PEARMAN,

The report was received and the bond approved.

The Executive Committee submitted the following report:

To the Board of Trustees Illinois Industrial University:

Your Executive Committee, finding that no appropriation was made at the last meeting of the Board for the payment of the bill of Burnham, Trevett & Mattis, which was reported and approved at that meeting, have ordered a warrant to be drawn in the sum of $130.08 to pay the same.

S. M. MILLARD.
J. T. PEARMAN.

The report was received and the action of the committee approved.

The Committee on Buildings and Grounds made the following report:

To the Board of Trustees of the Illinois Industrial University:

The undersigned committee, to whom was referred the claim of Gustav Klingenspor for extra services, would respectfully report that we have made inquiry relative to the claim, and find that, while the duties of gardener have been difficult to perform during the past winter on account of the severity of the weather, yet we feel that the matter is beyond our control or regulation, and the precedent of adjusting salaries according to weather would be dangerous and uncertain. We therefore recommend that the claim be not allowed.

ALEX. McLEAN,
G. A. FOLLANSBEE,
Committee.

The report was adopted and approved.

The Farm Committee submitted the following report:

To the Board of Trustees of the I. I. U.

SIRS—Your Farm Committee, to whom was referred the report of Prof. Morrow, would respectfully recommend that the report be received and placed on file.

J. T. PEARMAN.
CHAS. BENNETT.

The report was received and approved.

On motion of Trustee McLean, $100 was appropriated additionally for Board expenses.

The following report from the Auditing Committee was read and approved:

To the Board of Trustees of the Illinois Industrial University:

Your Auditing Committee beg leave to report that they have examined the vouchers of the Business Agent, from 326 to 550 inclusive, and find the same correct and properly receipted.

R. N. PADEN,
CHARLES BENNETT,
Committee.

The Finance Committee made a verbal report that the Business Agent's and Treasurer's reports as to finances were correct, and would recommend that the same be approved.

The report was approved and placed on file.

The Board then listened to a proposition from Mr. Vance for boring on the University farm for a supply of gas.

On motion the matter was referred to the Executive Committee, to report at the next meeting.

In the matter of the proposition of Mr. F. G. Jaques concerning the erection of a waiting-room at the street car track on Wright street, it was resolved that the question be submitted to Dr. Peabody to agree upon a plan for the same and report at next meeting.

The Board then proceeded to the consideration of the petition of Mr. Foster North.

Trustee Bennett offered the following resolution:

Resolved, That the matter of the communication of Foster North be referred to a specia committee of four, of which the President of the Board and the Regent shall be members' the other members to be appointed by the President; the said committee to report at the next regular meeting of this Board.

Thereupon Trustee Follansbee offered the following resolution as a substitute:

Resolved, That it is the sense of this Board that when Foster North shall have passed the requisite examination to entitle him to graduation and shall have prepared the proper thesis and oration required from persons graduating from this University. the customary degree to which he would be entitled should be conferred upon him.

Ayes, 2; noes, 5. The motion was lost.

The original motion was then put and prevailed.

The President appointed Trustees Bennett and Follansbee as additional members of the committee.

In regard to the exhibits at New Orleans the Regent reported that at the request of the officers of the exposition he had consented that they remain there until fall.

On motion leave of absence during vacation was granted to Professors Burrill, Snyder, McMurtrie and Roos.

The Regent's bill of $109.30 for expenses to Washington and Springfield was on motion allowed.

In the matter of the convention of representatives of the agricultural colleges and experimental stations, to be held on July 8, 1885, at Washington, D. C., on motion of Trustee McLean the Regent was authorized to attend (at the expense of the University) and represent this institution.

On request of Professor Burrill, an appropriation not to exceed $40 was made for the purchase and transportation of a set of wood specimens of Florida, illustrating the forestry of that State.

On motion the meeting adjourned to meet at such time and place in Chicago, Ill., as the President shall designate.

S. M. Millard, *President*.

E. Snyder, *Secretary*.

PROCEEDINGS OF THE BOARD OF TRUSTEES—JULY, 1885.

The Board met at 82 LaSalle street, Chicago, Ill., on July 1, 1885, at 10 o'clock A. M., at the call of the President, pursuant to adjournment.

Present: Trustees Landrigan, Cobb, Pearman, Paden, Follansbee, McLean, Eisenmayer, Millard and Earle. Absent: Governor Oglesby and Trustee Bennett.

The oath of office was administered to Trustees Landrigan and Earle.

The Regent submitted the following report, which was read and laid over for further consideration:

To the Trustees of the University of Illinois:

GENTLEMEN: Since the date of your last meeting all matters which were then pending before the General Assembly at Springfield have been determined favorably to the University and its interests, including the bill making appropriations for the expenses of the years 1885 to 1887, the bill changing the name of the University, and the bill authorizing the transfer to this University of the State Laboratory of Natural History, which has hitherto been connected with the Illinois Normal University. The kindly feeling which exists towards this institution generally through the State, as evinced by the public and private expressions of legislators, and the cordial support received by the several measures in which the University is interested, may well be considered as grounds for encouragement. The suspicions aroused by the mistaken assertions of interested partisans that the proposition to change the name of the institution was grounded in a purpose to change its character, must be entirely allayed in candid minds when the facts come to be understood. To meet this point, as the discussions upon the bill were going forward, I presented to senators a memorial, which, that it may go permanently upon record, I desire, if it meets your approval, to make part of this report:

To the Hon. ——— ———, Senator:

DEAR SIR: It had not been the purpose of the undersigned, the Regent of the Illinois Industrial University, to enter into the discussions which would arise upon the proposition to change the name of that institution, believing as he does that this proposition when fully understood would commend itself to all unprejudiced minds. But the turn which the discussion has taken, and the assertions freely made, that the change proposed is the off-spring and the evidence of a covert purpose to change the essential character of the University—a change from a school of science bearing practically upon the varied industries of the people to a "mere literary and classical college"—leads me to trespass briefly upon your attention. This duty seems incumbent upon me because, standing as I do between the Trustees on the one hand and the Faculty on the other, I may be supposed to know, if any one knows, the facts as to their purposes and wishes in this matter.

I desire, therefore, formally, with emphasis, and without any reservation, to assert that neither heretofore has there been, nor is there now, any purpose or wish to change the character of the University, as suggested, in the minds of any persons intrusted with the conduct of its affairs. The original law of Congress is the pillar of cloud by day and of fire by night, guiding in all the plans and designs of Trustees, Faculty and Regent. "ITS LEADING OBJECT shall be to teach such branches of learning as are related to agriculture and the mechanic arts, * * * without excluding other scientific and classical studies, * * * in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." Act of Congress, 1862, Sec. 4.

But as this purpose is charged as a *covert* purpose, a simple denial, however complete and emphatic, may not be enough. The only other answer that can be made is an appeal to the acts of those whose designs are questioned—to consider what has been done during the five years in which the University has been under its present administration. For this entire period we confidently affirm that the whole of both effort and result has been to develop and strengthen the technical or industrial side of the University.

1. As to students. In 1880, 60 per cent. of the students were engaged in technical courses, to 40 per cent. in other courses. In 1885, 68 per cent. are in technical courses, to 32 per cent. in other courses. As about 20 per cent. are women, nearly all of whom are in the literary courses, it follows that 68-80ths, or 85 per cent., of the young men now in attendance are pursuing technical courses of study. Moreover, the essentially scientific character of the instruction is defended and guaranteed by law—a guarantee which no one seeks to remove. The law of 1873 prescribes that *each person* shall be taught and shall study such branches of learning as are related to "agriculture and mechanic arts," and consequently the Trustees have provided a list of such studies, one of which, at least, each student must pursue in each term of his residence at the University, and this rule is enforced.

2. As to the facilities for instruction. All advances made have been such as have aided the technical studies. Among these may be noted: The tools and machines in the shops have been duplicated during the last two years, and are yet insufficient. More will be bought with the next means furnished. The working space in both shops has been enlarged about one-third. A blacksmith shop has been added, and this may be changed, at a half hour's notice, into a foundry, where the students are employed in molding and casting iron. A small observatory has been arranged for the use of instruments for advanced students in civil engineering. A dairy-house, for the proper handling of and experimenting on milk and cream. Laboratories for botanical, zoölogical and microscopical work have been arranged for the practical instruction of students in these several departments. The intent is to fully organize a school of mining engineering at the opening of the next year, and also to reorganize the department of veterinary science at the same time. We are doing all the work of a thorough school of pharmacy, except that of attendance behind the counters of an actual drug store. These and these only are the steps by which the present administration of the University is seeking to convert it into a "mere literary and classical college."

3. Much labor has been expended to bring the work of the University before the public by exhibits of its actual and practical results. These exhibits have been of its technical products, partly because these tangible things are more easily shown, but chiefly because we wished the public to see in these the leading work of the University. Many of you will remember the striking display made in the State House two sessions since. At the great educational congress held at Madison last year this University occupied a very prominent place with its manual training work alone. At New Orleans the University may claim to have done, with its varied and elaborate technical exhibit, more than any other interest, and almost as much as all others combined, to save the credit of the State of Illinois.

If, farther, the opinions of the undersigned are sought as to the true aim and scope of this and kindred schools of learning, they will be found in a paper read before a convention of agriculturists at Washington, January, 1882, and printed in the report of the University for that year,—a paper listened to by one of the most distinguished members of your body, and by him at the time most unqualifiedly endorsed and approved.

Is it possible, my dear sir, to meet more fairly and conclusively these imputations against our "covert intentions"?

Two points, only, as to the name.

1. We have no objection, *per se*, to the name as it stands. Its intent was good. But we know from the practical workings of seventeen years that this name is, and from the association which even the legislature itself has unintentionally united with it, will continue to be, a serious obstacle to the success of the university, in that it deters many of the best youth of the State from entering our doors, and that it too frequently casts an aspersion upon those who hold our certificates of proficiency. Whether this is right or not, IT IS. Why need it continue?

2. The founders and builders of this institution have honestly and earnestly labored to develop an institution which they have fondly hoped may be worth the affection, the pride and the support of the grand State of Illinois, and they have placed as its corner stone—Scientific Education. This stone, which so many others had in a measure rejected, we have made the head of the corner. We have joined with it such other elements as seem needful to a broad and wisely symmetrical culture. With no antagonisms, or jealousies, or heart-burnings, we are trying to show in this broad prairie land the virtue and the force of the "New Education." In this we shall claim no more of success than others are willing to concede to us. But will not those who believe in the dignity and grandeur of scientific training consent that our and their University shall be as worthy of a noble name as those other schools which have built on the chief corner stone of classical learning, but are themselves fast discovering from their and our experience, the equal if not superior power of scientific training in moulding and developing human and scholarly character?

I therefore beg leave to present as the deliberate and concurrent judgment of the Trustees and Faculty of this University, their opinion that the best interests of the people of the State of Illinois will be served if you will permit this institution to assume the title named in the bill now pending before the Senate.

I remain ever your most obedient servant,

SELIM H. PEABODY,

URBANA, May 30, 1885. *Regent, Illinois Industrial University.*

While the present may well become a new era in the prosperity of the University it cannot and must not be in any sense a point of a new departure. The only change we look to see is that of a more earnest and vigorous growth in the direction in which success has already been achieved.

The change of the name will require a corresponding change in the seal of the University, and will require that a new plate be engraved for the diploma.

MINING ENGINEERING.

Among the reasons given to the Legislature for asking the sums named, is the desire of opening in the College of Engineers a school of Mining Engineering. Most of the work of such a school—its mathematics, chemistry, general engineering, etc.—is already provided for in the other engineering departments. The only step now needed will be the securing of a proper person to take charge of the specialty of mining, the opening and management of mines, The mining interest of the State is a very important one, and is constantly becoming more so. The present laws, which call for mine inspectors, will create a demand for young men trained in this specialty. The school must begin with few students, and be developed as has been the School of Architecture. During its infancy the professor in charge could pe form other duties; the work of the Chair of Physics might very properly be assigned to him. I hope that you will authorize the nomination of a competent scientist to be Professor of Mining Engineering and Physics.

VETERINARY SCIENCE.

Professor Prentice's resignation leaves the Chair of Veterinary Science vacant. Its relations to the great live stock interests of the State make this an important professorship. I am not yet able to suggest a satisfactory solution of this problem; possibly a lecturer may be found until a suitable appointment can be made, or the chair might be left vacant for the coming year, and those wishing to pursue the subject might wait over one year without serious detriment. On no account, however, would it be wise to drop this subject from the curriculum of the School of Agriculture. On the contrary, it were much better if the Department of Veterinary Science could be so enlarged as to graduate doctors of veterinary science.

The subject of human anatomy and physiology does not properly belong to the veterinary professor. It was assigned to him for peculiar reasons several years ago. It is one that Assistant Professor Rolfe has taken great pains to prepare himself in, and I think it may very properly and safely be assigned to him. His work in geology during the past year has been satisfactory. I recommend that he be appointed Assistant Professor of Geology, and that in addition to that subject he have assigned to him anatomy and physiology, and that he continue to teach preparatory physiology and botany.

OTHER INSTRUCTORS

Assistant Professor Sondericker has resigned to become an instructor in the Massachusetts Institute of Technology. He has been a faithful and efficient teacher, with whom we are very sorry to part. I desire to name as his successor Mr. Arthur N. Talbot, a graduate of this University in the class of 1881. Mr. Talbot is well known to us as a student of the first rank and an excellent teacher, proved by good work as tutor of special classes while an undergraduate here. Since his graduation he has been constantly employed in engineering services of high grade, in which he has earned credit for himself and his alma mater.

I recommend Mr. Samuel W. Stratton, a graduate of the class of 1884, to be instructor in mathematics in the preparatory department.

The indications are that the work of teaching in the machine-shop in the next term will be greater than can possibly be done efficiently by one person. I ask that authority be given to the Regent to employ an assistant, if one should be needed, at a salary to be fixed by you.

Professor Forbes asks that Mr. William H. Garman be appointed assistant in natural history for the coming year.

Professor McMurtrie asks that Mr. Geo. C. Hewes be appointed first assistant in chemistry. Authority should be given to the Regent and the Professor of Chemistry to appoint a second assistant if one should be needed.

Professor Roos asks that the appointment of Mr. Horace Taylor as assistant in art and design be continued.

Miss E M. Hall has resigned her position of instructor in ancient languages. She performed, also, with great fidelity the duties of preceptress. Some arrangement must be made for filling the place, and for appointing an assistant in modern languages.

I recommend that Miss Kittie M. Baker be continued as instructor in music on the same terms as before.

RHETORIC AND ELOCUTION.

It has long been a matter of regret to me that the University has undertaken no general and systematic training of all its students, technical as well as literary, in the arts of writing good English and of expression in speech. The writing of essays has been an exercise required of certain classes and as an adjunct to certain studies. The work done by the students themselves in their societies, while good in intent, reaches less than one-third of their number, and lacks any element of proper control and drill. Errors and mannerism are as likely to be fostered as to be corrected in that discipline. If the funds of the University will allow, I would recommend the appointment of a competent man as Professor of Rhetoric and Elocution, and that he should be expected to give regular and systematic instruction in the writing of essays, and in other forms of English composition, and in elocution, to all classes in the University courses, under such regulations as the Faculty may provide. I believe that no so important a deficiency exists at the present time in our organization as this, which this recommendation is designed to supply.

I present several applications for appointments.

FIRE WALLS AND VENTILATION.

The appropriations contain an item of $4,500 for these purposes. The sum asked for was named in accordance with estimates made by Prof. Ricker, and is believed to be ample for the purpose. I recommend that these matters be referred to a suitable committee, with directions to carry these improvements immediately into effect.

TOOLS AND MACHINERY.

An item of $2,000 per annum is named for the purchase of additional machinery for the shops. While but one-half the sum can be used now, it would be well to consider the probable use to be made of the whole, and to make present purchases with proper reference to the use. I recommend that this subject be referred to a committee, with authority to purchase.

BUILDINGS AND GROUNDS.

Of the sum available for the year, $3,000, at least half should be set aside for current and contingent expenses, aside from improvements or repairs. Under the latter head the following should receive early attention:

The enlargement of the carpenter shop, as asked by Prof. Ricker, and also brought to your notice last year	$130 00
For repairs in janitor's apartments	225 00
For building half-way house	200 00
For laying floor in library, within railing	150 00
For finishing balcony railing in library and stairway	150 00
For finishing the floor and partitions in the Zoölogical laboratory	400 00

MUSEUM FUND.

For the proper application of the fund remaining from the appropriation of two years ago, now about $1,300, I respectfully refer you to a report of Prof. Forbes, herewith transmitted, and concur in its recommendations.

LABORATORY FUND.

I recommend that from the unexpended balance of this fund $100 be assigned to Prof. Burrill for purchase of a microtome and other microscopical accessories; and that the remainder be assigned for the physical laboratory, under direction of the Regent.

Prof. Ricker asks for 12 sets of tools for shop practice in the carpenter's shop, at a cost of $150, which should be allowed from the new appropriations for tools and machines.

Also for the repair of the dry kiln, to cost $50. This should be allowed from the new appropriation for shops and expenses.

Also for $35 for additional drawing desks, and for bulletin boards for his class-room. This should be allowed from the general fund.

PIANO FORTE.

Much complaint has been made about the piano which has been used in the music-room. About March 1st, shortly before the anniversary, I hired a new piano forte for temporary use, and it has remained in the room since, $15 having been paid for its rent. It is now offered to us for $200. If it is your opinion that the University should furnish this department with an instrument, I think this should answer the purpose.

ADVERTISING.

The present time, on account of the change of name, seems to be important for advertising. Probably $800 to $1,000 may be profitably used for this purpose.

Prof. Morrow is prepared to make some reports upon agricultural experiments conducted upon the University farms. The publication of an occasional bulletin would be of service to the agricultural department, and is recommended. An appropriation of $50 for this purpose is asked.

Respectfully submitted,

URBANA, July 1, 1885. S. H. PEABODY, *Regent.*

The following report from Prof. Forbes was read and laid over for further consideration:

DR. S. H. PEABODY, *Regent of the University:*

SIR: The requests and suggestions which I have to submit respecting the zoölogical and entomological work of the University relate to some additional appliances for the students zoölogical laboratory, to regular provisions for assistance in zoölogy, and to the purchase and collection of specimens for the geological and zoölogical cabinets.

In the student's laboratory we need gas fixtures, including half a dozen Bunson burners; a high table and cupboard against the east wall for some standing work, and some small fixtures for the construction of an apparatus for injection.· This is perhaps also the proper time to mention the prospective need of a set of microscopes for zoölogical and entomological work. Hitherto I have used the microscopes provided for the botanical laboratory, but we cannot expect that these will always be free when wanted by my classes. Excepting the microscopes and the gas fixtures, I estimate that the remaining improvements can be made for $25, and this sum I respectfully ask for these purposes.

With respect to assistance in the zoölogical laboratory, I have only to ask that Mr. Garman be continued in his present position, and that suitable provision be made for his pay. Under existing circumstances, I judge that his salary may properly be taken from that now allowed me as professor in the University. His time would be spent largely in the preparation of a systematic series of permanent specimens, anatomical and zoölogical, to illustrate thoroughly the work in the courses in zoölogy and entomology. He would also have special charge of the students' laboratory, in which he would sometimes take charge of the classes while engaged in laboratory work.

I am informed by the Business Agent that a balance of about $1,300 remains in the museum fund appropriated two years ago, and I respectfully request that the final balance available for the improvement of the museum be assigned in about the following ratios: For the purchase of geological specimens, $500; for the purchase of zoölogical specimens, $600, and for the expenses of collections in zoölogy and geology, $200. The specimens now needed are very much needed indeed, and would be at once made useful for the illustration of students' work in the natural history branches.

Besides the above suggestions respecting the University work, I have to call attention to the recent passage of a law by the State Legislature directing the transfer to the Trustees of the University of the essential part of the property of the State Laboratory of Natural History, hitherto under the charge of the State Board of Education, at Normal. I probably need not discuss here the consequences of this law, further than to request the assignment of quarters for the collections and property of the laboratory, and the suitable furnishing of rooms for the work of the establishment.

I presume that action by the Board will be necessary with respect to the receipt of the property, the financial system of the laboratory, the appointment of a director and assistants, and the form, scope and frequency of the official report; but these points are clearly raised by the law itself.

Respectfully submitted,

S. A. FORBES,

Professor of Entomology and Zoölogy.

CHAMPAIGN, ILL., June 29, 1885.

The following report rrom the Executive Committee was received and referred to the Committee on Buildings and Grounds for report at this meeting:

To the Trustees of the University of Illinois:

A request from Mr. A. B. Baker, made at the December meeting, for better accommodations for himself and family, was referred to the Executive Committee and the Regent for examination and report. The duty has been attended to and the committee reports as follows:

It appears to be essential to the safety and security of the main building that the janitor should occupy apartments within it, for its care and protection by day and by night. If this interferes with his privacy, or that of any member of his family, however much to be regretted, it is inherent in the duties of the position and cannot be avoided. If any reasonable changes can make the apartments assigned to the janitor more healthful, or more convenient, they should certainly be effected. As complaint is made that the rooms are damp, the floors should be taken up, and the ground underneath and the walls at the sides thoroughly coated with cement and asphalt, by which this trouble may doubtless be cured. The floors are but about eighteen inches below the level of the ground, and the ceilings are high and the rooms well ventilated. Doors to connect the rooms so that persons may pass from one to another without going into the main hall were authorized long since, and could have been provided at any time if the janitor had desired it done.

A wish has been intimated for a room on the main floor, but the committee learns that all rooms on that floor are occupied and are needed for class-rooms, and therefore can not be spared.

Your committee recommends that tbe floors be taken up, the ground under concreted, the floors relaid, and doors cut between the rooms; and present Prof. Ricker's estimate of $226.40 for the expense of the work.

Respectfully submitted.

S. M. MILLARD.
J. T. PEARMAN.

UNIVERSITY OF ILLINOIS,
URBANA, Ill., June 29, 1885.

Estimate for proposed changes in janitor's rooms:

Removing old floors, to use lumber again	$4 50
Removing old joists	2 00
Concreting three floors, 171 square yards at 20c	34 20
Plastering walls below floors with one coat cement mortar	13 65
Two coats asphaltum on concrete floors, 15.36 squares	30 72
Two coats asphaltum on plastered walls below floors	8 19
New floor joists for one room, 800 feet at $18	14 40
Lumber for supporting same	3 00
New flooring, 700 feet at $35	24 50
Setting new joists and replacing old ones	11 84
Laying new and old floor	12 00
New base, 96 feet at 10c	9 60
Old base removed and replaced, 178 feet at 5c	8 80
Cutting two doorways through brick walls and removing rubbish	4 00
Two new doors, frames, hardware, transoms, etc., to match those of the building, complete at $18	36 00
Painting base	5 00
Painting doors	4 00
Total	$226 40

It is assumed that the old floors and joints in two of the rooms can be removed and relaid without any material waste.

Respectfully submitted,
N. CLIFFORD RICKER,
Professor of Architecture.

A request from Mr. E. A. Kimball, in regard to salary, was read and laid over for further consideration.

The Regent presented to the Board the following certified copy of the law changing the name of the University:

AN ACT TO CHANGE THE NAME OF THE ILLINOIS INDUSTRIAL UNIVERSITY.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That the Illinois Industrial University, located at Urbana, in Champaign County, shall, after the passage of this act, be known as the University of Illinois, and under that name and title shall have, possess, be seized of, and exercise all rights, privileges, franchises and estates which have hitherto belonged to, or may hereafter inure to, the said Illinois Industrial University.

E. M. HAINES,
Speaker of the House of Representatives.
J. C. SMITH,
President of the Senate.

Approved June 19, 1885.
RICHARD J. OGLESBY.

OFFICE OF SECRETARY.

UNITED STATES OF AMERICA, }
STATE OF ILLINOIS, } SS.

I, Henry D. Dement, Secretary of State of the State of Illinois, do hereby certify that the foregoing is a true copy of an act to change the name of the Illinois Industrial University, approved June 19, 1885, the original of which is now on file in this office.

In witness whereof, I hereto set my hand and affix the great seal of State, at the City of Springfield, this 24th day of June, A. D. 1885.

HENRY D. DEMENT,
Secretary of State.

The Regent's report was taken from the table for consideration.

Trustee Follansbee offered the following resolution, which was adopted:

Resolved, That in view of the change of name of this University by the General Assembly of the State, the Regent is hereby authorized and directed to procure a new seal, of like design as the old one, with the name of the "University of Illinois" therein in place of the words "Illinois Industrial University." Also that he be instructed to procure a new plate or engraving for diplomas for the University of Illinois; the whole to be procured at a cost not to exceed $400.

The following appointments of professors and instructors were made for the ensuing academic year:

T. J. Burrill, Professor of Botany and Horticulture, salary $2,000 per annum.
S. W. Shattuck, Professor of Mathematics, salary $2,000 per annum.
E. Snyder, Professor of Modern Languages, salary $2,000 per annum.
J. C. Pickard, Professor of English Literature, salary $2,000 per annum.
N. C. Ricker, Professor of Architecture, salary $2,000 per annum.
J. D. Crawford, Professor of History and Ancient Languages, salary $2,000 per annum.
G. E. Morrow, Professor of Agriculture, salary $2,000 per annum.
P. Roos, Professor of Art and Designing, salary $1,700 per annum.
I. O. Baker, Professor of Civil Engineering, salary $1,800 per annum.
W. McMurtrie, Professor of Chemistry and Mineralogy, salary $2,000 per annum.
S. A. Forbes, Professor of Zoölogy and Entomology, salary $1,160 per annum.
C. W. Rolfe, Assistant Professor of Geology, salary $1,200 per annum.
W. H. Garman, Assistant in Zoölogical Laboratory, salary $840 per annum.
A. N. Talbot, Assistant Professor of Engineering and Mathematics, salary $1,000 per annum.
E. A. Kimball, Instructor in Iron Work and Foreman, salary $1,500 per annum.
G. W. Parker, Instructor in Wood Work and Foreman, salary $960 per annum.
A. T. Woods, Assistant Professor of Mechanical Engineering, salary $40 per month for ten months.
G. C. Hewes, First Assistant in Chemical Laboratory, salary $50 per month for ten months.
S. W. Stratton, Instructor in Mathematics, salary $50 per month for ten months.
H. Taylor, Assistant in Drawing, salary $25 per month for ten months.
Miss K. M. Baker, Instructor in Vocal and Instrumental Music, with fees for salary.
A. B. Baker, Janitor, salary $840 per annum.
S. W. Shattuck, Business Agent, salary $300 per annum.

A recess of one hour was taken.

The Board re-assembled at 2 o'clock P. M.

The following resolution was offered by Trustee McLean:

Resolved, That the Executive Committee and Professor Forbes be authorized to receive as the agents of this Board, from the Board of Education of the State of Illinois, such property, belonging to the establishment known as the State Laboratory of Natural History, as the above mentioned State Board of Education is by law required to transfer to this Board

The motion prevailed.

Professor S. A. Forbes was appointed Director of the Laboratory of Natural History.

The following resolution offered by Trustee McLean was adopted:

Resolved, That the following appropriations be made out of the several sums of money appropriated by the General Assembly for the use of the State Laboratory of Natural History and the State Entomologist office, viz:

For the field work and office and incidental expenses of the laboratory, the sum of one hundred and fifty dollars.

For the traveling, office and incidental expenses of the State Entomologist, the sum of one hundred and fifty dollars,

For improvement of the library, the sum of two hundred and fifty dollars.
For the pay of the entomological assistant, the sum of two hundred and fifty dollars.
For the pay of the botanical assistant, the sum of two hundred and fifty dollars.
For miscellaneous assistance, the sum of two hundred and fifty dollars.
For the publication of bulletins, the sum of seventy-five dollars.

Warrants to be drawn by the President of this Board and subject to the order of the Director duly appointed by the Board.

The following resolution was offered by Trustee Pearman, and passed:

Resolved, That the Director of the State Laboratory of Natural History is hereby authorized to employ such assistance in the work of the laboratory as the law provides, he to report the same to the Board at its next regular meeting.

Trustee Follansbee made the following motion, which prevailed:

Resolved, That it is the sense of this Board that the Director of the State Laboratory of Natural History should make quarterly reports to this Board, through the Regent of the University, of the affairs and operations of the laboratory under his charge.

The following report from the Committee on Buildings and Grounds was adopted and approved:

CHICAGO, July 1, 1884.

To the Board of Trustees of the University of Illinois:

The undersigned committee, to whom was referred the matter of repairs of rooms occupied by A. B. Baker, janitor of the building, would respectfully report that we have examined the same, and would recommend that such changes and alterations be made in the basement rooms now occupied by Janitor Baker, as recommended by the Regent, and that the same be done in accordance with estimated cost as set forth in report, and estimates presented by Prof. N. Clifford Ricker, dated June 29, 1885, and at a cost not exceeding $230, and the same is hereby appropriated, and that said repairs be made under the direction and control of the Regent and Executive Committee of this Board.

ALEX McLEAN,
G. A. FOLLANSBEE,
PARKER EARLE,
Committee.

Trustee Follansbee introduced the following resolution, which was adopted:

Resolved, That the Regent be, and he is hereby authorized to fill the position of Instructor of Ancient Languages, at a salary not to exceed $1,000 per annum; of Instructor in Modern Languages, at a salary not to exceed $600 per annum; of Instructor in the Machine Shops, at a salary not to exceed $400 per annum.

The following motion of Trustee Follansbee was adopted:

Resolved, That a sum not to exceed $1,800 be appropriated for the purpose of securing the services of a competent person to fill the chair of Assistant Professor of Rhetoric and Elocution, and that the Executive Committee be authorized to make the appointment.

Trustee McLean offered the following resolution:

Resolved, That the Regent be and he is hereby authorized to secure the services of a competent person to be known as Professor of Mining Engineering of this University, at a salary not to exceed $2,000 per annum, and that he report his action to this Board at its next regular session.

The motion prevailed.

The following resolution was offered by Trustee Follansbee, and was carried:

Resolved, That the Regent of the University be empowered to make efforts to secure a successor to the professorship of Veterinary Science; or if a satisfactory person cannot at present be secured for that position, that the services of a lecturer be obtained to deliver a course of lectures in that department during a part of the ensuing year; and if this could not be satisfactorily done, that the course of instruction be so arranged, that students desiring to pursue this line of studies can do so in the year succeeding the present one.

The Regent reported the offer of the Urbana and Champaign Street Car Company through their secretary, Mr. F. G. Jaques, to sell to the University the "Rush lot," near the crossing of their road with Wright street, and to join the University in building and maintaining a suitable structure for a waiting place at said crossing.

The report was received, and Trustee McLean offered the following resolution:

Resolved, That the Executive Committee and the Regent be authorized to carry out the proposition of Mr. Jaques, relating to building a waiting-room on the street-car track and proper transfer of the lot of ground to the University, and that they report their action to this Board.

Carried.

The erecting of fire-walls and carrying out of other improvements provided for by State appropriation, was referred to the Executive Committee and the Regent with power to act.

The following appropriations were made:

For improvement in carpenter shop	$150 00
For repairs in janitor's rooms	230 00
For building half-way house	200 00
For laying floor in library	150 00
For finishing balcony and railing in library	150 00
For finishing rooms for zoölogical laboratory	400 00
For purchases for museum and cabinets	1,358 63
For purchase of microtome for botanical laboratory	100 00
For purchases of apparatus for physical laboratory	747 00
For repair of dry kiln	50 00
For purchase of piano	200 00
For advertising	800 00
For publishing agricultural and horticultural bulletins	50 00

The Regent was authorized to purchase machinery and tools for the University shops, not to exceed the appropriation made by the State.

Adjourned.

S. M. MILLARD, *President.*

E. SNYDER, *Secretary.*

PROCEEDINGS OF BOARD OF TRUSTEES—SEPTEMBER, 1885.

The Board met at the University parlor on Tuesday, September 8, 1885, at 3:30 P. M.

Present—Trustees Bennett, Eisenmayer, Earle, Follansbee, McLean, Millard and Pearman.

Absent—Governor Oglesby, Trustees Landrigan, Cobb and Paden.

The minutes of the last two meetings were approved.

The Regent, Dr. Peabody, then read his report, which was received and laid over for further consideration.

REGENT'S REPORT.

To the Trustees of the University of Illinois:

GENTLEMEN—Pursuant to instructions given me at your last meeting, and since then by the Executive Committee, efforts have been made to fill suitably the vacancies in the corps of instruction.

The professorship of mining engineering has been tendered to Professor Theodore B. Comstock, of Cleveland, Ohio. He was graduated at Cornell University, and was afterwards a professor there, and has had an experience of several years as a superintendent of mines in Colorado. In both capacities, as instructor and as miner, he brings an excellent record. He has accepted the position, and will enter upon his duties at the beginning of the year. His salary will be $1,800 per annum.

The professorship of rhetoric and oratory has been offered to Professor James H. Brownlee, of the Southern Normal University at Carbondale, Ill., at a salary of $1,800 per annum. He holds the question of acceptance under advisement.

Miss Josephine A. Cass has been engaged as instructor in ancient languages and acting preceptress. She is a graduate of Wellesley College, Mass., and has taught some years in the preparatory department of that institution.

Miss Helen B. Gregory, one of our own alumni, and a lady well and favorably known to many of you, has been engaged as instructor in modern languages.

I am not prepared to make any report in the department of veterinary science. An extended canvass has not found the person to whom this important subject should be intrusted. It is probable that some temporary arrangement, as contemplated in your instructions of last meeting, will carry this work forward until a suitable appointment can be made.

With this exception, the ranks of the corps of instruction are filled, and all arrangements are completed for carrying forward efficiently the work of the coming year. The indications are good for a full attendance.

IMPROVEMENTS AND REPAIRS.

The work on the fire-walls in the mansard roof approaches completion. The brick work and plastering are done; tinner's work and most of the carpenter's work is finished. The decoration of the society halls must wait a little for the thorough drying of the walls. The expenditures in this account thus far amount to $1.490.35. The whole of this improvement will cost considerably less than the original estimates.

Some work will be done this fall upon the improvement of ventilation, but most of this must now go over until another season.

The improvements in the zoölogical laboratory, and in fitting up quarters for the State Laboratory of Natural History, have been more expensive than was anticipated. The bills thus far amount to $519.19, while the estimates were but $400. Of this expense about $100 should be charged to account of improved ventilation, a very important item in this place, and about $50 to expense of concreting the ground under the floor, found to be necessary when the floor was taken up.

To provide for the deficiency in this work, and to complete it, an appropriation of $250 is needed in addition to that made before.

There is also needed a farther appropriation for tables, desks, sinks and other furniture, to fit this department for service; $400 is asked for this purpose.

The changes and repairs in the janitor's apartments are completed. These also have exceeded the estimates. They have cost $360.99; the appropriations made were $280, and the deficiency needs to be provided for.

Nothing of importance has been done towards building the Halfway House. The work at the University has had the preference, because it had to be finished before the close of the vacation. The Halfway House will next receive attention, and will be pushed to a speedy conclusion. I have urged the architect to revise his plans, with a view to lessening the expense in a way which shall not detract from the utility or beauty of the structure.

The library floor has been relaid at a cost of $145.77. Appropriation for same, $150.

Upon the improvements in the carpenter shop $117.88 has been expended. The work is not quite complete, but the appropriation, $150, is sufficient.

The purchases of tools and machinery for the shops are still under advisement. The machines will be in place as soon as needed. Much care has been exercised in their selection.

The changes in the engravings for diploma, certificate and seal, required by the change of name of the University, are nearly completed. They will cost $164, instead of the sum estimated heretofore.

I present the report of the Professor of Agriculture. His request for $120 for repairs on his dwelling should be granted.

Professor Forbes asks the following items:

For purchase of material for dissection in the Zoölogical Laboratory, $50.

For painting casts of fishes, and for boxes for display of insects for the museum, $200.

Also, the following items for the expenses of the State Laboratory of Natural History for the ensuing quarter:

For field, office and incidental expenses of the laboratory	$150 00
For traveling, office and incidental expenses of the State Entomologist	150 00
For the library	250 00
For pay of assistants	750 00
For publication of bulletin	75 00

The sums are all pro rata of the State appropriations for this department.

An appropriation of $250 is asked for additional apparatus for assaying, and for repairs in the assaying room of the chemical laboratory.

I recommend that authority be given the usual committee to expend the State appropriations for the current year for books and publications, as follows:

For periodicals	$300 00
For binding, not to exceed	200 00
For new books, the balance of the appropriation of $1,500.	

The summary of special appropriations asked at this time is as follows:

For deficiency in repairs Zoölogical Laboratory and Laboratory of Natural History (B. & G.)	$250 00
For furnishing same in part (current)	400 00
For deficiency in repairs, janitor's rooms (B. & G.)	80 99
For repairs of house of Professor of Agriculture (farm)	120 00
For current expenses State Laboratory N. H., as asked by its director, for the quarter	1375 00
For expenses Zoölogical Laboratory for material (cab.)	50 00
For casts of fishes and boxes for insects (cab.)	200 00
For apparatus and repairs in assaying room, Chemical Laboratory (C. P. & B. Lab'ys)	250 00

Respectfully submitted,

S. H. PEABODY, *Regent.*

The report from the Professor of Agriculture was read and referred to the Farm Committee. Trustee Earle was appointed to serve on that committee *pro tem.*, vice Trustee Cobb, absent.

REPORT OF PROFESSOR OF AGRICULTURE.

URBANA, Ill., Sept. 1, 1885.

Dr. S. H. Peabody, Regent:

SIR: I respectfully present the following memoranda of the work of the University farm during the three months ending with this date:

The receipts have been	$1,094 56
Expenditures have aggregated	1,514 60

Sales have been somewhat less than usual during corresponding time. The expenses connected with harvesting and threshing have made the outlay greater than during the other quarters of the year.

With a few exceptions of minor importance, the work appropriate to the season has been promptly done. The extreme heat during the latter part of July added to the discomfort and cost of the oat and hay harvest. These crops were well secured, and the oats threshed from the field. The yields were fair.

We had 2,464 bushels of oats, machine measure; 70 bushels of timothy seed. Because of the severe winter, nearly all the wheat sown last fall had been plowed up in the spring, so that we only had a crop of 17 bushels. Of hay we have about 180 tons, aside from 10 tons of timothy straw. The oat straw was well stacked, and is more than usually good.

Pastures have kept in good condition, aside from a remarkable growth of weeds.

Hedge trimming and drawing of manure is nearly completed. We have plowed a few acres for wheat sowing.

As a whole the live stock has done well. We have a reasonable supply of lambs and pigs for sale for breeding purposes.

Feeding of a car-load of steers for sale was commenced August 20; also of a few cows and heifers not desirable to be retained for breeding.

A well bred and good Jersey bull has been obtained in exchange for a heifer calf.

Our corn crop promises to be better than for four years past. Most of it is already secure from injury from frost.

An exhibit of cattle, lambs, and some farm products, was made at the recent county fair.

There has been a noticeable increase in the requests received for information on agricultural questions, for special articles for the agricultural press, for addresses, etc. I count this an encouraging evidence of increased interest in our work.

Accompanying this is a copy of a bulletin just issued giving some results in our breeding and feeding on the farms.

The roof of the house where I reside and some of the flooring need renewing. The estimated cost is $120.

Respectfully submitted,

G. E. MORROW,

Professor of Agriculture.

The following report from Professor S. A. Forbes was read and laid over for further consideration:

URBANA, ILL., Sept. 7, 1885.

To the Trustees of the University of Illinois:

GENTLEMEN: I beg leave to nominate, in accordance with the law, the following named persons as assistants in the State Laboratory of Natural History, to serve until otherwise ordered:

For Entomological Assistants—Thomas F. Hunt, at $40 a month; Clarence M. Weed, at $40 per month.

For Botanical Assistant—Charles F. Hart, at $45 a month.

For amanuensis—Miss Mary J. Snyder, at $45 a month.

I would further like to be empowered to engage Prof. T. J. Burrill and Mr. F. S. Earle for certain services relating to the botanical survey of the State—the latter for such time as may be necessary, (within the limit of the appropriations made for botanical assistance), at the rate of $83⅓ a month, and the former for the gross sum of $300 for the current year.

If you deem it necessary that I should be formally authorized to engage such other miscellaneous assistants as the work may require and as the funds available will enable me to pay, I respectfully request that such authority be given me once for all, as it will be obviously impossible to submit the names of such assistants in advance, at the regular meetings of the Board.

It seems to me advisable that the Director of the Laboratory should be given general power to suspend assistants, for cause, until the next regular meeting of the Board.

Very respectfully,

S. A. FORBES, *Director of Laboratory.*

The Executive Committee submitted the following report:

A meeting of the Executive Committee of the University of Illinois was held at Chicago on the 21st day of July, 1885. Present: Emory Cobb and S. M. Millard.

Professor Ricker made a report of the needs of the University and the necessity for fire walls and ventilation.

Whereupon the committee took the following action:

WHEREAS, $4,500 was appropriated by the department to extend the fire walls of the University and for ventilation; therefore, *Resolved,* That the Regent, and Professors Ricker and Shattuck be, and are hereby, appointed a committee, and are hereby authorized to proceed at once to build fire walls in the mansard roof of the main building of the University, and with the additional ventilation according to plans submitted.

Resolved. That the committee procure material and let contracts for the extension of said walls, having regard to the needs of the society rooms. That all contracts be let to the lowest responsible bidder. That so far as can be done this material and labor be furnished by the committee on the best possible terms, and that the whole work be done under the personal supervision of the committee.

Resolved, That iron doors of substantial make be placed between the rooms where necessary on the fourth floor of the building.

Resolved, That it is the sense of this committee that the work should be done well, but with economy, and that if the amount appropriated will warrant, the ceiling under the fourth floor over the main hall should be made of iron laths and heavily plastered and made fireproof as nearly as possible.

Resolved, That the committee above appointed investigate the subject of permanent water supply for the University, and report to the Board at its September meeting the results of their investigations, giving cost, amount of water, character, and all information they can obtain on the subject.

Resolved, That $50 be appropriated to make the additional changes requested by Mr. Baker.

Whereupon the committee adjourned.

S. M. MILLARD,
EMORY COBB.
Executive Committee.

The report of the Executive Committee was approved, and their action, as set forth therein, was confirmed.

The Executive Committee further reported as follows:

A meeting of the Executive Committee of the University of Illinois was held in Chicago August 17, 1885, at the office of S. M. Millard.

Present—Messrs. Millard and Pearman.

Dr. Peabody, Regent, appeared before the committee and reported progress in securing needed instructors for the University, naming Professor Theodore B. Comstock, of Cleveland, Ohio, late of Cornell University, to the chair of Mining Engineering.

On motion, the Regent was authorized to appoint Professor Comstock to the chair named at a salary of $1,800 per annum.

On motion, the Regent was authorized to appoint a Professor of Rhetoric and Oratory, at a salary not to exceed $1,800 per annum.

On motion, the Regent was authorized to print a new edition of the catalogue and circular of the year 1884-5, not more than 3,000 copies, to cost not more than $250—which sum was appropriated for that purpose.

Whereupon the committee adjourned.

S. M. MILLARD,
J. T. PEARMAN.
Executive Committee.

The report of the Executive Committee was approved, and their action, as set forth therein, was confirmed.

A memorial from Mr. H. J. Dunlap and others, in regard to the Veterinary Department of the Universary, was received and placed on file.

The report of Prof S. A. Forbes was taken up, and on motion of Trustee Follansbee the report was approved and the appointments were confirmed.

The following communication from Trustee Earle was read and received:

To the Trustees of the University of Illinois:

I am authorized by Miss Fannie LeBaron, of Elgin, Ill., daughter of Dr. William LeBaron, late State Entomologist, to tender to the University the large and valuable entomological collection made by the doctor during his lifetime, upon the condition that it be given a place in the Museum of the University and cared for and maintained permanently as "The LeBaron Collection of Entomology."

PARKER EARLE.

The following resolutions were adopted:

Resolved, That the entomological collection of the late Dr LeBaron be accepted by the Trustees. as tendered, that it be given a suitable place in the Museum, and be cared for and maintained as "The LeBaron Collection."

Resolved, That the thanks of the Board of Trustees be returned to Miss Fannie LeBaron for this generous donation.

Resolved, That the Regent be authorized to expend an amount not exceeding twenty-five dollars in transporting this collection to the University, and the placing of it in a suitable cabinet.

The Regent's report was taken up for consideration.

On motion of Trustee McLean, the Regent, Librarian, and Business Agent were authorized to expend the State Appropriations for books and publications, as recommended in Regent's report.

The request of Prof. Forbes for an appropriation of $1,375 for salaries and contingent expenses for the Laboratory of Natural History and State Entomologist, was granted, and the funds were so appropriated.

The following appropriations were made, as recommended by the Regent.

$250 for Assaying Furnace and repairs.
$250 for Insect Cases and casts of fishes.
$50 for expenses for Zoölogical Laboratory.
$120 for repairs of Farm House.

Adjourned to meet at 7:38 P. M.

EVENING SESSION.

The Board met as by adjournment.

Present—Trustees Bennett, Eisenmayer, Earle, Follansbee, McLean, Millard, and Pearman.

Treasurer J. W. Bunn submitted the following report:

UNIVERSITY OF ILLINOIS,

To John W. Bunn, Treasurer, Cr.

1885.				
June	9	By Balance		$604 25
	15	" Interest on Morgan County Bonds		1,750 00
July	1	" " " Champaign County bonds	$5,850 00	
		" " " Pike County bonds	2,100 00	
		" " " Sangamon County bonds	880 00	
		" " " Chicago Water bonds	875 00	
		" " " Pittsfield School bonds	600 00	
		" " " Kankakee School bonds	300 00	
		" " " Macoupin County bonds	135 00	
		" " . " Kankakee County bonds	1,500 00	
				12,240 00
		" " " " " "		900 00
July	3	" Amount received from State for taxes on lands in Nebraska and Minnesota	$1,776 28	
		" Amount received from State for buildings and grounds	3,000 00	
		" " " " " expenses Chemical, Physical, and Botanical Laboratories	1,500 00	
		" Amount received from State for educational work in mechanical shops	1,500 00	
		" Amount received from State for library and museum	1,500 00	
		" " " " " specimens for cabinets	1,000 00	
		" " " " " expenses of instruction	12,000 00	
		" " " " " additional tools and machines	2,000 00	
		" Amount received from State for building fire-walls, mansard roof	4,500 00	
				28,766 28
Aug.	1	" Amount received from State for State Laboratory of Natural History—for field work	$150 00	
		" For traveling, incidental and office expenses	150 00	
		" For improvement of laboratory	250 00	
		" For Entomologist's assistants	250 00	
		" Botanical assistants	250 00	
		" For miscellaneous assistants	250 00	
		" For publication of bulletins	75 00	
				1,375 00
		" Amount received on account buildings and grounds	$18 33	
		" " " " Fuel and lights	50 62	
		" " " " Stationery and printing	6 10	
		" " " " Preparatory Department	130 00	
		" " " " Mechanical Department	312 76	
		" " " " Architectural Department	1,768 79	
		" " " " Agricultural Department	1,094 56	
		" " " " Horticultural Department	819 41	
		" " " " Chemical Department	162 02	
		" " " " Incidentals	8 00	
		" " " " Griggs farm	107 25	
		" " " " Music fees	67 00	
		" " " " Elocution fees	14 00	
		" " " " University fees	53 00	
		" " " " Laboratories	30 56	
		" " " " Ills. Cent. R. R. donation	881 50	
				5,523 90
				$51,159 43

UNIVERSITY OF ILLINOIS, *To John W. Bunn, Treasurer, Dr.*

1885.				
Aug. 31	To amount paid on account	Board expense	$477 24	
	" " " "	Salaries	7,679 23	
	" " " "	Buildings and grounds	40 20	
	" " " "	Fuel and lights	1,083 41	
	" " " "	Stationery and printing	689 02	
	" " " "	Mechanical Department	362 02	
	" " " "	Architectural Department	1,822 96	
	" " " "	Agricultural Department	1,514 80	
	" " " "	Horticultural Department	739 73	
	" " " "	Chemical Department	48 36	
	" " " "	Military Department	3 46	
	" " " "	Library and apparatus	146 08	
	" " " "	Incidental expense	95 70	
				$14,702 21
	" " " "	Cabinets	$4 65	
	" " " "	Drawings for Arch. Dept	19 50	
	" " " "	Library catalogue case	42 82	
	" " " "	Gymnasium	52 77	
	" " " "	Piano	200 00	
	" " " "	Music fees	67 00	
				386 74
	State appropriations;			
	To amount paid on account	taxes on lands in Nebraska and Minnesota	$1,766 28	
	" amount paid on account	buildings and grounds	2,443 82	
	" " " "	Laboratories	45 13	
	" " " "	Mechanical and Arch. shops	356 44	
	" " " "	Books and publications	571 31	
	" " " "	Cabinets	84 53	
	" " " "	Machines and tools	429 58	
	" " " "	Fire-walls and ventilation	1,490 35	
	" " " "	State Laboratory of Natural History,	1,085 14	
				8,272 58
	" Balance			27,797 90
				$51,159 43

Urbana, September 8, 1885. JOHN W. BUNN, *Treasurer.*

The report was received and referred to the Auditing Committee.

The following report from the Treasurer was received and approved:

URBANA, Sept. 8, 1885.

Hon. S. M. Millard, President:

I have purchased for the endowment fund of the University of Illinois the following bonds:

1885.		
March 31	Macoupin County 6 per cent refunded bonds	$8,000 00
July 1	" " " " " "	3,000 00
May 1	Sangamon County 6½ per cent. school district bonds	6,000 00
Sept. 1	Christian County 6 per cent. " " "	5,000 00
	Sangamon County 7 per cent. " " "	2,000 00
	Litchfield 5½ per cent. " " "	2,000 00
		$26,000 00

JOHN W. BUNN, *Treasurer.*

The Treasurer's bill for $235, paid out in premiums for the purchase of the bonds above mentioned, was audited and allowed, and a warrant for the same was ordered to be drawn.

The Business Agent submitted the following report:

Current Appropriations.

March 11, 1865.	Appropri-ated.	Receipts also ap-propriated	Expended.	Balance.
Board expense	$534 60		$636 81	
Salaries for instruction	16,010 00		15,567 12	$442 88
Salaries for services	1,210 00		1,187 46	22 54
Buildings and grounds	50 00	$56 66	65 43	42 23
Fuel and lights	1,000 00	57 41	1,501 21	
Stationery and printing	1,500 00	7 20	1,059 44	447 76
Nebraska lands	100 00	130 08	135 58	94 50
Library and apparatus	185 00		157 16	27 84
Incidental expense	200 00	8 00	174 75	33 25
Mechanical Department	500 00	363 61	618 89	244 72
Architectural Department	800 00	1,828 02	2,183 12	444 50
Agricultural Department	800 00	2,160 66	2,592 21	368 45
Horticultural Department	500 00	1,152 81	1,195 81	457 00
Chemical Department	400 00	166 02	159 46	406 56
Military Department	50 00		46 26	3 74
Sundries:				
Griggs Farm	100 00	107 25	40 40	156 85
Physical and Botanical Laboratories	25 00	30 56		55 56
Cabinets	25 00		4 65	20 35
Gymnasium	140 00		65 65	74 35
Engraving for report	65 00			65 00
Library card case	30 00		46 42	
Drawings, Architectural Department	50 00		19 50	30 50
Rubber stamp, Engineering coll	20 00		19 98	02
Elocution fees		157 00		157 00
Music fees		125 00	125 00	
Preparatory Department fees		350 00	350 00	
University students fees		2,481 75		2,481 75
Purchase of piano	200 00		200 00	
Seal and diploma plate	400 00			400 00

State Appropriations.

	Appropri-ated.	Received.	Expended	Balance.
July 1, 1883.				
Laboratories	$3,000 00	$3,000 00	$2,157 34	$842 66
Cabinets	2,000 00	2,000 00	725 90	1,274 10
July 1, 1885.				
Taxes on land, ½ per annum	4,000 00	1,766 28	1,766 28	
Buildings and grounds, ½ per annum	6,000 00	3,000 00	2,016 46	983 54
Laboratories, ½ per annum	3,000 00	1,500 00		1,500 00
Mech. and Arch. shops, ½ per annum	3,000 00	1,500 00	150 00	1,350 00
Books and publications, ½ per annum	3,000 00	1,500 00	9 08	1,490 92
Cabinets, ½ per annum	2,000 00	1,000 00		1,000 00
Current expense of instruction, ½ per annum	24,000 00	12,000 00		12,000 00
Machines and tools, ½ per annum	4,000 00	2,000 00	429 58	1,570 42
Fire walls and ventilation	4,500 00	4,500 00	1,490 35	3,009 65
Laboratory of Natural History	18,000 00	1,375 00	1,085 14	289 86

Summary of Accounts for the Six Months ending August 31, 1885.

1885.	CURRENT EXPENSE ACCOUNT.	*Dr.*	*Cr.*
March 10	By balance from last year		$4,570 50
Aug. 31	" collection, six months		5,471 00
	" balance laboratories		28 47
	" balance Griggs farm		66 85
	To balance board expense	$636 81	
	" " salaries for instruction	1,505 56	
	" " salaries for services	1,187 46	
	" " buildings and grounds	7 77	
	" " fuel and lights	1,443 80	
	" " stationery and printing	1,052 24	
	" " Nebraska lands	5 50	
	" " library and apparatus	157 16	
	" " Mechanical Department	255 28	
	" " Architectural Department	355 50	
	" " Agricultural Department	431 55	
	" " Horticultural Department	43 00	
	" " Military Department	46 26	
	" " incidentals	166 75	
	" " gymnasium	65 65	
	" " library and catalogue case	46 42	
	" " drawings, Architectural Department	19 50	
	" " rubber stamp eng. col	19 98	
	" " purchase of piano	200 00	
	" State buildings and grounds	3 88	
	" balance	2,486 75	
	Total	$10,136 82	$10,136 82

1885.	STATE APPROPRIATION ACCOUNT.	*Dr.*	*Cr.*
March 10	By balance from last year		$4,888 44
May 30	To warrants drawn	$1,449 87	
July 3	By amount received from State taxes on land		1,776 28
	" " " " buildings and grounds		3,000 00
	" " " " laboratories		1,500 00
	" " " " Mech. and Arch. shops		1,500 00
	" " " " books and publications		1,500 00
	" " " " cabinets		1,000 00
	" " " " current expense of instruction		12,000 00
	" " " " tools and machines		2,000 00
	" " " " fire walls and ventilation		4,500 00
Aug. 1	" " " " State Lab'y Natural History, etc		1,375 00
Aug. 31	To warrants drawn	8,272 58	
	By current expense (buildings and grounds)		3 88
	To balance	25,311 15	
	Total	$35,033 60	$35,033 60

The report was received and referred to the Auditing Committee.

Trustee McLean offered the following resolution, which was adopted:

Resolved, That the President and Secretary be directed to draw their requisition upon the State Auditor for the several sums of money appropriated by the General Assembly for the use of the State Laboratory of Natural History and the State Entomologist's office for the quarter ending December 31, 1885.

For the field work and incidental expense of the Laboratory the sum of one hundred and fifty dollars.

For the traveling, office, and incidental expenses of the Entomologist the sum of one hundred and fifty dollars.

For improvement of the Library the sum of two hundred and fifty dollars.

For the pay of the Entomological assistant the sum of two hundred and fifty dollars.

For the pay of the Botanical assistant the sum of two hundred and fifty dollars.

For miscellaneous assistance the sum of two hundred and fifty dollars.

For the publication of bulletins the sum of seventy-five dollars.

The Farm Committee, to whom was referred the report from the Professor of Agriculture, recommended that the same be approved and placed on file. The recommendation was agreed to.

The Auditing Committee submitted the following report:

To the Honorable Board of Trustees:

Your Auditing Committee report that they have examined warrants and vouchers from No. 551 to 750, both inclusive, and find them to all appearance correct, as reported by the Business Agent, also that they find the Treasurer's report correct, and they recommend the approval of both reports.

J. T. PEARMAN,
GEO. C. EISENMAYER,
Committee.

The report was approved.

The following appropriations from current funds were made for the six months ending February 28th, 1886:

For Current Expenses.

Board expense		$600 00
Salaries for instruction		18,524 00
Salaries for services		1,580 00
Buildings and grounds		25 00
Fuel and lights		2,000 00
Stationery and printing		800 00
Nebraska lands		50 00
Library and apparatus		100 00
Incidental expense		356 86
Mechanical department	$500 00	
Architectural department	500 00	
Agricultural department	500 00	
Horticultural department	500 00	
Laboratories	500 00	
Military department	50 00	
		2,550 00
Sundries--		
Gymnasium	$75 00	
Engraving for report	65 00	
Drawings, Architectural department	30 50	
Seal and diploma plate	200 00	
Drawing desks and bulletin boards in Architectural department	35 00	
Le Baron Entomological Collection, expenses	25 00	
		430 50
Total		$27,016 36

$250 from the State Appropriations for Buildings and Grounds were appropriated for the completion of the rooms of the Laboratory of Natural History.

The matter of an over expenditure of $80.99 above the appropriation in fitting up janitor's rooms, was referred to the Committee on Buildings and Grounds for report at next meeting.

For the furnishing of the Zoölogical Laboratory $400 were appropriated from such funds as were not otherwise assigned.

The Regent and Prof Ricker asked, and were granted further time for their report on permanent water supply.

A bill of traveling expenses of the Regent amounting to $156.86 was audited and allowed, and a warrant for the same was ordered to be drawn.

Trustee Bennett, from special committee, made the following report:

To the Board of Trustees:

Your committee to whom was referred the matter of the petition of Foster North, beg leave to report, that inasmuch as the said petition presents a question of constitutional law, therefore the committee recommend that the matter of said petition be referred to the Attorney-General of this State, for his opinion on the question of law raised thereby.

S. M. MILLARD,
S. H. PEABODY,
C. BENNETT,
Committee.

Trustee Follansbee submitted the following minority report:

To the Trustees of the University of Illinois:

In the matter of the petition of Foster North, Esq., which has heretofore been submitted by your honorable Board to a committee with directions to make a report thereon at this meeting, the undersigned begs leave to offer the following as a minority report in said matter.

In arriving at the conclusions hereinafter stated he has endeavored to keep steadily in view two objects, viz.: First, that Mr. North should be accorded by this Board all of his constitutional and legal rights, whatever they may be; and, secondly, that the benefit of the chapel exercises as heretofore enjoyed should be preserved to this institution.

Upon the first point we are of the opinion, and so recommend, that Mr. North shall be allowed to graduate from this University upon the completion of the required list of studies and upon passing a satisfactory examination therein, notwithstanding the fact that he was not in attendance upon his recitations during the last term of his course of studies. We make this recommendation inasmuch as we understand that it is conceded the reason he did not so attend was because he was not allowed to do so, having been suspended therefrom because of his non-attendance at the daily chapel exercises, at which portions of the New Testament are read and the Lord s Prayer repeated.

No good purpose would be subserved in this report by submitting an argument upon the constitutional question as to whether Mr. North's position in regard to his attendance upon such exercises is or is not correct.

Suffice it to say that the undersigned is of the opinion that the reading of the Bible and offering prayer at such stated intervals are, and are intended to be, acts of worship, and the chapel at such times is, and is intended for the time being, to be a "place of worship."

If so, the bill of rights of this State positively declares that no one shall be required to attend such a place without his consent, and it necessarily follows that no one should be deprived of any rights that he could otherwise enjoy or should otherwise have if he does not so attend.

A law of the State which would require each person to attend a place of worship, subject to pains and penalties, would clearly contravene this provision of our bill of rights. No less subject to the objection, to my mind, is a law or rule which deprives a person of the benefits of a public institution like this because he fails to give his consent to attend upon these acts of worship.

A rule or law is no less objectionable because in the one case it would deprive an individual of the right to public instruction, or to vote, or to hold office, unless he attends a place of worship, than it would be if it commanded or "required" him to do so under pains or penalties.

In the one case he is deprived of his rights, and in the other of his liberty or his property, because of his failure to attend "a place of worship."

With the wisdom of this right to entirely abstain from attendance upon any place of worship, which is reserved to each individual of this State, we have nothing to do. In conceding powers to the State government the people of this State have seen fit to reserve this one to themselves, so that each individual may follow out in this respect the dictates of his own conscience. Not only is each person now free to worship Almighty God according to the dictates of his own conscience—the principle for which our Puritan ancestors stood; but we have gone beyond that, and now say that each person is free to worship or not to worship God, according to the conclusions of his own judgment. And this enunciation of our reserved individual rights marks a wide departure from the declarations contained in the earlier State constitutions in this country. Nor does it, in my opinion, obviate the constitutional objection that the faculty offered to excuse Mr. North from attendance at such exercises, if he would request it or state that he had conscientious scruples against doing so.

He was not asking a favor, he was simply asserting a right; and he avers that he had no conscientious scruples on the subject, but to be compelled to go there was against his consent.

It must be apparent, I think, that Mr. North has planted himself upon his constitutional rights, and however widely we may differ from him in the opinions which he holds in regard to religious matters, we should not on account thereof deny him such privileges as the constitution of our State has guaranteed him.

I therefore, as above stated, recommend to the faculty of this institution that Mr. North be graduated upon the terms and conditions above set forth.

Upon the second question, as to the retention of the chapel exercises, I recommend that they be continued as heretofore.

I realize that this recommendation does not follow as a matter of course from the consideration of Mr. North's petition, yet inasmuch as fear is entertained that the effect of this report if adopted by you will be to encourage other students to willfully absent themselves from such exercises, and thereby cause their gradual disintegration, I feel instigated to urge that no marked deviation be made in that respect from the rules heretofore governing attendance thereat.

I understand in the past any person by representing to the Regent or Faculty that he has conscientious scruples against attending such exercises, or by furnishing other good reasons why he should not so attend, has been excused from such attendance.

The students who will decline to comply with this requirement will in my opinion be so few in number that there seems to be no real occasion to depart from the practice heretofore adopted.

I desire to say in conclusion that I thoroughly believe in the desirability of the religious instruction given to the pupils of this institution at such chapel exercises, and earnestly trust that no occasion will be furnished for doing away with them.

The boys and girls who attend this University are for the most part away from their homes and home influences, are here during the formative periods of their character, and it would be unfortunate, in my opinion, if, during these important years, the religious side of their education should receive no instruction or culture. Many parents in this State would hesitate to send their children to such a University.

Again, it would be comparatively an easy matter to obtain the "consent" of almost every person upon entering the University that he would attend such exercises.

The few persons who would want to appear "singular," and who would refuse such consent, would be exceedingly small.

Those who "consented" could be "required" to attend such exercises, and thus a uniform attendance secured.

I cannot feel that these recommendations in favor of Mr. North will have any serious effect upon the chapel exercises, and that if complied with it will only be doing an act of simple justice to him.

All of which is respectfully submitted,

G. A. FOLLANSBEE.

Trustee Pearman moved that the minority report be substituted for the majority report. The motion was lost.

The majority report was approved, and its recommendation adopted.

Adjourned.

S. M. MILLARD, *President*.

E. SNYDER, *Secretary*.

PROCEEDINGS OF BOARD OF TRUSTEES—DECEMBER, 1885.

The Board met at the University parlor on Tuesday, December 8, 1885, at 3:30 P. M.

Present—Governor Oglesby, Trustees Bennett, Cobb, Eisenmayer, Follansbee, McLean, Millard, Paden and Pearman.

Absent—Trustees Landrigan and Earle.

The minutes of last meeting were approved.

The reports of the Regent and Business Agent were deferred.

Professor Morrow read his report from the Agricultural Department (see Bulletin A), which was received and referred to the Farm Committee.

The report of Professor Burrill from the Horticultural Department was read, received and referred to Committee on Buildings and Grounds for report at this meeting (see Bulletin A).

In the absence of Trustee Earle, Trustee Eisenmayer was appointed by the chair to act on Auditing Committee.

The Regent extended an invitation to the Board to a reception at his residence this evening, which was accepted.

The Regent then read the following report, which was received and laid over for further consideration:

To the Trustees of the University of Illinois:

GENTLEMEN—The term now closing has been notable for quiet, good order and scholarly work. The new department of Mining Engineering has been organized, a course of study arranged, and a class is at work. Professor Comstock shows all the elements of an efficient and successful instructor.

Professor Brownlee, lately appointed to the chair of Rhetoric and Oratory, will enter on his duties at the beginning of the new year.

No permanent arrangement has been made for filling the professorship of Veterinary Science. The instruction pertaining to this department has been given during the current term by Professor Rolfe; but this cannot continue. I have to recommend that Dr. D. McIntosh, of Kingston, Ontario, be employed to give a course of lectures in veterinary science during the remaining terms of the current year.

The Halfway House on the street railway has been finished in accordance with the agreements and instructions made at your meeting in July. It was then arranged that the railway company should sell to the University a lot of land lying south of the track, and that the price of the lot, with such additional money as you should set aside for the purpose, should be used in the construction of the station. An appropriation was made towards building the house, but that for the payment for the lot was overlooked. The company has executed for the lot a deed, which is now in my hands, and may be passed to record whenever the appropriation of $150 is made and the vouchers passed. I ask your attention to this matter.

The University has now acquired possession of all the lots lying south of the car track, and the fence has been made to include them in the arboretum. The ground was originally intended to be included in the University property, but for a time was so held that it could not be properly acquired. It has finally come into our possession at a very moderate outlay.

Without desiring to recommend any large increase of the real estate of the University, which is certainly ample, I desire to call your attention to one addition which can now be cheaply made, and which I am sure will commend itself to your judgment. I refer to the two lots of land which adjoin the University Park on the east, lying between it and the next street. This ground will furnish the most desirable site for any additional building that may be required, and will give a street front to the park on that side. Building in the neighborhood of the University has revived, and these lots will certainly be sought for and occupied at an early day.

While advising this purchase, I would recommend a general policy of contraction as to our real estate. The old campus north of the Springfield road is no longer needed for University purposes. At least the north half of it, and probably the whole tract, might well be sold and the proceeds used for other purposes, or for endowment, whenever a sale can be made without sacrifice.

I present the annual reports of the Agricultural and Horticultural departments.

Professor Forbes asks that the usual quarterly requisition be prepared to provide for the Laboratory of Natural History, and that the corresponding appropriations be made, as per the last quarter.

Also from the State appropriations for museum account, that $50 be appropriated for material to be used in instruction in zoölogy, and $400 for purchase of microscopes for that department.

Professor Ricker asks that his department be allowed $15 for the purchase of Wolpert's apparatus for testing the purity of air in residences; also, for $100 for continuing his collection of engravings and photographs.

Professor Roos asks for an appropriation of $150 for shutters to control the light in the drawing-room. The curtains used for this purpose are worn out and need replacing; the shutters will be more permanent and more useful.

The floor of the veranda on the south side of the main building should be relaid at once. If it should appear that the framework as well as the floor is decayed the repairs will cost $110. If the frame may be used again the cost will be $50.

Agreeably to instructions given at your last meeting, I referred the papers in the case of Foster North to the Attorney General of the State, the Hon. George Hunt, with your request that he give his opinion upon the issues therein raised. His reply has been received and is herewith presented.

The supply of Rules for Students of the University is exhausted and a new edition is needed. The rules have been carefully revised by the Faculty; a few items have been changed, and as revised they are presented for your approval, with the request that authority be given to print.

The following special appropriations are asked:

For payment of lot to Railway Co., $150; General Fund.
For purchase of lots east of University Grounds, $830; General Fund.
For Department of Zoölogy, for material, $50; Museums.
For Department of Zoölogy, for microscopes, $400; Museums.
For Department of Botany, for apparatus, $75; Laboratories.
For Department of Chemistry, for additional fittings for Laboratory, $250; Laboratories.
For Department of Architecture, for apparatus, $15; Laboratories.
For Department of Agriculture, for the collection of designs, $100; General Fund.
For Band, for cornet, $20; General Fund.
For Drawing-room, for new shutters, $150; General Fund.
For repairs to veranda in rear, $110; B. and G.

Respectfully submitted,

S. H. PEABODY, *Regent.*

The Regent laid before the Board the opinion of the Attorney-General of the State in regard to the case of Student Foster North.

It was received, and ordered that the same, together with the communication of the Regent to the Attorney-General, be spread upon the records of this Board.

COMMUNICATION OF THE REGENT TO THE ATTORNEY-GENERAL.

UNIVERSITY OF ILLINOIS,
REGENT'S OFFICE.

URBANA, ILLINOIS, October 10, 1885.

To the Hon. George Hunt, Attorney-General of the State of Illinois:

SIR—I have the honor to forward to you a resolution passed by the Board of Trustees of this University, at their last regular meeting, and in connection therewith the following papers:

1. A petition of Foster North to the Trustees, dated May 24, 1885.

2. Additional arguments of Foster North to the Trustees, dated July 15, 1885, with two printed enclosures, A. and B.

3. A letter from said North to the Hon. Charles Bennett, one of the said Trustees, dated July 15, 1885.

4. A statement of the Regent of the University concerning its regulations, and the steps taken by the Faculty to protect and enforce those regulations when contravened by the act of said North.

The Trustees desire me to ask your opinion upon the questions of law, constitutional or other, raised in these communications, which I conceive to be substantially these, viz.:

May the Trustees and Faculty rightfully hold chapel exercises in the manner and form substantially as they have hitherto been held, and may they require the attendance of students thereon?

Were the constitutional rights of Foster North duly guarded by the offer to excuse him upon his assertion of conscientious scruples against attendance upon such chapel exercises?

I am, very respectfully, your obedient servant,

SELIM H. PEABODY,

Regent University of Illinois.

STATEMENT OF REGENT AS TO THE PETITION OF FOSTER NORTH.

UNIVERSITY OF ILLINOIS.

URBANA, ILLINOIS, September 8, 1885.

To the Trustees of the University of Illinois:

GENTLEMEN—In the matter of the petition of Foster North, referred by you to a committee for consideration and report, the Regent of the University begs leave to make the following statement of the customs and regulations of the Institution, the authority on which they rest, and the acts of the Faculty which are complained of by Mr. North in his aforementioned petition.

This statement is presented as follows:

1. This University was chartered by act of the Legislature of the State of Illinois, approved February 28, 1867, and by said act was made the recipient of a grant of land made by the Congress of the United States in an act approved July 2, 1862. By the act of incorporation the authority to make and establish by-laws for the management and government of the University was vested in the Board of Trustees, and by the Trustees has been intrusted to the Regent and Faculty of the University, acting in their behalf, and with their sanction, as is the custom in institutions of higher education of such grade and character.

2. From the opening of the University in March, 1868, the students of the University have been required, and have been accustomed, to assemble daily in some suitable place. This daily assembly has been deemed an important aid in the orderly and methodical conduct of the University business, furnishing an opportunity for giving publicity to such orders, directions, notices, etc., as were suitable and requisite and for giving such instructions of a general nature as might be deemed useful and necessary adjuncts to any course of liberal education.

At the time of this general assembly of students, and as a customary part of its public exercises, portions of the New Testament scriptures have been read, hymns or anthems have been sung, and prayers have been offered. For the last five years the prayer offered on each occasion has been that known throughout the Christian world as the Lord's Prayer, recited by the Regent. In these exercises, particularly in the reading of the New Testament, and in the singing, the students have been invited to take part, and many of them have so taken part, but no person has been required to participate therein against his wish.

Before entering into the assembly-room or chapel, the students are gathered into companies, and the rolls are called, the military organization being used for this purpose. The names of all absentees are reported to college officers assigned to receive them, and the absentees are required to present to such officers satisfactory reasons for failure to attend. Up to the refusal of Mr. North to attend, the authority of the University to require attendance has not been questioned, and the requirements to present reasons for occasional absences, as above stated, has been all that has been needed to secure regular and orderly attendance, without any resort to unusual or severe discipline. It has, however, been held that if any student should present to the Regent or Faculty a statement that his attendance upon the above described general assembly of the students, and his listening to the exercises therein conducted, were in opposition to his religious beliefs, and an infringement upon his rights of conscience, he should thereafter be excused from attendance. Thus, for example, a student who was a Jew has been told that if he or his parents objected to attendance upon the aforesaid exercises because of his Jewish faith, he should be excused therefrom.

Mr. Foster North entered the University as a student on the fifteenth of September, 1879, and remained as such, with occasional interruptions made by himself, until the present time. He has not been *expelled,* as he has sometimes stated. No objections are raised by the Regent and Faculty as to his general deportment or scholarship.

After nearly six years of acquiescence in the regulation concerning attendance upon chapel exercises, in March, 1885, Mr. North absented himself therefrom. In the absence of the Regent he was called to excuse absences by the Vice-President of the University, Prof. Burrill, and made reply substantially that the government of the University had no authority to ask his attendance.

His answer was reported to the Faculty by Prof. Burrill, and on April 3 the Faculty entered upon its minutes, that "he (Foster North) would be expected to comply with the regulation of the University as long as he remains a student therein," and this action was reported to Mr. North. He still remained absent from chapel exercises; the case was again brought to the knowledge of the Faculty, April 17, and the Faculty voted the following order:

"Case of F. North referred to Regent. If he claims conscientious scruples against attendance at chapel he may be excused; if not, he will be suspended."

On the 21st of April the Regent called Mr. North to his office, and offered to excuse him from farther attendance at chapel if he would present to the Faculty his objections to attendance on account of conscience, substantially as set forth in the draft of a statement, which is hereto appended as enclosure C. Mr. North declined to make answer at the time, and asked to have the paper for examination. On the 24th of April he filed in the Regent's office his reply in the paper herewith appended, enclosure D. In this paper he refused the offer of excuse on account of the repugnance of the chapel exercises to his religious convictions, saying that he had "no religious convictions for the chapel exercises to be repugnant to;" and, secondly, he took the ground that the Faculty had no right to make any regulation requiring students to attend chapel, and that even the act of formally expressing his wish not to attend would be a recognition of a right which he strenuously denied. His statement that the request "would be the asking a favor * * *not accorded to others*," is not in accordance with fact, and is therefore not of weight.

Finding that Mr. North would accept no solution of the difficulty, which he had himself raised, other than a complete abandonment by the Regent and Faculty of the chapel exercises, or at least so much thereof as may be deemed religious in character, the Regent believed that he could do no otherwise than carry into effect the alternative order of the Faculty, made in their minute of April 17. He accordingly addressed to Mr. North the following letter, of which the original is presumably in Mr. North's possession:

ILLINOIS INDUSTRIAL UNIVERSITY,
REGENT'S OFFICE.
URBANA, ILL., April 30, 1885.

Mr. Foster North:

DEAR SIR: It is in evidence before the Faculty of this University that during most of the current term you have purposely absented yourself from the general assembly of the students required daily of them by the regulations of this institution. You avèr that you have not done this on account of any conscientious objections to any of the exercises there held, religious or other, but because you deny the authority of the Faculty to require your attendance there, so long as any part of the exercises are religious in form. You therefore deny the authority of the Faculty as now administered.

The Faculty cannot accept your view of the case, nor admit your propositions thereupon, nor can they allow you to nullify their regulations. I am, therefore, directed to say to you that you are from this date suspended indefinitely from the University.

By order of the Faculty.

S. H. PEABODY, *Regent.*

With this paper the record of the action of the Faculty is complete.

The following points are suggested:

1. Attendance upon the University of Illinois is not a right inherent in the natural condition of any person, but a privilege accorded to such persons as can and will conform to conditions imposed by the laws of the State, or by the Trustees and Faculty, acting under authority of law. The latter authorities are competent to decide what rules and regulations are reasonable and proper, and may insist that students shall conform to them under penalty of forfeiture of said privileges on account of disobedience or abuse.

2. All students at the University of Illinois are in a state of pupilage, no matter whether they be of so-called "legal age" or not. While members of the University they are such by their own voluntary act and choice, for purposes of instruction and discipline, and that these purposes may the better be accomplished they have formally, or tacitly, in the act of joining the University, agreed to conform to its regulations. They have given, and during their continued attendance upon and enjoyment of the privileges of the University, do constantly give consent to such regulations as the lawfully constituted authorities may make.

3. The affirmation of the constitution that no person may be compelled to attend a place of worship without his consent expresses no new or restrictive principle of personal liberty. What person may lawfully be "compelled" to attend any place without his consent? Has any man or set of men a right to compel any person without his consent to go anywhere—to dinner, or to bed, to a workshop, or a place of discipline or amusement? Any such compulsion would be a plain violation of the personal rights of the one so coerced; the violation may be punished, and the personal rights may be vindicated by suitable legal process.

4. The general rule has always been, and must ever remain, that whenever any person voluntarily joins an organization, or accepts a privilege, his act of joining, or of acceptance, is his consent to obey all the regulations of the organization, and to fulfill all the conditions of the privilege. It is not in his power to elect that he will obey a part and disobey a part. He was under no obligation to join or accept. He is under no obligation to continue in his connection. In some cases, indeed, he may become part of the law-making power, and in the lawful exercise of his power he may succeed in changing or abolishing regulations which are distasteful. But in the University of Illinois the law-making power is in the hands of the Trustees and Faculty, and is not lodged with the students.

5. It will be admitted that it is within the powers of the Trustees and Faculty to make and enforce regulations which would restrict in many ways the personal liberty of students, which restrictions under other conditions would be unlawful. For example, these authorities might enact that every student should reside in buildings provided for the purpose, and not elsewhere. That no student should be absent without leave from the pre-

cincts of the University within defined hours, as between sunset and sunrise, or after ten o'clock at night. That each person should take his meals at specified hours; should at certain regulated hours go to duty, as to labor, or to drill, or to study.

The authorities of the University of Illinois have enacted no such rules, but no one will deny their authority so to enact, and every one will admit that by joining the University each student would have given his consent to such regulations if they had been made, and that his neglect or refusal to conform to such rules, if made, would be sufficient cause for his suspension or expulsion from the University. Having given his consent to such restriction of his personal liberty as the regulation may require, he may not after that elect which he will obey, and which he will defy, and remain a student.

A parallel case exists in the military organizations of the State. They are voluntary. Persons may join them, not by right, but as a privilege. But in the act of joining each person, private or officer, surrenders such portions of his personal liberty as the needs and the usages of the service require. The man was not obliged to join. He is not obliged to remain. While he remains he must conform to regulations and obey orders, or suffer such coercion and submit to such penalties, including dismission from the service, as the authorities above him may inflict, always within the scope of their powers.

Nor is the illustration without a parallel in regard to the matter of religious worship. The burial of the dead, even as performed with military rites, is usually accompanied with religious services, recitals or readings of Scripture, prayers, religious songs, the solemn ritual of ashes to ashes, dust to dust, and the assertion of the hope of a glorious resurrection at the last day. What soldier would be permitted to absent himself from such a service on the ground that his commanding officer had no right to require his attendance on a place of religious worship? The soldier, if so ordered, must join in escorting a criminal to the place of execution; he may be required even to assist in the infliction of the death penalty, and no excuse of conscientious scruples against the infliction of capital punishment will avail. His consent to perform all the duties of a soldier, and to obey all lawful orders of his superior officers, given when he joined the contingent and took the oath of a soldier, involved all these possibilities.

6. But the principles of republican government interpose every safeguard against the violation of one's conscience, as unquestionably they ought. In the case of Foster North, the Regent and Faculty believed at the time of his suspension, and still believe, that they took every reasonable precaution, carefully refraining to require of him any act which he would say, himself being the judge, was repugnant to his conscience or his religious convictions. He takes pains to deny that the exercise of which he complains in any way militates against his religious convictions. He says that he has no religious convictions to be opposed. He has no conscience to be violated. No overt act was required of him. He need not read. He need not sing. He need not pray. He need not even listen to those who do either. He is required only so to comport himself as not to annoy those who do read, or sing, or pray. If any of these acts were repugnant to his conscience he had only to state the fact to the proper officer, and he would have been permitted to stay away, not as a favor, but as a matter of right and justice. This he very well knew.

The presentation of a reason for excuse from any act, when made to the proper officer, does not involve the recognition of the authority of the officer to require the act or to refuse to accept the excuse, as claimed by Mr. North. It may mean no more than the recognition of the officer as the proper channel through whom the reason becomes known, and so is made effective.

Stripped of all disguises, what is the real purpose of Mr. North in thus refusing to conform to the usages of the University, and his subsequent proceedings?

It is not the defense of his rights. It is not the redress of his wrongs. It is not the protection of his conscience. He has said that the exercises could not harm him, but he thought they might injure others. His avowed and only purpose is to overthrow, not the requirement to attend, but the exercise itself. It is not simply to compel the Faculty to say that students may attend chapel services or not as they may see fit, and to be present or absent as caprice or whim may dictate. It is to compel the Faculty to abolish the exercise altogether, to the end that no Scripture may be read, and no prayer offered within the buildings provided by the State for the uses of the University of Illinois. It is not to relieve his conscience from coercion: it is to coerce the consciences of all the God-fearing and Christian men and women who may in any way be connected with the University as officers or students. These facts were understood by the Regent when Mr. North refused to sign the paper offered, or any paper whatever, for his own release. Letters which Mr. North has subsequently written to the Trustees substantiate these statements beyond a doubt.

That the people of the State of Illinois ever dreamed that, as the outcome of a misinterpreted constitutional provision, Christianity, the God of Heaven and Earth, and the Bible as His written word could be ruled out of its State University, so that it should be unlawful to read the Scriptures, or to pray to Him, within its walls, is a conclusion too monstrous to be entertained.

Respectfully submitted.

SELIM H. PEABODY.

Regent University of Illinois.

OPINION OF ATTORNEY-GENERAL.

STATE OF ILLINOIS,
ATTORNEY-GENERAL'S OFFICE.

SPRINGFIELD, December 7, 1885.

Dr. S. H. Peabody, Regent University of Illinois, Urbana, Illinois:

DEAR SIR—Your favor of recent date enclosing the resolution of the Trustees of the University of Illinois together with the petition of Foster North and papers relating thereto, was duly received. Said resolution purports to have been adopted at a meeting of the Trustees of the University, held on Sept. 9, 1885, and is as follows:

"*Resolved,* That the Regent be and he is hereby instructed to lay before the Attorney-General of the State of Illinois the petition of Foster North, with the accompanying papers, and to ask on behalf of this Board that the Attorney-General will give thereupon his opinion upon the claim of the said North that his constitutional and legal rights have been violated by the action of the government of the University toward himself as set forth in these premises."

The facts to which this resolution relates, as given in the statement of the Regent, are as follows;

"From the opening o Ithe University in March, 1868, the students of the University have been required, and have been accustomed, to assemble daily in some suitable place. This daily assembly has been deemed an important aid in the orderly and methodical conduct of the University business, furnishing an opportunity for giving publicity to such orders, directions, notices, etc., as were suitable and requisite, and for giving such instructions of a general nature as might be deemed useful and necessary adjuncts to any course of liberal education. At the time of this general assembly of students, and as a customary part of its exercises, portions of the New Testament Scriptures have been read, hymns have been sung and prayers have been offered. For the last five years the prayer offered on each occasion has been that known throughout the Christian world as the Lord's Prayer, recited by the Regent. In these exercises, particularly in the reading of the New Testament, and in the singing, the students have been invited to take part, and many of them have so taken part, but no person has been required to participate therein against his wish. Before entering the assembly room or chapel, the students are gathered into companies and the rolls are called, the military organization being used for this purpose. The names of all absentees are reported to college officers appointed to receive them, and the absentees are required to present to such officers satisfactory reasons for failure to attend. It has, however, been held, that if any student should present to the Regent and Faculty a statement that his attendance upon the above described general assembly of the students, and his listening to the exercises therein conducted were in opposition to his religious belief, and an infringement upon his rights of conscience, he should thereafter be excused from attendance. After nearly six years of acquiescence in the regulation concerning attendance upon chapel service, in March, 1885, Mr. North absented himself therefrom. In the absence of the Regent he was called to excuse absence by the Vice-President of the University, and made reply substantially that the government of the University had no authority to ask his attendance.

"On the 21st of April the Regent called Mr. North to his office and offered to excuse him from further attendance at chapel if he would present to the Faculty a statement that his objections to attendance were on account of conscience. On the 24th of April he filed in the Regent's office his reply. In this reply he refused the offer of excuse on account of the repugnance of the chapel exercises to his religious convictions, saying that he 'had no religious convictions for the chapel exercises to be repugnant to,' and taking the ground that the Faculty had no right to make any regulations requiring students to attend chapel, and that even the act of formally expressing his wish not to attend would be a recognition of a right which he strenuously denied. Whereupon, on April 30th, the Regent, by direction of the Faculty, informed Mr. North that he was from said date suspended indefinitely from the University. The statement made by Mr. North does not differ materially from the foregoing.

"The question here raised involves the right of the Trustees and Faculty of the University to hold chapel exercises in the manner and form substantially as they have hi herto been held, and the validity of the rule requiring the attendance of all students on said exercises unless excused therefrom. Mr. North contends that the rule referred to is void on account of being in conflict with that portion of Section 3 Article 11, of the Constitution of the State of Illinois which declares that 'no person shall be required to attend or support any ministry or place of worship against his consent, nor shall any preference be given by law to any religious denomination or mode of worship.'"

It is evident that, so far as the rights of Mr. North are concerned, only the first part of the above cited clause of the Constitution is involved. By section 1 of an act to provide for the organization and maintenance of the Illinois Industrial University it is provided that the Board of Trustees shall have power to make and establish by-laws for the management and government in all its various departments and relations of the Illinois Industrial University. By section 2 of the by-laws of the Faculty, adopted by the Trustees, it is provided that "the Faculty of the University, subject to the direction of the Board of Trustees, shall have general control of the discipline and studies of the University, and shall make in that behalf from time to time such regulations as they may deem expedient." It is under this power that the regulation with regard to chapel exercises was adopted. I do not believe that the constitutional objection urged by Mr. North is well taken, or that any of his constitutional rights are violated by the rule in question. That rule does not require him to attend any ministry or place of worship against his consent. In the first place, he was not required to attend the University. His attendance upon that institution was purely voluntary. Attendance upon the University was not even one of his rights as a citizen of the State of Illinois. It is, on the contrary, only a privilege accorded to such persons as come within the conditions prescribed in the statute and imposed by the laws of the State and the by-laws adopted by the Trustees, acting under authority of the law. It is presumed that the Trustees are competent to decide what regulations are proper for the government of the institution, and the law gives them the power to enforce obedience under penalty of forfeiture of said privilege on account of disobedience. Students are admitted to said University for the purpose of instruction and discipline and in accepting the privilege of attendance thereon either tacitly or formally agree to conform to the regulations for the government of said institution.

It is unnecessary to say that discipline is essential to every educational institution, and that this discipline must be administered by those in authority. The general rule is that whenever any person joins an organization or accepts a privilege he consents to obey the rules of the organization, and to fulfill the conditions of the privilege. He has no right to say that he will obey part and disobey part, and still continue his membership in the organization and the enjoyment of the privileges conferred thereby. He is under no obligation to join and subject himself to the regulations prescribed, nor is he under any obligation to remain. But so long as he does remain the obligation which he voluntarily took remains in force, unless relaxed by the powers which imposed it.

I find among the rules for the government of the students the following: "9. Each applicant for admission shall sign the following promise of good conduct: 'I, the undersigned, wishing to become a student in the Illinois Industrial University, hereby promise that during my connection therewith, I will perform all duties with fidelity, will yield loyal and instant obedience to all lawful authority, and at all times will strive to maintain a gentlemanly (or lady-like) demeanor in public and in private, always mindful of my own good name and of the fair fame of the University which I join.'" On entering the University every student agrees, in accordance with the foregoing, to yield loyal obedience to the lawful authority of said institution.

In the case in question, the student assented to this, and for nearly six years had yielded obedience before he seems to have discovered that the exercise in question was an abridgment of his rights as a citizen. He, doubtless, at the same time yielded obedience to many other rules which were restrictions upon his liberty as a citizen, and which, had he not been a student in this institution, would not have been binding upon him. It cannot be denied that the faculty might properly require his punctual attendance at all recitations, that it might also forbid him to visit neighboring cities during certain days in the week, or at certain hours of the day. These would be restraints upon his personal liberty, and yet no one will deny that they might be enforced, even if the enforcement required the expulsion of any one who refused obedience. But the rule in question is not in any proper sense compulsory in my opinion. He could attend chapel exercises if he wished, or if he did not so wish, he would be excused upon request; and the rule requiring such request was a proper regulation, and was an infringement of no natural or legal right.

I do not think that the other constitutional questions raised by the petitioner have any bearing upon this case. Any discussion of them, therefore, will be unnecessary. I am of opinion that the trustees and faculty had the right to adopt the rule in question; and for a continued refusal to obey it, they might suspend the student from the University.

I am, very respectfully,

Your obedient servant,

GEO. HUNT, *Attorney General.*

The Regent submitted the following report, which was received:

To the Trustees of the University of Illinois:

GENTLEMEN: Your committee intrusted with the sale of the University lands in Nebraska, respectfully report:

Since the date of the last report, the following sales have been made:

No.	Name.	Tract.				Price.	Cash.
38	David M. Gilmore	N. W.	26	3	8	$2,000 00	$500 00
39	John E. Blickenstaff	S. E.	31	3	8	2,000 00	500 00
40	Joseph Dezort	N. W.	34	3	8	2,000 00	500 00
41	John S. Reynold and Abraham L. French	S. W.	3	2	8	2,000 00	500 00
42	Wm. S. Morton and Frank L. Marrs	S. E.	3	2	8	2,000 00	500 00
43	Samuel Cox	E. ½ S. E.	15	3	8	1,120 00	280 00
44	Charles E. Baker	W. ½ S. E.	15	3	8	1,120 00	280 00
45	Jefferson Blevens and Robert J. Miller	N. W.	5	2	8	2,074 80	518 70
46	Joseph M. Thomas	S. W.	2	2	8	1,600 00	400 00
	Totals					$15,914 80	$3,978 70
	Before reported					77,356 57	19,339 14
	Total sales to date					$93,271 37	$23,317 84

Respectfully submitted,

CHAS. BENNETT,
S. H. PEABODY,
Committee.

URBANA, December 8, 1885.

Adjourned to meet at 10 P. M.

EVENING SESSION.

The Board reassembled at 10 P. M.

The following resolution was offered by Trustee Bennett and adopted:

Resolved, That the opinion of the Attorney General upon the legal questions involved in the petition of Foster North be and the same is hereby adopted as the judgment of this Board upon the matters contained in said petition, and that the Regent is hereby directed to notify Mr. North that the requests contained in his petition are refused.

The Regent reported that the LeBaron Entomological collection had been transferred to this University. The report was received.

A communication from Prof. Roos, in regard to the course in Drawing and Designing, was received, and, on motion, referred to the Regent and Faculty, to report at the March meeting.

President Millard called the attention of the Board to section 4, article 5, of the act of Congress granting land to agricultural colleges, in reference to the publication of annual reports. The following resolution was adopted:

Resolved, That the Regent be and he is hereby instructed to require of the chiefs of each department of the University an annual report of their respective departments, showing the work done during the year, also setting forth any improvements made, also the needs of such departments, together with such experiments, their results and cost as shall have been made in the respective departments, and the Corresponding Secretary shall cause the same to be published in the annual reports of the University.

The President also called attention to section 9 of said act, in regard to free scholarship to children of deceased soldiers.

Trustee Bennett offered the following resolution, which was adopted:

Resolved, That the matter of scholarships, prizes, etc., be referred to a special committee of three, to be appointed by the President, for report and recommendations at the next regular meeting of this Board.

Adjourned to 9 o'clock A. M.

SECOND DAY'S SESSION.

The Board assembled at 9:30 o'clock A. M.

Present: Governor Oglesby, Trustees Bennett, Cobb, Eisenmayer, Follansbee, McLean, Millard, Paden, and Pearman.

Trustee McLean offered the following resolution:

Resolved, That the Executive Committee be, and they are hereby authorized to purchase and have placed in the Trustees' room, or some other convenient place, a clothes closet of sufficient size to accommodate the Trustees.

The Board took a recess of twenty minutes to attend University Chapel.

On returning from the exercises, Treasurer Bunn read the following report, which was received and referred to the Auditing Committee:

UNIVERSITY OF ILLINOIS, *To John W. Bunn, Treasurer, Cr.*

1885.			
Sept. 9	By Balance		$27,797 90
Sept. 30	" Amount received on account University fees	$2,375 00	
	" " " " Preparatory year	400 00	
			2,775 00
Oct. 12	" " " from State for State Laboratory of Natural History	$1,375 00	
Nov. 30	" Amount received on account buildings and grounds	45 50	
	" " " " stationery and printing	100 00	
	" " " " University fees	416 25	
	" " " " Preparatory year	20 00	
	" " " " Mechanical Department	60 00	
	" " " " Architectural Department	231 40	
	" " " " Agricultural Department	2,183 58	
	" " " " Horticultural Department	110 25	
	" " " " Chemical Department	310 00	
	" " " " Incidentals	17 75	
	" " " " Music fees	70 00	
	" " " " Gymnasium	14 20	
			3,578 93
			$35,526 83

UNIVERSITY OF ILLINOIS, *To John W. Bunn, Treasurer, Dr.*

1885.			
Nov. 30	To amount paid on account Board expense	$98 83	
	" " " " salaries	2,416 88	
	" " " " buildings and grounds	50 06	
	" " " " fuel and lights	633 71	
	" " " " stationery and printing	829 60	
	" " " " Preparatory year	420 00	
	" " " " Nebraska lands	7 75	
	" " " " Mechanical Department	361 54	
	" " " " Architectural Department	753 41	
	" " " " Agricultural Department	1,199 68	
	" " " " Horticultural Department	376 55	
	" " " " Chemical Department	805 94	
	" " " " Military Department	13 38	
	" " " " library and apparatus	17 45	
	" " " " incidental expense	235 55	
			$8,220 33
	" " " " drawings for Arch. Dept	$11 88	
	" " " " seal and diploma plate	179 00	
	" " " " drawing desks	2 00	
	" " " " Le Baron collection	2 10	
	" " " " Music fees	70 00	
	" " " " premium on bonds	235 00	
			499 98
	State appropriations:		
	" amount paid on account buildings and grounds	$422 55	
	" " " " Laboratories	228 31	
	" " " " Mechanical and Arch. shops	363 65	
	" " " " books and publications	377 01	
	" " " " cabinets	487 33	
	" " " " current expenses of instruction	6,364 80	
	" " " " machines and tools	885 99	
	" " " " fire-walls and ventilation	420 67	
	" " " " State Laboratory of Natural History	1,101 10	
			10,651 41
	" Balance		16,155 11
			$35,526 83

URBANA, December 8, 1885.

JOHN W. BUNN, *Treasurer.*

Trustee McLean submitted the following resolution, which was carried:

Resolved, That the President and Secretary be directed to draw their requisition upon the State Auditor for the several sums of money appropriated by the General Assembly for the use of the State Laboratory of Natural History and the State Entomologist's office for the quarter ending March 31, 1886.

For the field work and incidental expense of the Laboratory, the sum of one hundred and fifty dollars.

For the traveling, office and incidental expenses of the Entomologist, the sum of one hundred and fifty dollars.

For improvement of the Library, the sum of two hundred and fifty dollars.

For the pay of the Entomological Assistant, the sum of two hundred and fifty dollars.

For the pay of the Botanical Assistant, the sum of two hundred and fifty dollars.

For miscellaneous assistance, the sum of two hundred and fifty dollars.

For the publication of bulletins, the sum of seventy-five dollars.

The report of the Business Agent was read and received, and the recommended appropriations were made.

List of appropriations asked for by the Business Agent, December 8, 1885:

Blackboard repairs	$71 45
Furniture	35 00
Freight	31 30
Stationery and printing	200 00
Griggs Farm	78 86
	$416 61

State Appropriations.

	Appropriated.	Received.	Expended.	Balance.
July 1, 1883.				
Laboratories	$3,000 00	$3,000 00	$2,385 00	$614 35
Cabinets	2,000 00	2,000 00	1,213 23	786 77
July 1, 1885.				
Taxes on land, ½ per annum	4,000 00	1,766 28	1,766 28	....
Buildings and grounds, ½ per annum	6,000 00	3,000 00	2,439 00	560 99
Laboratories, ½ per annum	3,000 00	1,500 00	....	1,500 00
Mech. and Arch. shops, ½ per annum	3,000 00	1,500 00	513 15	986 85
Books and publications, ½ per annum	3,000 00	1,500 00	386 09	1,113 91
Cabinets, ½ per annum	2,000 00	1,000 00	....	1,000 00
Current expense of instruction, ½ per annum	24,000 00	12,000 00	6,364 88	5,635 20
Machines and tools, ½ per annum	4,000 00	2,000 00	1,315 57	684 43
Fire walls and ventilation	4,500 00	4,500 00	1,911 02	2,588 98
Laboratory of Natural History	18,000 00	2,750 00	2,186 24	563 96
	$76,500 00	$36,516 28	$20,481 04	$16,035 24

Current Appropriations.

September 9, 1885.	Appropriated.	Receipts also appropriated	Expended.	Balance.
Board expense	$600 00	....	$98 83	$501 17
	....	Cur. State	1,737 00	....
Salaries for instruction	18,524 00	....	6,364 30	10,422 20
Salaries for services	1,580 00	....	679 88	900 12
Buildings and grounds	25 00	$45 50	50 06	20 44
Fuel and lights	2,000 00	....	633 71	1,366 29
Stationery and printing	800 00	100 00	829 60	70 40
Nebraska lands	55 00	....	7 75	42 25
Library and apparatus	100 00	....	17 45	82 55
Incidental expense	356 00	17 75	235 55	139 06
Mechanical Department	500 00	60 00	361 54	198 46
Architectural Department	500 00	231 40	753 41	....
Agricultural Department	500 00	2,183 58	1,199 68	1,483 90
Horticultural Department	500 00	110 25	376 55	233 70
Laboratories Department	500 00	310 00	805 94	4 06
Military Department	50 00	....	13 38	36 62
Sundries:				
Gymnasium	75 00	14 20	....	89 20
Engraving for report	65 00	....	....	65 00
Drawings, Architectural Department	30 50	....	11 88	18 62
Seal and diploma plate	200 00	....	179 00	21 00
Drawing, desks, etc., Architectural Department	35 00	....	2 00	33 00
The Le Baron collection	25 00	....	2 10	22 90
Music fees	....	70 00	70 00	....
Preparatory Department fees	....	420 00	420 00	....
University students fees	....	2,791 25	....	....
Premium on bonds	235 00	....	235 00	....

Trustee McLean, from the Committee on Buildings and Grounds, made the following report, which was received and approved:

To the Hon. Board of Trustees:

In the matter of the annual report of the Professor of Horticulture, which was referred to the undersigned, your committee beg leave to report that they deem the suggestions made and conclusions reached therein worthy of extended circulation among horticulturists and farmers, and we recommend that the Regent cause the same to be issued as a bulletin and circulated among those interested.

In this connection we beg leave to recommend to the Regent that whenever any report presented from the head of any department of this University contains matter of general interest to the public, that a bulletin containing the same be published and circulated where calculated to do the most good, and that necessary appropriations be made to carry out this recommendation.

ALEXANDER McLEAN.
G. A. FOLLANSBEE,
Committee.

Trustee Bennett submitted the following report, which was received:

To the Board of Trustees:

Your Auditing Committee, to whom was referred the report of the Treasurer, beg leave to report that they have found the same correct and in proper form, and recommend that the same be approved.

CHAS. BENNETT,
GEO. C. EISENMAYER,
R. N. PADEN,
Committee.

The Farm Committee asked and received further time for report.

Mr. Fisher, of Chicago, appeared before the Board in behalf of Secret College Societies, with request to withdraw the prohibition against the same at this University. After hearing the case, on motion the matter was referred to a committee consisting of the President and three members to be appointed by the chair, for consideration, and report at the next meeting.

The Regent was authorized to engage the services of D. McIntosh, D. V. S., as lecturer on Veterinary Science, at a salary of $150 per month for the balance of the academic year.

The following appropriations were made, as recommended in the Regent's report:

Purchase of lot from Street Railway Company	$150 00
Purchase of lots east of Chemical Laboratory	830 00
For microscopes and materials	450 00
For Botanical Laboratory	75 00
For Chemical Laboratory	250 00
For Architectural Department (apparatus)	25 00
For Architectural Department (Collection of Designs)	100 00
For Military Department (band instrument)	20 00
For new shutters in Free-hand Drawing-room	150 00
For new floors on south veranda	110 00

Trustee Bennett offered the following resolution, which was passed:

Resolved, That the President of the Board, the Regent, and the Corresponding Secretary be, and hereby are, constituted a standing Committee on Publications, such committee to supervise the publication of the reports of this University, and all other publications and advertisements.

The Regent's request for republishing Regulations for the Students of the University, was referred to the above committee with power to act.

President Millard presented to the Board a collection of laws and decisions concerning the University. It was received and referred to the Committee on Publication with power to act.

Trustee McLean offered the following resolution, which was adopted:

Resolved, That the sum of two hundred dollars be, and the same is hereby appropriated, to be used by the Committee on Publications for the printing of regulations, laws, and bulletins, and report at the next session of the Board.

Trustee McLean, from Committee on Buildings and Grounds, made the following report:

To the President and Board of Trustees of the University of Illinois:

The undersigned, to whom was referred the matter of over expenditure of $80.99 in fitting up Janitor's rooms, would report that the original estimates of cost of the changes contemplated in the Janitor's rooms were increased in the belief that the flooring joists and studding in said rooms could be used again in refitting, but were found to be decayed and entirely worthless; it therefore became necessary to purchase new lumber. We therefore recommend that the expenditure made on the same be allowed and warrants drawn on the treasury for amount. We further recommend, however, that in all cases expenditures authorized by this Board should not exceed the appropriations made therefor.

Respectfully submitted,

ALEX. McLEAN,
G. A. FOLLANSBEE,
Committee.

The report was received and the recommendations adopted.

The following report from the Auditing Committee was received and on motion adopted:

To the Board of Trustees:

Your Auditing Committee, to whom was referred the report of the Business Agent, report that they have examined vouchers No. 751 to 800 inclusive, old series, and No. 1 to 200 inclusive, new series, and find them correct and properly receipted, and would recommend that the same be approved.

R. N. PADEN,
CHAS. BENNETT,
GEO. C. EISENMAYER,
Committee.

The President appointed the following committees:

On Scholarships—Trustees Bennett and Pearman and the Regent.

On Secret Societies—Trustees McLean, Bennett, and Follansbee.

Adjourned.

S. M. MILLARD, *President.*

E. SNYDER, *Secretary.*

PROCEEDINGS OF THE BOARD OF TRUSTEES—MARCH, 1886.

The Board met at the University Parlor, on Tuesday, March 9th, 1886, at 3 P. M.

No quorum being present the Board adjourned to meet on Tuesday, March 23d, 1886, at 3 P. M.

E. SNYDER, Secretary.

The Board met at the University Parlor on Tuesday, March 23d, 1886, at 3 P. M.

No quorum being present the Board adjourned to Wednesday, March 24th, 1886, at 2 P. M.

The Board assembled at the University Parlor at 2 P. M. on Wednesday, March 24th, 1886.

Present—Trustees Bennett, Eisenmayer, Follansbee, McLean and Pearman.

Absent—Governor Oglesby, Hon. John Landrigan, Trustees Cobb, Earle, Millard and Paden.

Trustee Follansbee was elected Chairman pro tempore.

The records of last meeting were read and approved.

The Board then proceeded to the election of officers for the ensuing year.

The Recording Secretary was directed to cast the unanimous vote of the Board for Trustee Millard as President of the Board.

The vote was so cast and Trustee Millard declared elected.

The Chairman was directed to cast the unanimous vote of the Board for Prof. T. J. Burrill as Corresponding Secretary, and Prof. E. Snyder as Recording Secretary.

The vote being so cast the Secretaries were declared elected.

Treasurer J. W. Bunn read the following report, which was received and referred to the Auditing Committee:

UNIVERSITY OF ILLINOIS.

To John W. Bunn, Treasurer, Cr.

1885.				
Dec.	8	By balance		$16,155 11
	24	State Laboratory of Nat. Hist. from Ill. Board of Education		2,035 65
1886.				
Jan.	2	By interest on Chicago water bonds		875 00
	2	" " "		1,760 00
	8	By amount received from State for State Lab. of Nat. Hist.		1,375 00
	28	By interest on Champaign school bonds		360 00
Feb.	27	By interest on Nebraska land contracts		4,171 39
"		To amount paid on account buildings and grounds	$37 00	
"		" " " fuel and lights	117 00	
"		" " " mechanical department	325 88	
"		" " " architectural department	1,115 47	
"		" " " agricultural department	579 21	
"		" " " horticultural department	79 12	
"		" " " laboratories	431 47	
"		" " " incidentals	33 00	
"		" " " music fees	83 00	
"		" " " preparatory year	460 00	
"		" " " University students' fees	2,228 75	
"		" " " Illinois Central freight	1,232 60	
				6,722 50
				$33,454 68

UNIVERSITY OF ILLINOIS,

To John W. Bunn, Treasurer, Dr.

1885.				
Feb.	27	To amount paid on account Board expense	$107 17	
"		" " " salaries	4,027 00	
"		" " " buildings and grounds	86 22	
"		" " " fuel and lights	1,477 07	
"		" " " stationery and printing	188 74	
"		" " " preparatory year	340 00	
"		" " " mechanical department	380 37	
"		" " " architectural department	502 85	
"		" " " agricultural department	473 29	
"		" " " horticultural department	306 71	
"		" " " military department	46 13	
"		" " " laboratories	204 98	
"		" " " library and apparatus	33 39	
"		" " " incidental expense	112 67	
"		" " " drawings for architectural dept.	44 12	
"		" " " drawing desks, etc., for do	33 00	
"		" " " furnishing Zoölogical Lab	255 49	
"		" " " blackboard repairs	71 45	
"		" " " furniture repairs	33 45	
"		" " " drawing-room shutters	86 65	
"		" " " publication of bulletins	49 75	
"		" " " gymnasium	1 30	
"		" " " Griggs farm	78 66	
"		" " " music fees	83 00	
"		" " " purchase of lot east of University	830 00	
"		" " " purchase of lot on horse railroad	150 00	
				$10,003 46
Feb.	27	To amount paid on account buildings and grounds	$445 19	
"		" " " laboratories	1,013 92	
"		" " " mechanical and arch. shops	345 00	
"		" " " books and publications	648 01	
"		" " " cabinets	620 68	
"		" " " current expenses of instruction	5,635 20	
"		" " " machines and tools	676 73	
"		" " " fire walls and ventilation	218 68	
"		" " " State Laboratory of Nat. Hist.	1,471 32	
				11,074 73
		To balance		12,376 46
				$33,454 65

The following report from the Business Agent was read and referred to the Auditing Committee:

MARCH 9, 1886.

S. M. Millard, President Board of Trustees, University of Illinois:

SIR: I have the honor to present herewith the usual statements, as Business Agent, at this time.

Paper A is that of the current appropriations and expenditures for the six months from September 1st, 1885, to February 28th, 1886.

Paper B is that of the State appropriations. February 28th. 1886.

Paper C is a list of vouchers presented for auditing.

Paper D gives a list of the appropriations required for the next six months.

Respectfully submitted,

S. W. SHATTUCK. Business Agent.

Current Appropriations.

SEPTEMBER 9th, 1885—FEBRUARY 28th, 1886.	Appropriated.	Receipts also appropri'ted.	Expended.	Balance.
Board expense	$600 00	....	$206 00	$394 00
		Cur. State.	4,893 60	....
Salaries for instruction	18,524 00	....	12,000 00	1,630 40
Salaries for services	1,580 00	....	1,550 28	29 72
Buildings and grounds	56 30	$82 50	136 28	2 52
Fuel and light	2,000 00	117 00	2,110 78	6 22
Stationery and printing	1,000 00	100 00	1,018 34	81 66
Nebraska lands	50 00	....	7 75	42 25
Mechanical department	500 00	385 88	741 91	143 98
Architectural "	500 00	1,346 87	1,256 26	590 61
Agricultural "	500 00	2,762 79	1,672 97	1,589 82
Horticultural "	500 00	189 47	633 26	6 21
Military "	70 00	....	59 51	10 49
Laboratories "	500 00	741 47	1,010 92	230 55
Library and apparatus	100 00	....	50 84	49 16
Incidental expense	356 86	50 75	348 22	59 39
SUNDRIES.				
Gymnasium	75 00	14 20	1 30	87 90
The Le Baron collection	25 00	....	2 10	22 90
Premium on bonds	235 00	....	235 00	....
Engraving for report	65 00	....	....	65 00
Drawings Architectural department	130 50	....	56 00	74 50
Seal and diploma plate	200 00	....	179 00	21 00
Desks and diploma boards	35 00	....	35 00	....
Furnishing Zoölogical laboratory	400 00	....	255 49	144 51
Blackboard repairs	71 45	....	71 45	....
Furniture	35 00	....	33 45	1 55
Griggs farm	78 86	....	78 86	....
Purchase of lot of U. & C. S. R. Co	150 00	....	150 00	....
Purchase of lots east of Chemical laboratory	830 00	....	830 00	....
Shutters free-hand drawing-room	150 00	....	86 65	63 35
Publications of bulletins, etc	200 00	....	49 75	150 25
Music fees	....	153 00	153 00	....
Preparatory year fees	....	880 00	760 00	120 00
Students' fees	....	5,020 00	....	....
Illinois Central R. R. freight	....	1,232 60	....	....

State Appropriations.

Of July 1st, 1883.	Approp'td.	Received.	Expended.	Balance.
Cabinets	$2,000 00	$2,000 00	$1,833 91	$166 09
Of July 1st, 1885.				
Taxes on lands (½ per annum)	4,000 00	1,766 28	1,766 28	....
Buildings and grounds (½ per annum)	6,000 00	3,000 00	2,884 20	115 80
Laboratories "	3,000 00	1,500 00	399 57	1,100 43
Mech. and Arch. shops "	3,000 00	1,500 00	858 15	641 85
Books and publications "	3,000 00	1,500 00	1,034 10	465 90
Cabinets "	2,000 00	1,000 00	....	1,000 00
Current expenses of Inst. "	24,000 00	12,000 00	12,000 00	....
Machines and tools "	4,000 00	2,000 00	1,992 30	7 70
Fire-walls and ventilation	4,500 00	4,500 00	2,179 70	2,370 30
Laboratory of Natural History	18,000 00	6,160 65	3,657 56	2,503 09
Totals	$73,500 00	$36,926 93	$28,555 77	$8,371 16

The special committee on secret societies submitted the following report, which was received, and its recommendations adopted:

To the Board of Trustees of the University of Illinois:

GENTLEMEN: Your committee, to whom was referred the matter of secret societies, beg leave to report that they have given audience to the representative of the society asking for admission, and have carefully considered the arguments in favor of admitting them into the University.

Originally the object of prohibiting these societies was in the interest of good order and discipline. To prevent cliques, jealousies, strife between rival societies, disturbances because of such strife: to keep the every day life of the student free from the temptation to extravagance, and to make student life as nearly democratic as possible, were the chief reasons for the action of the Board. Since the resolution excluding all secret societies was passed the University has made a record of good order and excellent work among its students of which it may well be proud.

Formerly the government of the students was not free from jealousies and friction, but your committee feel warranted in saying that the discipline has grown better and constantly more earnest until we feel there can scarcely be found a body of students who deserve more credit for good deportment, than those in attendance here,

It is a grave consideration whether this Board or the Faculty of the University should change the policy of the government now existing. One of the proposed benefits to be derived from secret societies is the good order they promote among students. If we are not suffering with disorder, we do not deem it necessary to look for a remedy for a disease we are not afflicted with. The fact that the society seeking admission claims to have centralized its power into a board with a tribune or secretary, which takes cognizance of all matters of dispute between its members and college authorities, must lend outside support to the rebellious students in a college, whenever a society board and tribune shall differ with the Faculty. This society profess through its central organization to arbitrate differences between members of its chapters and the government of the college. What then must be the consequences when the two sets of authorities differ? A State University is supported by the taxpayers. The law imposes upon the Board of Trustees the duty of passing by-laws for the management or government in all its various departments and relations of the University.

Now comes an aggregation of young men, most of whom are inexperienced, who have formed a government for themselves, professedly secret, and ask to place in our midst a "Chapter." In due time the members of that "Chapter" in their eagerness to exercise authority beg leave to differ with the Faculty and Board in matters of college government. In this difference the "Chapter" calls upon the Central Board, and perchance if the matter is of importance, upon their sister chapters, to exert their combined influence in support of the dissenting students. The very fact that this society board proposes to arbitrate, implies a possibility of conflict between it and the College Board. When that is reached the wisdom of the Legislature is at once called in question by the wisdom of a body of young men whose whole organization professes to be secret and whose whole idea is to promote the interests of their society, rather than the institution of learning. It is a well known fact that secret college societies in the Eastern colleges nurse jealousies between each other. "Friendly rivalry" between societies means competition often accompanied with all the strategy, work, expenditure of money and time and political machinery which commonly enters into a sharp political campaign.

In the opinion of this committee there are many other objections to admitting secret secieties which are unnecessary to present here. We cannot, however, refrain from referring to the intimation in the circular presented to the Board in this matter, in which it is said that a former secret society of this University has continued "desultory existence until the present time." This expression derives greater significance when backed up by an implied insinuation that the *Sigma Chi* authorities encourage the violation of our rules by covertly and secretly aiding students who have signed the pledge required by our Board, thus secretly using the power of their organization to induce our best students, as they claim, to violate their pledges and their honor. This insinuation goes farther as an argument why we should repeal the obnoxious rule, in this, that we might as well repeal it, because if we do not, this very society will secretly and in direct violation of the rules which now exist, aid and abet those students who will violate their honor, and keep in existence a society in our midst.

We are further confronted with a threat that if we do not repeal the rule the secret societies will use their influence with the Legislature to defeat our appropriations and endanger the existence of the University.

It is the opinion of your committee that the people of this State, through their representatives, will not do an injustice to the University, because an outside organization can not assume authority in its government. If the people and tax-payers express a desire to have secret societies installed in this institution, your committee do not hesitate to say that the Board would promptly and obediently heed such a public wish; and it would not be necessary to attack the life of the University to convey to the Board such a desire.

Your committee therefore recommend that the petition in behalf of the Grand Council of the *Sigma Chi* fraternity be not granted.

CHAS. BENNETT,
S. M. MILLARD,
G. A. FOLLANSBEE,
ALEX. McLEAN,
Committee.

The Regent then read his report, which was received and ordered on file.

To the Trustees of the University of Illinois:

GENTLEMEN: Agreeably to your request I shall endeavor to set before you a statement of the present condition of the University in its educational and financial aspects, with more completeness than usual, and with the aid of special reports from the various full Professors.

The organization of the University has not changed from its original plan. The four colleges of Agriculture, Engineering, Natural Science and Literature and Science remain as the chief elements of classification, followed by the subordinate classification into schools. The various instructors teach the subjects assigned to them independently of any division into either schools or colleges, so that most, if not all, work with the students of every department. It is, however, the variety of the work done, rather than the numbers of students taught, which makes the largest call for the variety and the number of professors and assistants necessary for the proper performance of the work here undertaken.

In the College of Agriculture the technical instruction is given by the professors of agriculture, of botany and horticulture, and of veterinary science; collateral work is done by the professors of zoölogy and entomology, of chemistry, of geology, of mathematics, of English language and literature, of modern languages, and of industrial art.

Laboratory work is done on the farm, in the work-shops, and in the work-rooms of the department of chemistry, botany, zoölogy, veterinary science and drawing; the time given to actual work or experiment, as distinguished from recitation in the class-room or book-work in the student's private study, being usually from two to four hours daily.

The nature of the work done under Professor George E. Morrow will be learned from his report, as follows: (Paper A.)*

The work done under Professor T. J. Burrill. (Paper B.)

The chair of Veterinary Science was vacated at the end of the last college year by the resignation of Professor Prentice, and at the opening of the fall term no provision had been made for the appointment of a successor. The subject of animal anatomy was undertaken by Assistant Professor Rolfe, and its demands were well satisfied. The facilities for the prosecution of this study are the model of a horse, by Auzoux, and a number of elegantly mounted skeletons of the domesticated animals. While much more might be obtained by a proper course of actual dissections, it is doubtless true that for the time allotted to this subject the facilities furnish as much material for study as the students can thoroughly digest and assimilate.

At the first of January Dr. D. McIntosh, D. V. S., from Kingston, Ontario, was appointed Lecturer in Veterinary Science for the remainder of the current year. He has given himself diligently to the work, and has carried it forward in a very satisfactory manner. He has a daily lesson in veterinary science, in which the conditions of domesticated animals, in health and in disease, are discussed; and a daily lesson in veterinary materia medica, in which the nature and uses of remedies are explained. A weekly clinic is held, and the supply of animals for examination, diagnosis, and prescription has been constantly improving. It will be necessary soon to arrange for more frequent clinics, as the interest in them increases in the farming community. The department is important. Its early development is needed, and should be fostered by the University. Plans looking to this end are already under discussion, and will be laid before you in another form.

The work of other professors, who render indispensable services to the College of Agriculture, will be described under other heads.

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*The papers referred to in this report by the letters A, B, C, &c., to M, are found in connection with the general report of the Regent, pages

THE COLLEGE OF ENGINEERS

Contains now four schools—the Schools of Mechanical Engineering, of Civil Engineering, of Mining Engineering, and of Architecture.

The School of Mechanical Engineering is under the direct charge of the Regent, as professor of that chair, aided by Assistant Professor Woods, engineer in the navy; by Mr. Kimball, foreman in the machine shop, and, in common with other schools, by Assistant Professor Talbot.

The technical work of this school begins with the freshman class as it enters in the fall term. It finds work for two hours per day in the drawing-room, where instruction is given first in the use of mathematical drawing instruments, and in drawing of right and curved line problems, and in the elements of projection and the conventional perspectives. The pupil is at once put in the way to make and to read simple elementary drawings for shop purposes.

The student has also two hours per day of practice in the machine shop. He is first taken to the wood-working room, to learn the elementary steps of sawing, planing, morticing and turning. He next goes to the blacksmith shop, and is practiced in drawing out, upsetting, bending in squares and rings, welding, etc. In the second term his work in the shop is at the vise, chipping and filing, and at the speed lathe, hand turning, etc. His drawing continues, in descriptive geometry and in lettering.

In the spring term he has free-hand sketching; in the shop elementary work with machine tools, as planing, stabbing, drilling, turning iron in various forms, and screw cutting.

In the sophomore year the students work three hours per day for three days per week, alternating on the other two days with drawing and designing of the elements of machinery.

During the freshman year his work has been entirely instructional. The product of his work is not expected to have value beyond that acquired in the facility of using tools, and the training of the hand and eye. In the second year his work, now having acquired some degree of excellence, is expended upon some form of machine construction. To this end it has for a long time been deemed advantageous to have some piece of machinery under construction in the shops, usually a tool which is needed and which supplies a place which otherwise would have to be filled by purchase. In this way we have obtained the machinery now in use—the steam engine, the large power drill press, the milling machine, the large wood lathe, four small wood lathes, and various other pieces of smaller moment. Each student has a course of tool forging, tempering and grinding, so that he is competent to keep his power machinery supplied with cutting tools.

In the junior year the student's attention is given to the study of the principles of mechanism and the study of applied mechanics. For drawing he has advanced descriptive Geometry.

Two terms are given to Physics, with laboratory practice, and a term is devoted to the discussion of the materials used in engineering structures. Hereafter the term's work in the resistance of materials will be taken in this year.

In the senior year the technical work is upon the principles of mechanism as applied to prime movers, including steam, wind and water engines, boilers and their setting, the link motion, etc. Two terms are given to construction drawing. Each graduate must design, draw and execute in metal some model of a mechanical movement, to be left at the University as an addition to the museum of such motions, useful in illustration and instruction.

In this connection I desire to express the entire satisfaction I have felt in the service rendered to the University by Assistant Engineer Arthur T. Woods, U. S. N., as assistant professor in this department. Mr. Woods came here nearly three years ago, by order of the Secretary of the Navy, being detailed under authority of law to teach here the principles of steam engineering. His work has been done with energy, skill, and good judgment. Unless his services here can be permanently secured, which would be very desirable, he will be ordered to sea at the expiration of his detail, that is at the end of the current year, and his place must be filled by another instructor, obtained like himself from the navy, or from some other source. The course you will take in this matter must be decided at this meeting.

An account of the work done in the School of Civil Engineering is given by Professor Ira O. Baker in paper C.

The work in the School of Mining Engineering is given by Professor Theo. B. Comstock, who also gives instruction in physics. (Paper D.)

The School of Architecture is described by Professor N. Clifford Ricker in paper E.

Assistant Professor A. N. Talbot has aided in the work of the College of Engineers wherever his services have been most needed. He taught classes in projection drawing, descriptive geometry and lettering, trigonometry to engineers, analytical geometry, and will take the important subjects of topographical surveying and sanitary engineering during the spring term. He has shown himself well qualified to carry forward the work so thoroughly done by Assistant Professor Jerome Sondericker up to the end of the last collegiate year.

THE COLLEGE OF NATURAL SCIENCE

has as yet only the two schools of Chemistry and Natural History. This college has received an important impetus lately by the transfer to this University of the State Laboratory of Natural History, and the office of State Entomologist, both under the direction of Professor Stephen A. Forbes, aided by a corps of competent assistants in each department. Much pains have been taken to provide these offices with a suite of convenient, well-arranged, and spacious rooms, and the original outfit is now nearly completed, it is believed to the great satisfaction of those in charge of the work.

Other movements are now in progress, which it would be premature to discuss here, but which if successfully accomplished will add much more to the value and importance of this department of the University, and must add also to the larger recognition which it will deserve at the hands of the public. Already special students are seeking to avail themselves of the improved opportunities to forward biological studies, such as can be found nowhere else in our State.

The work in Geology and Physiology has been performed by Assistant Professor Charles W. Rolfe, whose success in carrying part of the veterinary work has already been mentioned. Professor Rolfe is an earnest student of natural science, and I can cheerfully attest his success as a growing and efficient teacher. Several minor additions have been made during the past season to the geological collection, including the borings made by a diamond prospecting drill in the city of Urbana, being a complete section of the geological strata for a depth of about 530 feet. These are to be properly mounted and placed in the Museum. A collection of fossils, prepared with superior skill, and containing about four thousand specimens, has been purchased in Cleveland and is now daily expected at the University. This collection contains very few Illinois fossils, which we hope to obtain from another source.

A report of the work of Professor Forbes is presented in Paper F.

A report of the School of Chemistry is given by Professor Wm. McMurtrie in Paper G.

THE COLLEGE OF LITERATURE AND SCIENCE.

The right of this University to exist under the original endowment act of Congress of 1862 as a school of technical and practical science has been abundantly demonstrated in the foregoing statements and reports concerning the three colleges described. The reports have touched only the leading and prominent features, the particular technical subjects which give specific character to the several schools. But the proper scope and balance of an education which should be formative as well as technical, which should build schools as well as scientists, and develop character as well as mechanical skill, has made it necessary to provide another series of instructors, who should care for a different series of subjects. In every school the English, French and German languages, history, the elements of industrial art and the more philosophic subjects, psychology, logic and political economy, demand and have received suitable attention. No man can pretend to fair scholarship in agriculture, in engineering, or in the sciences of nature, who has not some acquaintance with the other topics named, both for personal culture and practical use. This provision has been necessary to carry into effect that injunction of the organic law not to neglect "other scientific and classical studies." This provision, necessary for the technical schools, has made it possible, and a most natural corollary, to arrange a course specially leading to the work of teachers in the public schools of the State, which we have called the course in English and modern languages, and, with a small addition to the force of instruction, to furnish for such as wish a course in ancient languages equal in extent to that furnished in the leading classical colleges. It is, however, true that in the years that have passed most of attention and effect has been given to the development of the technical side of the University, and the literary schools have in a measure languished. This condition of things, so far as these literary schools are concerned, ought not to continue. The University cannot exist in its proper sense without them. They are essential to its complete and well balanced character. There should be no department of the institution which does not receive enough fostering care to make it the best of its kind. The literary schools should not be allowed to take the lead, and under present conditions there is little danger of their doing so; but by an equal rule of propriety they should not be permitted to lag behind the other schools of the University. That there is at present a tendency towards weakness in these schools is too apparent, and immediate steps should be taken to obviate this tendency. This comes most notably from the present conditions of admission, which permit students to enter who have not the kind of preparation which will best enable them to take up the special work of these schools.

I earnestly recommend that, after proper notice to the public, no students be matriculated to the college of Literature and Science who shall not have the ability to pass a fair examination in the rudiments of the Latin language, as evinced by the ability to read at least reasonable selections from Cæsar, Cicero and Virgil, or their equivalents. It ought no longer to be said in our catalogue that students are permitted to "make up" these subjects *after* matriculation. Suitable remissions of other subjects, not mathematical, should be made, so that the amount of preparation required for admission to literary or to technical schools should be as nearly equal as possible; but it is not practicable to build the two courses upon precisely the same bases. I am aware that many of the so-called high schools in the State, including some, which are on our own accredited list, are but poorly prepared to give the best training in the respect desired; but the best aid we can give them toward doing the work they ought to do, and can do if they will, is to decline longer to accept their insufficient work, and to demand, with moderation and firmness, that they shall do the work that belongs to them. I therefore advise that the forthcoming catalogue shall distinctly require that candidates for matriculation in the College of Literature and Science shall have passed satisfactory examinations in the Latin named, and that the clause permitting these subjects to be afterwards made up be withdrawn—both these changes to take effect in September, 1887, after one year's notice.

Professor S. W. Shattuck's instruction in mathematics enters into the courses of all colleges, technical and literary. His report is as follows: (Paper H.)

Professor Edward Snyder's work in French and German, enters also into long courses. (Paper I.)

He is assisted by Miss Helen Gregory, in French.

Professor Joseph C. Pickard's work in English languages and literature is as follows: (Paper K.)

Professor James D. Crawford gives the following account of the work in History and Ancient Languages. Miss Josephine A. Cass, assists in English and Ancient Languages. and acts as preceptress. (Paper L.)

The recommendations concerning a course of general instruction in the writing and speaking of English, under the general terms Rhetoric and Oratory—made in June last, and very cordially approved by you, have been quite successfully put into practical operation. After an extended search for the right man who should undertake this laborious and delicate task selection was made of Professor James H. Brownlee, of the Southern Normal University, and he entered upon the discharge of his duties at the opening of the winter term. As might be expected the term has been employed to considerable extent in exploring the field. It has not been intended to interfere with the specific work of the course in English language in the School of Literature and Science. But a course has been arranged for all students of all courses, extending through the entire University curriculum. Each class is divided into manageable sections, and each section meets the professor once each week. The work of composition is explained and illustrated: items are assigned; the written productions are carefully criticised, partly in public, partly in private, in such a way as to effect the sensibilities least, and to teach results and methods best; the papers are re-written, and the whole result carefully noted and recorded. The new departure has been very well received by the students, and even those who were at first naturally repelled by the nature and required character of the work have been led to acquiesce and approve by the judicious methods and management of the instructor. The work of theme writing is to be carried through the freshman and sophomore years. In the junior and senior years the art of expression will receive attention. It is not expected, it is not desired to teach elocution as that subject is now popularly understood and taught. We want no stage rant, and no tickling of the funny bone; none of the cheap and common tricks that bring down the house. We hope to train the students of the University, with success varying with individual capacity, in two things; first, to write what they know in plain, clear and intelligible English; second, to say what they have to say in a style at once unassuming and lucid, in an upright and manly way. These exercises have been successfully begun. It might be an aid and may perhaps prevent any question from arising if you should in some way formally voice the wish which so many of you have privately expressed that all students should take part in the work.

THE ADDITIONAL SCHOOLS OF INDUSTRIAL ART AND OF MILITARY SCIENCE.

In the absence of a report from the Professor of Industrial Art, I shall be obliged to make such a report as comes from my own knowledge of that work.

It has come to be recognized that all education, and especially all technical education, requires the development in each individual of some degree of the art of representing, by drawing, things which exist in fact for the sense of sight. I need not remind you of the essential service rendered by drawing, in its various methods, to all branches of technical and applied science. When for a season, some years ago, the Trustees of this University saw fit to close the Department of Art, the need of the technical schools were soon seen to be such as required the re-opening of this form of instruction without delay. I have now to speak, as I have always spoken, with unqualified praise of the abilities of Professor Roos, as an instructor in Elementary Drawing and of Industrial Art. This work, which he can so well perform, is that which the University now needs. Drawing with the pencil, pen, chalk, or crayon—from the flat, the round, from objects animate and inanimate, is an art indispensable to the student in agriculture, in chemistry, in engineering, in natural history, with and without the microscope—indeed every child who learns to write should also learn to draw. To some extent modeling in clay, and sketching in color is also valuable. All these forms of free drawing are wanted here as co-laborers with the work of other departments, and all these forms have been and are successfully treated and taught here. It has been my opinion, as I have understood it to be your wish, that the extent of art instruction here should, for the present at least, have this scope, and practically this limitation. It does not seem feasible, nor even desirable, at the present stage of this University that an art school, in the higher and specific use of the word, should be inaugurated here. The oil painting that is practised, is only permitted, and should not be allowed to usurp the time and strength of the instructor which is needed upon other lines of art work which while they may be less artistic have yet a more practical and industrial value. I regret to say that the interests and ambitions of the instructor, natural enough and laudable enough in themselves, have tended to lead him away from the elementary lines of instruction which are more important because more needed by the students of the University. The communication from Professor Roos, laid before you at your last meeting and by you referred to the Faculty for consideration and report, has received careful attention. It was first referred to a committee, consisting of the Regent and the Deans of the several colleges: this committee after extended deliberations reported unanimously to the Faculty, and its report, adopted by the Faculty with but a single dissenting voice, will be presented to you in its proper place.

The Regent desires to add that in his opinion Professor Roos' real merits are fully appreciated; and that in his appropriate and legimitate sphere, he will continue to receive, as he has always had, the cordial and earnest support of the Regent and the Professors in all the schools of the University.

The report of Lieut. Charles McClure, 18th Infantry, U. S. A., detailed by the Secretary of War as Military Instructor at this University, gives a brief account of the work of that department. Professor McClure's detail will expire with the close of the current year. Suitable recognition of his valuable services will be made at the proper time. (Paper M.)

THE PREPARATORY CLASS.

Instruction in this class has been given during the year with good results, as follows:

In Algebra, Geometry, and Natural Philosophy, by Mr. Samuel W. Stratton; in Physiology and in Botany by Assistant Professor Rolfe; in English Composition, Cicero, Virgil and Anabasis, by Miss Cass; in the spring of 1885 these subjects were taught by Miss Emma M. Hall. Miss Helen Gregory has taught elementary classes in Cæsar, to volunteer students desiring such instruction.

Of the general order and the studious character of the students of the University, nothing not commendatory can be said. The spirit of captious criticism, of disaffection, and of insubordination, seems to have given place to good-will, purposes of earnest study, and willing recognition of authority. The *Illini* has been handled with good judgment, and reflects the kindly feelings of the students which it has labored to promote. No student has been cited before the Faculty for an offense, during the present year.

Nor should this account close without noting the excellent music which Miss Kittie Baker and choir of well trained singers has given us daily in the Chapel, and at the Sunday lectures. These are revived for the last half of the year, though the generosity of Mr. T. W. Harvey and Mr. E. W. Blatchford, of Chicago.

The report of the Librarian, Professor Crawford, is as follows: (Paper N.)

Professor Morrow's quarterly report of the Farm is herewith presented. (Paper O.)

Professor Burrill's reports.

I present the balance sheets of the Business Department of the University; the Agricultural Department covering the year ending December 1st. and the Departments of Horticulture, Chemistry and the Mechanical Shops, to the year ending March 1st. The details of these departments other than these figures are so like those presented one and two years since, that their repetition seems unnecessary. (Paper P.)

I also present my report of the expenditures of the State appropriations for mechanics and tools, entrusted to me at your meeting in July last. (Paper Q.)

THE NEW ORLEANS EXPOSITION

Will close finally on the 31st of the current month. There will be about two car-loads of material to come back to the University. The Commissioners will return our goods free of charge to the railway station in Champaign, together with any goods that remain uncalled for which we may want. This will include all series of articles which were gathered at the expense of the Commissioners, as woods, grains, soils, coals, technological products, etc.

The Commission will pay the expenses of a man to go to New Orleans and pack the goods and put them on the cars. He prefers that we select the person who shall go, and I recommend that Mr. Parker be sent for that purpose. The packing here was mostly done by him, and I shall feel most safe in committing this duty to his hands. His absence will not need to extend over two or three weeks.

The sixteen glass cases and the several hundred bottles used in the display are the only items from which the Commissioners expect to realize any return. They will be at once needed here, to put the articles in proper display in the Museum on the upper floor. Some expense will also be incurred in moving the goods from the station to the University. I recommend that the Regent be authorized to expend not to exceed $250 for purchase of cases and bottles, and for the expense of replacing the exhibit in the University.

FARMERS' INSTITUTES.

Under authority given at your last meeting the State Board of Agriculture was informed that the Professors of this University would aid in the conduct of a limited number of Farmers' Institutes. Institutes were held as a result of this proposition in Princeton, Mattoon and Nashville. Professor Morrow attended all, and papers were also presented by Professors Burrill and McMurtrie, and the Regent. Reports indicate that the University has profited by these meetings. As yet no provision has been made for payment of expenses of those Professors who attended, which expenses are in some cases matters of consequence

At a meeting of the presidents and delegates of agricultural colleges held at the office of the Commissioner of Agriculture in Washington, in July last, resolutions were adopted urging Congress to make appropriations for establishing agricultural stations at the several colleges, in accordance with the terms of the so-called Cullom bill, which passed the senate of the last Congress, but was left on the calendar of the house at the expiration of the session. A committee was appointed to wait upon Congress and press this subject, the committee consisting of Presidents Atherton, of Pennsylvania; Willets, of Michigan, and Lee, of Mississippi. It was agreed that the necessary expenses of this committee would be borne by the several colleges. A request from President Atherton for leave to draw upon this University was referred to the members of the executive committée, and with their sanction I informed him that his drafts would be honored to the amount of not more than $100. None of this money has yet been called for, but if you approve of this action some provision should be made to meet such a call when made.

I present the following communications:

From Prof. Ricker, concerning use of text-books.

From Prof. Comstock, concerning the use of his cabinet of minerals.

From the principal of Bunker Hill Academy, desiring to have his school placed on the accredited list.

The report of the Faculty on the communication of Professor Roos to President Millard, was referred to the Faculty at your last meeting.

Authority is asked to publish 6,000 copies of the annual catalogue at an expense not to exceed $300.

S. H. PEABODY, *Regent.*

Paper N.

CHAMPAIGN, ILL., March 2, 1886.

Dr. S. H. Peabody, Regent:

SIR: I herewith present my report as Librarian of the University of Illinois, from March 1, 1885, to March 1, 1886.

The income of the library is fifteen hundred dollars from State appropriation. Of this, three hundred dollars were expended for periodicals, two hundred for binding, and one thousand for books. I wish that the State appropriation for the library might be doubled.

The additions to the library for the past year have been nine hundred and seventy-nine volumes, making the total fifteen thousand nine hundred and ninety. The numbers in some of the principal departments are nearly as follows:

Agriculture	2,000	volumes.
Natural History and Chemistry	1,900	"
Engineering, Architecture and Mathematics	2,600	"
English and American Literature	1,900	"
History	2,400	"
Bound Periodicals of all sorts	2,500	"
Philology and Concurrent Literature	1,000	"
Philosophy, Social and Political Science	1,000	"

Respectfully submitted,

J. D. CRAWFORD, *Librarian.*

Paper O.

UNIVERSITY, CHAMPAIGN, ILL., March 8, 1886.

Dr. S. H. Peabody, Regent:

The receipts from sales on the farms for three months, ending March 1, amounted to $579.21. The expenditures for same time were $473.29. The winter has been a favorable one for stock, with the exception of a few days, and all classes of the farm animals have done well, almost without exception. Excepting the care of the stock, removal of manure, etc., it has not been practicable to do much work on the farms.

In accordance with the directions of the farm committee of the trustees, I have announced a public sale of Short-horn cattle. The announcement was made for June 4, but various circumstances have made it seem best to change this to Friday, June 11.

In accordance with the authorization of the same committee, I have been in correspondence with several breeders of Hereford and Holstien cattle, and have visited some herds of each breed with reference to purchase of a foundation for a herd of each of these breeds. I have found a kindly interest manifested aside from any question of direct profit from selling one or two animals, and hope to be soon able to make desirable purchases.

The State Board of Agriculture has accepted the offer of the use of land on the University farms for the trial of machines for digging ditches for tile, and it is expected the trial will be had June 10 and 11, 1886. The Prairie Farmer Company, Chicago, has forwarded to the University the large collection of Indian corn made in competition for prizes offered by it. The collection includes specimens forwarded by 156 persons in various States. While much of it is not in the best condition, it is a valuable collection.

During the past three months I have, by request, attended and addressed the Farmers' Institute, at Paris, Princeton, Nashville, Mattoon, and Farmers' Club at Kankakee, in our own State; an institute at De Soto, Mo., under the auspices of the Missouri State Board of Agriculture; the annual convention of the Wisconsin State Agricultural Society; the annual meeting of the Wisconsin Short-horn Breeders' Association; and have forwarded an address to be read at the Inter-State Agricultural Convention at Jackson, Tenn.

My class-room work has been as usual. The members in each class—"Animal Husbandry" and "Rural Economy"—has been small, but good progress has been made.

Respectfully submitted,

G. E. MORROW,

Professor of Agriculture

Paper P.

Balance Sheet of Agricultural Department, Dec. 1, 1885.

Credits.			
Inventory Dec. 1, 1885:			
Live stock		$10,055 00	
Farm products		2,936 25	
Teams		1,250 00	
Machinery and tools		1,800 00	
			$16,041 25
Sales—Live stock	$3,437 42		
Butter and milk	473 05		
		$3,910 47	
Grain and hay		733 25	
Miscellaneous		197 10	
			4,840 82
			$20,882 07
Debits.			
Inventory Dec. 1, 1884:			
Live stock		$10,080 00	
Farm products		1,980 00	
Teams		1,350 00	
Machinery and tools		1,850 00	
			$15,260 00
Paid—For labor		$2,487 33	
Stock and service		733 56	
Food and seeds		616 46	
Machinery		106 00	
Threshing		103 56	
Miscellaneous		467 13	
Permanent repairs		400 00	
			4,914 04
			$20,174 04
Balance in favor of department			708 03
			$20,882 07

Balance Sheet of the Horticultural Department, March 1, 1886.

Credits.		
Work and materials for University	$234 76	
Sales	1,107 42	
		$1,342 18
Debits.		
Foreman	$683 00	
Labor	743 53	
Materials	452 54	
		1,879 07
Balance against department		$536 89
Appropriation for department		500 00
Net balance against department		$36 89

Balance Sheet Chemical Department, March 1, 1886.

Credits.			
State appropriations	....	$632 09	
From students	....	869 69	
Miscellaneous	....	57 11	
			$1,558 89
Debits.			
For chemicals and apparatus, permanent	$232 09		
Table for organic combustions	150 00		
Renovation of Assay Laboratory	250 00		
		$632 09	
Chemicals and apparatus, stock	....	920 74	
Gas	....	122 00	
Repairs, freight, etc	....	93 22	
			1,768 05
Balance against department	....	....	$209 16
Inventory March 1, 1886	....	$15,009 83	
Inventory March 1, 1885	....	14,453 20	
Increase during year	....	....	556 63
Net balance for department	....	....	$247 47

Balance Sheet Machine and Carpenter Shops, March 1, 1886.

	Carpenter Shop.		Machine Shop.	
Credits.				
Work for University	$2,784 57		$587 29	
Work for other parties	481 15		162 20	
State appropriations	530 64		896 49	
		$3,796 36		$1,645 98
Debits.				
Materials and tools	$1,819 89		$764 61	
Labor	1,345 47		448 12	
Power	144 56		144 56	
Instructor	960 00		1,500 00	
		4,269 92		2,857 29
Balance against general fund	....	$473 56		$1,211 31
Inventory of stock on hand	$624 48		$491 40	
Special appropriation for machines and tools, 1885-6:				
Amount appropriated, for both shops	....	....	....	$2,000 00
Expended for carpenter shop	....	....	$407 36	
Expended for machine shop	....	....	1,584 00	
				1,991 36
Balance	....	....	....	$8 64

General Balance Sheet.

Department.	Loss.	Gain.
Agricultural Department	....	$708 03
Horticultural Department	$36 89	
Chemical Department	....	247 47
Mechanical shops	1,684 87	
Total balance against general fund	....	766 26
	$1,721 76	$1,721 76

Paper Q.

To the Trustees of the University of Illinois:

Gentlemen—The State appropriation of $2,000 for purchase of machines and tools for the mechanical shops has been expended as follows:

For carpenter shop:		
Bench tools	$144 11	
Planer	153 00	
Boring machine and counter shaft	76 50	
Dado cutter	18 00	
		$391 61
For machine shop:		
Shaper	$285 00	
Engine lathes, Fitchburg, 15 inches by 6 feet	290 00	
" Flather, 15 inches by 6 feet	310 00	
" Gould & Eberhardt, 16 inches by 6 feet	330 00	
		1,215 00
Freight	$97 56	
Shafting and belting	139 74	
Mandel	20 00	
Exhaust wheel for blacksmith shop	40 00	
Hoods for forges for blacksmith shop	63 39	
Labor setting up, etc., all machines	25 00	
		385 69
		$1,992 30

Respectfully submitted,

S. H. PEABODY.

Paper R.

University of Illinois, March 22, 1886.

Dr. S. H. Peabody, Regent:

Reference to the accounts furnished by the Business Agent will show the financial condition of the Horticultural Department for the year just closed. Counting the total expenses, including salary of foreman, the expenditures are considerably more than the income. The latter was almost wholly from sales from the green-house and from the strawberry beds. Something was secured from the nursery, but nothing from the orchard and vineyard, and very little from the plantations of blackberries and raspberries. The severe effects of the winter caused most of this loss. The experimental orchard has always been an expense to the department, as indeed might be assumed, for out of the thousand kinds planted it could hardly have been anticipated that more than a score would prove profitable. The destruction all over our part of the country during the winters of 1883-4 and 1884-5 of apple trees supposed to be hardy, shows what an ordeal befell this orchard. It could not be otherwise than in poor condition; but, after all, this test is a beneficial one for the experiment. We may now know whether or not there is anything of promise in the way of extremely hardy trees. During the summer of 1886 we hope to make up the record of these trees and present the results for publication.

The forest plantation also yearly receives more than it returns. Nothing, whatever, has been derived from these trees in the way of income except for trees to plant. Some of the thinning has been done by ourselves, without use or sale for the part cut away; some has been taken for the wood. Theoretically this young stuff has been counted of great value for hoops, stakes, poles for beans, grapes, fence, etc.; but we have not found the theory to hold good here, Much more use could be made of the material on a home farm. When the trees are large enough for posts and ties ready sale can be had for those suitable for these purposes, and larger timber will always be valuable.

The green-house cannot be considered from a purely financial standpoint. A large portion of the main room is occupied by plants expressly for exhibition, to be made use of by students in general as illustration of the vegetation of foreign countries, and by the classes in botany, agriculture and horticulture, especially as aids to their studies. Attention to visitors consumes no small part of the time of the attendant. Experiments in vegetable physiology, not otherwise possible, are in progress most of the time in these apartments. If, therefore, we do not receive from sales enough to meet the expenses of labor and coal, together with the expenditures for repairs and for stock, the balance is not necessarily against the green-house. Counting the plants furnished the grounds at the average wholesale rates, together with the amount of sales, the proceeds are equal to the expenses. It is not possible, however, to strictly divide the salary of the foreman, who really does most of the work in the houses, between this and the other subdivisions of the department, so that the exact expenses can be stated.

Should an income permit it nothing ought to be said against charging the full salary of the foreman and total expense of green-house against the Horticultural Department, but as the case now stands it does not seem to me unjust that one or the other—at least in part—should be met from the general fund.

In this connection I recommend that the salary of Mr. McClure be increased by furnishing him the house in which he now lives free of rent. He is in every way worthy of this additional pay.

A part of the house—four rooms—southwest of the University building has been offered to a man (with a small family) who is to work on the horticultural grounds. The other four rooms are now occupied by students.

With the funds at command it has not been possible for the Horticultural Department to do much in the way of experimental work. There is no difficulty whatever in naming unsolved problems such a horticultural experiment station ought to undertake, and with the means at hand I am sure we could advance knowledge in several of these lines. Just now there is abundant call for tests of new kinds of apples, especially of those from Russia. By top grafting many of these could be fruited within three years, and during this time small trees could be grown. It seems to me wise in this matter to let the Iowa Agricultural College lead, the work being there so well in hand already; but they cannot make tests for our latitude. Cions and trees can now be had from Iowa and we might enter this season upon the tests. There is also an opportunity of making cross-fertilizations of fruit tree blossoms in the hope of getting from seed new varieties of promise. At least work in this line would be in accord with popular demand. As a matter of great scientific and prectical interest experiments in cross-fertilization with a large number of kinds of plants would be highly desirable, but to find results several years would often be required. The work requires skill and much painstaking labor, but except for the expense we can have it creditably done. I cannot regard the mere testing of varieties as the most desirable experimental work, yet this is what is most asked of us. The testing of seeds found in the markets, the growth obtained from those of different qualities, the influence of gathering in different states of maturity, that is, whether fully ripe or not; the effects of fertilizers, of modes of training and treatment, etc., etc.—these, and such as these barely indicate work that may be undertaken.

For this year I should be glad to have an appropriation of two hundred dollars for purely experimental work, provided there is a prospect that the undertaking can be carried forward from year to year. We will do the best we can with or without this appropriation, but certainly can do more with some aid of this kind. If the expenses can be provided for, much reater undertakings can be suggested.

With the prospects we now have the income from horticultural sales will be about the same as for last year. The expense for labor will be somewhat less,

Respectfully submitted,

T. J. BURRILL.

The following report from the Faculty in the matter of the School of Art, referred to them at last meeting, was read, received, and its recommendation adopted:

URBANA, ILL., March 8, 1886.

To the Trustees of the University of Illinois:

GENTLEMEN: The Faculty, to whom was referred a communication made by Professor Roos to the President of the Board of Trustees, and by the Trustees referred to yourselves, has considered the same, and begs leave to report as follows:

The essential point in Professor Roos' communication appears to lie in the concluding statement, which is: "I respectfully recommend that the students in the course of art and design be granted the privilege of graduating in that course under conditions equivalent to that in other departments in the University."

Graduation in this University may now occur in either of two ways:

1. The candidate for graduation may have a degree of B. A., B. L., or B. S., respectively, according as he has completed some one of the courses of study authorized by the Trustees and Faculty, as leading to such a degree.

2. The candidate for graduation may have completed thirty-six University studies of his own selection, and may have a so-called full certificate "which shall set forth the precise attainments of the party applying for the same in the various branches of learning he may have studied during his attendance in the University."

As to graduation with a degree. The theory upon which, in the main, the courses of instruction in the several schools and colleges have been constructed, appears to be this: That at least one-third of the subjects in each course shall be of such a nature as to bear specifically upon the general objects of the course, the remaining subjects being either of allied character, or for general culture. Your committee, therefore, finds itself confronted with these questions: Will a course of study in which at least one-third of the subjects are technical in the school of art and design, with such other subjects as would naturally be connected therewith, possess such solid qualities, and have such value for education, discipline, and culture, as shall entitle it to be counted equal with the other degree courses of the University? Should the students who have taken such a course thereupon be entitled to either of the Bachelor's degrees now given, or to one of equal significance? Your committee conceives that these questions present the vital issues of this subject, and it feels constrained unanimously to answer both in the negative.

As to graduation with a full certificate. It was evidently intended that this certificate should be the evidence of attainments and culture not inferior to those for which degrees were usually given in colleges of highest rank. It is also evident that this intent is not now attained, and that its attainment can hardly be expected. The options permitted not unfrequently lead the student to choose studies which are easy instead of those which are severe. This fact, which in the early days of the University prevented the certificates from passing current in the community with the significance of diplomas for degrees, led to the demand for, and the conferring of degrees as the evidence of the completion of severe and required courses of study in the several schools.

The number of art studies which may be included among the thirty-six credits that led to a certificate has never been formally determined, and your committee is of the opinion that this number should be fixed. It appears that hitherto no more than nine art studies have been credited in any full certificate. Your committee believes that no more than twelve art studies should be included among the thirty-six for which a full certificate is given; or, in other words, that no less than twenty-four other University studies should be required for graduation in this form.

Your committee recognizes, however, the provision of the law by which a certificate must be given to any person who has studied at least one year in the University; and that this paper shall set forth the attainments of the student in all branches of whatever nature which he may have studied in the University. This credential any student may demand and receive. Whether its possession shall entitle the holder to be an alumnus of the University is a matter subject to other regulation.

Your committee feels impelled to say farther, that the school of art and design was intended originally to furnish such instruction in art studies as should be found necessary to supplement and complete the courses of study in other schools, particularly those of a technical nature. When in 1879 this school was temporarily suspended, Dr. Gregory, in urging to the Trustees the propriety of reopening it, said: "The school of design would not have been recommended, great as is its practical value and importance, but for the fact that the necessary instructors and apparatus are required also by other schools. The teacher of free-hand drawing, required by the school of architecture and engineering, as also by the several schools of natural science and agriculture, has always been able to give the special instruction required in the school of design." Your committee believes that the giving of degrees in the school of art and design would serve to increase the tendency to withdraw the school from its primary and most important duties towards the other colleges and schools.

All of which is respectfully submitted.

By order of the Faculty

J. D. CRAWFORD, *Secretary*.

The Committee on Water Supply made the following report:

To the Trustees of the University of Illinois:

GENTLEMEN: Agreeably to your instructions your committee reports as follows upon the supply of water at the University building:

At the main building the total roof area is about 18,000 square feet, upon which the fall of rain at three feet per annum, whould aggregate about 400,000 gallons, Of this about five-ninths are divided into the tanks and cistern, or about 245,000 gallons.

The receiving capacity consists of two cisterns in yards	16,918 gallons
And two tanks on fourth floor	3,388 gallons
Total storage for rainwater	20,306 gallons

To fill this storage under present arrangements requires 3¼ inches of rain fall.

A well in the yard 24 feet deep, 38 inches diameter, has now about 74 inches depth of water. Its storage is from 350 to 800 gallons and it has at ordinary times an influx of about 10 gallons per minute.

The total amount of water possibly in control of the pump in the engine house is about 21,000 gallons, or about 700 barrels, with a flow of about 1,000 gallons per hour, under best conditions.

The amount of water used is about 1,250 gallons per day in term time.

This for 180 days is	225,000 gallons
Add one-fourth for other days	56,000 gallons
Total	281,000 gallons

or say 300,000 gallons per annum.

Counting the well, tanks, and cisterns, it is evident that the present supply is ample for purposes of daily consumption, and it has been so found since the building was erected. It is equally evident that it would be utterly inadequate to control a fire which should acquire any serious headway.

The boiler-house is furnished with a Duplex Worthington pump, new one year ago, with water cylinder 6x4, capable together of throwing about sixth-tenths of a gallon at a stroke or at ordinary speed 50 gallons per minute. This could easily be increased to 80 or 90 gallons per minute if desired. At 80 gallons per minute the total maximum supply would last 4½ hours. If the cisterns and tanks should happen to be empty the well would be exhausted in about ten minutes.

The water now used is raised to the tanks in the fourth story, a distance of about 65 feet above the pump. It has been found to take about 200 pounds of coal for a day's pumping. This, with allowance for oil and repairs, but not for firemen's wages, will make the cost of raising 300,000 gallons of water per annum about $80. It should be remembered that in these estimates the water used at the green-house is included.

At the Chemical building the area of roof is about 8,700 square feet. Of this about half drains into a tank and two cisterns whose united capacity is about 18,500 gallons. To fill this storage will require 6.8 inches of rainfall.

The well contains from 350 to 800 gallons, with influx of about 10 gallons per minute. The pump has a capacity of about 20 gallons per minute. and lifts the water about 50 feet to the tank in the roof. The consumption of water is about 1,200 gallons per day in term time or about 200,000 gallons per year. No lack of water for ordinary purposes has ever been experienced here.

The cost of elevating the water here is about the same per barrel as at the other building or say $60 per year.

The Mechanical building has about 10,000 square feet of roof, but has no cistern, and the rainwater is suffered to flow away. It has two wells, one being four feet in diameter and now holding 29 feet of water. The other is three feet in diameter and has 9 feet of water.

The daily use of water is about 150 gallons, or about 30,000 gallons per year. The supply is ample, but the wells are in the yard and might be inaccessible in case of fire.

All of which is respectfully submitted.

S. H. PEABODY,
N. CLIFFORD RICKER,
Committee.

The report was received, ordered on file, and committee were discharged.

The following report from the Farm Committee was presented and read:

CHAMPAIGN, ILL., Jan. 26, 1886.

At a meeting of the Farm Committee of the University of Illinois, held at the University building on the above date, Professor Morrow was authorized by said committee to purchase for the use of the University two or three animals of each of the breeds of Hereford and Holstein cattle, at an expense not to exceed $1,200. He was further authorized to make necessary arrangements for a public sale of about thirty head of the Short-horn cattle now belonging to the University, such sale to take place at such time in the early spring and summer as may seem most desirable.

The Regent was also authorized to tender to the State Board of Agriculture proper facilities on the University farm for a competitive trial of tile ditching machines.

It was agreed by said committee that in their report to the Board of Trustees at its next regular meeting the committee would recommend the employment by the University of an assistant in agriculture, such assistant to be selected with reference to his fitness to give instruction to students and classes, and his ability, under the general supervision of the Professor of Agriculture, to superintend the affairs of the farm, and especially to conduct agricultural experiments.

CHARLES BENNETT,
J. T. PEARMAN,
Farm Committee.

The report was received and approved, and the Regent was authorized to employ a competent assistant in agriculture at a salary of $80 per month.

The following report from Professor S. A. Forbes, Director of the State Laboratory of Natural History, was read:

CHAMPAIGN, ILL., March 24, 1886.

DR. S. H. PEABODY, *Regent:*

SIR—The State Board of Education, formerly in charge of the State Laboratory of Natural History, held last December its first meeting at Normal since the law was passed authorizing and requiring the transfer of the property of the State Laboratory of Natural History to the Trustees of this University, and at that meeting they passed a resolution authorizing one of the standing committees of that Board to effect the transfer according to the terms of the law. An informal understanding was had that whatever arrangement might be mutually satisfactory to the Curator of the Museum at the Normal University and myself would have the approval of that committee, but owing to the unexpected absence from the State of the former gentleman some part of the business remains still unsettled.

It has been my intention to prepare for this meeting of the Board of Trustees a formal report of the condition of the property and work of the State Laboratory of Natural History, but thinking that this report may best be rendered after the belongings of the Laboratory are all in hand, I now beg to defer it until the June meeting of the Board.

I have consequently at this time only to request the passage of the usual formal resolution making the quarterly installment of our appropriations available, and to ask authority to increase to $45 per month the salaries of Thomas F. Hunt and Clarence M. Weed, assistants in the Laboratory; this increase in the salary of Mr. Hunt to date from the 1st of February, that of Mr. Weed from the 1st of April.

Respectfully submitted,
S. A. FORBES, *Director of Laboratory.*

The report was received, and the recommendation of increase of salary for Assistants T. F. Hunt, (from February 1) and C. M. Weed (from April 1), from $40 to $45 per month, was approved.

The Regent's recommendation in regard to admission to the course of Literature and Science was approved.

It was moved and carried that schools accredited by this University be confined, as heretofore, to public high schools of this State.

The salary of Mr. G. W. McClure, foreman of Horticultural Department, was increased to $60 per month.

The resolution in regard to clothes closet for Trustees, passed at last meeting, was rescinded.

The Regent and Prof. Burrill were authorized to furnish a certain number of trees, not otherwise needed, for the improvement of Green street, on which the University is located.

The Regent was authorized to publish 6,000 copies of catalogue for 1886-7, at an expense not to exceed $300.

The traveling expenses of the Regent, amounting to $44.25, were audited and allowed.

The following appropriations from current funds, for the six months ending August 31, 1886, were approved:

Board expense	$300 00
Salaries for instructors	17,385 00
Salaries for services	1,215 00
Buildings and grounds	300 00
Fuel and lights	1,000 00
Stationery and printing	600 00
Nebraska lands	50 00
Library and apparatus	50 00
Incidental expenses	200 00
Mechanical department	300 00
Architectural department	300 00
Agricultural department	600 00
Horticultural department	300 00
Military department	50 00
Laboratories	300 00
Sundries—	
Drawings for Architectural department	74 50
Publication of bulletins, etc	150 25
Furnishing Zoölogical Laboratory	144 51
Gymnasium	15 00
Furniture and fixtures	50 00
	$23,384 26

The following resolution, offered by Trustee McLean, was passed:

Resolved, That the President and Secretary be directed to draw their requisition upon the State Auditor for the several sums of money appropriated by the General Assembly for the use of the State Laboratory of Natural History, and the State Entomologist's office, of the quarter ending June 30, 1886.

For field work, incidental expense of the Laboratory, the sum of $150.

For traveling, office, incidental expenses of the Entomologist, the sum of $100.

For improvement of the Library, the sum of $250.

For the pay of the Entomological Assistant, the sum of $250.

For the pay of the Botanical Assistant, the sum of $250.

For miscellaneous assistance, the sum of $250.

For the publication of bulletins, the sum of $75.

The following appropriations were made:

For purchase of chemical supplies	$650 00
For Physical Laboratory	100 00
For current expense of Zoölogical Laboratory	100 00
For cases for Zoölogical Laboratory	135 00
For painting casts of fishes	106 75
For purchase of geological specimens	500 00
For buildings and grounds	370 00
For New Orleans Exposition	250 00
For taxes on purchased lots, for last year	25 00
For lecturing expenses at farmers' institutes	50 00
For replacing U. S. rifle, accidentally burned	18 00
For Nebraska land sales, expenses	265 33

The Auditing Committee submitted the following report, which was approved:

To the Board of Trustees:

Your Auditing Committee, to whom was referred the report of the Business Agent and Treasurer, report that they have examined vouchers 201 to 500, inclusive, present series, and find them correct and properly receipted, and would recommend that the same be approved.

CHARLES BENNETT,
GEO. C. EISENMAYER,
Committee.

The following resolution, presented by Trustee McLean, was passed:

Resolved, That this Board has heard with pleasure the account of the work lately begun by the Professor of Rhetoric and Oratory, and that it desires the responsive efforts of all undergraduate students. The Faculty is thereupon hereby requested to provide such regulations as shall insure the performance of the duties of this department of instruction by all matriculated undergraduates of the University.

The Executive Committee submitted the following report in regard to the Griggs farm:

To the Trustees of the University of Illinois:

GENTLEMEN: At your last June meeting your Executive Committee, to whom was referred the matter of leasing the Griggs farm for the year 1885-6, reported the terms on which said lease was made. We now beg leave to submit the following as the proceeds of said lease and our further actions in said matter. We received for oats grown on said farm $107.25; for hay, $125; which sums were turned over to the Business Agent. The corn, about 1,700 bushels, remains unsold in cribs on said farm. We also caused to be built on said farm a crib 10 feet wide by 11 feet high and 48 feet long, at a cost of $78.66.

Respectfully submitted,
J. T. PEARMAN,
Committee.

The report was received and approved, and Trustee Pearman was authorized to rent the farm.

The Regent was authorized to expend not to exceed $100 for the purpose of securing an experimental station.

In the matter of land contracts the Board instructed the Committee on Nebraska Lands that they should close contracts for deeds only in accordance with the terms of original contracts.

The Board then adjourned to meet again Tuesday, April 6, 1886, at 10 o'clock A. M., at Chicago, at the office of Trustee Follansbee, 14 and 18 Bryan Block, unless otherwise directed by the President.

GEORGE A. FOLLANSBEE,
President pro tem.

E. SNYDER,
Recording Secretary.

PROCEEDINGS OF THE BOARD OF TRUSTEES—APRIL, 1886.

The Board met at the office of the President, room 90, No. 115 Dearborn street, Chicago, on Tuesday, April 6th, 1886, at 10 o'clock A. M., pursuant to adjournment from March 23d, as designated by the President.

Present—Trustees Pearman, Eisenmayer, Bennett, McLean, Earle and Millard.

Absent—Governor Oglesby, Hon. John Landrigan, Trustees Cobb, Follansbee and Paden.

President Millard in the chair.

Minutes of the last meeting read and approved.

The Regent offered a communication from E. Lemme, class of 1886, asking to be excused from elocution.

It was moved and carried that the above communication be referred to the Regent and Faculty with power to act.

The following communication from C. B. Gibson, President of the Chicago Club, University of Illinois, was offered and read:

To the Board of Trustees of the University of Illinois:

GENTLEMEN: At a special meeting of the Chicago Club of the Alumni of the University of Illinois, the undersigned were appointed a committee to prepare a memorial address to your honorable body in relation to the subject of endowments, praying that you may take such action, at the meeting of Trustees March 23d, as shall be deemed by you advisable, after hearing this petition, and upon a careful consideration of the whole subject at this meeting.

The students and graduates of the University desire to cooperate with the Trustees and Faculty in their efforts to make the University of the greatest possible benefit to all who shall enter it; and to assist in the work of presenting to the people of this State and of the country the privileges and advantages to be enjoyed here by those who are seeking a broad and liberal education; and to unite with you in placing the University among the foremost institutions of learning in the land.

With this subject before us we have brought up and discusssd the subject of endowments, as a means of commanding the attention, and securing the help of those who are empowered to grant appropriations for the fund of the University, and to invite the notice and enlist the good will of public spirited and generous citizens of our State and the nation, who are able, and with the proper understanding of the matter would be ready, to make donations, gifts or bequests.

Correspondence has been had with the leading colleges and universities of the country, which has furnished information, in facts and figures, upon this question of endowment.

Section 7 of the Organic Act founding the University, in relation to the power of Trustees upon the question of endowments, reads;

"They may accept the endowments of voluntary professorships of departments in the University from any person, or persons, or corporations who may proffer the same, and at any regular meeting of the Board may prescribe rules and regulations in relation to such endowments. and declare on what general principles they may be admitted: Provided, that such voluntary endowments or professorships shall not be incompatible with the true design and scope of the act of Congress, or of this act."

Your memorialists, representing the alumni and students of Chicago and vicinity, referring to the act and section above quoted, respectfully ask that at the regular meeting of the Board of Trustees March 23d, 1886, you will prescribe the rules and regulations in relation to such endowments which Section 7, as quoted above, directs may be prescribed for the admission of such endowments; so that the alumni, students, and friends of the University may solicit endowments for special purposes, as provided.

Your petitioners also respectfully ask that the Trustees will, at a convenient day, prepare a paper setting forth your ideas upon the subject of this memorial, and submit the same at your June meeting, 1886, that we may know your views and be prepared to act with you in the matter.

Lastly, we understand that progress will be slow, and that it will require years to mature and develop a successful plan of endowment.

Believing that your honorable body already concurs in the views we have stated, and hoping that the subject may have your careful consideration, this memorial is presented And your memorialists will ever pray.

Respectfully submitted,

C. B. GIBSON,

President Chicago Club, University of Illinois.

CHICAGO, March 6, 1886.

Trustee McLean moved that the above communication be placed on file, and that a committee of three be appointed to confer with the club, which motion was seconded and carried.

Trustees McLean, Bennett, and Follansbee were appointed as such committee.

It was moved and carried that the Regent and President of the Board be added to the committee on the petition of the alumni.

A communication from L. Franklin, Secretary of the Illinois State Teachers' Association, was then presented and read, as follows:

BELVIDERE, ILL., Jan. 25, 1886.

Hon. S. M. Millard, President Board of Trustees, University of Illinois:

The following resolutions were passed by the Thirty-second Annual Meeting of the Illinois State Teachers' Association, held at Springfield December last:

Resolved, That we desire to see a chair of Pedagogy established in the University of Illinois at an early day, and that we request the Trustees of the University to take measures to establish such department, and pledge them our co-operation in securing any legislation which may be necessary to this end.

Resolved, That the Secretary of the association is hereby instructed to communicate this resolution to the President of the Board of Trustees of the Illinois State University.

L. FRANKLIN, *Secretary.*

Trustee Earle then offered the following resolution:

Resolved. That this Board receives very cordially the request of the Illinois State Teachers' Association for the establishment of a chair of Pedagogy in the University of Illinois, and that it will make the subject one of serious consideration at the earliest reasonable opportunity.

Which resolution was seconded by Trustee McLean, and unanimously carried by the Board.

The Board then proceeded to the election of the Executive Committee.

On motion of Trustee McLean, Trustees S. M. Millard, John T. Pearman and Charles Bennett were unanimously elected members of the Executive Committee.

Adjourned at 1:30 P. M. until 2 o'clock P. M.

Two o'clock P. M.—Board reassembled at the office of the President of the Board, No. 115 Dearborn street.

Dr. S. H. Peabody, Regent, appeared before the Board and presented his resignation as Regent, as follows:

CHAMPAIGN, ILL., March 23, 1886.

To the Trustees of the University of Illinois:

GENTLEMEN—I herewith tender this my resignation of the office of Regent of this University, to take effect at such time as may suit your convenience, not later than the first of July next.

While so doing I beg to express my profound acknowledgments for the continued courtesies which you have shown me while engaged in the discharge of the duties of this office, and to express my sincere wish for the continued and greater prosperity of the University of Illinois.

I remain ever sincerely yours,

SELIM H. PEABODY.

Upon receiving the communication the Board resolved itself into a committee of the whole to discuss the same, and after full consideration the following resolution was offered by Trustee Pearman, seconded by Trustee Eisenmayer, and unanimously adopted:

Resolved, That the resignation of Dr. S. H. Peabody, now on file with the Board, be not accepted.

On motion of Trustee Eisenmayer, seconded by Trustee Earle, the following resolution was unanimously adopted:

Resolved, That the sum of one thousand dollars be added to the salary of Regent S. H. Peabody for the current year ending March 8, 1887.

The President then announced the following standing committees:

By election, Executive Committee—President Millard, Trustees Pearman and Bennett.

Farm Committee—Trustees Pearman, Cobb and Earle.

Buildings and Grounds—Trustees McLean, Follansbee and Eisenmayer.

Auditing Committee—Trustees Paden, Eisenmayer and Bennett.

Finance Committee—Trustees Follansbee, Bennett and Paden.

Committee on Publications (by resolution)—President, Regent and Corresponding Secretary.

On motion of Mr. McLean, the Board adjourned.

PROCEEDINGS OF THE BOARD OF TRUSTEES—JUNE, 1886.

The Board met at the University parlor on Tuesday, June 8th, 1885, at 3 o'clock P. M.

Present—Trustees Bennett, Cobb, Earle, Eisenmayer, McLean, Millard and Pearman.

Absent—Governor Oglesby, Hon. John Landrigan, Trustees Follansbee and Paden.

The records of the March and April meetings were read and approved.

On recommendation of the Faculty degrees and certificates were granted as follows:

College of Engineers—Degree of B. S.
School of Mechanical Engineers—John C. Cromwell, James H. Garrett, Henry M. Morse. Samuel W. Stratton.

School of Civil Engineers—James O. Davis, James Fulton, James W. Harris, Walter A G. Olshausen.

School of Architecture—George S. Bannister, Harry Schlaudeman.

College of Natural Science—Degree of B. S.
School of Chemistry—Dwight H. Barrett.

School of Natural History—Leroy Endsley, John B. Garvin, Frank K. Vial.

College of Literature and Science.
School of English and Modern Languages—Degree of B. L.—Laura Belle Ayers, William A. Babcock, William L. Chitty, Joseph C. Dodds, A. Mae Ermentrout, Rozina P. Fairchild, Bertie Huff, Minnie Jaques, Charles H. Kammann, Clinton G. Lumley, Grace E. Parminter. William L. Plowman, Z. Lincoln Whitmire.

School of Ancient Languages—Degree of B. A.—T. Ward Beecher Everhart, Henry W. Wilder.

Masters Degree—
Alphonso S. Gates, Civil Engineer.
Mrs. Margaret E. (Stewart) Robbins, Master of Literature.
Charles W. Woodworth, Master of Science.
Arthur B. Seymour, Master of Science.

Full Certificates—S. Foster Bullard, Nettie Elder, Harry T. Hubbard, Jacob S. Jacobson, Emil Lemme, William D. Pence, Alvah Philbrick, Vertus B. Roberts, Charles E. Sargent, Luther Thompson.

The following named persons were reported as having been recommended to the Governor to receive commissions as captains by brevet in the State militia: James O. Davis, William D. Pence, Vertus B. Roberts, Luther Thompson, Henry W. Wilder.

The Regent then submitted the following report, which was received for further consideration:

To the Trustees of the University of Illinois:

GENTLEMEN: After the exhaustive reports concerning the educational and business interests of the University made to you at your meeting in March, it will not be expected that I should present extended details of a similar nature at this time. It is pleasant to state that the good character of the work and feeling which has before been remarked has extended to the close of the year.

I present reports as follows:

From Prof. Forbes upon the Department of Natural History and the removal of the State Laboratory to this University.

From Dr. McIntosh on the work of the classes in Veterinary Science.

From Prof. Morrow upon the affairs of the farm.

I present a communication from George W. Henry, Esq., in which he offers to present to the University the thoroughbred Hereford cow, Empress, a superb example of that important breed.

The trial of ditching apparatus and machinery which is to take place on the University farm, June 10 and 11, has been largely announced and promises much interest.

I call attention to the accompanying list of Professors and Instructors whose appointments should be made or renewed for the year ending August 31, 1887.

I have to recommend special appropriations for expenditures as follows:

1. That the committee appointed last year to oversee the construction of fire walls and the continuance of ventilation of the main building, consisting of the Regent, the Business Agent and the Professor of Agriculture, be continued, with power to carry on the improvements as originally designed.

2. That authority be given to the Regent to purchase additional tools and machines for the mechanical shops, to the amount of the State appropriation for the new year.

3. That the following-named improvements be authorized to be paid from State appropriations for buildings and grounds:

(*a*). The flight of stone steps now at the south end of the chemical building be taken down and reërected at the west side, making suitable changes to permit the main entrance to be on the first floor, with entrance below into the basement.

Also, that the earth be removed from the outside of the stone foundation walls to their footings, the walls thoroughly coated with asphalt, and the earth replaced, a layer of furnace cinders to be placed against the stone, the object of this being to prevent further inroads of dampness upon the basement of this building.

The estimate of cost for these improvements is $500.

(*b*). The floor of the veranda to be relaid. This has already been allowed, but the work has been delayed, and the payment must come from next year's fund. Cost, $125.

(*c*). The railing to balcony in library to be finished, costing $50. The condition of this item is the same as the last.

(*d*). Repairs to the gardener's house in the arboretum, to the amount of $100.

(*e*). To be used for fencing in various places about public grounds, as required, $100.

(*f*). For raising floor in the room east of Professor Burrill's room in basement, connecting that room with his, and providing the necessary fittings for its use in connection with his laboratory, $150.

(*g*). For inside shutters for Professor Forbes' room, $100.

That the following be assigned from the State appropriations for cabinets:

For two microscopes and accessories, Professor Forbes	$154 76
For additions to herbarium, Professor Burrill	150 00
For clerical services on same, Professor Burrill	15 00
For labor preparing wood specimens, Professor Burrill	15 00

That the following be assigned from State appropriations for laboratories:

For new microscopic objective, Professor Burrill	$125 00
For apparatus for electrical measurements, Physical Laboratory	450 00

Professor Morrow asks leave to buy steers for feeding and for payment for breeding stock to the amount of $1,200. This will be reimbursed later by sales from the farm of short-horn cattle, and of hay.

Professor Ricker asks for cases in his rooms	$55 00
For continuing his collection of photographs	50 00

Very respectfully,

S. H. PEABODY, *Regent.*

PROFESSOR FORBES' REPORT.

Dr. S. H. Peabody, Regent:

I have the honor to submit the following as my report on the work of the zoölogical department of the University for the past term, and on the operations of the State Laboratory of Natural History since its transfer to the Trustees of this University:

ZOÖLOGICAL DEPARTMENT.

I have taught during the last term the regular classes in entomology and advanced zoölogy, the latter class having been taken over ground new to the course in the University, viz., the elements of histology and embryology. The histological work consisted of the preparation in the zoölogical laboratory, by the students of the class, of slides illustrating the various tissues of the animal body, and a careful study of these original preparations, together with a study and discussion of the text. In embryology a course of lectures was given on the elements of comparative embryology, and on the earlier stages of the development of the chick, and these were supplemented by six hours' work a week by the students in the zoölogical laboratory, in sectioning embryos and the preparation and study of slides.

Necessarily, the students taking this course have acquired a very considerable familiarity with some of the most difficult processes of microscopy. Incidentally to this, an efficient injecting apparatus and about a hundred embryological preparations and microscope slides of embryology and histology have been added to the permanent laboratory collection during the term.

The material sent to New Orleans last fall having now been returned, painted casts of thirty-three species of Illinois fishes and mounted specimens of one thousand species of insects have been incorporated with the museum collections.

Besides these, the principal recent zoölogical additions to the museum are forty-three more glass models of aquatic invertebrates and a pair of antlers of the Irish elk.

I have to request at this time only the assignment of $154.76 for the purchase of two additional microscopes and microscopical appliances required for the zoölogical laboratory.

STATE LABORATORY OF NATURAL HISTORY—PROPERTY.

The transfer of the property of the State Laboratory of Natural History to the Trustees of the University, as required by a law of the last Legislature, is now complete, and all the belongings of the establishment are under my custody in the University building, in the basement rooms assigned for our use. Thinking it proper that a summary statement of the material thus brought under the control of the Board should now be made, I have had prepared careful estimates of the specimens, apparatus, and other objects included under this transfer, and from these have drawn up the following abstract:

The library of the Laboratory contains 1,207 bound volumes, 3,856 pamphlets and periodicals, and 185 charts and plates, a total of 5,248 pieces; while the duplicate bulletins of the Laboratory and other duplicate pamphlets available for distribution and exchange number 9,410.

The collections contain 13,500 specimens of fungi (of which nearly 9,000 are mounted as herbarium specimens, and 1,100 as microscope slides); 300 bird skins; 11,700 fishes (mostly from Illinois); 1,400 reptiles and amphibians; 3,700 specimens of mollusks (about 1,200 in alcohol); 42,000 mounted insects (7,000 of which are named); 6,225 bottles and vials of insects; 127 bottles of Arachnida; and 2,526 tanks, jars, bottles, vials, and boxes of various aquatic animals. Besides the above we have nearly 7,000 bottles and vials illustrating the food of fishes and birds; a set of seeds of 700 species of plants; and about 2,500 microscope slides of zoölogy, histology, etc.

These Laboratory collections amount, in a word, to 75,000 specimens, in round numbers, besides 15,000 bottles, vials, and other packages, the contents of which are as yet largely unclassified.

The apparatus transferred with this material consisted chiefly of a very full outfit of collecting apparatus for both terrestrial and aquatic work, including a wall-tent, six seines, three dredges, a beam trawl, 1,500 feet of whale line, two sounding lines, and other deep water apparatus, etc., etc. We also transferred a considerable amount of microscope material and apparatus.

QUARTERS AND PERSONNEL.

This property is now contained in the three rooms of the west basement, fitted up for the State Laboratory of Natural History, and in room 6 on the first floor, in use as the entomological office. The furniture for these rooms has now been finished or provided for, except four tables in the general laboratory room, and a part of the book cases in the zoölogical library. These rooms answer our present purposes very well, having only the disadvantages connected with their situation in the basement.

The regular assistants of the Laboratory are five in number, consisting of entomological, botanical, and general assistants, an amanuensis, and a librarian. Two student assistants are temporarily engaged, at present, for a part of their time. Professor Burrill also gives us the benefit of his experience and special knowledge in the direct supervision of the botanical work of the Laboratory—now almost wholly turned to technical and experimental researches on the cryptogamic botany of Illinois.

OPERATIONS.

Much time has been consumed since the transfer, in the reörganization and re-arrangement of the material.

The work of the natural history survey of the State, made by law a part of the special duty of the Laboratory, has been confined chiefly to the fields of entomology and cryptogamic botany and to the preparation and publication of the first volume of the Zoölogical Report—that on the ornithology of the State. Three hundred pages of this volume are now in print, and the entire volume—to consist of five hundred pages and forty-five plates, uniform in typography and general character with the volumes of the State Geological Survey—will be through the press in about two months. The printing is being done by H. W. Rokker, of Springfield, the State Printer—the contract providing for one thousand copies of the volume, the pages and plates to be stereotyped, so that additional copies may be ordered printed by the Legislature if deemed desirable. As this volume will probably be ready for distribution before the next meeting of the Board, and as the law gives no directions whatever with respect to the mode of distribution or the persons to whom the volumes shall be sent, I respectfully ask instructions of the Board on this point.

The Laboratory is by law directed to supply to the State educational institutions and to public schools specimens of natural history illustrative of their work. I have received from the latter several requests for aid of this description, but as no appropriation was made for this special purpose at the last session of the Legislature. I can at present only accumulate as large a reserve of duplicates as possible for distribution to educational institutions. I expect to be able to make a large issue to the public schools in which zoölogy and botany are taught, during the coming winter, so far as these had not been already supplied by us before our removal here.

We have issued from the Laboratory, here, three bulletins of our second volume—one of one hundred and fifteen pages by Professor Burrill, on a family of Illinois fungi; one of sixty-five pages by myself, on the contagious diseases of insects, and a brief paper on new Illinois fishes. A fourth article is now in press, and the manuscript of a fifth is ready for the printer.

Elaborate studies are now in progress for the Laboratory by Professor Burrill on the life histories of fungi, and by Mr. Garman and myself on the contagious diseases of insects. Mr. Weed and Mr. Hart are engaged on the life histories of insects—especially the injurious species—and Mr. Garman and I have well under way the manuscript of the second volume of the State Zoölogical Report.

Respectfully submitted,

S. A. FORBES,

Professor of Zoölogy and Entomology, and Director of Natural History Laboratory.

REPORT OF PROF. MORROW.

UNIVERSITY OF ILLINOIS, June 5, 1886.

Dr. S. H. Peabody, Regent:

During the past three months affairs on the University farms have, in the main, progressed satisfactorily. The spring opened unusually early; the weather has been exceptionally favorable for cultivation, and until now, when there is pressing need for rain for growth of crops.

We have planted about 115 acres of corn, receiving a good stand, and it is now in good condition. Of oats about 40 acres were sown and, save for present need of rain, promise a good yield. The few acres of wheat sown in trial of varieties, and a few acres of potatoes, are promising well.

In general the live stock has done well. In accordance with authorization by Farm Committee of purchase of specimens of Hereford and Holstein-Fresian cattle, I visited herds at Beecher, Aurora, Elgin, Ashkum, and Gilman, in all cases finding breeders interested in the proposed purchase and disposed to name reasonable prices. At a public sale of Holstein-Fresian cattle, at Chicago, from the well-known herd of Thomas B. Wales and Edgar Huidekoper, I purchased two imported heifers, one with a promising bull calf; the other having since given us another fine bull calf. These calves were sired by very noted bulls. The dams I count good specimens of the breed. The prices paid were unexpectedly small.

Among Hereford breeders no one manifested more interest in the matter of the University receiving desirable specimens than did G. W. Henry, Esq., of Chicago, proprietor of the Rossland herd, at Ashkum, Ill. A finely-bred and excellent imported young cow with bull calf was purchased from him, and Mr. Henry, as will be seen by accompanying letter, proposes presenting the University another young cow, bred to one of his fine young bulls.

At the public sale last month of Short-horn cattle belonging to T. W. Harvey, Esq., of Chicago, I purchased a very finely bred—nearly pure Bates—young cow with bull calf; and at the sale of S. E. Prather, Esq., of Springfield, Ill., last week, I purchased a yearling Short-horn heifer of good pedigree and quality.

The Short-horn cattle catalogued for public sale on Friday next include 23 cows, 10 of them with young calves, and 5 young bulls. They are in good health and condition.

There are many indications of interest in the trial of ditching machines on the University farms, on Thursday and Friday next, under the auspices of the State Board of Agriculture, for which we have made such arrangements as seemed practicable.

Respectfully submitted.

G. E. MORROW.

REPORT OF DR. McINTOSH.

UNIVERSITY OF ILLINOIS, June 3, 1886.

Dr. S. H. Peabody, Regent:

SIR: I have the honor to submit the following report of my work in Veterinary Science during the winter and spring terms now drawn to a close.

Although the class was not large, it was composed of young farmers who exhibited great interest in the subject, and passed good examinations in Veterinary Science and Materia Medica. The excellent instruction which they had received from Professor Rolph, in the fall term, in Animal Anatomy and Physiology, had given a good foundation for the study of Veterinary Science. The lectures of Prof. Morrow on the breeding and management of farm stock enabled them better to understand the transmission of hereditary diseases. If I may judge from the letters of inquiry received from young men in the State, we shall have a large class at the opening of the fall term.

I have also to report a successful series of clinics, in which the neighboring farmers and the inhabitants of adjoining cities have accepted the opportunity offered by the University to have their domestic animals operated on, or prescribed for, free of charge. The clinics have been well attended, and have been of much service to the students. The list appended does not include cases examined for which no treatment seemed needful. Other cases in the neighborhood were visited by the students with me, and operations of castration upon animals at the University farm were performed in their presence.

CLINIC CASES.

Abscess of shoulder	6
Bone spavin	5
Bog spavin	6
Diseases of teeth	4
Diseases of eye	6
Diseases of bone	2
Enlarged glands of neck	4
Fistula of neck	3
Fistula of face	4
Fractures of face (bones)	1
Heel disease (grease)	4
Heart disease (chronic)	2
Lymphingitis (swollen legs)	6
Laryngitis (inflammation of throat)	5
Lameness of various kinds	15
Lung disease (chronic)	4
Out of condition (from various causes)	16
Ring-bone	4
Skin diseases	5
Tumors (fungus)	6
Tumors (fibrous)	4
Wounds (chronic)	7
Wounds (fresh)	6
Total	125

Respectfully submitted,

D. McINTOSH, V. S.

The report of Prof. Morrow was referred to the Farm Committee.

The Regent's request in regard to steps of Chemical Building was referred to Committee on Buildings and Grounds.

The following appointments of Professors and Instructors were made for the ensuing academic year:

	Salary Per Annum.
T. J. Burrill, Professor of Botany and Horticulture	$2,000
S. W. Shattuck, Professor of Mathematics	2,000
Edward Snyder, Professor of Modern Languages	2,000
J. C. Pickard, Professor of English Language and Literature	2,000
N. C. Ricker, Professor of Architecture	2,000
J. D. Crawford, Professor of History and Ancient Languages	2,000
G. E. Morrow, Professor of Agriculture	2,000
P. Roos, Professor of Industrial Art and Designing	1,700
I. O. Baker, Professor of Civil Engineering	1,800
Wm. McMurtrie, Professor of Chemistry and Mineralogy	2,000
S. A. Forbes, Professor of Entomology and Zoölogy	1,160
T. B. Comstock, Professor of Mining Engineering	1,800
J. H. Brownlee, Professor of Rhetoric and Oratory	1,800
C. W. Rolfe, Professor of Geology	1,500
A. T. Woods, Assistant Professor of Mechanical Engineering	400
D. McIntosh, Professor of Veterinary Science	1,800
E. A. Kimball, Instructor in Iron work and Foreman	1,500
G. W. Parker, Instructor in Woodwork and Foreman	960
N. Butler, Jr., Professor of Latin	1,500
H. B. Gregory, Instructor in Modern Languages	600
S. W. Strattan, Instructor in Mathematics	600
Kittie M. Baker, teacher of Vocal and Instrumental Music, with fees for salary.	
A. W. Palmer, First Assistant in Chemical Laboratory	700
D. H. Barrett, Second Assistant in Chemical Laboratory	400
W. H. Garman, Assistant in Zoölogical Laboratory	840
T. F. Hunt, Assistant in Agriculture	960
S. W. Shattuck, Business Agent	300
H. Taylor, Assistant in Drawing	250
A. B. Baker, Janitor	840

The Board adjouned to 9:30 P. M.

EVENING SESSION.

The Board met as by adjournment.

Present—Trustees Bennett, Cobb, Earle, Eisenmayer, McLean, Millard, and Pearman.

Treasurer J. W. Bunn read his report, as follows:

UNIVERSITY OF ILLINOIS,

To John W. Bunn, Treasurer, Dr.

1886.				
Feb.	27	To am't paid on acc't Board expense	$153 51	
"		" " " Salaries	10,408 54	
"		" " " Buildings and grounds	97 20	
"		" " " Fuel and lights	242 40	
"		" " " Stationery and printing	120 90	
"		" " " Preparatory year	360 00	
"		" " " Nebraska lands	202 83	
"		" " " Mechanical department	243 55	
"		" " " Architectural department	204 98	
"		" " " Agricultural department	1,187 68	
"		" " " Horticultural department	339 59	
"		" " " Chemical department	131 78	
"		" " " Military department	51 42	
"		" " " Library and apparatus	7 85	
"		" " " Incidental expense	79 75	
"				$13,831 98
"		" " " Griggs farm	$10 09	
"		" " " Agricultural lectures	32 44	
"		" " " New Orleans Exposition	233 65	
"		" " " Taxes on lots east of University	18 47	
"		" " " Furnishing Zoölogical Laboratory	50	
"		" " " Furniture and fixtures	25	
"		" " " Music fees	97 00	
"				392 31
Feb.	27	To am't paid on acc't Buildings and grounds	$115 80	
"		" " " Laboratories	396 98	
"		" " " Mechanical and architectural shops	349 35	
"		" " " Books and publications	168 63	
"		" " " Cabinets	807 98	
"		" " " State laboratory of Natural History	1,704 60	
				3,543 36
		To balance		293 98
				$18,061 63

UNIVERSITY OF ILLINOIS,

To John W. Bunn, Treasurer, Cr.

1886.				
March	1	By balance		$12,376 46
"	31	By am't rec'd on acc't University fees	$1,012 50	
"		" " " Preparatory year	250 00	
"		" " " Griggs farm	125 00	
				1,387 50
April	16	By am't rec'd from State for State Lab. of Nat. History—		
		For improvement of library	$250 00	
		For field work	150 00	
		For traveling and office expenses	150 00	
		For Entomologist and assistants	250 00	
		For botanical assistants	250 00	
				1,050 00
May	1	By interest on Sangamon county school bonds		390 00
May	29	" " Land contract No. 6, T. A. Woodward		125 60
				$15,329 56
May	31	By am't rec'd on acc't University fees	$1,087 50	
"		" " " Preparatory year	205 46	
"		" " " Buildings and grounds	61 00	
"		" " " Mechanical department	60 00	
"		" " " Architectural department	76 31	
"		" " " Agricultural department	616 30	
"		" " " Horticultural department	228 50	
"		" " " Laboratories	150 00	
"		" " " Music fees	97 00	
"		" " " Leib note	150 00	
				2,732 07
				$18,061 63

JOHN W. BUNN, *Treasurer.*

URBANA, June 8, 1886.

The Business Agent then presented the following statement of expenditures from State and current funds for the past three months, with vouchers:

Of July 1, 1885.	Appropriated.	Received.	Expended	Balance.
Taxes on land, ½ per annum	$4,000 00	$1,766 28	$1,766 28	....
Buildings and grounds, ½ per annum	6,000 00	3,000 00	3,000 00	....
Laboratories, ½ per annum	3,000 00	1,500 00	796 55	$703 45
Mech. and Arch. shops, ½ per annum	3,000 00	1,500 00	1,207 50	392 50
Books and publications, ½ per annum	3,000 00	1,500 00	1,202 75	297 25
Cabinets, ½ per annum	2,000 00	1,000 00	641 89	358 11
Current expense of instruction, ½ per annum	24,000 00	12,000 00	12,000 00	....
Machines and tools, ½ per annum	4,000 00	2,000 00	1,992 30	7 70
Fire walls and ventilation	4,500 00	4,500 00	2,129 70	2,370 30
Laboratory of Natural History	18,000 00	7,210 65	5,362 16	1,848 49
	$71,500 00	$35,976 93	$30,099 13	$5,877 80

Current Appropriations.

September 9, 1885—February 28, 1886.	Appropriated.	Receipts also appropriated	Expended.	Balance.
Board expense	$300 00	....	$153 51	$146 49
Salaries for instruction	18,385 00	....	9,535 96	8,849 04
Salaries for services	1,215 00	....	872 58	342 42
Buildings and grounds	300 00	$61 00	97 20	263 80
Fuel and lights	1,000 00	....	242 40	757 60
Stationery and printing	600 00	....	120 90	479 10
Nebraska lands	265 33	....	202 83	62 50
Mechanical Department	300 00	60 00	243 55	116 45
Architectural Department	300 00	76 31	204 98	171 33
Agricultural Department	600 00	616 30	1,187 68	28 62
Horticultural Department	300 00	228 50	330 59	188 91
Military Department	68 00	....	51 42	16 58
Laboratories Department	300 00	150 00	131 78	318 22
Library and apparatus	50 00	....	7 85	42 15
Incidental expense	244 25	....	79 75	164 50
Sundries:				
Gymnasium	15 00	....	....	15 00
Cases, etc., Zoölogical Laboratory	274 51	....	50	274 01
Farmers' Institutes	50 00	....	32 44	17 56
New Orleans Exposition	250 00	....	233 65	16 35
Drawings, Architectural Department	74 50	....	....	74 50
Furniture and fixtures	50 00	....	25	49 75
Griggs Farm	....	125 00	10 00	115 00
Taxes of lots east of Chemical Laboratory	25 00	....	18 47	6 53
Publications of bulletin, etc	150 25	....	....	150 25
Music fees	....	97 00	97 00	....
Preparatory year fees	....	455 46	360 00	95 46
University students' fees	....	2,100 00	....	....

The reports of the Treasurer and Business Agent were referred to the Auditing Committee.

The Regent was authorized to purchase machinery and tools for the University shops, not to exceed the appropriation made by the State.

The Committee appointed last year to expend the State appropriation for fire-walls and ventilation were continued with power to act.

The following appropriations were made on recommendation of the Regent:

$63 05 for shutters in Drawing Room.
125 00 for repairs of veranda floor.
50 00 for railing in Library.
100 00 for repair of gradener's house.
150 00 for additonal room for Botanical Library.
100 00 for shutters in Zoölogical Laboratory.
154 76 for microscopes for cabinets.
180 00 for Herbarium and specimens.
125 00 for Microscopic Objective for Botanical Laboratory.
450 00 for apparatus for Electric Measurements,
50 00 for collection of architectural drawings and photographs.
55 00 for cases for same.
110 00 for fitting Drill Hall for Commencement exercises.

A letter from Minnesota in regard to University lands was referred to the Regent, with power to act.

The Regent was authorized to investigate, in his discretion, the condition of the University lands in Minnesota, and $100 was appropriated for his expenses. He was also authorized to have the patents recorded, if deemed desirable, and $50 was appropriated for the purpose. The Treasurer was directed to deliver the patents to the Regent for recording.

Trustee McLean offered the following resolution, which was adopted:

Resolved, That the President and Secretary be directed to draw their requisition upon the State Auditor for the several sums of money appropriated by the General Assembly for the use of the State Laboratory of Natural History and the State Entomologist's office for the quarter ending September 30, 1886.

For field work and incidental expense of the Laboratory, the sum of one hundred and fifty dollars.

For the traveling, office and incidental expenses of the Entomologist, the sum of one hundred and fifty dollars.

For improvement of the Library, the sum of two hundred and fifty dollars.

For the pay of the Entomological assistant, the sum of two hundred and fifty dollars.

For the pay of the Botanical assistant, the sum of two hundred and fifty dollars.

For miscellaneous assistance, the sum of two hundred and fifty dollars.

For the publication of bulletins, the sum of seventy-five dollars.

On motion of Trustee McLean, the President and Recording Secretary were directed to draw their requisition upon the State Auditor for the State appropriation due July 1, 1886, for the ensuing year.

The Board then adjourned to Wednesday, June 9, 1886, at 10 A. M.

SECOND DAY'S SESSION.

The Board assembled at 10 o'clock A. M.

Present: Trustees Bennett, Cobb, Earle, Eisenmayer, McLean,, Millard, and Pearman.

The Board took a recess until 3 P. M., to attend commencement exercises.

AFTERNOON SESSION.

The Board reassembled at the hour appointed.

The Regent's account of traveling expenses to Washington, amounting to $64.30, was audited and ordered to be paid.

Prof. Forbes was authorized to employ Mr. C. Weed from July 1, at a salary not to exceed $50 per month.

The Committee on Buildings and Grounds made the following report, which was adopted, and its recommendations concurred in:

To the President of Board of Trustees, University of Illinois:

The undersigned, to whom was referred the matter of change of stairs on Laboratory building, would respectfully report that we have examined the building, and the plans and specifications of the proposed change, and recommend that the stairs on south end of building be taken down and erected on west side, immediately in front of and over the large double door on west side of building, and landing on second floor through the window immediately over said large doorway; that the stairs be built according to the plans submitted to your committee; and the place from whence the stairs were taken be finished as a balcony, so as not to deface the building. We further recommend that the grading around the building be removed from the walls and asphalt and cinders be placed against the walls as requested by the Regent in his report. We recommend that an appropriation of $500 be made to complete these improvements.

ALEX McLEAN,
GEO. C. EISENMAYER.

The Farm Committee made the following report which was accepted and its recommendations approved:

To the Board of Trustees of the University of Illinois:

GENTLEMEN: Your Farm Committee to whom was referred the report of Prof. Morrow, together with a communication from Mr. George M. Henry, would respectfully recommend that the same be received, and that the sum of $1,600 be appropriated for the Hereford and Holstein purchase, and for the purchase of eighteen head of grade cattle for feeding, and that Prof. Morrow be requested to reply to the communication of Mr. Henry in appropriate form.

J. T. PEARMAN.
PARKER EARLE,

Six hundred dollars were appropriated for advertising, to be expended under the direction of the Regent.

The Auditing Committee submitted the following report:

To the Board of Trustees of the University of Illinois:

We, the undersigned, your Auditing Committee, hereby report that we found all accounts submitted by the Business Agent in proper form and duly receipted from number 501 to 750, inclusive, and recommend that the same be approved. We also examined the report of J. W. Bunn, Treasurer, and found his report correct, and recommend the approval of the same by the Board.

GEO. C. EISENMAYER.
C. BENNETT,

The report was received and approved.

Mr. McLean offered the following resolution which was adopted:

Resolved, That the Regent, at his discretion, may give leave of absence to any professor who shall apply to be absent from the University during vacation.

The Board was informed that the detail of Second Lieutenant Charles McClure, 18th Inft. U. S. A., to be Instructor in Military Tactics at this University for three years, will expire on the 1st of July next, and that he is under orders then to rejoin his regiment.

Whereupon, on motion of Mr. McLean, the following resolution was adopted unanimously:

Resolved, That this Board desires especially to thank Lieutenant Charles McClure for the efficient manner in which he has discharged the important and delicate duties entrusted to him while he has been a Professor of this University; and to express the hope that his merits as a gentleman and a soldier may ever receive the recognition and reward which they richly deserve.

On motion, the Secretary was instructed to transmit a copy of the above resolution to Lieutenant McClure and the Secretary of War.

Adjourned.

S. M. MILLARD,
President.

E. SNYDER,
Secretary.

List of Warrants Fiscal Year 1884-85.

No.	Date.	To Whom.	For What.	Amount.
	1884			
1	Sept 15	Alex McLean	Expenses to meeting	$17 20
2	" 15	Parker Earle	" "	12 00
3	" 15	R. N. Paden	" "	19 00
4	" 15	J. T. Pearman	" "	12 00
5	" 15	Chas. Bennett	" "	18 00
6	" 15	E. Snyder	" "	10 65
7	" 15	S. W. Shattuck	" "	11 40
8	" 15	Thomas Kerr	Mason work	11 60
9	" 15	W. W. Davis	Sand	4 50
10	" 15	Jansen, McClurg & Co	Books	88 73
11	" 15	Fuller & Fuller	Glass	7 05
12	" 15	Fred Pell	Draining	30 00
13	" 15	J. W. Shuck	Barb-wire and nails	40 91
14	" 15	Burnham, Trevett & Mattis	Expense in land sales	82 66
15	" 15	Western Electric Co	Battery and materials	2 77
16	" 15	Springfield Journal	Advertising	6 00
17	" 15	Y. M. C. A	"	2 50
18	" 15	W. F. Storey	"	60 00
19	" 15	I. B. & W. R. W	Freight	12 83
20	" 15	S. W. Adams	Tubing	42 29
21	" 30	S. H. Peabody	Salary, September, 1884	250 00
22	" 30	T. J. Burrill	" "	166 66
23	" 30	S. W. Shattuck	" "	166 66
24	" 30	E. Snyder	" "	166 66
25	" 30	J. C. Pickard	" "	166 66
26	" 30	N. C. Ricker	" "	166 66
27	" 30	J. D. Crawford	" "	166 66
28	" 30	G. E. Morrow	" "	166 66
29	" 30	P. Roos	" "	133 33
30	" 30	F. L. Prentice	" "	150 00
31	" 30	I. O. Baker	" "	150 00
32	" 30	Wm. McMurtrie	" "	166 66
33	" 30	J. Sondericker	" "	90 00
34	" 30	C. W. Rolfe	" "	100 00
35	" 30	A. T. Woods	" "	40 00
36	" 30	E. A. Kimble	" "	125 00
37	" 30	G. W. Parker	" "	80 00
38	" 30	E. M. Hall	" "	100 00
39	" 30	M. E. Darrow	" "	60 00
40	" 30	H. Slawson	" "	50 00
41	" 30	A. B. Baker	" "	70 00
42	" 30	G. Klingenspor	" "	50 00
43	" 30	Agricultural Department	Expenses "	460 76
44	Oct. 15	Grace Peabody	Salary "	14 50
45	" 15	W. A. Baker	Work in bin and firing	34 50
46	" 15	H. E. Parker	" Acchitectural shop	2 08
47	" 15	Central Union Telephone Co	Instrument, 3 months	15 00
48	" 15	L. Hoarn	Work on grounds	4 42
49	" 15	Illinois Central Railroad	Adv. freight charges	9 19
50	" 15	C. Wroten	Shingling barn	3 00
51	" 15	E. Snyder	23 volumes bd. of Nation	23 00
52	" 15	R. R. Donnelly & Sons	Electrotypes	3 50
53	" 15	C. & U. Gaslight Co	Lights to October, 1884	20 00
54	" 15	C. J. Sabin	Pipe, etc	11 56
55	" 15	J. B. Claw & Sons	Valves and cocks	16 18
56	" 15	Walden & Stove	Advertising	8 00
57	" 15	Illinois State Register	"	7 00
58	" 15	Eaton Bros	Printing	3 50
59	" 15	Wm. Lim	200 Testaments for chapel	10 00
60	" 15	F. P. Elliott & Co	Envelopes	8 12
61	" 15	Champaign Mfg. Co	Maple plank	16 90
62	" 15	Du Quoin Mining Co	One car coal	18 75
63	" 15	L. M. Hull	Work on grounds and copying	11 38
64	" 15	Fuller & Fuller	Glass	13 13

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1884			
65	Oct. 15	Horticultural Department	Expenses, September, 1884	$53 45
66	" 15	Jansen, McClurg & Co	Books	6 22
67	" 15	Carl Schoenhof	"	4 05
68	" 15	Ames Mfg. Co	Lathe fixture	16 50
69	" 15	Peoria Pottery Co	One bbl. clay	5 00
70	" 15	J. A. Fay & Co	Lathes and counters	163 20
71	" 15	S. W. Adams	Pump and boiler	585 00
72	" 15	Students' labor pay roll	September, 1884	169 08
73	" 15	Rudolph Birkholz	Painting and glazing	25 50
74	" 15	Wm. Price	Paper	2 28
75	" 15	Pay roll of workmen	On grounds, September, 1884	30 63
76	" 31	S. H. Peabody	Salary, October, 1884	250 00
77	" 31	T. J. Burrill	" "	166 66
78	" 31	S. W. Shattuck	" "	166 66
79	" 31	E. Snyder	" "	166 66
80	" 31	J. C. Pickard	" "	166 66
81	" 31	N. C. Ricker	" "	166 66
82	" 31	J. D. Crawford	" "	166 66
83	" 31	G. E. Morrow	" "	166 66
84	" 31	F. W. Prentice	" "	150 00
85	" 31	P. Roos	" "	133 33
86	" 31	I. O. Baker	" "	150 00
87	" 31	Wm. McMurtrie	" "	166 66
88	" 31	J. Sondericker	" "	90 00
89	" 31	C. W. Rolfe	" "	100 00
90	" 31	A. T. Woods	" "	40 00
91	" 31	E. A. Kimball	" "	125 00
92	" 31	G. W. Parker	" "	80 00
93	" 31	E. M. Hall	" "	100 00
94	" 31	M. E. Darrow	" "	60 00
95	" 31	H. Slausson	" "	50 00
96	" 31	A. B. Baker	" "	70 00
97	" 31	G. Klingenspor	" "	50 00
98	Nov. 15	W. McGregor & Co	Pulleys and shafts	42 22
99	" 15	W. T. Pratt	Roof repair	22 90
100	" 15	W. A. Baker	Firing and work on grounds	29 88
101	" 15	Pay roll of workmen, etc	Work, October, 1884	17 98
102	" 15	Brown & Co	Book	5 50
103	" 15	H. E. Parker	Work in shops	3 20
104	" 15	Anton Iten	9 1/10 days' work on grounds	11 37
105	" 15	H. H Martin	Fireman's salary, ½ month	20 00
106	" 15	Grace Peabody	Salary October, 1884	14 87
107	" 15	Christ Singbush	4 days' work on flower beds	5 00
108	" 15	Rudolph Birkholz	Glazing and whitewashing	7 40
109	" 15	Lyon & Healy	Repairs of band instruments	9 20
110	" 15	Ayres & Wilson	Wrench	1 50
111	" 15	Students' labor pay roll	For October, 1884	174 04
112	" 29	S. H. Peabody	" " "	250 00
113	" 29	T. J. Burrill	" " "	166 66
114	" 29	S. W. Shattuck	" " "	166 66
115	" 29	E. Snyder	" " "	166 66
116	" 29	J. C. Pickard	" " "	166 66
117	" 29	W. C. Ricker	" " "	166 66
118	" 29	J. D. Crawford	" " "	166 66
119	" 29	G. E. Morrow	" " "	166 66
120	" 29	F. W. Prentice	" " "	150 00
121	" 29	P. Roos	" " "	133 33
122	" 29	I. O. Baker	" " "	150 00
123	" 29	Wm. McMurtrie	" " "	166 66
124	" 29	J. Sondericker	" " "	90 00
125	" 29	C. W. Rolfe	" " "	100 00
126	" 29	A. T. Woods	" " "	40 00
127	" 29	E. A. Kimball	" " "	125 00
128	" 29	G. W Parker	" " "	80 00
129	" 29	E. M. Hall	" " "	100 00
130	" 29	M. E. Darrow	" " "	60 00
131	" 29	H. Slauson	" " "	50 00
132	" 29	A. B. Baker	" " "	70 00
133	" 29	G. Klingenspor	" " "	50 00
134	" 29	Agricultural Department	Farm expenses, October, 1884	584 30
135	" 29	" "	Farm expenses, November, 1884	339 05
136	" 29	S. W. Shattuck	Salary Business Agent 3 months	75 00
137	" 29	Miss Kittie M. Baker	Salary Organist for term 1884	50 00
138	" 29	A. J. Stoneburner	Wages fireman 2 days	3 00
139	" 29	Grace Peabody	Salary November, 1884	13 00
140	" 29	A. Iten	Work on grounds, etc	5 67
141	" 29	H. H. Martin	Fireman's wages 26 days at $40 per mo	34 70

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1884.			
142	Nov. 29....	W. T. Pratt	Roof repair	$2 00
143	" 29....	A. B. Baker	Pay roll of women cleaning building	65 00
144	" 29....	Horticultural Department	Expenses November, 1884	3 55
145	" 29....	Champaign Tile Co	Tile	5 67
146	" 29....	A. G. Spaulding & Co	Fixtures for gymnasium	29 32
147	" 29....	Rudolf Birkholz	Painting and glazing	9 20
148	" 29....	Pleasant Vance	Boring well	32 65
149	" 29....	Peter Roos	Petty expenses	2 10
150	" 29....	I., B. & W. Railway	Freight	20 16
151	" 29....	D. Weeks	Black walnut lumber	121 72
152	" 20....	H. E. Parker	Work in shop	3 40
153	" 29....	American Express Co	Charges	5 40
154	" 29....	T. W. Bicknell	Periodicals	4 00
155	" 29....	Am. Philological Asso'tion	Books	3 00
156	" 29....	L. R. Hamersly & Co	Periodicals	3 00
157	" 29....	Tice & Lynch	Freight and duties	4 70
158	" 29....	C. and U. Gaslight Co	Lights October and November, 1884	54 00
159	" 29....	Abendroth & Root Mfg. Co	Boiler tubes	163 31
160	" 29....	Wm. Price	Paints	6 80
161	" 29....	Peterson & Lloyde	Sundries	5 65
162	" 29....	Illinois School Journal	Advertising	12 50
163	" 29....	Jansen, McClurg & Co	Books	11 88
164	" 29....	Johns Hopkins University	"	11 50
165	" 29....	George F. Kimball	Window glass	3 06
166	" 29....	M. E. Laphan	Lumber	26 84
167	" 29....	Champaign County Gazette	Printing and binding	129 99
168	" 29....	Thos. Wright & Sons	Castings	31 79
169	" 29....	Trevett Bros	Hardware	25 91
170	" 29....	Trevett & Green	Hardware and plumbing	80 02
171	" 29....	Crane Bros. Mfg. Co	Pipes and fittings	49 10
172	" 29....	Robinson & Burr	Forging and machine work	20 75
173	" 29....	S. W. Adams	Pump and boiler	285 53
174	" 29....	H. Swannell	Chemicals and sundries	15 06
175	" 29....	Students' labor pay roll	November, 1884	319 77
176	" 29....	Jno. N. Hickox	Publications	1 00
177	" 29....	F. Alfred Reichardt & Co	Chemicals and apparatus	500 61
178	" 29....	Kittie M. Baker	Music fees collected fall term 1884	113 00
179	" 29....	E. N. McAllister	Postage 3 months	27 05
180	Dec. 31....	S. M. Millard	Expense to Board meeting	20 93
181	" 31....	G. A. Follansbee	" " "	13 33
182	" 31....	Alexander McLean	" " "	26 90
183	" 31....	Chas. Bennett	" " "	5 00
184	" 31....	A. G. Manns	Salary Assistant Chemist Laboratory	10 00
185	" 31....	Clark Rush	115½ hr. work in shop	28 87
186	" 31....	F. Alfred Ruchardt & Co	Chemicals and apparatus	35 92
187	" 31....	Powner. Ackerman & Co	Advertising	10 00
188	" 31....	Abendroth & Root Mfg. Co	Sectional boiler tubes	100 00
189	" 31....	J. Bacon	7160 pounds coal	12 90
190	" 31....	Frank G. Jaques	Tile and hauling	32 00
191	" 31....	W. A. Baker	Work	14 40
192	" 31....	American Express Co	Charges	3 00
193	" 31....	J. A. Fay & Co	Belting	25 67
194	" 31....	J. O. Baker	Petty expenses	3 62
195	" 31....	I. B. & W. R. R	Freights	9 34
196	" 31....	S. H. Peabody	Salary, December, 1884	250 00
197	" 31....	T. J. Burrill	" "	166 66
198	" 31....	S. W. Shattuck	" "	166 66
199	" 31....	E. Snyder	" "	166 66
200	" 31....	J. C. Pickard	" "	166 66
201	" 31....	N. C. Ricker	" "	166 66
202	" 31....	J. D, Crawford	" "	166 66
203	" 31....	G. E. Morrow	" "	166 66
204	" 31....	F. W. Prentice	" "	150 00
205	" 31....	P. Roos	" "	133 33
206	" 31....	I. P. Baker	" "	150 00
207	" 31....	Wm. McMurtrie	" "	166 66
208	" 31....	J. Sondericker	" "	90 00
209	" 31....	C. W. Rolf	" "	100 00
210	" 31....	A. T. Woods	" "	40 00
211	" 31....	E. A. Kimball	" "	125 00
212	" 31....	G. W. Parker	" "	80 00
213	" 31....	E. M. Hall	" "	100 00
214	" 31....	M. E. Darrow	" "	60 00
215	" 31....	H. Slanson	" "	50 00
216	" 31....	A. B. Baker	" "	70 00
217	" 31....	G. Klingenspor	" "	50 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
218	Jan. 15	Trevett & Green	Pipe and plumbing	$618 33
219	" 31	Bausch & Lamb Opt. Co.	Microscopes	114 38
220	" 31	Mechanical department	Lathes	37 98
221	" 31	Credit Archl. department	Work and material	125 42
222	" 31	Agricultural department	Farm expenses, December, 1884	344 41
223	" 31	Horticultural department	" " "	25 75
224	" 31	Students' pay roll	Labor, December, 1884	204 95
225	" 31	H. G. Peterson	Services band leader, fall term, 1884	15 00
226	" 31	Grace Peabody	Salary, December, 1884	13 88
227	" 31	A. J. Stoneburner	" "	55 00
228	" 31	P. H. Postell	Expense to December Board Meeting	16 35
229	" 31	A. Price	Hack work	2 00
230	" 31	James L. Bennett	Trimming grapes	3 67
231	" 31	J. Bacon	4000 pounds coal	7 20
232	" 31	Peoria Pottery Co.	Flower pots	33 62
233	" 31	C. J. Sabin	3000 pounds coal	6 00
234	" 31	Central Union Tel. Co.	First qr., 1885	15 00
235	" 31	J. W. Wilske	Mason work	1 40
236	" 31	Fuller & Fuller	Glass	11 50
237	" 31	Wm. Leary	Work on sewer	4 05
238	" 31	G. R. Shuck	Hardware	18 79
239	" 31	Cameron, Amberg & Co.	Printing	4 50
240	" 31	J. Wallis Smith	Map	5 00
241	" 31	Anton Iten	Work, 32 hours	4 00
242	" 31	Rudolph Birkholz	Glazing	4 20
243	" 31	John Tierney	Work, 3[8]/10 days at $2.25	8 55
244	" 31	John F. Creek	Carpenter work	38 24
245	" 31	H. E. Parker	Work, 75 hours at 8 cents	6 00
246	" 31	L. C. Carran & Co.	Machine oil	18 59
247	" 31	G. F. Kimball	Glass	42 23
248	" 31	Fauth & Co.	Artificial horizon	25 00
249	" 31	DuQuoin Coal Co.	Car coal	18 75
250	" 31	James W. Queen & Co	Apparatus	21 83
251	" 31	S. H. Peabody	Salary, January, 1885	250 00
252	" 31	T. J. Burrill	" "	166 66
253	" 34	S. W. Shattuck	" "	166 66
254	" 31	E. Snyder	" "	166 66
255	" 31	J. C. Pickard	" "	166 66
256	" 31	N. C. Ricker	" "	166 66
257	" 31	J. D. Crawford	" "	166 66
258	" 31	G. E. Morrow	" "	166 66
259	" 31	F. W. Prentice	" "	150 00
260	" 31	P. Roos	" "	133 33
261	" 31	I. O. Baker	" "	150 00
262	" 31	Wm. McMurtrie	" "	166 66
263	" 31	S. A. Forbes	" "	166 66
264	" 31	J. Sondericker	" "	90 00
265	" 31	C. W. Rolfe	" "	100 00
266	" 31	A. T. Woods	" "	40 00
267	" 31	E. A. Kimball	" "	125 00
268	" 31	G. W. Parker	" "	80 00
269	" 31	E. M. Hall	" "	100 00
270	" 31	M. E. Darrow	" "	60 00
271	" 31	H. Slauson	" "	50 00
272	" 31	A. B. Baker	" "	70 00
273	" 31	G. Klingenspor	" "	50 00
274	" 31	Champ. & Urbana Gas Co.	Lights, December, 1884	44 00
275	" 31	Jas. B. Clow & Son	Pipes and values	31 15
276	" 31	N. A. Williams	Sewer pipe	10 10
277	" 31	L. Y. Manspeaker	Sundries,	8 37
278	" 31	D. H. Lloyde & Son.	Stationery and band music	10 55
279	" 31	Walker & Mulliken	Lumber and packing	16 50
280	Feb. 16	Student L. pay roll	Labor, January, 1885	243 45
281	" 16	A. J. Stoneburner	Salary " "	55 00
282	" 15	Grace Peabody	" " "	13 12
283	" 16	John Tierney	Work in shops 231½ hours at 22½c.	52 08
284	" 16	R. Birkholz	Painting	18 20
285	" 16	W. A. Baker	Firing and painting	25 10
286	" 16	A. Iten	Work, on sewer 83 hours	12 45
287	" 16	Agricultural department	Farm expenses, January, 1885	221 30
288	" 16	Horticultural department	" " " "	12 95
289	" 16	A. B. Baker	Paid women for scrub. and cleaning	26 25
290	" 16	C. W. Anderson	Repairs on furnace	4 00
291	" 16	F. Alfred Reichart & Co.	Chemicals	19 78
292	" 16	Zell, Schnaber & Co.	Two barrels alcohol	45 00
293	" 16	I., B. & W. R. R. Co.	Freight	5 81

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
294	Feb. 16....	H. E. Parker	Work, 62 hours @ 8c	$5 00
295	" 16....	Fritz Finder	Drayage	2 25
296	" 16....	Lyon & Healy	Rapair of band instrument	5 50
297	" 16....	The Illini	Printing, etc	45 65
298	" 16....	Yale & Towne Mfg. Co	Locks	2 55
299	" 16....	F. K. Robeson & Bros	Toweling and sundries	5 92
300	" 16....	Champaign Mfg. Co	Ash and maple lumber	8 92
301	" 28....	S. H. Peabody	Salary, February, 1885	250 00
302	" 28....	T. J. Burrill	" "	166 66
303	" 28....	S. W. Shattuck	" "	166 66
304	" 28....	E. Snyder	" "	166 66
305	" 28....	J. C. Pickard	" "	166 66
306	" 28....	N. C. Ricker	" "	166 66
307	" 28....	J. D. Crawford	" "	166 66
308	" 28....	G. E. Morrow	" "	166 66
309	" 28....	F. W. Prentice	" "	150 00
310	" 28....	P. Roos	" "	133 33
311	" 28....	I. O. Baker	" "	150 00
312	" 28....	Wm. McMurtrie	" "	166 66
313	" 28....	S. A. Forbes	" "	166 66
314	" 28....	J. Sondericker	" "	90 00
315	" 28....	C. W. Rolfe	" "	100 00
316	" 28....	A. T. Woods	" "	40 00
317	" 28....	E. A. Kimball	" "	125 00
318	" 28....	G. W. Parker	" "	80 00
319	" 28....	E. M. Hall	" "	100 00
320	" 28....	M. E. Darrow	" "	60 00
321	" 28....	H. Slauson	" "	50 00
322	" 28....	A. B. Baker	" "	70 00
323	" 28....	G. Klingenspor		50 00
324	" 28....	Kittie M. Baker	Services organist, winter term, 1885	50 00
325	" 28....	S. W. Shattuck	Business Agent, 3 mos. ending Feb. 28.	75 00
326	" 28....	Fuller & Fuller	Mercury and hard oil	21 28
327	" 28....	J. B. Mayo & Co	Chronometer	134 50
328	" 28....	Publishers Weekly Co	Am. Catalogue	10 00
329	" 28....	Jansen, McClurg & Co	Books	19 03
330	" 28....	A. H. Roffe & Co	Periodicals	204 50
331	" 28....	S. W. Adams	Fittings	85 58
332	" 28....	E. H. Sargent & Co	Glass and corks	19 05
333	" 28....	Wm. Price	Window glass	4 00
334	" 28....	Larrabee & North	Tools and hardware	1 25
335	" 28....	Enterprise Coal Co	Twelve cars coal	225 50
336	" 28....	J. H. Sanders & Co	Advertising	42 00
337	" 28....	W. C. Vittum	Crocks and jars	9 40
338	" 28....	C. & U. Gas Co	Lights, January, 1885	60 00
339	" 28....	Henry & Kariher	Oil, turpentine and sundries	33 51
340	" 28....	Besore Bros	Lumber	143 29
341	" 28....	Besore Bros	Lumber	16 22
342	" 28....	A. M. Scott	Tile	4 52
343	" 28....	W. C. Vittum	Lamps	2 90
344	" 28....	Illinois Central R. R	Advanced freights	4 02
345	" 28....	J. Hamilton & Co	Lumber	38 74
346	" 28....	E. S. Sargent & Co	Chemicals	3 60
347	" 28....	J. McCann & Bros	Brooms	3 30
348	" 28....	E. N. McAllister	Postage, 3 months	39 50
349	" 28....	Champaign Co. Gazette	Printing, etc	64 00
350	" 28....	Credit to Ill. C. R.R. donation	Freight for 6 months	1,050 75
351	" 28....	A. J. Stoneburner	Salary, Feb., 1885	55 00
352	" 28....	W. A. Baker	21 nights firing @ $2	42 00
353	" 28....	Horace Taylor	Services as teacher, Jan. and Feb., 1885	43 75
354	" 28....	Grace Peabody	Salary, Feb., 1885	13 25
355	" 28....	Illini	Printing and advertising	26 16
356	" 28....	A. P. Cunningham	Ink and sponges	2 30
357	" 28....	Agricultural Department	Farm expense, Feb., 1885	478 70
358	" 28....	Horticultural Department	Expense, Feb., 1885	11 25
359	" 28....	Burnham, Trevett & Mattis	Services in sales Nebraska lands	65 89
360	" 28....	E. H. Sargent & Co	Chemicals	2 00
361	" 28....	G. C. Willis	Towels, etc	14 94
362	" 28....	D. H. Lloyde & Son	Stationery and piano rent	9 15
363	" 28....	Pay-roll of women	Cleaning building	7 00
364	" 28....	John Tierney	Work, 200 hours @ 22½c	45 00
365	" 28....	Ernest Welshly	Turning	3 00
366	" 28....	M. E. Lapham	Flooring	30 50
367	" 28....	I. B. & W. R. R	Freight	5 06
368	" 28....	H. E. Parker	Work in shop	4 36
369	" 28....	M. Swarts	Lumber	23 86
370	" 28....	Du Quoin Coal Co	11 cars coal	206 85
371	" 28....	S. W. Adams Mfg. Co	Grate bars	6 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
372	Feb. 28	Trevett & Green	Hardware	$32 20
373	" 28	" "	"	89 36
374	" 28	Crane Bros. Mfg. Co	Pipes and fittings	61 37
375	" 28	Students' labor pay-roll	February, 1885	208 19
376	" 28	S. W. Shattuck	Petty expense, 6 months	69 02
377	" 28	S. A. Forbes	" " in Nat. History Lab'y.	14 34
378	" 28	Agricultural Department	Hauling and moving	30 00
379	" 28	" "	Work of men and teams for season	35 00
380	" 28	Mechanical Department	" and materials furnished	188 46
381	" 28		" " " to other dep'ts	327 98
382	" 28	Architectural Department	" " " furnished	401 16
383	" 28	" "	" " " for other dep'ts	744 28
384	Mar. 16	S. M. Millard	Expense to Board meeting	20 00
385	" 16	Emory Cobb	" " "	7 00
386	" 16	Alex McLean	" " "	23 60
387	" 16	R. N. Paden	" " "	11 50
388	" 16	W. W. Carnes	Instruction in elocution	100 00
389	" 16	Charles Woodworth	Work on cabinets	16 20
390	" 16	Bansch & Lamb Opt. Co	Apparatus	21 25
391	" 16	Brown-Sharp Mfg. Co	Tools	15 92
392	" 31	S. H. Peabody	Salary, March, 1885	250 00
393	" 31	T. J. Burrill	" "	166 66
394	" 31	S. W. Shattuck	" "	166 66
395	" 31	E. Snyder	" "	166 66
396	" 31	J. C. Pickard	" "	166 66
397	" 31	N. C. Ricker	" "	166 66
398	" 31	J. D. Crawford	" "	166 66
399	" 31	G. E. Morrow	" "	166 66
400	" 31	F. W. Prentice	" "	150 00
401	" 31	P. Roos	" "	133 33
402	" 31	I. O. Baker	" "	150 00
403	" 31	W. McMurtrie	" "	166 66
404	" 31	S. A. Forbes	" "	166 66
405	" 31	J. Sondericker	" "	90 00
406	" 31	C. W. Rolfe	" "	100 00
407	" 31	A. T. Woods	" "	40 00
408	" 31	E. A. Kimball	" "	125 00
409	" 31	G. W. Parker	" "	80 00
410	" 31	E. M. Hall	" "	100 00
411	" 31	M. E. Darrow	" "	60 00
412	" 31	H. Slauson	" "	50 00
413	" 31	A. B. Baker	" "	70 00
414	" 31	G. Klingenspor	" "	50 00
415	Apr. 15	D. H. Barrett	" winter term, 1885	40 00
416	" 15	H. Peterson	" band leader, winter term, 1885.	15 00
417	" 15	Horace Taylor	" March, 1885	25 00
418	" 15	A. M. Coffeen	Tracing paper	2 63
419	" 15	Wm. Dodson & Co	Timothy seed	19 50
420	" 15	R. H. Smith Mfg. Co	Rubber type, etc	19 98
421	" 15	Central Telephone Co	Instrument 2 quarters, and bill repairs	16 00
422	" 15	Educational Supply Co	Apparatus	3 50
423	" 15	C. & U. Gaslight Co	Lights, February and March, 1885	70 00
424	" 15	Agricultural Department	Farm expense, March, 1886	262 45
425	" 15	Du Quoin Coal Co	6 cars coal	110 00
426	" 15	Lyon & Healy	Music racks	4 35
427	" 15	Thos. Wright & Sons	Castings	7 94
428	" 15	John Tierney	Work in shops	51 19
429	" 15	Grace Peabody	Salary, March, 1885	16 25
430	" 15	Jeffrey Morris	Hauling manure	38 90
431	" 15	C. W. Butler	Specimens	50 00
432	" 15	Jansen, McClurg & Co	Books	63 44
433	" 15	Pay-roll of workmen	Work on grounds	38 76
434	" 15	U. S Patent Office	Bindings	15 60
435	" 15	Rudolf Birkholz	Glazing and painting	7 40
436	" 15	Fritz Finder	Drayage	2 26
437	" 15	H. E. Parker	Labor in Architect shops	7 80
438	" 15	H. Swannell	Microscope	90 00
439	" 15	S. M. Adams Mnfg. Co	Pig-iron, coal, etc	93 41
440	" 15	John Forst	16 loads manure	7 10
441	" 15	A. J. Stoneburner	Salary, March, 1885	55 00
442	" 15	W. A. Baker	Work in building	1 50
443	" 15	Wm. Price	Oil, lead and putty	10 15
444	" 15	Mrs. A. B. Baker	Making and washing towels, etc	8 20
445	" 15	Sutton & Sheldon	Brick	4 00
446	" 15	Besore & Bro	Fencing	4 90
447	" 15	Kittie M. Baker	Music fees collected	58 00
448	" 15	Am. Society of Civ. Eng	Transactions, 1885	10 00
449	" 15	Colegrove Book Co	Books	6 45

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
450	Apr. 15	Western Electric Co	Bell	$4 25
451	" 15	S. W. Stratton	Blue printing	4 23
452	" 15	Stearns & Co	1 brl stucco	1 85
453	" 15	Students' pay-roll	March, 1885	185 47
454	" 15	Brown & Co	Books	5 50
455	" 15	F. W. Christern	"	72 48
456	" 15	J. A. Fay & Co	Belting and materials	23 08
457	" 30	S. H. Peabody	Salary, April, 1885	250 00
458	" 30	T. J. Burrill	" "	166 66
459	" 30	S. W. Shattuck	" "	166 66
460	" 30	E. Snyder	" "	166 66
461	" 30	J. C. Pickard	" "	166 66
462	" 30	N. C. Ricker	" "	166 66
463	" 30	J. D. Crawford	" "	166 66
464	" 30	G. E. Morrow	" "	166 66
465	" 30	F. W. Prentice	" "	150 00
466	" 30	P. Ross	" "	133 33
467	" 30	I. O. Baker	" "	150 00
468	" 30	Wm. McMurtrie	" "	166 66
469	" 30	S. A. Forbes	" "	166 66
470	" 80	J. Sondericker	" "	90 00
471	" 30	C. W. Rolf	" "	100 00
472	" 30	A. T. Woods	" "	40 00
473	" 30	E. A. Kimball	" "	125 00
474	" 30	G. W. Parker	" "	80 00
475	" 30	E. M. Hall	" "	100 00
476	" 30	M. E. Darrow	" "	60 00
477	" 30	H. Slauson	" "	50 00
478	" 30	A. B. Baker	" "	70 00
479	" 30	G. Klingenspor	" "	50 00
480	" 30	Colegrove Book Co	Books	105 64
481	" 30	Horticultural Department	Pay-roll of workmen, March 1885	23 12
482	" 30	Walker & Mulliken	Stools and reeds	13 50
483	May 15	Pay-roll of workmen	April, 1885	64 72
484	" 15	" "	"	89 34
485	" 15	A. J. Stoneburner	Salary, April, 1885	35 00
486	" 15	A. J. Mann	Salary services in C. L	21 00
487	" 15	Grace Peabody	Salary, April, 1885	12 00
488	" 15	T. J. Burrill	Expense to Springfield	6 29
489	" 15	Agricultural Department	Farm expense, April, 1885	320 22
490	" 15	A. Squire	Music for band	7 50
491	" 15	A. Iten	Work on grounds	1 00
492	" 15	Thos. Wright & Son	Castings	8 00
493	" 15	H. E. Parker	Work in Architect shops	5 80
494	" 15	John Tierney	" " "	53 88
495	" 15	R. Birkholz	Painting	9 80
496	" 15	G. W. McClain	Salary from April 13 to 30, 1885	33 00
497	" 15	H. Taylor	Salary, April, 1885	25 00
498	" 15	Frank G. Jaques	Fencing	16 00
499	" 15	W. W. Carnes	Salary, April, 1885	100 00
500	" 15	Pay-roll of students	Labor, April, 1885	147 81
501	" 30	S. H. Peabody	Salary, May, 1885	250 00
502	" 30	T. J. Burrill	" "	166 66
503	" 30	S. W. Shattuck	" "	166 66
504	" 30	E. Snyder	" "	166 66
505	" 30	J. C. Pickard	" "	166 66
506	" 30	N. C. Ricker	" "	166 66
507	" 30	J. D. Crawford	" "	166 66
508	" 30	G. E. Morrow	" "	166 66
509	" 30	F. W. Prentice	" "	150 00
510	" 30	P. Roos	" "	133 33
511	" 30	I. O. Baker	" "	150 00
512	" 30	Wm. McMurtrie	" "	166 66
513	" 30	S. A. Forbes	" "	166 66
514	" 30	J. Sondericker	" "	90 00
515	" 30	C. W. Rolfe	" "	100 00
516	" 30	A. T. Woods	" "	40 00
517	" 30	E. A. Kimball	" "	125 00
518	" 30	G. W. Parker	" "	80 00
519	" 30	E. M. Hall	" "	100 00
520	" 30	M. E. Darrow	" "	60 00
521	" 30	H. Slauson	" "	50 00
522	" 30	A. B. Baker	" "	70 00
523	" 30	G. W. McClure	" "	55 00
524	" 30	S. W. Shattuck	" "	75 00
525	" 30	Kittie M. Baker	" "	50 00
526	" 30	Burnham, Trevett & Mattis	Services in land sales	130 08

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
527	May 30	W. W. Carnes	Salary, May, 1885	$100 00
528	" 30	H. Taylor	" "	25 00
529	" 30	A. G. Mann	" "	16 50
530	" 30	W. H. Stockham	" Spring term, 1885	37 50
531	" 30	H. L. Reynolds	" " "	37 50
532	" 30	Grace Peabody	" May, 1885	15 25
533	" 30	A. J. Stoneburner	" "	37 00
534	" 30	H. E. Parker	Work in Architectural department	4 88
535	" 30	John Tierney	" " "	51 07
536	" 30	Rudolph Birkholz	Painting	10 20
537	" 30	W. T. Pratt	Roof repairs, etc	4 80
538	" 30	Pay-roll of workmen	Work on grounds, May, 1885	74 93
539	" 30	Horticultural department	Labor and petty expense, May, 1885	98 49
540	" 30	Agricultural department	Farm expense, May, 1885	442 97
541	" 30	Students' labor pay-roll	May, 1885	204 29
542	" 30	Cent. Union Telephone Co.	Repairs on electric bell	3 25
543	" 30	American Express Co	Charges	6 20
544	" 30	Cameron, Amberg & Co	Racks for library card case	3 60
545	" 30	D. McKinzie	Champaign Directory	10 00
546	" 30	D. H. Barrett	Salary assistant Chemical Laboratory.	29 00
547	" 30	E. P. Niles	Expense of com. of judges on drill	17 90
548	" 30	D. Appleton & Co	Books	6 00
549	" 30	Robinson & Burr	Labor on soil tester	4 95
550	" 30	Pay-roll of women	Cleaning building	14 00
551	" 30	Tice and Lynch	Expenses on imported books	4 80
552	" 30	Carl Schoenhof	Books	8 41
553	" 30	Brown & Co	"	5 50
554	" 30	Colegrove Book Co	"	257 43
555	" 30	B. S. Taylor	Teams and hack hire	37 00
556	" 30	Lindsey & Owens	Expense of Legislative Committee	32 00
557	" 30	R. J. Beck	Microtome	42 50
558	" 30	Browne, Sharpe & Co	Tools	4 33
559	" 30	F. A. Reichart & Co	Tubes	9 00
560	" 30	E. H. Sargent & Co	Chemicals	29 10
561	" 30	S. W. Adams Mfg. Co	Nut and bolts	5 48
562	" 30	F. P. Elliot & Co	Paper	2 75
563	" 30	Powner, Ackerman & Co	Advertising	10 00
564	" 30	Illinois School Journal	"	12 50
565	" 30	John S. Stott	Catalogue, 1885	274 25
566	" 30	Illini	Printing	55 92
567	" 30	Robinson & Burr	Forging and other work	66 10
568	" 30	R. S. Wilber	Hauling	182 25
569	" 30	C. & U. Gas Co	Lights, April, 1885	68 00
570	" 30	DuQuoin Cal. Mfg. Co	4 cars coal	70 00
571	" 30	Peterson & Lloyd	Stationery	13 90
572	" 30	M. E. Lapham	Lumber	20 81
573	" 30	Champaign Co. Gazette	Printing	41 03
574	" 30	Trevett & Green	Hardware	52 79
575	" 30	Jansen, McClurg & Co	Books	6 00
576	" 15	S. M. Millard	Expenses to Board meeting	43 15
577	" 15	G. A. Follansbee	" " "	26 56
578	" 15	Charles Bennett	" " "	4
579	" 15	Alexander McLean	" " "	24 63
580	" 15	George C. Eisenmayer	" " "	15 50
581	" 15	R. N. Paden	" " "	14 00
582	" 15	S. H. Peabody	Trav. exp. to Springfield and Wash'ton	134 60
583	" 15	G. A. Huff	Hack and teaming	16 00
584	" 15	W. W. Carnes	Instruction in elocution	50 00
585	" 15	A. G. Manns	Sal. Ass't Chem. Lab., spring term, 1885	10 00
586	" 15	W. B. Brancher	Salary, band leader, spring term, 1885	15 00
587	" 15	G. C. Willis	Ribbons	3 50
588	" 15	A. M. Coffeen	Tracing cloth	3 00
589	" 15	C. & U. Gaslight Co	Lights, May, 1885	36 00
590	" 15	J. Bacon	3,770 lbs coal	7 07
591	" 15	Carl Schoenhof	Books	144 53
592	" 15	W. W. Mathews	Printing	14 25
593	" 15	E. P. Niles	Expense of reporter	1 50
594	" 15	Mrs. Iten	House-cleaning and other work	4 00
595	" 15	Kittie M. Baker	Music fees collected	57 00
596	" 15	B. F. Stevens	Books	200 00
597	" 15	S. W. Shattuck	"	23 05
598	" 15	F. W. Christern	Periodical	3 20
599	" 15	W. T. Pratt	Roof repairs	10 00
600	" 15	Ludington, Wells & V. S. Co.	Lumber	252 18
601	" 30	S. H. Peabody	Salary, June, 1885	250 00
602	" 30	T. J. Burrill	" "	166 66
603	" 30	S. W. Shattuck	" "	166 66
604	" 30	E. Snyder	" "	166 66

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
605	June 30	J. C. Pickard	Salary, June, 1885	$166 66
606	" 30	N. C. Ricker	" "	166 66
607	" 30	J. D. Crawford	" "	166 66
608	" 30	G. E. Morrow	" "	166 66
609	" 30	F. W. Prentice	" "	150 00
610	" 30	P. Roos	" "	133 33
611	" 30	I. O. Baker	" "	150 00
612	" 30	Wm. McMurtrie	" "	166 66
613	" 30	S. A. Forbes	" "	166 66
614	" 30	J. Sondericker	" "	90 00
615	" 30	C. W. Rolfe	" "	100 00
616	" 30	A. T. Woods	" "	40 00
617	" 30	E. A. Kimball	" "	125 00
618	" 30	G. W. Parker	" "	80 00
619	" 30	E. M. Hall	" "	100 00
620	" 30	M. E. Darrow	" "	60 00
621	" 30	H. Slauson	" "	50 00
622	" 30	A. B. Baker	" "	70 00
623	" 30	G. W. McClure	" "	55 00
624	" 30	Colegrove Book Co	Books	57 34
625	" 30	B. F. Stevens	"	50 43
626	" 30	Douglass, Thompson & Co	Chemicals	3 74
627	" 30	J. W. Shuck	Drying oven	2 85
628	" 30	Hubbard & Son	Hardware	7 40
629	" 30	Henry & Kariher	Brushes, paints, oils, etc	69 68
630	" 30	Mechanical Department	Labor and materials	88 80
631	" 30	Architectural Department	" "	108 78
632	" 30	Credit Chemical Department	Chemicals furnished	12 90
633	" 30	Ganthier Villars	Books	83 68
634	" 30	W. C. Bullock	Alcohol lamps	2 40
635	" 30	A. J. Stoneburner	Labor in June	37 00
636	" 30	Horticultural Department	Labor and materials	234 76
637	" 30	Pay-roll of workmen	Labor on grounds, June	67 18
638	" 30	E. W. McAllister	Postage, March, April and May	33 58
639	" 30	C. W. Shattuck	Clerk in business office	29 88
640	" 30	Grace Peabody	Clerk in Regent's office	13 25
641	July 10	S. M. Millard	Expenses to Springfield, July 1	26 64
642	" 10	John Landrigan	Expenses to Board meeting	7 90
643	" 10	R. N. Paden	" " "	21 00
644	" 10	Parker Earle	" " "	5 00
645	" 10	G. C. Follansbee	" " "	9 00
646	" 10	G. C. Eisenmayer	" " "	29 80
647	" 10	J. T. Pearman	" " "	10 00
648	" 10	Alex. McLean	" " "	29 95
649	" 10	E. Snyder	" " "	13 70
650	" 10	S. W. Shattuck	" " "	15 70
651	" 31	S. H. Peabody	Salary, July, 1885	250 00
652	" 31	T. J. Burrill	" "	166 66
653	" 31	S. W. Shattuck	" "	166 66
654	" 31	E. Snyder	" "	166 66
655	" 31	J. C. Pickard	" "	166 66
656	" 31	N. C. Ricker	" "	166 66
657	" 31	J. D. Crawford	" "	166 66
658	" 31	G. E. Morrow	" "	166 66
659	" 31	F. W. Prentice	" "	150 00
660	" 31	P. Roos	" "	133 33
661	" 31	I. O. Baker	" "	150 00
662	" 31	Wm. McMurtrie	" "	166 66
663	" 31	S. A. Forbes	" "	166 66
664	" 31	E. A. Kimball	" "	125 00
665	" 31	G. W. Parker	" "	80 00
666	" 31	A. B. Baker	" "	70 00
667	" 31	G. W. McCture	" "	55 00
668	" 31	Agricultural Department	Farm expense, June	527 43
669	" 31	Horticultural Department	Expenses June	307 42
670	" 31	Students' pay-roll	Labor, June, 1885	126 68
671	" 31	H. E. Parker	" "	16 30
672	" 31	L. Clutter	Hack work	3 00
673	" 31	Union Telephone Co	Rent of instrument	15 00
674	" 31	D. McLennan	Police duty	5 00
675	" 31	H. Siegmund	Labor	10 92
676	" 31	J. W. Bunn	Taxes on wild lands	1,766 28
677	" 31	S. A. Forbes	Expense, labor, etc	324 63
678	Aug. 15	Tribune Co	Advertising	42 00
679	" 15	The Occident	"	10 00
680	" 15	E. M. Shaw	Team work	6 19
681	" 15	A. N. Curtis	Specimens of wood	24 20
682	" 15	Frank Blake	Apparatus	2 13

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
683	Aug. 15	Douglass, Thompson & Co.	Apparatus	$7 25
684	" 15	Colegrove Book Co	Books	9 08
685	" 15	J. D. Benedict	Advertising	5 00
686	" 15	International News Co	Books	7 50
687	" 15	E. N. McAllister	"	11 00
688	" 15	I. O. Baker	Civil Engineer expenses	4 95
689	" 15	Horticultural Department	July expenses	116 77
690	" 15	J. C. Lewis	Mason work	34 90
691	" 15	W. H. Lewis	" "	41 72
692	" 15	W. C. Ricker	Expense to Chicago	10 93
693	" 15	S. W. Shattuck	" "	14 68
694	" 15	James Lindsey	Sand	30 87
695	" 15	Grace Peabody	Regent's clerk, July	12 50
696	" 15	Miss K. Baker	Music fees	10 00
697	" 15	J. Wilskie	Mason work	47 20
698	" 15	Students' pay-roll	Labor in July, 1885	228 18
699	" 15	Pay-rolls men and women	" "	339 99
700	" 15	Agricultural Department	July expenses	416 06
701	" 31	S. H. Peabody	Salary, August, 1885	250 00
702	" 31	T. J. Burrill	" "	166 66
703	" 31	S. W. Shattuck	" "	166 66
704	" 31	E. Snyder	" "	166 66
705	" 31	J. C. Pickard	" "	166 66
706	" 31	N. C. Ricker	" "	166 66
707	" 31	J. D. Crawford	" "	166 66
708	" 31	G. E. Morrow	" "	166 66
709	" 31	F. W. Prentice	" "	150 00
710	" 31	P. Roos	" "	133 33
711	" 31	I. O. Baker	" "	150 00
712	" 31	Wm. McMurtrie	" "	166 66
713	" 31	S. A. Forbes	" "	166 66
714	" 31	E. A. Kimball	" "	125 00
715	" 31	G. W. Parker	" "	80 00
716	" 31	A. B. Baker	" "	70 00
717	" 31	G. W. McClure	" "	55 00
718	" 31	W. H. Garman	" July and August, 1885	166 66
719	" 31	C. A. Hart	" " "	90 00
720	" 31	M. J. Snyder	" " "	90 00
721	" 31	C. W. Woodworth	" " "	70 00
722	" 31	S. W. Shattuck	" June, July and August	75 00
723	" 31	H. Flangher	Labor	2 40
724	" 31	Prairie Farmer Co	Advertisements	2 00
725	" 31	I. C. R. R. donation	Freight, 6 months	881 50
726	" 31	John E. Hanson	Cleaning well	7 00
727	" 31	J. Morris	Hauling	4 00
728	" 31	H. Lewis	Plastering	5 10
729	" 31	W. H. Lewis	" etc	21 25
730	" 31	James Lindsey	Sand	16 63
731	" 31	B. F. Hill	Derrick irons	10 00
732	" 31	Julius Wilske	Mason work	238 19
733	" 31	Thomas F. Hunt	Field expenses	22 70
734	" 31	W. H. Garman	" "	30 00
735	" 31	S. A. Forbes	Expense of laboratories, etc	169 11
736	" 31	C. Maltby	Salary of August, 1885	40 00
737	" 31	T. F. Hunt	" "	29 68
738	" 31	D. T. Stewart	Advertisement	5 00
739	" 31	I., B. & W. R. R	Freight	18 59
740	" 31	A. J. Stoneburner	Work	9 65
741	" 31	J. T. Pearman	Expenses Executive Committee Mt.	10 00
742	" 31	B. V. Page	Oil	11 95
743	" 31	Anton Iten	Work	23 50
744	" 31	R. Berkhoe	Painting	32 20
745	" 31	E. N. McAllister	Postage, 3 months	93 00
746	" 31	S. W. Shattuck	Petty expenses, 6 months	69 71
747	" 31	Students' pay-roll	Labor, August, 1885	161 33
748	" 31	Pay-roll men and women	" "	314 39
749	" 31	Agricultural Department	August expenses	308 31
750	" 31	Horticultural Department	" "	41 63
751	" 31	Trevett & Green	Hardware	86 90
752	" 31	U. S. Express Co	Charges	2 95
753	" 31	Inter-Ocean	Advertising	56 00
754	" 31	Chicago Times	"	60 00
755	" 31	D. H. Lloyd & Son	Piano and sundries	201 25
756	" 31	Bond & Chandler	Wood-cuts	19 00
757	" 31	Prairie Farmer	Advertising	63 00
758	" 31	Farmers' Review	"	53 65
759	" 31	Urbana Herald	Printing	49 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885			
760	Aug. 31....	Champaign County Gazette	Printing................................	$46 25
761	" 31....	Milton George................	Advertising............................	50 40
762	" 31....	Springfield Journal..........	"	8 00
763	" 31....	J. C. Bonton.................	"	25 00
764	" 31....	Janson, McClurg............	Stationery.............................	34 89
765	" 31....	F. P. Eliot & Co.............	Paper and wrappers...................	12 50
766	" 31....	H. Swannell..................	Chemicals.............................	8 45
767	" 31....	Champaign Mfg. Co..........	Lumber................................	48 42
768	" 31....	Abendroth & Roots..........	Gaskets................................	37 50
769	" 31....	Trevett Bros.................	Hardware..............................	26 49
770	" 31....	C. & U. Gas Co..............	Light, July, 1885......................	14 00
771	" 31....	Larrabee & North............	Tools, etc.............................	228 18
772	" 31....	Crane Bros...................	Pipe and fittings.......................	84 78
773	" 31....	Besore Bros..................	Lumber................................	639 19
774	" 31....	Wm. Price....................	Calcimining, etc.......................	326 75
775	" 31....	Du Quoin Coal Co...........	oal......................................	186 00
776	" 31....	R. S. Wilbur..................	Hauling................................	31 75
777	" 31....	Fuller & Fuller..............	Glass..................................	43 54
778	" 31....	E. H. Sargent................	" and tubing........................	38 06
779	" 31....	G. W. Troyer.................	Books..................................	21 00
780	" 31....	Naturalists' agency..........	Book...................................	2 00
781	" 31....	Singer & Talcot Stone Co...	Roof coping...........................	32 55
782	" 31....	Union Foundry...............	Castings...............................	122 83
783	" 31....	Anderson & Barnum.........	Plastering.............................	50 00
784	" 31....	M. E. Lapham................	Lumber................................	35 90
785	" 31....	Sutton Brick & Tile Co......	Brick and tile.........................	537 74
786	" 31....	Robinson & Burr.............	Work and material....................	20 65
787	" 31....	Illinois Central Railroad....	Advanced freight.....................	7 95
788	" 31....	J. B. Clow & Sons...........	Pipe and fittings.......................	88 17
789	" 31....	Grace Peabody...............	Service, August, 1885.................	4 63
790	" 31....	Crandoll & Godley...........	Sample tins...........................	6 60
791	" 31....	Gould & Eberhardt..........	Shaper.................................	285 00
792	" 31....	J. W. Randolph..............	Whitewashing.........................	3 80
793	" 31....	Besore Bros..................	Plaster and lime.......................	5 85
794	" 31....	American Express Co.......	Charges................................	8 60
795	" 31....	Jas. Smith....................	Work on grounds.....................	17 00
796	" 31....	Ludington, Wells & Van S...	Lumber................................	8 75
797	" 31....	Mechanical Department....	Work for Departments................	75 54
798	" 31....	" "	Work and material....................	148 42
799	" 31....	Architectural "	Work for other departments..........	307 71
800	" 31....	" "	Work and material....................	1,317 33

List of Warrants, Fiscal Year 1885-86.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
1	Sept. 30	S. H. Peabody	Salary for September	$250 00
2	" 30	T. J. Burrill	" "	166 66
3	" 30	S. W. Shattuck	" "	166 66
4	" 30	E. Snyder	" "	166 66
5	" 30	J. C. Pickard	" "	166 66
6	" 30	N. C. Ricker	" "	166 66
7	" 30	J. D. Crawford	" "	166 66
8	" 30	G. E. Morrow	" "	166 66
9	" 30	P. Ross	" "	141 66
10	" 30	I. O. Baker	" "	150 00
11	" 30	W. McMurtrie	" "	166 66
12	" 30	S. A. Forbes	" "	96 66
13	" 30	J. B. Comstock	" "	150 00
14	" 30	C. W. Rolf	" "	120 00
15	" 30	A. T. Talbot	" "	100 00
16	" 30	A. T. Woods	" "	40 00
17	" 30	W. H. Garman	" "	84 00
18	" 30	J. A. Cass	" "	100 00
19	" 30	H. B, Gregory	" "	60 00
20	" 30	E. A. Kimball	" "	125 00
21	" 30	G. W. Parker	" "	80 00
22	" 30	G. C. Hewes	" "	50 00
23	" 30	S. W. Stratton	" "	50 00
24	" 30	A. B. Baker	" "	70 00
25	" 30	G. W. McClure		55 00
26	" 30	S. M. Millard	Expenses to Board meeting	18 00
27	" 30	C. Bennett	" "	6 65
28	" 30	G. A. Foliansbee	" "	18 03
29	" 30	A. McLean,	" "	20 90
30	" 30	P. Earle	" "	18 00
31	" 30	G. C. Eisenmayer	" "	15 00
32	" 30	J. W. Bunn	Premium on bonds	235 00
33	" 30	S. H. Peabody	Traveling expenses	156 86
34	" 30	H. A. Ward,	Specimens	243 60
35	" 30	Nathan Manufacturing Co.	Pumps	12 00
36	" 30	Southwick & Jencks	Insect pins, etc	17 25
37	" 30	E. H. Sargent	Bottles and corks	20 30
38	" 30	S. A. Forbes	Petty expenses	24 49
39	" 30	C. A. Hart	Salary, September	45 00
40	" 30	M. J. Snyder	" "	29 43
41	" 30	C. Maltby	" "	40 00
42	" 30	S. A. Forbes	Material for Laboratory	50 12
43	" 30	C. Schoenhof	Books	190 99
44	" 30	J. W. Shuck	Tin roofing	169 80
45	" 30	Anderson & Barnum	Plastering	12 00
46	" 30	Union Fund Pulman Car W.	2 iron doors	50 00
47	" 30	A. H. Andrews & Co	Slating	4 80
48	" 30	J. Lindsay	Sand	9 50
49	" 30	DuQuoin Coal Co	10 cars coal	156 75
50	" 30	W. Bank Note Engraving Co.	Diploma plate	142 50
51	Oct. 15	Grace Peabody	Work on library catalogue	15 00
52	" 15	Jansen, McClurg & Co	Books	3 75
53	" 15	Gustav Hinstorf	"	2 45
54	" 15	F. W. Christern	"	3 99
55	" 15	Colegrove Book Co	"	6 00
56	" 15	J. W. Randolph	Whitewashing	2 80
57	" 15	W. H. Lewis	Plastering	1 20
58	" 15	Fuller & Fuller	Glass	24 49
59	" 15	Darling, Brown & Sharp	Tools	24 53
60	" 15	Larrabee & North	Locks and hardware	18 65
61	" 15	D. T. S. Bronson	Work	7 13
62	" 15	John Trainer	Advertising	5 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
63	Oct. 15	B. F. Pedro	Advertising	$5 00
64	" 15	Lord & Thomas	"	76 50
65	" 15	A. R. McDonald	"	52 32
66	" 15	Cranston & Stove	"	8 40
67	" 15	Bloomington Bulletin	"	10 00
68	" 15	J. H. Sanders & Co	"	63 00
69	" 15	Chicago Daily News	"	25 00
70	" 15	Century Co	"	7 50
71	" 15	Bloomington Pantagraph	"	25 00
72	" 15	Milton George	"	10 00
73	" 15	E. P. Elliott & Co	Envelopes	4 50
74	" 15	C. S. Scott	Paper	9 00
75	" 15	Shober & Carqueville	Lithography	30 00
76	" 15	W. H. Lewis	Bricklaying and plastering	15 00
77	" 15	Pay-roll of workmen	September	145 17
78	" 15	Geo. Shawhan	Advertising	5 00
79	" 15	C. & U. Gas Co	Lights, July to October	22 00
80	" 15	T. Wright & Sons	Castings	24 21
81	" 15	C. Tobias	Work	10 13
82	" 15	J. Forrester	"	3 37
83	" 15	C. Black	"	10 87
84	" 15	B. F. Carman	Hauling brick	9 71
85	" 15	Wadsworth, Howland & Co.	Fresco colors	12 10
86	" 15	Butler Paper Co	Cardboard	11 88
87	" 15	E. N. McAllister	Postage	5 70
88	" 15	D. H. Barrett	Salary, Sept., 1885	15 00
89	" 15	H. Taylor	" "	25 00
90	" 15	H. E. Parker	Work	11 00
91	" 15	J. F. Creek	"	58 50
92	" 15	J. Tierney	"	58 50
93	" 15	A. J. Stoneburner	Salary, Sept., 1885	16 33
94	" 15	J. W. Pepper	Band books	3 00
95	" 15	Agricultural Department	Farm expense	318 16
96	" 15	A. Iten	Labor	15 88
97	" 15	R. Birkholz	Painting and glazing	35 80
98	" 15	Grace Peabody	Salary, Sept., 1885	13 00
99	" 15	Central Union Telephone Co	Rent of instrument to Jan. 6, 1886	15 00
100	" 15	Students' pay-roll	September, 1885	163 73
101	" 31	S. H. Peabody	Salary, October, 1885	250 00
102	" 31	T. J. Burrill	" "	166 66
103	" 31	S. W. Shattuck	" "	166 66
104	" 31	E. Snyder	" "	166 66
105	" 31	J. C. Pickard	" "	166 66
106	" 31	N. C. Ricker	" "	166 66
107	" 31	J. D. Crawford	" "	166 66
108	" 31	G. E. Morrow	" "	166 66
109	" 31	P. Roos	" "	141 66
110	" 31	I. O. Baker	" "	150 00
111	" 31	W. McMurtrie	" "	166 66
112	" 31	S. A. Forbes	" "	96 66
113	" 31	T. B. Comstock	" "	150 00
114	" 31	C. W. Roff	" "	120 00
115	" 31	A. N. Talbott	" "	100 00
116	" 31	A. T. Woods	" "	40 00
117	" 31	W. H. Garman	" "	84 00
118	" 31	J. A. Cass	" "	100 00
119	" 31	H. B. Gregory	" "	60 00
120	" 31	E. A. Kimball	" "	125 00
121	" 31	G. W. Parker	" "	80 00
122	" 31	G. C. Hewes	" "	50 00
123	" 31	S. W. Stratton	" "	50 00
124	" 31	A. B. Baker	" "	70 00
125	" 31	G. W. McClure	" "	55 00
126	" 31	Horticultural Department	Expense, September, 1885	40 29
127	" 31	Lyon & Healy	Mouthpieces	2 13
128	" 31	Western Electric Co	Cells for batteries	2 75
129	" 31	Abendroth & Root	Gaskets	30 20
130	" 31	Champaign County Gazette	Printing	22 25
131	" 31	F. Miller	Piano tuning	3 00
132	" 31	American Express Co	Expressage	6 70
133	" 31	U. S. Patent Office	Binding reports	15 60
134	" 31	D. A. Bassett	Specimens	60 00
135	" 31	Singer & Talbot Stone Co	Cut stone	14 00
136	" 31	Western Bank Note Eng. Co	Engraving and printing	100 00
137	Nov. 14	Students' pay-roll	Labor, October, 1885	197 82
138	" 14	Agricultural Department	Farm expense	364 20
139	" 14	Horticultural Department	Expense	47 72
140	" 14	A. J. Stoneburner	Salary, October, 1885	40 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
141	Nov. 14	Grace Peabody	Salary, October, 1885	$16 12
142	" 14	John Tierney	Work in shop	60 30
143	" 14	John Creek	" "	57 93
144	" 14	Horace Taylor	Salary, October, 1885	25 00
145	" 14	D. H. Barrett	" "	15 00
146	" 14	S. W. Stratton	Lettering diploma	9 50
147	" 14	E. I. Cantine	Library checks	2 00
148	" 14	Lee Clutter	Carriage hire	2 25
149	" 14	G. A. Burgess	Advertising	6 00
150	" 14	American Express Co	Charges	8 24
151	" 14	C. C. Carman	Labor	6 87
152	" 14	B. F. Carman	Hauling	7 75
153	" 15	R. Birkholz	Painting, etc	21 44
154	" 15	Stearns & Co	Cement, stucco	5 35
155	" 15	A. Iten	Labor	20 06
156	" 15	D. Bronson	Labor	5 75
157	" 15	W. T. Pratt	Painting, etc	25 42
158	" 15	L. F. Allison	Birds' eggs	1 85
159	" 15	A. Wright	Golden eagle	3 00
160	" 15	C. W. Rolfe	Petty expenses	2 10
161	" 15	I. B. & W. R. R. Co	Freight	77 30
162	" 15	Pittsburg Mach. Co	Engine lathe	290 00
163	" 15	Flather & Co	" "	310 00
164	" 15	Hendey Mach. Co	Shaper	16 90
165	" 15	C. A. Hart	Salary, October, 1885	45 00
166	" 15	Mary Snyder	" "	45 00
167	" 15	Cora Maltby	" "	23 70
168	" 15	S. B. Skehan	" "	18 60
169	" 15	C. M. Weed	" "	35 56
170	" 15	Normal Book and News Co.	Stationery, etc	16 96
171	" 15	T. F. Hunt	Salary, September, 1885	10 87
172	" 15	S. A. Forbes	Expense of office	200 00
173	" 15	Maxwell Book Co	Books	1 75
174	" 15	Amer. Field Co	Subscription	5 00
175	" 15	Jansen, McClurg & Co	Books	26 23
176	" 15	S. H. Peabody	Salary, November, 1885	250 00
177	" 15	T. C. Burrill	" "	166 66
178	" 15	S. W. Shuttuck	" "	166 66
179	" 15	E. Snyder	" "	166 66
180	" 15	J. C. Pickard	" "	166 66
181	" 15	N. C. Ricker	" "	166 66
182	" 15	J. D. Crawford	" "	166 66
183	" 15	G. E. Morrow	" "	166 66
184	" 15	P. Roos	" "	141 66
185	" 15	I. O. Baker	" "	150 00
186	" 15	W. McMurtrie	" "	166 66
187	" 15	S. A. Forbes	" "	96 66
188	" 15	F. B. Comstock	" "	150 00
189	" 15	C. W. Rolfe	" "	120 00
190	" 15	A. T. Woods	" "	40 00
191	" 15	A. N. Talbott	" "	100 00
192	" 15	E. A. Kimball	" "	125 00
193	" 15	G. W. Parker	" "	80 00
194	" 15	J. A. Cass	" "	100 00
195	" 15	H. B. Gregory	" "	60 00
196	" 15	S. W. Strattan	" "	50 00
197	" 15	G. C. Hewes	" "	50 00
198	" 15	W. H. Garman	" "	84 00
199	" 15	G. W. McClure	" "	55 00
200	" 15	A. B. Baker	" "	70 00
201	" 15	S. W. Shuttuck	Salary B. A. 3 mos	75 00
202	" 15	K. M. Baker	Salary N. 3 mos	50 00
203	" 15	A. E. Foote	Books	87 67
204	" 15	Publisher's Science	Subscription	5 00
205	" 15	American Naturalist	"	4 00
206	" 15	Bloomington Pantagraph	Binding, etc	57 25
207	" 15	ʻ. A. Fay & Co	Shafting, etc	125 53
208	" 15	E. H. Sargent	Glass tubes, etc	25 55
209	" 15	J. W. Queen & Co	Apparatus	23 03
210	" 15	Chicago K. Supply Co	Micro. slides	10 50
211	" 15	Funk & Lackey	8 gro. slides	20 00
212	" 15	C. West	Fishes	1 00
213	" 15	W. M. Walmsley & Co	Micro. slides	40 50
214	" 15	Brown & Co	Books	5 50
215	" 15	Richards & Co	Chemicals	612 14
216	" 15	Abendroth Roots & Co	Plates	4 00
217	" 15	Jameson & Morse	Certificates	14 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
218	Nov. 15	Ill. School Journal	Advertising	$15 00
219	" 15	C. and U. Telephone Co.	Material furnished	3 00
220	" 15	Henry Heel & Co	Chemicals	46 14
221	" 15	C. & U. Gas Co	Lights, October	54 00
222	" 15	J. Bacon	Coal	21 56
223	" 15	R. Hitchcock	Book	3 75
224	" 15	R. S. Wilber	Hauling	121 00
225	" 15	C. H. Hanson	Seal	19 00
226	" 30	H. Taylor	Salary, November, 1885	25 00
227	" 30	C. H. Barrett	" "	15 00
228	" 30	A. J. Stoneburner	" "	40 00
229	" 30	Grace Peabody	" "	20 20
230	" 30	Students' pay-roll	Labor, November, 1885	182 23
231	" 30	J. F. Wollensak	Keys	8 00
232	" 30	DuQuoin Coal Co	Coal	227 75
233	" 30	Darling, Brown & Sharpe	Tools	5 20
234	" 30	John Tierney	Work in shop	49 95
235	" 30	H. E. Parker	" "	10 00
236	" 30	Besore Bros	Lumber and cement	184 44
237	" 30	Agricultural department	Farm expenses	315 32
238	" 30	Horticultural department	Expenses	4 45
239	" 30	H. Swannell	Chemicals, etc	61 78
240	" 30	H. Troemner	Repairs on balance	19 50
241	" 30	K. M. Baker	Music fees, etc	76 00
242	" 30	B. F. Stevens	Books	9 11
243	" 30	H. W. Rokker	"	5 25
244	" 30	Champaign Co. Gazette	Printing, etc	390 74
245	" 30	W. H. Blue	Expanding mandrel	20 00
246	" 30	Eshaus Ventilator Co	1 18-inch wheel	40 00
247	" 30	J. C. Lewis	Masonwork	3 60
248	" 30	W. H. Lewis	"	9 60
249	" 30	Trevett & Green	Hardware	77 56
250	" 30	Trevett Bros	"	127 38
251	" 30	Crane Bros. & Co	Pipes and fittings	21 45
252	" 30	Anton Iten	Labor	29 00
253	" 30	R. Birkholz	Painting, etc	29 78
254	" 30	J. W. Queen	Balance	18 00
255	" 30	U. S. Express Co	Charges	12 60
256	" 30	Bausch & Lamb	Optical apparatus	93 86
257	" 30	Union Bridge Co	Test pieces, etc	50 00
258	" 30	A. Williamson	Collection	8 00
259	" 30	H. A. Ward	Models of invertebrates	45 15
260	" 30	C. A. Hart	Mat for Zoölogical laboratory	6 46
261	" 30	H. F. Miller	Cans	6 00
262	" 30	M. J. Snyder	Salary, November, 1885	45 00
263	" 30	C. A. Hart	" "	45 00
264	" 30	C. M. Weed	" "	40 00
265	" 30	S. Skehan	" "	12 15
266	" 30	Cora Maltby	" "	6 92
267	" 30	Friedlander & Son	Books, etc	112 95
268	" 30	W. Price	Painting and material	153 43
269	" 30	D. H. Lloyd & Son	Stationery	10 05
270	" 30	Illini	Printing and advertising	16 66
271	" 30	S. W. Shattuck	Petty expenses, 3 months	65 00
272	" 30	E. N. McAllister	Postage, 3 months	66 45
273	" 30	Agricultural department	Labor	59 15
274	" 30	Mechanical department	Power for shop practice	60 00
275	" 30	Architectural department	" "	176 00
276	Dec. 15	Lyon & Healy	Instruments, etc	14 68
277	" 15	N. E. Publishing Co	Subscription	4 00
278	" 15	C. J. Sabin	Wheelbarrow, etc	9 00
279	" 15	B. V. Page & Co	Machine oil	7 89
280	" 15	E. H. Sargent & Co	Rubber tubing, etc	4 90
281	" 15	N. W. Davis	Sand	2 00
282	" 15	G. C. Willis	Toweling	5 00
283	" 15	W., St. L. & P. Ry	Freight	2 60
284	" 15	Larrabee & North	Fittings, etc	5 77
285	" 15	C. H. Evans	Advertising	2 00
286	" 15	Fuller & Fuller	Sand	2 25
287	" 15	B. F. Carman	Hauling	4 58
288	" 15	C. West	Fishes	1 35
289	" 15	Maypole Bros	Extra pipe-head	15 00
290	" 15	Jansen, McClurg & Co	Stationery	10 35
291	" 15	F. B. Comstock	Petty expenses	5 05
292	" 15	I. O. Baker	" "	2 10
293	" 15	John First	Teaming	2 00
294	" 15	M. E. Lapham	Lumber	62 11
295	" 15	Trevett & Green	Nails	2 55

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
296	Dec. 15	W. S. Beard	Building corn-crib	$14 00
297	" 15	H. McElwin	Slating black-board	71 45
298	" 15	S. W. Stratton	Lettering certificates	12 00
299	" 15	W. & C. Railway Co	One lot	150 00
300	" 15	Champaign National Bank	Two lots	830 00
301	" 31	S. H. Peabody	Salary for December, 1885	250 00
302	" 31	T. J. Burrill	" "	166 66
303	" 31	S. W. Shattuck	" "	166 66
304	" 31	E. Snyder	" "	166 66
305	" 31	J. C. Pickard	" "	166 66
306	" 31	N. C. Ricker	" "	166 66
307	" 31	J. D. Crawford	" "	166 66
308	" 31	G. E. Morrow	" "	166 66
309	" 31	P. Roos	" "	141 66
310	" 31	I. O, Baker	" "	150 00
311	" 31	Wm. McMurtrie	" "	166 66
312	" 31	S. A. Forbes	" "	96 66
313	" 31	T. B. Comstock	" "	150 00
314	" 31	C. W. Rolfe	" "	120 00
315	" 31	W. T. Woods	" "	40 00
316	" 31	A. N. Talbot	" "	100 00
317	" 31	E. A. Kimball	" "	125 00
318	" 31	G. W. Parker	" "	80 00
319	" 31	J. A. Cass	" "	100 00
320	" 31	H. B. Gregory	" "	60 00
321	" 31	S. W. Stratton	" "	50 00
322	" 31	G. C. Hewes	" "	50 00
323	" 31	W. H. Garman	" "	84 00
324	" 31	G. W. McClure	" "	55 00
325	" 31	A. B. Baker	" "	70 00
326	" 31	M. J. Snyder	" "	45 00
327	" 31	C. A. Hart	" "	45 00
328	" 31	C. M. Weed	" "	40 00
329	" 31	C. W. Woodworth	Entomological work	29 68
330	" 31	D. S. Harris	Field assistance	15 00
331	" 31	S. A. Forbes	Expenses of Entomological office	100 00
332	" 31	Colegrove Book Co	Books	2 38
333	" 31	Anderson & Bainum	Mason work	12 75
334	" 31	Illini	Printing	7 35
335	" 31	C. & U. Gas Co	Lights, November, 1885	56 00
336	" 31	P. A. Fulton	Advertising	2 50
337	" 31	S. M. Millard	Expenses to December meeting	19 18
338	" 31	G. C. Eisenmayer	" " "	18 50
339	" 31	C. Bennett	" " "	6 00
340	" 31	G. A. Follansbee	" " "	11 18
341	" 31	P. N. Paden	" " "	11 00
342	" 31	Alexander McLean	" " "	24 38
343	" 31	G. A. Huff	Carriage hire	7 25
344	" 31	Grant Gregory	Band, L. F. term, 1885	15 00
345	" 31	A. J. Stoneburner	Salary, December, 1885	65 00
346	" 31	American Philological Soc'y	Transactions, 1885	2 50
347	" 31	Marshall Field & Co	Cord and brackets	3 46
348	" 31	P. Prybil	Plainer and shaftings	247 50
349	" 31	ames Queen & Co	Objective, etc	30 00
350	" 31	D. C. Long	Book	3 50
	1886.			
351	Jan. 15	D. H. Barrett	Salary, December, 1885	15 00
352	" 15	Grace Peabody	" "	14 87
353	" 15	Agricultural Department	Farm expenses, December, 1885	143 30
354	" 15	Horticultural Department	" " "	14 55
355	" 15	E. T. Engle	Night firing	10 50
356	" 15	J. Tierney	Work in architectural shops	50 40
357	" 15	H. E. Parker	" " "	11 25
358	" 15	R. Birkholz	Painting	13 29
359	" 15	Anton Iten	Work	22 01
360	" 15	Central Union Telephone Co	One quarter's rent	15 00
361	" 15	E. N. McAllister	Drawings	6 25
362	" 15	W. P. Gerhard	Wolfert air tester	10 00
363	" 15	Gould & Eberhard	Engine lathe	330 00
364	" 15	D. H. Lloyde & Son	Repairs on Philo. hall	75 00
365	" 15	C. M. Maltby	Salary, December, 1885	11 85
366	" 15	S. B. Skehan	" "	11 10
367	" 15	T. J. Burrill	Botanical assistance	100 00
368	" 15	P. Baumgrass	Pt. fish casts	30 00
369	" 15	B. F. Thumen	Book	3 50
370	" 15	Photo Engraving Co	Plates of birds	10 80
371	" 45	American Ento. Society	Transactions, Vol. 12	4 00
372	" 15	Geo. W. Tryon	Book	6 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886			
373	Jan. 15	J. B. Ellis	Books	$14 27
374	" 15	Mathews, Northrup & Co.	Printing	4 00
375	" 15	S. A. Forbes	Expenses of office	200 00
376	" 30	S. H. Peabody	Salary, January, 1886	250 00
377	" 30	T. J. Burrill	" "	166 66
378	" 30	S. W. Shuttuck	" "	166 66
379	" 30	E. Snyder	" "	166 66
380	" 30	J. C. Pickard	" "	166 65
381	" 30	N. C. Ricker	" "	166 66
382	" 30	J. D. Crawford	" "	166 66
383	" 30	G. E. Morrow	" "	166 66
384	" 30	P. Roos	" "	141 66
385	" 30	I. O. Baker	" "	150 00
386	" 30	W. McMurtrie	" "	166.66
387	" 30	S. A. Forbes	" "	96 66
388	" 30	T. B. Comstock	" "	150 00
389	" 30	J. H. Brownlee	" "	150 00
390	" 30	D. McIntosh	" "	150 00
391	" 30	C. W. Rolfe	" "	120 00
392	" 30	A. T. Woods	" "	40 00
393	" 30	A. N. Talbot	" "	100 00
394	" 30	E. A. Kimball	" "	125 00
395	" 30	G. W. Parker	" "	80 00
396	" 30	J. A. Cass	" "	100 00
397	" 30	H. B. Gregory	" "	60 00
398	" 30	S. W. Stratton	" "	50 00
399	" 30	G. C. Hewes	" "	50 00
400	" 30	W. H. Garman	" "	84 00
401	" 30	G. W. McClure	" "	55 00
402	" 30	A. B. Baker	" "	70 00
403	" 30	Gardner's Monthly	Subscription	3 20
404	" 30	Academy Nat. Sci., Phila.	Proceedings, 1885	10 00
405	" 30	Kansas C. Review	Subscription	1 00
406	" 30	Lea Bros. & Co.	Books, etc	11 25
407	" 30	C. Scribner & Sons	"	4 00
408	" 30	F. W. Christern	Periodicals	2 67
409	" 30	J. Hopkins, University	"	3 50
410	" 30	W. F. Keener	Books	6 00
411	" 30	Champaign County Gazette	Binding	60 63
412	" 30	A. S. Tiffany	Collection of fossils	14 00
413	" 30	J. W. Queene	Rep. of balance	22 50
414	" 30	Anderson & Bainum	Mason-work	40 20
415	" 30	E. W. Blatchford & Co	Lead	18 32
416	" 30	T. Wright & Co	Castings	106 10
417	" 30	C. & U. Gas Co	Lights, December	49 00
418	" 30	A. M. Coffeen	Tracing-cloth	4 50
419	" 30	Robinson & Burr	Castings, etc	32 27
420	" 30	Besore Bros	Lumber	49 81
421	" 30	Fuller & Fuller	Glass	25 88
422	" 30	I. C. R. R	Freight	6 95
423	" 30	I., B. & W. R. R	"	47 90
424	" 30	J. A. Fay & Co	Belting and files	34 45
425	" 30	N. C. Ricker	Drawings	6 00
426	" 30	Students' pay-roll	Labor, December, 1886	192 04
427	" 30	A. J. Stoneburner	Salary January, 1886	65 00
428	" 30	Mrs. Eaton	Cleaning, etc	4 50
429	" 30	Cora Maltby	Work on insect boxes	18 80
430	" 30	H. Taylor	Salary, January, 1886	25 00
431	" 30	Sub. News Co	Periodicals	276 15
432	" 30	Colegrove Book Co	Books	6 00
433	" 30	Matthews, Northrup & Co	Printing	156 00
434	" 30	M. J. Snyder	Salary, January, 1886	45 00
435	" 30	C. A. Hart	" "	45 00
436	" 30	C. M. Weed	" "	40 00
437	" 30	E. H. Sargent & Co	Apparatus	14 50
438	" 30	J. B. Clow & Son	Pipe and fittings	53 00
439	" 30	Jones Laughlin	Iron and pulleys	41 05
440	Feb. 15	Laclede F. Brick Co	Tile	6 25
441	" 15	Agricultural Department	Expense, January, 1886	137 44
442	" 15	J. Tierney	Work in shop	48 49
443	" 15	H. E. Parker	" "	4 25
444	" 15	C. McClure	Music for band	3 60
445	" 15	H. Taylor	Salary, December, 1885	25 00
446	" 15	D. H. Barrett	" January, 1886	25 00
447	" 15	Grace Peabody	" "	14 62
448	" 15	E. T. Engles	Night firing	38 00
449	" 15	C. M. Maltby	Salary, January, 1886	40 00
450	" 15	F. S. Earle	" "	95 68

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
451	Feb. 27	S. H. Peabody	Salary, Feb., 1886	$250 00
452	" 27	T. J. Burrill	" "	166 66
453	" 27	S. W. Shattuck	" "	166 66
454	" 27	E. Snyder	" "	166 66
455	" 27	J. C. Pickard	" "	166 66
456	" 27	N. C. Ricker	" "	166 66
457	" 27	J. D. Crawford	" "	166 66
458	" 27	G. E. Morrow	" "	166 66
459	" 27	P. Roos	" "	141 66
460	" 27	I. O. Baker	" "	150 00
461	" 27	W. McMurtrie	" "	166 66
462	" 27	S. A. Forbes	" "	96 66
463	" 27	T. B. Comstock	" "	150 00
464	" 27	J. H. Brownlee	" "	150 00
465	" 27	D. McIntosh	" "	150 00
466	" 27	C. W. Rolfe	" "	120 00
467	" 27	A. T. Woods	" "	40 00
468	" 27	A. N. Talbot	" "	100 00
469	" 27	E. A. Kimball	" "	125 00
470	" 27	G. W. Parker	" "	80 00
471	" 27	J. A. Cass	" "	100 00
472	" 27	H. B. Gregory	" "	60 00
473	" 27	S. W. Stratton	" "	50 00
474	" 27	G. C. Hewes	" "	50 00
475	" 27	W. H. Garman	" "	84 00
476	" 27	G. W. McClure	" "	55 00
477	" 27	A. B. Baker	" "	70 00
478	" 27	H. Taylor	" "	25 00
479	" 27	S. W. Shattuck	" Business Agent, 3 months	75 00
480	" 27	A. J. Stoneburner	" Feb., 1886	65 00
481	" 27	M. J. Snyder	" "	45 00
482	" 27	C. A. Hart	" "	45 00
483	" 27	C. M. Weed	" "	40 00
484	" 27	S. B. Skehan	Work in laboratory	21 90
485	" 27	C. Bennett	Expense committee meeting	9 68
486	" 27	R. S. Polk & Co	Advertising	25 00
487	" 27	R. Birkholz	Painting and glazing	11 96
488	" 27	W., St. L. & P. R. R	Freight	7 90
489	" 27	Trevet & Green	Wire cloth	3 00
490	" 27	Mrs. A. B. Baker	Washing towels	2 30
491	" 27	Mrs. Eaton	Cleaning	22 00
492	" 27	J. E. Lindsey	Gravel	1 00
493	" 27	W. T. Pratt	Work on sash	4 50
494	" 27	A. Iten	Work	7 63
495	" 27	J. C. Lewis	Mason work	14 00
496	" 27	I. B. & W. R. R	Freight	16 70
497	" 27	American Express Co	Charges	29 10
498	" 27	Robinson Bros	Sheeting	3 25
499	" 27	Students' pay- oll	January, 1886	155 88
500	" 27	Credit I. C. R. R. donation	Freights	1,232 60
501	" 27	J. W. Queen & Co	Apparatus	59 31
502	" 27	Heliotype Printing Co	Printing	40 00
503	" 27	G. W. Tryon	Books	12 00
504	" 27	W. McMurtrie	Work for State Lab'y Natural Hisiory	31 00
505	" 27	American Naturalist	Subscription	4 00
506	" 27	Naturalist's agency	Books	4 25
507	" 27	C. P. Gillette	"	4 50
508	" 27	S. E. Cassino & Co	"	23 75
509	" 27	W. R. Mitchell	Assistant in entomological work	8 34
510	" 27	T. F. Hunt	Salary, January, 1886	17 10
511	" 27	J. Wolfe	Collection of fossils	10 00
512	" 27	P. Baumgrass	Painting fish casts	100 00
513	" 27	Bausch & Lamb Op. Co	Apparatus	354 00
514	" 27	C. West	Material for Zoölogical Laboratory	11 33
515	" 27	Richards & Co	Apparatus	86 80
516	" 27	U. S. Electric Lighting Co	Dynamo	417 75
517	" 27	Fuller & Fuller	Glass	8 89
518	" 27	Am. Short-horn Breed. Ass'n	Records	34 00
519	" 27	Subscription News Agency	Periodicals	3 45
520	" 27	J. Hopkins University	Publications	3 00
521	" 27	D. H. Lloyde & Son	Books	4 50
522	" 27	Popular Science News Co	Subscription	1 00
523	" 27	International News Co	Periodicals	5 00
524	" 27	C. Schoenhof	Books	64 76
525	" 27	J. W. Butler Paper Co	Boards	12 19
526	" 27	C. Maltby	Salary, February, 1886	40 00
527	" 27	T. F. Hunt	" "	40 00
528	" 27	Trevet & Green	Hardware and plumbing	207 04

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
529	Feb. 27	Henry & Kariher	Paints and sundries	$25 29
530	" 27	Robinson & Burr	Castings	10 41
531	" 27	R. Birkholz	Painting and glazing	24 75
532	" 27	W. Price	Paints, oil, etc	38 70
533	" 27	H. Swannell	Chemicals and paints	33 85
534	" 27	K. M. Baker	Collected music fees	83 00
535	" 27	Champaign Times	Printing	27 75
536	" 27	Champaign Co. Gazette	"	68 70
537	" 27	J. B. Clow & Sons	Pipe and fittings	12 99
538	" 27	R. S. Wilber	Hauling	121 25
539	" 27	A. Iten	Work on grounds	6 63
540	" 27	G. C. Willis	Towels, etc	9 50
541	" 27	C. and U. Gas Co	Lights for January, 1886	84 00
542	" 27	D. H. Lloyde	Stationery	4 08
543	" 27	C. W. Minard	Advertising	3 25
544	" 27	Stock Journal Co	"	41 60
545	" 27	H. E. Parker	Work in Architectural department	3 62
546	" 27	J. Tierney	" " "	45 45
547	" 27	O. Miller	Kettle	4 00
548	" 27	Agricultural department	Expense, February, 1886	141 22
549	" 27	Horticultural department	" "	39 99
550	" 27	E. H. Sargent	Crucibles	8 40
551	" 27	DuQuoin Coal Co	Coal	135 00
552	" 27	American Express Co	Charges	11 50
553	" 27	Barrett's Bindery	Binders	6 24
554	" 27	Nat. School Furn. Co	Crayons	1 50
555	" 27	Bausch & Lamb Op. Co	Apparatus	15 12
556	" 27	D. H. Barrett	Salary, February, 1886	15 00
557	" 27	G. Peabody	" "	15 00
558	" 27	E. T. Engle	Night firing	16 00
559	" 27	Jansen. McClurg & Co	Books	163 37
560	" 27	Ticknor & Co	"	1 00
561	" 27	A. H. Roffe & Co	Periodicals	3 00
562	" 27	U. S. Patent office	Binding	15 60
563	" 27	Students' labor pay roll	February, 1886	167 91
564	" 27	E. M. McAllister	Postage	36 12
565	" 27	S. W. Shattuck	Petty expense, 3 months	39 28
566	" 27	Mechanical department	Work and material for other depart's.	187 12
567	" 27	Mechanical department	Work and material	127 41
568	" 27	Architectural department	Work and material for other depart's.	356 03
569	" 27	Architectural department	Work and material	518 72
570	Mar. 31	K. M. Baker	Salary of organist	50 00
571	" 31	Grant Gregory	" band leader	15 00
572	" 31	A. J. Stoneburner	Salary, March, 1886	65 00
573	" 31	H. Taylor	" "	25 00
574	" 31	C. A. Hart	" "	45 00
575	" 31	M. J. Snyder	" "	45 00
576	" 31	S. H. Peabody	" "	250 00
577	" 31	T. J. Burrill	" "	166 66
578	" 31	S. W. Shattuck	" "	166 66
579	" 31	E. Snyder	" "	166 66
580	" 31	J. C. Pickard	" "	166 66
581	" 31	N. C. Ricker	" "	166 66
582	" 31	J. D. Crawford	" "	166 66
583	" 31	G. E. Morrow	" "	166 66
584	" 31	P. Roos	" "	141 66
585	" 31	I. O. Baker	" "	150 00
586	" 31	W. McMurtrie	" "	166 66
587	" 31	S. A. Forbes	" "	96 66
588	" 31	T. B. Comstock	" "	150 00
589	" 31	J. H. Brownlee	" "	150 00
590	" 31	D. McIntosh	" "	150 00
591	" 31	C. W. Rolfe	" "	120 00
592	" 31	A. T. Woods	" "	40 00
593	" 31	A. N. Talbot	" "	100 00
594	" 31	E. A. Kimball	" "	125 00
595	" 31	G.W. Parker	" "	80 00
596	" 31	J. A. Cass	" "	100 00
597	" 31	H.B. Gregory	" "	60 00
598	" 31	S. W. Stratton	" "	50 00
599	" 31	G. C. Hewes	" "	50 00
600	" 31	W. H. Garman	" "	84 00
601	" 31	G. W. McClure	" "	55 00
602	" 31	A. B. Baker	" "	70 00
603	" 31	G. C. Eisenmayer	Expense to Board meeting	18 50
604	" 31	Alexander McLean	" two " "	36 80
605	" 31	G. A. Follansbee	" " "	17 76
606	" 31	Chas. Bennett	" " "	11 20

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1885.			
607	Mar. 31	A. T. Pearman	Sundry expenses	$10 00
608	" 31	G. E. Morrow	Expense to Farm Institute	29 86
609	" 31	E. M. & M. W. Knowlton	Jars and mucilage	1 30
610	" 31	Heller & Toy	Hauling	2 50
611	" 31	Hubbard & Son	Hardware	2 35
612	" 31	Zell, Schwabacher & Co	Alcohol	47 00
613	" 31	P. Baumgrass	Painting casts of fishes	135 75
614	" 31	T. F. Hunt	Salary, March, 1886, and February, 1886.	50 00
615	" 31	Cora Maltby	" " "	40 00
616	" 31	C. M. Weed	" " "	40 00
617	" 31	T. J. Burrill	Botanical survey of State	100 00
618	" 31	S. A. Forbes	N. H. Lab. expense for quarter	358 74
619	" 31	Richards & Co	Chemicals and apparatus	82 83
620	" 31	Jones & Laughlins	Pipe fittings, etc	41 34
621	" 31	Stearns & Co	1 barrel stucco	1 85
622	" 31	Thos. Wright	Casting	8 05
623	" 31	J. Tierney	Work in shop	21 82
624	" 31	H. E. Parker	" "	4 37
625	" 31	D. H. Barrett	Salary, March, 1886	25 00
626	Apr. 15	Chas. Bennett	Expense to Board meeting	5 75
627	" 15	Parker Earle	" " "	26 50
628	" 15	S. H. Peabody	Traveling expenses	44 25
629	" 15	S. H. Peabody	Balance of salary for March, 1886	62 50
630	" 15	W. Union Tel. Co	Telegrams	3 15
631	" 15	C. Union Tel. Co	1 quarter rent and material furnished.	33 25
632	" 15	Crane Elevator Co	Rubber valves	2 00
633	" 15	J. M. W. Jones	Index	2 00
634	" 15	Illinois School Journal	Advertising	12 50
635	" 15	The Illini	Printing and advertising	30 08
636	" 15	Agricultural department	Expense, March, 1886	538 75
637	" 15	Horticultural department	" "	30 34
638	" 15	Rudolf Birkholz	Painting and glazing	7 10
639	" 15	C. & U. Gas Co	Lights, March, 1886	88 00
640	" 15	C. M. McClure	Band music	2 60
641	" 15	Students' labor pay-roll	March, 1886	138 36
642	" 15	Grace Peabody	Salary, March, 1886	16 87
643	" 15	Pay-roll of workmen	March, 1886	7 01
644	" 15	M. T. Keener	Books	6 00
645	" 15	Ticknor & Co	Books and drawings	7 00
646	" 15	A. C. McClurg & Co	Books	125 70
647	" 15	U. S. Electric L. Co	Wires, insulators, etc	40 54
648	" 15	D. S. Roots	Boxes, etc	9 70
649	" 15	S. A. Forbes	Expenses of Lab. Nat. History	183 33
650	" 15	F. Gilbert	Cases and bottles	200 00
651	" 30	S. H. Peabody	Salary, April, 1886	333 33
642	" 30	T. J. Burrill	" "	166 66
653	" 30	S. W. Shattuck	" "	166 66
654	" 30	E. Snyder	" "	166 66
655	" 30	J. C. Pickard	" "	166 66
656	" 30	N. C. Ricker	" "	166 66
657	" 30	J. D. Crawford	" "	166 66
658	" 30	G. E. Morrow	" "	166 66
659	" 30	P. Roos	" "	141 66
660	" 30	I. O. Baker	" "	150 00
661	" 30	W. McMurtrie	" "	166 66
662	" 30	S. A. Forbes	" "	96 66
663	" 30	T. B. Comstock	" "	150 00
664	" 30	J. H. Brownlee	" "	150 00
665	" 30	D. McIntosh	" "	150 00
666	" 30	C. W. Rolfe	" "	120 00
667	" 30	A. T. Woods	" "	40 00
668	" 30	A. N. Talbot	" "	100 00
669	" 30	E. A. Kimball	" "	125 00
670	" 30	G. W. Parker	" "	80 00
671	" 30	J. A. Cass	" "	100 00
672	" 30	H. B. Gregory	" "	60 00
673	" 30	S. W. Stratton	" "	50 00
674	" 30	G. C. Hewes	" "	50 00
675	" 30	W. H. Garman	" "	84 00
676	" 30	G. W. McClure	" "	60 00
677	" 30	A. B. Baker	" "	70 00
678	" 30	T. F. Hunt	" "	80 00
679	" 30	C. A. Hart	" "	45 00
680	" 30	C. M. Weed	" "	45 00
681	" 30	M. J. Snyder	" "	45 00
682	" 30	H. W. Rokker	Printing	500 00
683	May 15	J. T. Pearman	Expenses to Board meeting	10 00
684	" 15	G. C. Eisenmayer	" "	27 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
685	May 15	C. M. Maltby	Salary, April, 1886	$40 00
686	" 15	A. J. Stoneburner	" "	40 00
687	" 15	D. H. Barrett	" "	15 00
688	" 15	H. Taylor	" "	25 00
689	" 15	G. Peabody	" "	14 75
690	" 15	T. A. Lewis	Taxes on lots	18 47
691	" 15	Agricultural Department	Expenses, April, 1886	225 80
692	" 15	Horticultural Department	" "	48 88
693	" 15	H. E. Parker	Work in Architectural shops	6 37
694	" 15	Labor pay-roll	Work on grounds	25 43
695	" 15	W. Swartz	Fence posts	8 80
696	" 15	Ill. Soc. of Eng. Surv	Advertising	10 00
697	" 15	T. B. Comstock	Petty expenses	9 35
698	" 15	C. W. McClure	Musket and parts	22 42
699	" 15	Renner & Bro	Coal	8 60
700	" 15	Students' labor	Pay-roll, April, 1886	195 44
701	" 31	S. H. Peabody	Salary, May, 1886	333 33
702	" 31	T. J. Burrill	" "	166 66
703	" 31	S. W. Shattuck	" "	166 66
704	" 31	E. Snyder	" "	166 66
705	" 31	J. C. Pickard	" "	166 66
706	" 31	N. C. Ricker	" "	166 66
707	" 31	J. D. Crawford	" "	166 66
708	" 31	G. E. Morrow	" "	166 66
709	" 31	P. Roos	" "	141 66
710	" 31	I. O. Baker	" "	150 00
711	" 31	Wm. McMurtrie	" "	166 66
712	" 31	S. A. Forbes	" "	96 66
713	" 31	T. B. Comstock	" "	150 00
714	" 31	J. H. Brownlee	" "	150 00
715	" 31	D. McIntosh	" "	150 00
716	" 31	C. W. Rolfe	" "	120 00
717	" 31	A. T. Woods	" "	40 00
718	" 31	A. N. Talbot	" "	100 00
719	" 31	E. A. Kimball	" "	125 00
720	" 31	G. W. Parker	" "	80 00
721	" 31	J. A. Cass	" "	100 00
722	" 31	H. B. Gregory	" "	60 00
723	" 31	S. W. Stratton	" "	50 00
724	" 31	G. C. Hewes	" "	50 00
725	" 31	W. H. Garman	" "	84 00
726	" 31	T. Hunt	" "	80 00
727	" 31	G. W. McClure	" "	60 00
728	" 21	A. B. Baker	" "	70 00
729	" 31	J. A. Stoneburner	" "	40 00
730	" 31	K. M. Baker	" Spring term	50 00
731	" 21	S. W. Shattuck	" Business Agent, 3 months	75 00
732	" 31	H. Taylor	" May, 1886	25 00
733	" 31	D. H. Barrett	" "	15 00
734	" 31	M. J. Snyder	" "	45 00
735	" 31	C. A. Hart	" "	23 93
736	" 31	C. M. Weed	" "	45 00
737	" 31	Richards & Co	Apparatus	19 49
738	" 31	I., B. & W. R. R. Co	Freight	36 34
739	" 31	W., St. L. & P. Ry	"	2 90
740	" 31	D. C. Long	Book	3 50
741	" 31	J. C. Lewis	Mason work	5 90
742	" 31	American Express Co	Charges	8 65
743	" 31	Douglas, Thompson & Co	Plates	6 31
744	" 31	Stearns & Co	1 bbl stucco	1 85
745	" 31	W. McMurtrie	Traveling expenses	1 79
746	" 31	G. Gregory	Salary, band leader	15 00
747	" 31	J. H. Garrett	Salary as laboratory assistant	37 50
748	" 31	J. C. Cromwell	" " "	37 50
749	" 31	N. Ayers	Salary as Botanical Assistant	16 80
750	" 31	Cora Maltby	Salary, May, 1886	36 80
751	" 31	Burnham, Trevet & Mattis	Expenses for land sales	202 83
752	" 31	R. S. Wilbur	Hauling	106 00
753	" 31	Robinson & Burr	Work and material	18 45
754	" 21	A. M. Coffeen	Tracing cloth	3 00
755	" 31	Du Quoin Coal Co	Coal	147 00
756	" 31	Champaign M. and G. works	Stone-cutting	2 00
757	" 31	A. H. Renner & Co	Coal	6 45
758	" 31	C. & U. Gas Co	Lights, April, 1886	42 00
759	" 31	A. C. McClurg & Co	Stationery	30 57
760	" 31	Illini	Printing	39 50
761	" 31	J. A. Fay & Co	Files, etc	3 96
762	" 31	J. Bacon	Coal	17 30

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
763	May 31	Besore Bros	Lumber and lime	$57 66
764	" 31	Western Electric Co	Magnets	10 34
765	" 31	E. H. Sargent & Co	Apparatus	11 86
766	" 31	J. Hinchey	Zoölogical specimens	100 00
767	" 31	H. Hertzer	Geological "	500 00
768	" 31	U. S. Patent Office	Binding reports	15 60
769	" 31	American Chem. Journal	Subscription	3 00
770	" 31	D. Appleton & Co	Books	6 00
771	" 31	E. N. McAllister	Periodicals	1 85
772	" 31	M. E. Lapham	Fencing	28 20
773	" 31	J. First	Hauling	4 75
774	" 31	U. S. Electric Light Co	Arc lights	152 98
775	" 31	Crosby Steam Valve Co	Repairing indicator	2 50
776	" 31	Agricultural department	Farm expenses, May, 1886	417 58
777	" 31	Horticultural "	" "	31 05
778	" 31	Students' pay-roll	May, 1886	185 08
779	" 31	Grace Peabody	Salary, May, 1886	16 73
780	" 31	Mrs. Eaton	Cleaning	17 00
781	" 31	C. McClure	Expense of judges at drill	11 50
782	" 31	Illinois Central Railroad	Advanced freight	2 18
783	" 31	T. J. Burrill	Petty expenses	5 14
784	" 31	Mrs. A. B. Baker	Washing towels	2 50
785	" 31	K. M. Baker	Music fees collected	97 00
786	" 31	Pacific Express Co	Charges	3 15
787	" 31	Pay-roll of workmen	May, 1886, on B. and G	50 61
788	" 31	Architectural department	Power	60 00
789	" 31	Mechanical "	"	60 00
790	June 15	S. M. Millard	Expense to board meeting	25 11
791	" 15	Charles Bennett	" " "	7 18
792	" 15	G. C. Eisenmayer	" " "	18 50
793	" 15	A. McLean	" two " "	39 38
794	" 15	S. H. Peabody	Traveling expenses	64 30
795	" 15	P. Mueller	Decoration of hall	110 00
796	" 15	Bausch & Lamb Opt. Co	Apparatus	174 63
797	" 15	H. A. Ward	Glass models	110 40
798	" 15	A. C. McClurg & Co	Books	121 90
799	" 15	W. R. Roberts	Book	2 25
800	" 15	S. A. Forbes	Expense of office and library	183 33
801	" 30	S. H. Peabody	Salary, June, 1886	333 33
802	" 30	T. J. Burrill	" "	166 66
803	" 30	S. W. Shattuck	" "	166 66
804	" 30	E. Snyder	" "	166 66
805	" 30	J. C. Pickard	" "	166 66
806	" 30	N. C. Ricker	" "	166 66
807	" 30	J. D. Crawford	" "	166 66
808	" 30	G. E. Morrow	" "	166 66
809	" 30	P. Roos	" "	141 66
810	" 30	I. O. Baker	" "	150 00
811	" 30	W. McMurtrie	" "	166 66
812	" 30	S. A. Forbes	" "	96 66
813	" 30	T. B. Comstock	" "	150 00
814	" 30	J. H. Brownlee	" "	150 00
815	" 30	D. McIntosh	" "	150 00
816	" 30	C. W. Rolfe	" "	120 00
817	" 30	A. T. Woods	" "	40 00
818	" 30	A. N. Talbot	" "	100 00
819	" 30	E. A. Kimball	" "	125 00
820	" 30	G. W. Parker	" "	80 00
821	" 30	J. A. Cass	" "	100 00
822	" 30	H. B. Gregory	" "	60 00
823	" 30	S. W. Stratton	" "	50 00
824	" 30	G. C. Hewes	" "	50 00
825	" 30	W. H. Garman	" "	84 00
826	" 30	T. F. Hunt	" "	80 00
827	" 30	G. W. McClure	" "	60 00
828	" 30	A. B. Baker	" "	70 00
829	" 30	A. J. Stoneburner	" to June 9, 1886	12 60
830	" 30	D. H. Barrett	" Spring term, 1886	10 00
831	" 30	M. Powers	" as assistant	10 00
832	" 30	A. Iten	Work on grounds	13 07
833	" 30	A. E. Johnson	Building fence	6 50
834	" 30	J. S. Hawkins	Repairs on water barrels	4 00
835	" 30	Trevett & Green	Hardware	14 19
836	" 30	Wallace & Maltby	Lawnmower and work	15 00
837	" 30	C. & U. Gas Co	Lights, May, 1886	70 00
838	" 30	Wm. Price	Paints	11 31
839	" 30	H. E. Parker	Work in carpenter shop	12 87
840	" 30	J. Tierney	" "	15 52

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
841	June 30	DuQuoin Coal Mining Co.	2 cars coal	$40 00
842	" 30	D. H. Lloyde & Son	Stationery	6 80
843	" 30	E. J. Cantine	Blue printing	1 80
844	" 30	Walker & Mulliken	Sundry fixtures	3 90
845	" 30	Besore Bros	Blinds	63 05
846	" 30	Champaign Co. Herald	Printing	13 00
847	" 30	West'n Bank Note Eng. Co.	Diplomas	12 50
848	" 30	Champaign Co. Gazette	Printing	35 75
849	" 30	H. Swannell	Chemicals	80 91
850	" 30	C. F. Hart	Salary, June, 1886	50 00
851	" 30	C. M. Weed	" "	45 00
852	" 30	Mary J. Snyder	" "	45 00
853	" 30	C. M. Maltby	" "	32 34
854	" 30	Judd Detweiler	Electroscope	1 75
855	" 30	J. F. Luhme & Co	Apparatus	54 71
856	" 30	C. Schoenhof	Books	123 82
857	" 30	E. Cobb	Expenses to Board meetings	15 10
858	" 30	F. Miller	Piano tuning	5 00
859	" 30	S. W. Shattuck	Petty expenses, 3 months	41 02
860	" 30	E. N. McAllister	Postage, 3 months	54 45
861	" 30	H. Taylor	Salary, June, 1886	25 00
862	" 30	M. B. Waite	Work on specimens	79 53
863	" 30	Credit arch. department	Belting and material	57 00
864	" 30	Credit mech. department	Four wood lathes	160 00
865	" 30	Architectural department	Repairs of machines and tools	7 70
866	" 30	S. A. Forbes	Expenses	183 33
867	" 30	Ganther & Villars	Books	25 00
868	" 30	A. Hermann	"	25 00
869	July 15	J. W. Bunn	Taxes on W. lands	1,666 87
870	" 15	N. Ayers	Labor on herbarium	19 20
871	" 15	W. R. Mitchell	Assistant	21 00
872	" 15	E. Carmann	Labor	30 75
873	" 15	I. Smith	"	16 88
874	" 15	R. Birkholz	Setting glass	5 70
875	" 15	Wm. Roysdon	Hauling	10 00
876	" 31	S. H. Peabody	Salary, July, 1886	333 33
877	" 31	T. J. Burrill	" "	166 66
878	" 31	S. W. Shattuck	" "	166 66
879	" 31	E. Snyder	" "	166 66
880	" 31	J. C. Pickard	" "	166 66
881	" 31	N. C. Ricker	" "	166 66
882	" 31	J. D. Crawford	" "	166 66
883	" 31	G. E. Morrow	" "	166 66
884	" 31	P. Roos	" "	141 66
885	" 31	I. O. Baker	" "	150 00
886	" 31	W. McMurtrie	" "	166 66
887	" 31	S. A. Forbes	" "	96 66
888	" 31	T. B. Comstock	" "	150 00
889	" 31	J. H. Brownlee	" "	150 00
890	" 31	E. A. Kimball	" "	125 00
891	" 31	G. W. Parker	" "	80 00
892	" 31	T. F. Hunt	" "	80 00
893	" 31	G. W. McClure	" "	60 00
894	" 31	A. B. Baker	" "	70 00
895	" 31	J. Tierney	Work in shop	43 09
896	" 31	H. E. Parker	" "	12 00
897	" 31	G. Peabody	Salary as clerk	14 25
898	" 31	Horticultural department	Expenses, June, 1886	195 48
899	" 31	Agricultural department	" "	2,060 06
900	" 31	Students' pay-roll	Labor, "	133 42
901	" 31	Champaign Co. Gazette	Printing 6,000 catalogues	299 00
902	" 31	F. P. Elliott & Co	Catalogue wraps	6 45
903	" 31	J. Jones St. and Pt. Co	Files	7 35
904	" 31	T. A. DeWeise	Advertisement	2 00
905	" 31	Our Co. and V. Schs. Pub. Co.	"	26 67
906	" 31	Champaign Times	Printing	35 00
907	" 31	C. & U. Telephone Co	Rent, etc., July to October, 1886	15 00
908	" 31	Burnham, Trevett & Mattis.	Advertisement of Nebraska lands	29 00
909	" 31	W. H. Garman	Class material	8 13
910	" 31	J. W. Queen & Co.	Repairs	25 40
911	" 31	S. A. Forbes	Expenses of State Laboratory	183 33
912	" 31	N. Bardwell	Assistance in laboratory	23 55
913	" 31	W. H. Garman	Salary, July, 1886	80 00

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
914	July 31	M. J. Snyder	Salary. July, 1886	$45 00
915	" 31	C. M. Maltby	" "	45 00
916	" 31	C. F. Hart	" "	45 00
917	" 31	C. M. Weed	" "	50 00
918	" 31	S. A. Forbes	Class material	19 00
919	" 31	L. McQuay	Cutting stone	19 20
920	Aug. 14	Agricultural department	Expenses, July, 1886	879 40
921	" 14	Horticultural department	" "	83 16
922	" 14	Students' pay-roll	Labor, July, 1886	155 94
923	" 14	Pay-rolls	" "	86 62
924	" 14	J. Wilske	Mason work	79 70
925	" 14	C. Woodworth	Assistance and expenses	80 41
926	" 31	S. H. Peabody	Salary, Aug., 1886	333 33
927	" 31	T. J. Burrill	" "	166 66
928	" 31	S. W. Shattuck	" "	166 66
929	" 31	E. Snyder	" "	166 66
930	" 31	J. C. Pickard	" "	166 66
931	" 31	N. C. Ricker	" "	166 66
932	" 31	J. D. Crawford	" "	166 66
933	" 31	G. E. Morrow	" "	166 66
934	" 31	P. Roos	" "	141 66
935	" 31	I. O. Baker	" "	150 00
936	" 31	W. McMurtrie	" "	166 66
937	" 31	S. A. Forbes	" "	96 66
938	" 31	T. B. Comstock	" "	150 00
939	" 31	J. H. Brownlee	" "	150 00
940	" 31	E. A. Kimball	" "	125 00
941	" 31	G. W. Parker	" "	80 00
942	" 31	T. F. Hunt	" "	80 00
943	" 31	G. W. McClure	" "	60 00
944	" 31	A. B. Baker	" "	70 00
945	" 31	S. W. Shattuck	" as Business Agent	75 00
946	" 31	G. A. Huff	Hack hire	7 50
947	" 31	N. Ayers	Labor on herbarium	31 20
948	" 31	S. W. Stratton	Engrossing	16 50
949	" 31	Sylvester Ogg	Mowing with team	2 80
950	" 31	A. R. Bronson	Plowing	6 00
951	" 31	K. M. Baker	Music fees collected	18 50
952	" 31	G. Peabody	Salary, July, 1886	7 62
953	" 31	Butler Paper Co	Paper	36 81
954	" 31	Farmers' Call	Advertisement	6 50
955	" 31	J. H. Sanders Pub. Co	"	21 00
956	" 31	Inter Ocean Co	"	28 00
957	" 31	Chicago Tribune	"	33 60
958	" 31	Chicago Times	"	17 92
959	" 31	Farmers' Review Co	"	22 50
960	" 31	Baker & Co	Engraving	50 00
961	" 31	Elder Publishing Co	Advertisement	3 00
962	" 31	Illinois School Journal	"	7 50
963	" 31	C. H. Evans & Co	"	2 00
964	" 31	Fruit Growers' Journal	"	5 00
965	" 31	A. Iten	Labor on grounds	28 50
966	" 31	Larrabee & North	Tools and hardware	4 71
967	" 31	Agricultural department	Expenses, August, 1886	272 12
968	" 31	Horticultural department	" "	22 97
969	" 31	J. Creek	Labor in July	51 07
970	" 31	J. Tierney	" "	36 56
971	" 31	H. E. Parker	" "	29 25
972	" 31	B. F. Carmann	Hauling	5 00
973	" 31	I. B. & W. R. R	Steel rails	8 26
974	" 31	R. Birkholz	Painting	10 50
975	" 31	Ayers & Wilson	Dressing chisels	2 55
976	" 31	I. Smith	Labor	13 75
977	" 31	Mrs. Iten	Labor, in June, 1886	3 50
978	" 31	J. Furst	Hauling	1 50
979	" 31	Stearns & Co	Fire clay	7 50
980	" 31	A. J. Stoneburner	Police service	1 50
981	" 31	J. Wilske	Mason work	10 00
982	" 31	Besore Bros	Lime and cement	3 00
983	" 31	Trevett & Green	Material and labor	440 00
984	" 31	Natick Citizen	Printed labels	2 50
985	" 31	M. B. Waite	Work on herbarium	14 99
986	" 31	I. B. & W. R. R	Freight	14 34
987	" 31	American Express Co	Charges	6 70

List of Warrants—Continued.

No.	Date.	To Whom.	For What.	Amount.
	1886.			
988	Aug. 31....	H. E. Parker	Labor, August, 1886	$29 87
989	" 31....	J. Tierney	" "	58 50
990	" 31....	J. Creek	" "	31 50
991	" 31....	S. A. Forbes	Field and office expenses	183 33
992	" 31....	A. B. Seymour	Botanical Assistant	83 33
993	" 31....	W. H. Garman	Salary, Aug., 1886	80 00
994	" 31....	C. A. Hart	" "	45 00
995	" 31....	C. M. Weed	" "	50 00
996	" 31....	C. M. Maltby	" "	15 58
997	" 31....	Nellie Bardwell	Drawing	17 50
998	" 31....	W. R. Mitchell	Assistant in laboratory	35 40
999	" 31....	Pay-roll of men	Labor in August, 1886	93 25
1000	" 31....	Students' pay-roll	" "	48 20

UNIVERSITY OF ILLINOIS.

REPORTS OF THE REGENT AND OF THE PROFESSORS OF THE DEPARTMENTS.

The event most important to the institution during the two years now drawing to a close has been the change of its name by authority of the General Assembly, expressed in an act approved by the Governor, July 19, 1885, which reads as follows:

"*Be it enacted by the People of the State of Illinois, represented in the General Assembly,* That the Illinois Industrial University, located at Urbana, in Champaign Co., shall after the passage of this act be known as the University of Illinois, and under that name and title shall have, possess, be seized of and exercise all rights, privileges, franchises and estates which have hitherto belonged to or may hereafter inure to the said Illinois Industrial University."

The passage of this act had been greatly desired by all who had carefully watched the progress of the University since its organization in 1868, who understood the true scope and breadth of its operations, and who wished to see it stand in its true place in the galaxy of western State institutions of learning. The measure was earnestly opposed by some who, honestly without doubt, feared that the change in name was but the precursor of a radical change in the underlying plan and the outworking methods of the University. These persons could not understand as did they who had more immediately toiled in building the walls, and in developing the character of the new institution, how little of good and how much of harm came to the enterprise with the word which was eliminated from the name it at first received. The meaning it should have symbolized came to the minds of relatively the few, who best understood its true aims. Another, and that an injurious significance, came to the multitudes who knew of it in only a casual and an imperfect manner.

But the character and the qualities of a living and fruitful tree, that has flourished in blossom and in fruit for nearly twenty years, can not be modified by any change in its name. It has come by that time to be known by its fruits. People know whether it bears figs or thistles without looking at its label, and the friends of the University of Illinois confidently point to the work doing and done in its various colleges and schools, as evidence that the great interests intrusted to its care have never been forgotten or neglected. Its recognized mission has been to illumine and to vitalize all the industries of the men of this State in this age, with the light and the warmth contributed by the discoveries and the developments of science —the science which is the crowning and tra scendent glory of this youngest century of the world's life. The fable ran that Prometheus seized the fire of heaven and kindled therewith a blaze upon the hearthstone of each humblest cottager. So must learning open the store houses of nature and bring her powers captive to work by the ways and wains, lighten the labor, and fill garner and warehouse for every toiling son and daughter of the soil, the mill and the mine. And the yet greater and nobler mission of this, as of all schools of whatever grade from the humblest to the highest, is to develop and to enrich the resources of the State in the characters and the capacities of the young men and women who will so soon constitute the State.

The plan of organization of the University remains as it has been from the very first. It comprises the four colleges of Agriculture, Engineering, Natural Science, and Literature and Science. This combination affords with a comparatively limited amount of working force, a very large scope of working capacity, for to each specialty is added opportunities of aid from all the others. The available faculty for the College of Agriculture, or for that of Natural Science, is considerably larger than would be likely, not to say possible, if either of these two departments were organized separately from all the others.

The College of Agriculture maintains its early and honored place at the head of the list of colleges and schools. In its faculty and its equipment it is kept constantly in the foreground. Its attendance has not fallen below the figures of former years. It has been the habit of certain agricultural writers to refer to the schools of agriculture of other states, particularly Michigan, Kansas and Mississippi, as unqualifiedly successful, and to count those of other states, including Illinois, as without question failures. There is a semblance of truth, and a large proportion of error in both these statements. In the first place the schools named lie closer in time to the common schools of the state, by one, two, or even three years, and are in so far doing academic or high school work rather than collegiate or technical work. In the second place, the schools named are schools of general science, and count all their students under the general term agricultural.

The University of Illinois is one of specialized science, and reports as agricultural students only such as make the study of that subject the special business of their attendance. If those schools would set forth distinctly the names of such of their students as make the study of agriculture a specialty, there is no doubt that our lists would compare favorably with any others. In the third place, an examination of the several courses of study will show that the course pursued in the University of Illinois in agriculture has an amount of actual technical agriculture in it larger than is found in any other institution in the west, and more than twice as much as in either of those named.

The generosity of the general government has furnished large opportunity for the study of agriculture by the sons of American farmers, more than forty colleges which make this subject an object of special attention being now in successful operation.

The number of students who are pursuing agricultural studies makes a very considerable aggregate, and yet is very small in proportion to the magnitude of the agricultural interests of the country. Very many reasons have been assigned for the small number of agricultural students, as compared with those in other departments of technical science. Without pausing to discuss or deny many others which might be presented, one overshadows all the rest. The young men who reflect upon the idea of making this subject their choice ask of it, as they do of other lines of study—Will it pay?—and very few discover that it will pay. The question to them is individual and personal. It is not: Will the development of agricultural science and the diffusion of agricultural knowledge benefit the country and help the farming interests? That is admitted, but it is vague and remote. The pertinent question is: Can I earn better wages on the farm if I have graduated from an agricultural course of study than if I had not? When a similar question is asked by one who proposes to study engineering, chemistry, architecture, mechanism, or to take a course of normal instruction, the answer is promptly in the affirmative. The querist knows numerous instances within his own circle of acquaintance of persons whose monthly or yearly earnings are larger by very considerable and definite amounts than they would have been if those persons had not invested a certain amount of capital in securing an education specially adapting them for such work. If the graduate of an agricultural college is the fortunate possessor of a farm, or if his father has one on which he may exercise his special skill, there is little doubt that a student of fair ability will show good results for his study and discipline. If he is without the means to get the management of a farm into his own hands—and the opportunities for farm superintendence on salary or month's wages are very scarce in so new a country as this—he does not find occupation at wages that will pay for his investment as a student. However earnestly we may regret that the facts are as they are, we can not deny them, and the change in them will come but slowly.

The Veterinary Department of the School of Agriculture has received a valuable accession in Dr. Donald McIntosh, late of Kingston, Ontario. Dr. McIntosh has proved himself an accomplished practitioner and a careful instructor. His clinics are very fully attended. Farmers bring diseased animals of every domestic variety and have them treated and prescribed for, free of charge, in the presence of the class. The benefits of the School are thus disseminated as far as neighborhood lines can reach, as well as to those who are making veterinary science a study. Indeed, the subjects which pertain to animal husbandry in all its forms have long received careful attention here. The varied breeds of animals, the laws of breeding and crossing, their care in health and in sickness, the practical details of feeding, fattening, and marketing, are all made the objects of careful study and instruction, illustrated by specimens of thoroughbred animals of many breeds, in every principal department, horses, cattle, sheep, swine, and poultry. Dairying and butter-making are not forgotten.

For reasons precisely the opposite of those just cited, the College of Engineering has made the most decided advancement. Machinists, engineers, architects, are in constant demand. Each season brings to us more calls than we can supply. This College has been enlarged within the last two years by the organization of a School of Mining Engineering, to meet the demands of this very important interest in our State. Large additions have been made to the equipments in the machine shop, and the carpenters' shop, and both these are now running to nearly their full capacity. The students in Civil Engineering are now expected to take a course of training in the machine shop, as a very necessary preparation for an important branch of their profession.

The School of Architecture of this College deserves particular notice, as it is one of but four in our country which make this subject a specialty. Among these it has distinguished itself by the peculiar attention given in its courses to structural excellence, but without neglecting artistic culture. The first requisite in any structure is security, the second convenience, the third artistic adaptation. Good building demands all of these. Proper teaching inculcates such principles and fosters such practice as will secure all of these. If such instruction is not obtained in our classes it must be from the want of attention or of preparation in those who pursue the studies of this department.

It is hoped that greater interest will be shown in the School of Mining Engineering than has yet been apparent. The subject is one of constantly growing importance, both to those who are interested in developing the mineral resources of this great State and to those who are seeking opportunities for investment in the constantly growing mining operations among the Rocky Mountains and on the Pacific slope. The day rapidly approaches when improved methods of mining, and improved processes of metallurgy, will turn the scale in many enterprises which have heretofore been unrenumerative, and will bring prosperity and wealth instead of disaster and loss. The place where these improvements will have their sources is in the scientific instruction given and to be given in schools of mining engineering. When the time comes that managers of mines have had proper training, including both theoretical and applied science, a mine will be something more than a dangerous burrow in the rock, and the dump piles, that now signify only wasted labor, will themselves yield profit for labor.

The College of Natural Science has received a new and more efficient impulse within the two years now closing. This has come from the removal to the University of the State Laboratory of Natural History, under its accomplished Director, Dr. Stephen A. Forbes, and with its corps of trained and skillful assistants. The Director of this Laboratory is also the State Entomologist. The union of these two functions in one person was a step wisely taken, since the work of the two offices is so similar in its nature and so identical as to its field. The devastation caused by insect foes is becoming annually a growing cause of loss to the farmer and the fruit grower. The causes which influence and modify these evils are climatic and biologic. The study which shall discover and bring into practical operation methods of anticipating, of mitigating, of controlling, or of absolutely destroying these evils, will be long, careful and intricate. We must believe that in most cases it will ultimately be successful.

Evidently this University is the natural home of investigation and of instruction in the work of these specialties. The University has been at much expense in providing not the best and most suitable accommodations for such work which could be devised, but those which will greatly facilitate the labors of Prof Forbes and his assistants. While providing for this work, equal care has been taken to advance the biological work of the University itself, and the equipment for that specialty has received much attention. The work of Professor Burrill in the more occult lines of botanical research has constantly progressed, and has been aided with better facilities, instrumental and other. The day can not be far distant when the State must furnish a distinct and well arranged building for the School of Natural History, which shall contain all its material for illustration, in museum and herbarium, and all its laboratories, work-rooms and class-rooms.

It is a matter of present regret that the State University, an institution particularly devoted to technical and applied science, is almost entirely destitute of material to illustrate the geology of the State of Illinois. The University has sent its teachers and pupils into the prairies and forests of the State, has seined its streams, and netted its insects, and collected and mounted a goodly representation of its animal and vegetable life. But although the State has expended large sums for a careful and thorough geological survey, and has in its possession a great wealth of material in the various departments of rocks, fossils, and minerals, the University has next to none at all. Here, if anywhere, these collections can have instructional and illustrative value. Elsewhere they are of necessity chiefly objects of curiosity, the delight of such as suppose a museum is normally a place of amusement.

The State Geological Collection ought certainly to be deposited and displayed where it can give to science the largest and most useful returns. It is difficult to see where these ends can be had so certainly as at the State University; but if it should appear that in some other place its usefulness may be greater, surely the University may be permitted to use the duplicates which for so many years have lain in the basement of the State House in quiet seclusion, scarcely less complete than when they occupied their native graves in the strata of the earth, before the geological survey resurrected them from their sleep of eons.

The School of Chemistry maintains its useful activity. Its pupils have been in so great demand that the University has not been able to keep its graduates for its own purposes as teachers, and has been compelled to secure its assistants elsewhere. Without being able to answer all the calls made upon it, it has nevertheless made many analyses for public officers, including the State Board of Health. Had the Laboratory done all of this work which has been asked of it, the entire time of an accomplished chemist would have been demanded and used. No call is now more constant than for instruction in Pharmacy. With slight exceptions, easily provided for, all the instruction of a full School of Pharmacy might be given here. Our courses of chemistry and botany are already more complete than in most Colleges of Pharmacy. The great obstacle now exists in the demand of the State Board of Pharmacy for four years of active practice in a drug store, in which it is understood that the time spent in selling over the counter perfumes, spirituous liquors, soda-water and cigars counts equally with that employed in rolling pills or compounding tinctures. It would seem that a course of thorough training in a quantitative laboratory, in weighing, analysis, synthesis, valuing drugs, determining poisons, etc., ought to receive better recognition as a part of a druggist's training than is now given to it, and that it is really of more fundamental importance in making a druggist careful, intelligent and exact, than the chief part of what he actually does when professedly serving a drug-shop apprenticeship. We believe it would not be unreasonable to ask that at least one-half the time spent at the University in the pursuit of a course of pharmaceutical instruction should be counted towards the time of drug-shop practice required of the student. We believe that this concession could be made without lowering in the least the high standard of qualification which every citizen recognizes as needful in those who dispense to us in prescriptions the things which lay hold of life and death to us and to our families.

The College of Literature and Science is now that which needs the most earnest fostering care. For six years at least, and, indeed, from the organization of the University, the other colleges have been earnestly cherished, while this has been permitted to live. Other schools have been provided with lands and laboratories, museums and workshops, apparatus and machinery, while this has had nothing but the patient labor of some earnest workers, and a small proportion of the books bought for the library. In spite of all assertions to the contrary, it has been literally true that at this University the "leading object has been to teach those subjects which relate to Agriculture and the Mechanic Arts." Science has been the Isaac and Literature has been the Ishmael of this household. Nor is it now proposed to take away any of Isaac's property to give to Ishmael. Science must ever continue to have the leading place, but Literature and literary students deserve and ought to receive better opportunities than have hitherto been vouchsafed to them.

Particular care ought to be given to furnish the best facilities to such as seek the University because of its peculiar training in scientific subjects as a foundation for teaching. In this respect its field and scope are so different from those of the Normal Schools —invaluable as they are in the school system of the State—that there is and can be no unfriendly competition between the two, the University and the Normal Schools, and no attempt on the part of the one to supplant the other. The resolution of the State Association of Teachers, asking for the appointment of a Professor of Pedagogy, was received very cordially by the Board of Trustees of the University. No appointment has yet been made, for the very sufficient reason that the Trustees have as yet no funds which could be used for paying the salary of such an instructor. The subject, however, has not been neglected, as much instruction is given in topics which would perhaps be transferred to such a teacher when one should be appointed.

The course of instruction in English and Modern Languages, with its line of theoretical and applied science, is especially a teacher's course, and as such has been largely accepted, especially by ladies. It should be remembered, too, that the University has maintained from the first a thorough course of study in the ancient languages, equivalent to those of the leading Eastern colleges. Some of the best representatives of the University have graduated from this course; yet its numbers have been few, and it has been quite overshadowed by the technical courses. Is there any reason in the fitness of things why this course may not have a fair amount of the care and nourishment which the other courses enjoy? Not at their expense, or to their diminution, but as one of the children of the same family, sitting in a place of equal honor at the common table.

A late step of progress affects not the department of Literature especially, but all departments as well. It has been observed that many of the graduates of the University, particularly from the technical schools, were deficient in power to speak and write intelligently and forcibly. Yet they were representatives of the University, duly accredited, taking stand in their several communities as persons of education and culture, and assuming—compelled to assume whether they would or would not—the responsibilities and places of educated persons. The power to do, the capacity to know, needs also the ability to tell what one knows, and to explain what one can do. This ability comes not usually as a natural gift, but rather from large experience and long practice. Accordingly, a chair of rhetoric and oratory has been established and filled with an accomplished writer and speaker. It is required that all students, of whatever course, shall take a course of training under this officer, beginning with matriculation and ending only at graduation. The evidences of the value of this training are already beginning to accumulate, and there can be no doubt that it will tell ultimately in the very decided improvement of all our students in these essential graces and accomplishments.

More detailed accounts of the work in the various departments of the University are given in the reports of the Professors herewith appended.

AGRICULTURE.

PROFESSOR GEORGE E. MORROW, M. A.

S. H. PEABODY, LL. D., *Regent:*

DEAR SIR: In accordance with request, I respectfully present the following statement concerning the instruction annually given to the classes in technical agricultural studies.

The method of instruction is by lectures—often conversational in form. Brief notes of these lectures are taken by the students. Daily references are given to books or periodicals in the University library, in which the subject of the lecture is further discussed. The farms, barns, stables, fields, etc., are visited and studied as object lessons. Frequent oral or written reports are required from students on subjects assigned for investigation in library, field or of practices observed. More than nine out of ten of the members of these classes come from—and most of them return to—the daily practice of the comparatively simple systems of farming in use in Illinois or other Western States, so that little time is given to instruction or practice in acquiring skill in the manual labor of the farm.

ELEMENTS OF AGRICULTURE.—This study, pursued at the opening of the freshman year, is designed to give an introductory outline of the leading principles to be studied in other technical studies of the course, and to point out some of the ways in which the scientific studies may be made most helpful. An effort is made to impress the student with the importance of agriculture as a study, and with the wide range of knowledge directly applicable to its practice. The soil in its composition and management; the leading farm crops, with modes of culture; farm animals, with brief description of breeds and methods of management. These and like topics are treated of, partly for the sake of giving information of direct value, but principally to awaken increased interest and to point out the sources from which instruction in fuller measure is to be gained.

AGRICULTURAL ENGINEERING AND ARCHITECTURE.—In this study, methods of determining area of land are discussed and practiced. The number, size and arrangement of the divisions of the farm; the laying out, construction and repair of farm and public roads; the comparative advantage of different kinds of fences and the best methods of constructing these, receive attention. Especial prominence is given to land drainage. It is expected that each student, even without previous knowledge of the subject, will be prepared to fairly well lay out a system of drainage for a farm, determine the fall, and either do or superintend the work. Planning and arrangement of farm buildings of all classes, so as to secure at smallest expenditure the largest degree of convenience and practical utility is made the subject of careful study, plans being required from each student. The implements and machinery of the farm are described with reference to their intelligent choice and proper care and use. The place which implements and machines hold in our agriculture; historical sketches of their development; the points to be considered in deciding whether the purchase of any one implement will be wise, and suggestions as to choice between different kinds for the same purpose, receive attention, so far as time permits.

Animal Husbandry.—In this study it is designed to aid the student in gaining an accurate, although necessarily an elementary knowledge of the relations of stock-breeding and management to Ameri can farming; of the principles of breeding, feeding and management of each class, and of the characteristics, adaptation and history of each of the more important breeds of horses, cattle, sheep and swine. The rea and fictitious value of pedigree; the place for pure-bred stock; practical methods of feeding and management, with reference to the production of the highest quality, and also modes adapted to production at moderate cost; methods of "judging" animals; methods of disposing of animals and their products, are some of the points to which especial attention is given.

Rural Economy.—In this study an attempt is made to apply leading principles of political economy to the management of a farm. A careful study is made of the peculiar conditions which have made the agriculture of this country what it is, and of probable changes; of the questions to be studied before deciding where to select a farm, and what class of farming should have preference; of the coöperative merits of "mixed" and "specialty" farming, of grain-growing and stock-raising; of our system of land tenure, and of the place of the tenant farmer. Coupled with this is discussion of the culture of various farm crops, including choice and improvement of variety, and of times, methods and places for disposal of these products. Methods for maintaining the fertility of the soil by direct fertilization, cultivation and rotation of crops are emphasized.

History of Agriculture.—The history and development of agriculture in various countries in ancient and medieval times is briefly sketched. Fuller discussion is had concerning its progress in modern times. The agriculture of Great Britain receives special attention, because of its having had so great influence on that of our own country, to which by far the largest space is given. The influence of climate, natural fertility of soil; of the character of the government and of legislation; of the state of civilization, in determining the character and prosperity of the agriculture of the country, is made a prominent subject of inquiry. Such mention and review as is practicable is made of the leading books and periodicals devoted to agriculture and of the chief organizations in its interest.

Rural Law.—In the course of lectures on this subject, after a brief sketch of some leading principles of law, an attempt is made to make clear the essentials of the laws especially relating to business, such as contracts in general commercial paper, agents, etc., after which, laws relating to real estate, personal property, leases, exemptions, roads, fences, drainage, etc., etc., are reviewed. No attempt is made to have the student feel competent to be "his own lawyer;" rather to help him to an intelligent understanding of the laws with which his business makes it probable he will have to do.

Respectfully,

G. E. Morrow,

Professor of Agriculture.

BOTANY.

Professor Thomas J. Burrill, A. M., Ph. D.

University of Illinois, March 4, 1886.

S. H. Peabody, LL. D., *Regent:*

Dear Sir: During the spring term of 1885 I had classes in *Vegetable Physiology* and in *Landscape Gardening* besides students in the senior *Natural History Laboratory Work.* My work out of doors in the spring time requires several hours daily.

Vegetable Physiology is required in the sophomore year in the courses of Agricultural Chemistry and Natural History. Landscape occurs only in the agricultural course, junior year. The special laboratory work is only for the Natural History course, where it occurs in the senior year.

Vegetable Physiology.—This subject is taught by lectures, laboratory experiments and field observations. The shortness of the time devoted to the study, together with the want of much laboratory apparatus, renders it impossible for the students to make very many experiments; but each one is expected to select some subject for practical investigation and to make full notes upon methods and results. Such topics as the following have been taken: The evaporation of water from leaves; the absorption of water by roots; the pressure of sap; the effects of light, white and colored; the effects of heat; germation of seeds; growth of shoots; fertilization of flowers; penetration and direction of growth of roots; movements of climbing vines, tendrils, etc.; plant diseases; artificial culture of fungi. Usually a student gives his whole attention to one subject for such investigation, for it seems to me better that one thing should be thoroughly done than several hurriedly examined. The time, about eight weeks—some time being necessarily taken in introductory work—does not permit of many such undertakings even if the student's whole time were given to them. Reports are made to the class of some of the results obtained and the full notes are kept for reference.

The lectures, five each week, are intended to cover the plain facts as known of plant life, and to introduce the student to the literature of the subject. The latter, unfortunately for us, is still very largely in foreign languages, but the impetus given the study by the observations of Darwin and his followers and the translation of certain German works make it certain that better things are at hand. We shall have the coming term the use of an excellent text book by Professor Goodale of Harvard University. Plant pathology is included in our work.

LANDSCAPE GARDENING.—Landscape Gardening is taught by lectures with an abundant reference to books and drawings in the library. The lectures are devoted to the history and development of the art, the classification of styles, the principal requirements for given results, the things to avoid, the materials and processes. Much attention is given to trees and shrubs for ornamentation, shelter and also for various economical uses. Students make drawings at first from copy, then from original designs. Finally some problem is given which each one is required to work out, and the results, with estimates of expense, are presented in plans and specifications.

NATURAL HISTORY LABORATORY WORK.—This is the title of a term's work required of the senior students of Natural History, but the actual course of instruction and study is especially arranged for each student. Those taking botanical subjects do so under my direction. Last year one investigated the microscopical structure of the timber trees of Illinois, making mounted slides of all the kinds of forest trees native to our State, and studying the characteristics of their tissue. One experimentally studied plants in their relation to water, and the third devoted the term to a study of the development and growth of nuts and fruits.

In the fall term my classes were *Botany* and *Physiography*. The first is required in the courses of Agriculture and Natural History and is an elective alternate in the courses of Chemistry and Modern Languages; the second occurs in courses in Agriculture, Natural History, Chemistry and Ancient Languages. There were in the latter eight students, all gentlemen; in the former six students, three ladies and three gentlemen.

BOTANY.—An entrance examination in elementary Botany is required of candidates for matriculation. A class is taught in the spring term of the preliminary year, preparatory to this examination. *Gray's Lessons*, or an equivalent, together with the ability to analyze such flowers as are usually found growing wild in spring time, give an idea of these entrance requirements. The work in the University comes in the sophomore year.

During the first half of the term attention is paid to systematic and economic Botany. The autumnal flora is rich in *Compositae*, *Chænopodiaceæ* grasses, sedges, etc., mostly too difficult for beginners, and these are now especially studied. The characteristics and determination of forest trees receive careful attention. During these first weeks of the terms lectures are also given upon the principles of classification, the discussion of the terms, orders, genera, species, etc., the rules of nomenclature, and upon the distribution of plants over the earth. The second half of the term is devoted to the histology of plants. Compound microscopes are now furnished the students, and each is required to examine and describe, in writing, the various characteristics of the elements and tissues of vegetation. In connection with this laboratory work, a text book is studied, and about two lessons per week recited. For material much dependence is placed upon specimens preserved in alcohol, but fresh material is obtained from the green house and from out of doors. A specimen plate of drawings with accompanying descriptive notes, is required of each student for preservation in the library.

Physiography.—This study is intended to be a comprehensive survey of the earth and its inhabitants, more especially as connected with the condition and well-being of man. Appeal is made to all the special sciences of the course in Natural History, including Astronomy, Geology, Botany, Zoölogy, etc., and finally Anthropology is made a special part of the term's work. The instruction is largely by lectures, but a text book upon Anthropology is also used.

After an examination of things existing as they now are, a sketch is attempted of the origin and development of the Earth, the origin and dissemination of plants and animals, the natural history of man, the influence of Nature upon man, and finally the effects of man upon Nature.

It will be seen that the field is a very broad one, and that with the time at our disposal, whatever the capacity of the instructor, in most cases only general results and prominent theories can be given. The works of reference in the library are numerous and important, and students are expected to become familiar with them, at least to some extent. Reports are called for at stated times of books read.

In the winter term I have *Botany* continued, *Elements of Horticulture* and *Microscopy*. The first is required in the courses of Agriculture and Natural History, and is an elective alternate in the course of English and Modern Languages. The second is in the Agricultural course, and the third in those of Chemistry and Natural History. There were in the Botany six students—four ladies and two gentlemen,—in Horticulture five gentlemen, and in Microscopy seven gentlemen. Besides these classes I have two students doing prescribed post graduate work.

Botany.—During the winter term the chief attention is given to the lower orders of plants, commencing with the simplest, such as are usually classed in the great groups of *Algæ* and *Fungi*, and ascending in order to mosses, ferns, etc., and flowering plants. The microscopes are in constant use. Students have the opportunity of getting practical information concerning all the classes of cryptogamous vegetation. They study the structure, the modes of reproduction, and the classification, making descriptions and drawing of typical specimens. Text book recitations occur twice per week. Special attention is given to bacteria and parasitic fungi.

Elements of Horticulture.—This subject is taught by lectures and recitations from a text book. Students also have practical work in grafting, propagating plants by cuttings, etc., pruning grapes and orchard trees, and as far as possible in the determination and classification of fruits. Each student is expected to graft one thousand apple roots—enough to secure considerable manual dexterity in the art.

The term's work is largely devoted to fruits, but some attention is also given to vegetable and landscape gardens and to forestry. The diseases of horticultural plants are also studied. The green house and the various plantations, vineyard, orchards, etc., belonging to the University, render important service in this work.

MICROSCOPY.—This is taught by lectures, text-book lessons and laboratory work. The microscope itself, with the various accessories, are studied in relation to the construction and use. The methods of testing and measuring the optical parts, the means of securing their best performance, the care required, etc., are taught in detail. The theory of the instrument is likewise studied. Besides the foregoing, prominence is given to the preparation of objects and the making of permanent mounts.

Each student is furnished with a microscope and sets of accessories, a section cutter, turn-table, sets of reagents and mounting media, etc., and material of various kinds.

It is highly desirable that this study should come earlier in the course of instruction.

Very respectfully submitted,

T. J. BURRILL,

Professor of Botany and Horticulture.

ARCHITECTURE.

PROFESSOR N. CLIFFORD RICKER, M. ARCH.

DR. S. H. PEABODY, *Regent:*

DEAR SIR: It is assumed that the report now required from me is to be a clear and concise statement of the manner in which the work intrusted to my charge by you has been performed during the year just terminating.

This work is naturally subdivided in four distinct lines:

1. The University work proper, consisting of the methods employed and the instruction imparted, in the technical classes under my charge.

2. The general supervision of the course of instruction in shop practice, arrangement of course of study, selection of problems, etc.

3. The supervision of the commercial work of the University, comprising superintendence of work, contractors, the making of estimates, drawings, specifications, etc.

4. The supervision of the Blue-printing Laboratory.

1. UNIVERSITY INSTRUCTION.—It will be necessary for me to describe only the methods of instruction employed in the so-called "Technical Classes" of the course in Architecture taught by myself,

since full information concerning the general studies may be obtained from the reports of the several Professors in charge of those studies.

The means of imparting information employed in these technical classes are of several kinds:

1. *Text-Books.*—Since there are but four Schools of Architecture in the United States, none of which are twenty years old, very few text-books have yet been prepared for the use of architectural students. Translations of similar French or German works are not often suitable, owing to our different system of construction, of professional practice, and of instruction. But these are used when possible, a daily recitation being required from each student in most cases, mere memorizing of the text-book being discouraged, while the actual knowledge of the student is tested by the solution of numerous practical problems in construction, making applications of his knowledge as fast as acquired.

2. *Blue-Print Lectures.*—The material is carefully prepared, being condensed as much as possible, then written on transparent paper with a type-writer, using a black ribbon. These originals are then copied by the well-known blue process, making as many copies as are required, with the advantage over other copying processes that these copies may be taken at different times. This is really a stereotyping process.

These lectures really form a concise text book with the advantage that each new edition can be revised and corrected, and that new pages can be inserted in place of old ones, as may be required to keep the lectures up with the progress of the times.

They are used for recitations and for reference, and applications are made to practical problems, as in case of text books.

3. *Extemporaneous Lectures.*—Points are frequently touched upon in recitation which possess extraordinary interest from contemporary circumstances or they may require a more complete elucidation than is possible in a text book or formal lecture. This instruction is then imparted by extemporaneous lectures or talks, which specially emphasize the essential points. This affords opportunity for the mention of new ideas in construction, new discoveries in archæology, etc., and relieves the tedium of formal recitations, and is also found to be an excellent means of arousing the interest and enthusiasm of the student. The communication of the personal enthusiasm of the instructor to the student is one of the prime factors of University education, and finds its opportunity here.

For imparting facts and the solid basis of professional education, dictated or extemporaneous lectures alone possess but little value for the average student, in my opinion and experience. Very few educated men possess the ability of making a good abstract of a lecture during its delivery; the desire of obtaining as much as possible almost invariably results in the loss of the really important ideas, or in a belief that the unaided memory will retain them.

The system of dictated lectures is very slow, requires a great deal of time for copying, leaves small opportunity for recitation or the solution of practical problems, and is far better suited to mediæval times, when both books and facts were infinitely more scarce than they are to-day.

4. *Problems and Designs.*—Problems are employed for testing the accuracy of the knowledge acquired by the student, and are arranged to be as nearly similar to those occurring in actual practice as possible. They afford the best means of determining whether the student has merely memorized the instruction or has actually digested and assimilated it.

Designs are merely graphical solutions of problems, capable of this expression, and are required wherever possible throughout the course, not being limited to the work of the two terms in Architectural designing alone.

Students are referred to examples of similar problems, worked out by professional draftsmen, just as students of English Literature are advised and required to study some of the classical writers, to observe their modes of expression, peculiarities, etc.

Whenever the number of students in a class permit this the average character of their work is considerably improved by individual emulation, especially if some member of the class possesses considerable talent and a refined taste. This is the chief means employed in the Ecole des Beaux Arts at Paris, everything else being subordinated to this idea, resulting in the production of a small number of expert designers.

The following grades of paper are now used in the School of Architecture:

Paragon, for Architectural Drawings.

Universal, for Construction Drawings.

Duplex, for Details, Tinted Sketches, etc.

To better systematize the work, the following standard dimensions of drawings have been adopted, taking imperial paper as a basis:

Full size to be cut 20x28 inches.

Half size, cut 14x20.

Quarter size, cut 10x14.

TECHNICAL STUDIES.

Graphical Statics.—This is a study of the effects of equilibrated forces, employing scale diagrams instead of algebraic formulæ. The course of instruction now comprises composition and resolution of forces, moments of forces, center of gravity of figures, moment of inertia of figures.

The principal application is made to the determination of the strains in roof-trusses of various type-forms, caused by wind, snow and dead loads. The modes of determining the sections of truss-members required to resist these strains, the calculation of the actual lengths of members, dimensions and detail drawings of joint connections, are also fully given, though properly belonging to resistance of materials, studied later in the course.

About twenty problems are given in Graphic Statics proper, the strains are found in six type-trusses, and full determinations of sections and details of joints are made for two trusses, one being of wood, the other of wrought-iron.

After trying numerous text-books, blue-print lectures have been employed for several years past. During the last summer these lectures have been revised, simplified, as well as extended by considerable additions, printed in book-form, and it is intended to employ this text-book during the next term.

This study was introduced in this University in 1875—as early as anywhere in the United States, with the possible exception of Sheffield Scientific School. It is now taught in every Engineering College of any importance.

Elements of Wood, Stone, Brick and Metal Construction — This study occupies two terms of the second year, and blue-print lectures are employed. The course of study embraces the technology of the woods and their uses, the formulæ used in determining the strength of materials, joints used in carpentry, the construction of floors, walls, ceilings and roofs of various forms. Joints used in joinery, mouldings, panelling, doors, windows and stairs with their railings.

Technology of building-stones and mortars, stone construction, stone-cutting, drawings for stone-work.

Technology of bricks and terra cotta, brick masonry, tiles, terra cotta work.

Manufacture of cast-iron, wrought-iron and steel, their qualities and uses. Columns, girders, joints, fire-proof construction.

The problems require special computation, and each student is required to prepare working drawings of the construction specified. About twenty problems are usually worked out in each term, and special attention has been devoted to accuracy and neatness of execution.

Elements of Sanitary Construction.—This study was under my charge at first, but has been transferred to the Assistant in Engineering.

The work consists of recitations from Gerhard's Drainage and Sewerage of Dwellings for half a term, the remaining time being occupied by the use of engineering instruments in making surveys or drains, staking out-buildings, etc.

Architectural Drawing.—This study also occupies two terms, and about six full size plates are required per term, according to the subject chosen.

Tuthill's Architectural Drawing is used as a text-book, because it contains many excellent suggestions for the execution of drawings, considerable information on construction, and several very complete sets of drawings for different kinds of buildings. The student is required to copy one complete set of these drawings during each term, taking a simple building at first, and a complex one during he second term. These drawings are finished in the manner usually employed in office work. The object of the study is to give the student a good knowledge of drawing as actually practiced, so as to make him of real assistance to a practicing architect, since he must usually enter the profession as a simple draughtsman, gradually becoming a designer, afterwards commencing practice for himself, as he finds opportunity.

History of Architecture.—Various text-books have been used, but found unsatisfactory, and instruction has been given for some years by means of blue print lectures, with daily recitations. Students are also required to make five different plates of tracings of architectural ornaments and details per term, for the purpose of familiarizing them with the most important and characteristic forms, for acquiring a better command of the hand and pen, than is possible in any other way, now so useful in finishing etched perspectives and sketches, and as a means of inculcating the necessity for each student to commence for himself the collection of a series of architectural ideas and motives, absolutely essential to every successful designer.

These tracings are retained by the University as specimens of the work of the student, forming a part of his record, but each student can obtain blue-print copies of any tracings at a small cost. This collection of tracings now numbers about 300 sheets, 8x10, containing thousands of figures.

This study requires two terms, the first ending with the Mohammedan style, the second being devoted to later styles.

Each style is considered in reference to preceding and succeeding styles, the natural conditions influencing its development, effect of political changes, nature of building materials, results of race-tendencies and preferences, and of national customs; in fact, the gradual evolution of architecture is studied in a manner similar to that employed by the student of evolution in nature, though the former is largely the work of man, instead of that of a Divine Being.

Special emphasis has been laid on tracing primitive form-ideas through their successive modifications by succeeding races, to determine the origin of modern forms. Descriptions of the more important examples of each style are required, to afford a ready means of comparing the relative values of different styles. Suggestions are made relative to the adoption of ancient ideas in modern buildings.

These lectures are not yet quite completed, but it is hoped to accomplish this during the present year.

Esthetics of Architecture.—This study treats of the Beautifying of Architectural Forms and Structures, so as to render them most pleasing to a cultivated eye, and forms the essential basis for the principal characteristic, which distinguishes architecture from engineering, wherein a simple and economical solution of any structural problem is the end to be attained, without any attempt to render this form as pleasing as possible.

Good and simple construction is also found in all good architecture, but with the added condition that the structure must be satisfactorily decorated. Hence, this study is the foundation of all good architectural designing, and is of paramount importance.

Many excellent ideas are scattered through the works of Ruskin, Fergusson, Viollet-Le-Duc, Semper and other writers, but there is no suitable general work in English, and hardly in any other language. The preparation of an ideally perfect course of Lectures, such as are needed by the Architect, would require the leisure of many years, with the free use of the largest libraries, and is almost impossible under present conditions.

In 1883, after writing a partial course of Lectures, and an examination of the French and German works best adapted to the requirements, I selected Redtenbacher's Architektonik as most satisfactory, translated it, traced the nearly 900 wood engravings, and prepared it for copying by the blue process, and have since used it as a text book.

The leading idea of the author is that architectural details should be decorated in accordance with their material, with the mode of working this material, and with the functions of this member. He proceeds from the consideration of the most elementary portions of a structure, to the treatment of the massforms of the entire building.

The work treats of the proper decoration of each material, of walls of stone, brick and wood, of plane and vaulted ceilings of stone, brick, wood and iron, of columns, piers, cornices and string courses, doors and windows, floors, stairways, towers and roofs; the requirements and arrangement of different kinds of buildings, of public parks, plans of cities, of monuments in memory of distinguished men, etc.

Three recitations are required per week, with the preparation of about 10 designs for special problems, executed in accordance with the principles established by the author. The designs made during last fall term were all finished in color, requiring considerable additional time and labor.

Architectural Designing.—This study is limited to two terms, though actually the most important in the entire course. Still, original designing is introduced in other studies, whenever possible. Various plans have been tried, in order to satisfy the double problem of obtaining the best and most complete designs, and of maintaining the interest and enthusiasm of the student, finally deciding to use the one pursued during the last year. This consists in devoting the first term to making designs for several distinct problems, requiring an elevation and the more important details. Five designs were required during the term just ended, for a seaside store, a city dwelling, a water tower, a view pavilion, and a store and office building.

The second term is devoted to the preparation of a complete design and the necessary drawings, for a single building, a large office building having been worked up last year. The requirements of the building and the arrangement of its plan are fully studied, and full details are required.

These problems are changed each term, so as to compel students to do original work, and their subjects are also selected with the same view, some special requirements being added to prevent copying.

A collection of engravings and photographs has been commenced and a part of these are now mounted, for the use of students in Designing, as illustrations of the manner in which similar problems have been solved by professional architects. This collection promises to become one of the most efficient means of elevating the character of students' designs possible and has already proved to be very valuable. When a student graduates from the University, he should be thoroughly en rapport with the spirit and style prevailing in the offices of the leading architects, and not entirely educated on the basis of past historical styles of Architecture.

Heating and Ventilation.—This study is of great importance, yet no good text-book exists in English, suited to the needs of the Architectural student. After examining several French and German works, I found that Planat's Chauffage et Ventilation was the most comprehensive and scientific. Accordingly, I translated this during the last summer vacation, re-drew the plates, abridging it by the omission of the descriptions of French heating apparatus. It was copied by the blue process, and has been used as a text-book during the present term with satisfactory results. Daily recitations were held, and 38 numerical problems in application of the formulæ were solved, some of which required a great deal of labor.

Estimates, Agreements and Specifications.—A little more than half the term is usually devoted to estimates, which is taught by blue-print lectures, verbal explanations, and also by preparation of estimates for various kinds of work under practical conditions. When last taught, 53 problems were given to the class, comprising estimating by squaring, by cubing and by quantities, for the various building trades.

The principal importance is attached to the teaching of a convenient order and system of arrangement of estimates, and the knowledge of the usual modes of measurement of the trades, but actual prices are employed as far as possible, though these necessarily differ for various localities.

Vogdes' Architect's Price-book is used for prices of carpenter's and joiner's work.

The instruction in Agreements and Specifications chiefly consists in the careful study of the printed forms employed by architects, and in filling these out to suit a specified building, usually taking an example from Tuthill's Drawing.

The Course in Shop Practice.—This has not been materially changed for several years past, and is entirely arranged on the Russian system. No attempt is made to compel the members of an entire class to do each part of the work at exactly the same time, which constitutes the principal difference between the system employed in the shops of this University, and the Woodward system, adopted in the Manual Training Schools of St. Louis and Chicago. It is believed that the Woodward system unduly restrains the brightest and quickest members of the class, soon causing the loss of their interest and enthusiasm, while the slowest members are continually hurried, and fail to ever learn to do good work. Evidently, it is first essential to teach the student how to work in the best manner, no matter how long it takes him; practice and competition will give him rapidity in execution. The opposite course rarely produces an excellent workman. Hence, the work of the student must pass a certain minimum standard, even if he succeeds in doing little during a term.

The following kinds of work are now taught: Carpentry and joinery, 24 pieces, occupying the first term; cabinet-making, about 8 pieces, and turning, about 6 pieces, together take the second term; metal work, about 8 pieces, and plaster work, about 4 pieces, complete the year.

For several years past no attempt has been made to construct complex models, requiring the united work of a class.

The Russian system was introduced in this school in 1873, then being limited to a single term, the remaining time being devoted to the construction of models. It is believed that this system was not earlier employed anywhere else in the United States.

Benches and sets of tools are now provided, sufficient for 24 students, as many as can be profitably placed under the charge of a single instructor. The instruction in this class is entirely given by Mr. Parker, under my supervision.

The Commercial Work.—Most of the work performed in the Architectural Shop during the past year was for the University, and consisted in the repairs and modification of the University buildings, mostly done during the summer vacation, with the making of a considerable number of cases, etc., required by the Department of Zoölogy. This was mostly done under my general supervision, but in direct charge of Mr. Parker, as foreman. I have made estimates, as required, and have also furnished some drawings.

To this may be added the supervision of the contractors for brick-laying, tinning, etc., employed by the University last summer. This required me to remain here last summer, and I usually visited the work each day, sometimes twice. Since the beginning of the fall term this work has mostly been left to Mr. Parker.

4. The Blue-Print Laboratory.—About 30,000 pages of blue-prints were made during the year 1884–5, and the number for the present year will not be much less. Since the resignation of Mr. Stratton, this work has been done by Mr. E. I. Cantine. It has been found advisable and simplest to allow the blue-printer to purchase his own supplies, instead of this being done by the University, and also for him to make payment directly to the business agent, so that I have merely retained a supervision of the quality of the work done, and of the supplies furnished to students. These are now as satisfactory as at any previous time.

Very respectfully submitted,

N. Clifford Ricker,

Professor of Architecture.

CIVIL ENGINEERING.

PROFESSOR IRA O. BAKER, C. E.

UNIVERSITY OF ILLINOIS, Feb. 27, 1886.

DR. S. H. PEABODY, *Regent:*

DEAR SIR: In accordance with your request, I submit the following report in behalf of the School of Civil Engineering:

The primary object of the instruction is to train students to think and reason for themselves. The secondary object is to give information concerning the various branches of civil engineering. The attempt is to ground the student thoroughly in the fundamental principles, and give him practice in applying these to specific cases. Whenever possible the theoretical instruction is accompanied and illustrated by practice. The field practice is arranged on the plan of what is known in mechanical engineering as the Russian system of shop practice. The way in which these principles are carried out can probably best be described by considering separately the subjects specially under my direction.

In the freshman year the civil engineering students receive instruction in common with other engineering students. The first distinctively civil engineering subject is LAND SURVEYING, which is pursued during the fall term of the sophomore year. The instruction is given by a text-book with practice. The chain, plain-table and compass are used in finding distances, areas, etc. In this work special stress is laid upon the accuracy of the work, and the results uniformly obtained have been very gratifying. This is believed to be largely due to the specially prepared area, whereby the instructor knows the precise result which the student should obtain. This is an incentive to the student, and enables the teacher to show him the degree of accuracy attained and to point out the errors. During the cold weather at the end of the term, instruction is given in the methods of the U. S. public land surveys, including the legal points involved in the re-establishment of boundaries.

SURVEYING is continued during the winter term, the transit, level and stadia being used. The instruction is given by lectures and practice. In explanation of the term *lectures*, it may be proper to add that the teacher writes out at considerable length what he has to say on a subject, and passes the manuscript to a student, who copies it by a cheap photographic process and sells to the members of the class. The lectures thus virtually become text-books, from which recitations are had in the usual way. Particular attention is given to the form of instrument and the method of using it to secure speed and accuracy. The student always enter into the work with enthusiasm, and a large amount of work is done with satisfactory results. Not a single problem or exercise is given in which the instructor has not an absolute check upon the result. This is considered an important feature of the instruction in this subject, as well as of that in land surveying, and geodesy and practical astronomy; and, as far as can be learned, is in the main peculiar to this institution. It is expected that, by the work of this and the preceding term, the student will become familiar with the instruments and methods of orditary surveying, and form habits of precision and accuracy in field practice and in computations.

Topographical Drawing and Surveying is taken up in the spring term. The object of the first is to cultivate skill in the representation of topographical features and in mapping; of the second, to familiarize the student with the methods of topographical and hydrographical surveying, and to afford practical word in the drawing. This class is under the instruction of the assistant to this department; for a number of years past it was ably conducted by Professor Sondericker, and it will be none the less ably conducted by his successor, Professor Talbot.

Railroad Engineering.—The mathematics of railway curves is studied from a text-book with practice, after which the questions relating to economic location are discussed in lectures, and then several preliminary lines are run. The lines are then compared to determine the most economical, due consideration being given to both constructing and operating expenses; a line is then located and the various engineering operations connected with the construction of the road are gone through with in order. A large amount of work is done in this term, and it is believed that the dissemination of the principles of economic location will save to the country money where in times past it has been lavishly wasted.

Analytical Mechanics is pursued during the two remaining terms of the junior year, all engineering students taking it together. A text-book is used. The results of this work are the least satisfactory of any which I have. This complaint is said to be common at other colleges. The subject, besides being difficult and requiring thorough mathematical training, is the first in which the student is required to apply his pure mathematics. Too often the value of a thorough knowledge of pure mathematics is not realized until the lack of it is felt in the attempt to apply it. The subject is one of great disciplinary and practical value, but often the student fails to realize this, and hence will not exert himself sufficiently.

Descriptive Astronomy, in the third term of the junior year, is pursued by students from several courses; the class is taught in two sections. A text-book is used. The subject is interesting, and a very large amount of good work is done even in a short term at the end of the year.

Practical Astronomy and Geodesy occupy the fall term of the senior year. About half a term is devoted to each; a text-book is used for the first and the second is given by lectures. The results obtained through the new instrument and the observatory have far exceeded my most sanguine expectations. From the first the results obtained by the students have been so surprisingly accurate that I have refrained from mentioning them for fear I might be mistaken. But, after further experience with students, and after mature reflection, I believe that a majority of the members of this class read angles an precisely as is done anywhere by anybody with a similar instrument. It illustrates an important principle to know that a trained man, with a comparatively small amount of practice, is able to attain such proficiency. In determining time the results are relatively not so good as in measuring angles. This difference is due to the fact that all previous training has been of the eye and the hand, while the determination of time depends upon the eye and ear. However, the results obtained with even the small amount of practice, are not much behind those of expert observers. This term's work is counted important since it sets a high ideal before the student, and gives him every facility to exercise his greatest skill. The instruments and the arrangement of the observatory are very satisfactory. The new instrument is equal to the best.

STONE WORK.—The object is to give information about a few subjects of importance to the engineer, which are not included elsewhere in the course. The instruction is given by lectures. Stone, brick, cement, etc., are described, and the manner of testing, preparing and using them is discussed. The various means of securing a firm foundation are next considered. The designing of structures of stone and brick is then taken up; the student makes the necessary computations and drawings for a few simple structures, such as retaining water, bridge piers, and box and arch culverts.

BRIDGES are considered in the winter and spring terms of the senior year. The first term is devoted to the determination of the forces to be resisted and the resulting strains; the intention is to apply all methods of analysis to the ordinary forms of bridges. The second term is given to designing trusses, proportioning sections, and working out a few details.

All through the course students are urged to supplement, but not to supplant, the recitation room work with outside reading of standard works and the current professional literature. The most of them do considerable of such reading.

It is not claimed that the study of the preceding subjects, together with others in the course, will make experienced engineers, but it is believed that such a course will enable our students to make rapid progress and ultimately become more competent engineers. The experience of our students confirms this belief. Most of them find employment in engineering work soon after graduating, and some of them have already reached positions of considerable prominence and responsibility. The demand for engineering graduates has certainly increased very rapidly within the past few years. They have been tried, and, found to be good, more will be wanted. This may seem to be an element helpful to the teacher, but it is certainly not wholly so. It entices young men with the idea that graduation, or even a few terms of school, generally the latter, will enable them to get lucrative positions. Young men with such ideas are undesirable students; they are unwilling to do "dead work." They think that the teacher should show them some royal road to learning. Such young men actually believe that it is the duty of the teacher to prepare formulæ, tables and diagrams which they can convert into money after leaving school. They seem to want to be machines instead of men. In college their example is bad, and, after leaving college, they do not help the reputation of either the institution or its graduates. They are very difficult to deal with.

The equipment in this department is fairly satisfactory, although it is believed that a little money could be used profitably in completing our collection of building stones, cements, etc. Also a few full-sized bridge joints would be very useful. The location of the University is such that there are no engineering structures near which can serve for illustrations in the study of bridges and stone-work. Before many years we will need a considerable outlay for new engineering field instruments; some of them, which were second-hand in the beginning, are badly worn. The equatorial telescope is not as good as we need for the work in descriptive astronomy. I hope we may soon be able to secure an instrument as suitable for that purpose as the new alt-azimuth is for the work which we do with it. I have no desire for a large telescope, a small one will suit our purposes better.

All of which is respectfully submitted,

I. O. Baker.

Prof. of Civil Engineering.

MINING ENGINEERING.

Professor Theodore B. Comstock, Sc. D.

Dr. S. H. Peabody, *Regent*:

Sir:—I have the honor to present herewith a brief statement of the work done in my department since the beginning of the current scholastic year. As you are aware—owing to the undeveloped condition of the school of mining engineering and the lack of students already committed to such study—it was impossible for me to start at once upon a well-defined systematic course. As soon as practicable, however, I prepared and suggested a line of subjects intended to cover four years of thorough work leading to the degree of B. S. in the course in Mining Engineering. This scheme, after some revision by yourself, and the special faculty of the College of Engineering, was adopted by the General Faculty.

The scope and character of the work required of students in this new course is clearly outlined in the special circular issued under your direction soon after its adoption. In addition to the wide distribution from your office, I sent out many of these announcements to mining engineers and others whose interest and practical support may be useful to our institution. Although it is yet early to look for direct results, there is much reason to believe that the building up of this department in the University is attracting the favorable attention of those whom we most desire to secure and retain as friends and patrons. Among the students there has been a strong feeling of interest in the subjects introduced into this curriculum by the founding of the new chair, as was evidenced by the applications for membership in the class in Mine Surveying in the Fall Term, when seven names were presented, only one of which was that of a regular student in the course.

My special duties requiring only the one class in Mine Surveying in the fall term this year, the subject of Mineralogy was assigned to me. This department, having previously been under the able control of Dr. McMurtrie, it is quite unnecessary to say that I could do very little to improve its efficiency, without going beyond what the present appliances will permit. An excellent collection of working material provided by former appropriations, has enabled me to give the students a better drill in blow-pipe work than is afforded at many of our eastern colleges; and I do not think any present demand exists for extending this work in any undergraduate course of study. At the same time, it will be necessary to expend each year a small sum in the purchase of illustrative material, and I would recommend that the general collection be made somewhat more extended. We now have the nucleus of a very choice cabinet, but it is defective in some particulars. It seems to me desirable also that its display should be made more attractive and that a reasonable sum should be at the disposal of the department for enlarging the collection by exchanges. The cost of this enlargement will be almost exclusively made up of items of freight charges upon packages received, and if I am allowed to do this work, my experience in connection with private exchanges and the building up of special collections elsewhere, proves that a very trifling sum will accomplish very much. The cases in room 16, Chemical Building, are not large enough, and I do not see any way to add others conveniently. It is also a matter of much importance to have the collections near the lecture room. Unless, therefore, it be deemed practicable to provide more space, I would merely suggest now that a small sum be set aside for this department, to be used in refitting the present cases, adding shelves, painting and providing better locks, and in paying freight charges upon specimens secured by exchange. In addition to this, if the sum of $50.00 could be appropriated for the purchase of a set of thin slices of rocks to illustrate microscopic structure and for certain inexpensive apparatus for polariscopic analysis, a beginning could be made in the direction of lithological work, which is lacking now, but which is very important to students in the courses in Natural History and in

MINING ENGINEERING.—In the subject af Mine Surveying and Reconnoitering field work is very necessary. I have found the main building quite convenient for illustrating topics connected with the surveys of underground passages. The department has had no suitable instruments, however, for giving practical work in certain important lines. By the use of a transit sent from Colorado, which I was able to borrow for this purpose, I was enabled to get some creditable work from the class this year, but eventually there will be needed some similar apparatus, and more of it, belonging to the University. Whenever the Board of Trustees is prepared to consider the wants of this new school—when it shall have proven its claim to rank among to older schools by the work it has actually accomplished—I shall be free to state more fully the explicit needs. By thoughtful attention and rigid economy, if there be any fund available, however small, I can use it at any time, however, in such a manner as to aid very materially in the work of instruction, without detriment to any future plans for the enlargement of the scope of the apparatus. I may suggest, also, that there is, to some extent, a lack of apparatus in the Physical Department in just the direction in which pressing needs will first appear in the Department of Mining Engineering. For instance, aneroid barometers, anemometers, etc., will be equally applicable in both departments.

As agreed at the time of my appointment to the professorship of Mining Engineering, the work of the Department of Physics has been temporarily placed in my hands. The more I become familiar with the apparatus and with the system of instruction marked out in detail by yourself, the more clearly I realize how ably and effectively this department was managed before I took charge. Had I desired to arrange the work under all the circumstances to the best advantage of all, I could not have begun to accomplish it in my own way in anything like such thorough manner. Every detail of the work I find all gone over and clearly arranged for me, so that the burden of this department, although much increased by certain changes made by the faculty since my arrival, is still nothing like what it must have been under other circumstances. I have had two classes in Physics, one comprising chiefly the students in the engineering courses, the other what are known as general students, so far as this department is concerned. One term of work under this system has amply proven the wisdom of the division. I am satisfied, however, that other radical changes must be made before the instruction in this essential subject can fulfill its proper office in the curriculum. Time enough is not allowed for the special class, and I believe that more laboratory work would be an admirable thing. The subject is so broad and so intimately connected with the engineer's daily work, that we are obliged to crowd too subjects into two terms. This leaves little room for the solving of practical problems. There are other questions connected with laboratory work, which do not properly fall to be here discussed. I wish to most emphatically commend my senior assistants, Messrs. Garrett and Cromwell, to whose untiring zeal, patience and readiness to do more than their duty has been largely due the success of the laboratory work thus far.

I can say but little at this time of the actual work in my department beyond what has been mentioned. In planning the new course every other consideration has given way to the purpose of giving students in this University the most thorough training possible without regard to the amount of labor demanded of instructors. In my own case, while the time must come, if I remain, when I shall be overburdened, this is not the place to speak of it, for I shall be able to carry all now required of me in addition to the Physics, at least through the present collegiate year.

In conclusion, I should overlook one of the chief causes for whatever of success I have attained thus far, were I not to notice the very rare interest you have always taken in my work and the kindness and courtesy which has marked your action towards me without exception. By this generous support I have been able to work unhindered and with very important aid at the greatest times of need, and I beg that you will accept my hearty thanks and my expressions of most cordial esteem. It would be a sad day for me, should I be called upon to sever relations which, I assure you, have been more happy and sincere than any of the kind I have heretofore been permitted to enjoy. Nor must I omit to record my deep sense of the frank and cordial sympathy and coöperation which has been freely extended to me by every member of our corps of instructors. With such surroundings the lack of facilities with which any new department must contend, does not play so important a part as it might under different circumstances. I am also indebted in many ways to every member of the Board of Trustees with whom I have had any contact, as well as to many, very many of the good friends of the University among the citizens of Champaign and Urbana.

Trusting that each succeeding report may find the department of Mining Engineering growing and doing its full share of efficient work, I am, sir, very cordially and respectfully,

THEO. B. COMSTOCK,
Professor of Mining Engineering.

ZOÖLOGY.

PROFESSOR STEPHEN A. FORBES, PH. D.

UNIVERSITY OF ILLINOIS.

DR. S. H. PEABODY, *Regent:*

Although my appointment to the chair of Zoölogy and Entomology in the University took effect September 1, 1884, circumstances made it impossible for me to report here until January 1, 1885. Since that time my University duty has consisted of the teaching of the two classes in zoölogy and one in entomology, of the care of the Museum and Zoölogical Laboratory, and of the oversight and direction of the work of various special students in zoölogy and entomology.

The principal zoölogy class continues throughout the year, two hours per day; the second zoölogy and the entomology are one-term studies, each one hour a day. The time appropriated each day by the special students is difficult to estimate, but probably does not vary far from an average of one-half hour. Although during a part of this time myself and my zoölogical assistant are engaged together, usually I have needed to give only general attention to such work as has been especially committed to the assistant, so that he has relieved me of probably one-third of this instruction work.

Extensive changes have been made in the zoölogical course, and large additions to its equipment, amounting practically to a reorganization of this department; and this, also, has necessarily consumed some time.

The time of the zoölogical assistant, besides that given to the supervision of a large part of the laboratory work of the students, as above mentioned, has been devoted principally to the preparation of specimens to illustrate the zoölogical course, chiefly preparations of comparative anatomy in alcohol, and microscope slides. The re-labeling, mounting and arrangement of the Museum material—of which we have undertaken a systematic revision—has also fallen chiefly to his share.

On account of the extensive changes made in the Natural History Department, a brief report of its present condition will perhaps be expected.

The Sophomore zoölogy has been changed from a one-hour to a two-hour study. It includes at present a considerable amount of laboratory work in comparative anatomy and systematic zoölogy, in comparative histology and in embryology, supplemented by lectures, demonstrations, and a study of text. The individual work of the student, always supervised and directed either by myself or by my assistant, in person, or else guided by carefully prepared directions in "blue-print" supplied to the students, furnishes the foundation throughout upon which the superstructure of secondary knowledge is raised by lectures and by study of text. Besides a practical acquaintance with types and with the general characters of the principal animal groups thus acquired, the students are expected to become reasonably proficient in dissection, drawing, description, in determination of species, in the methods of histological study, and in practical embryology. They have also an opportunity to acquire a knowledge of field methods of work in zoölogy, both terrestrial and aquatic, and to learn the methods of the permanent preparation of specimens for zoölogical cabinets.

In arranging the short course in zoölogy, I have assumed that this should be designed to impart a knowledge of the leading general features and results of zoölogical science so far as this is attainable by elementary students, and that this class should be so far introduced to methods of zoölogical work and study as to enable them to become intelligent, if so disposed, with respect to the animal forms about them. Some analytical and anatomical work has consequently been required of these students, especially in ornithology, on which, in fact, about one-third of the time has been spent. Otherwise this course has consisted of lectures, demonstrations, and study of text.

The entomological course has been little changed since I took charge of it, varying only towards a practical acquaintance with a larger number of economic species and their life histories, at the possible sacrifice of some of the knowledge of general entomology which was formerly given.

The facilities for zoölogical instruction now consist of a furnished students' laboratory, conveniently fitted with everything needful for our work to accommodate thirty-six students at a time. Microscopes and the apparatus of microscopy generally have been provided for the students in the year's course. A series of permanent preparations has been begun illustrating all the parts of the zoölogical course as at present organized,—these to be kept as an independent special collection. The museum collections and preparations have been regularly drawn upon for class use with the idea that it is better to replace a specimen occasionally, as it becomes injured by actual use, than to keep everything under lock and key as a display for chance visitors. The collections, apparatus, library, and facilities generally of the State Laboratory of Natural History, in rooms adjoining the student's laboratory, and those of the State Entomologist's office on the floor above, have been freely used in every way for class work, and especially as aids to the work of the post-graduate and special students of zoölogical and entomological subjects.

The condition of the Museum has changed only by accretion and by a revision of the labeling arrangement and mode of display of the alcoholics and a part of the shells. The principal additions have been a series of forty-two Blatschka glass models of perishable invertebrates; a set of thirty painted casts of Illinois fishes; about one thousand species of insects (not including the LeBaron collection) mounted and prepared for exhibition; and about two hundred skins of Illinois birds. The insects and half the fish casts are on exhibition at New Orleans, these collections having been prepared in pursuance of an arrangement with the Board of State Commissioners of the New Orleans Exposition, by virtue of which about $160 of the expense was saved the University. Between four and five thousand geological specimens purchased by the Regent and Professor Rolfe should also be included under this head.

With respect to the development of the department, I believe that nothing is now more important than such announcement of its advantages for high-grade work as will attract to it a larger and better attendance,—although I am of the opinion that some further modification of its course, or some addition of special courses, may still be made with advantage.

Those who are likely to elect a good natural history course in the University may be divided into four groups: (1) those who, seeking only a general, liberal education, are led to elect one with a biological rather than a literary basis; (2) those whose abilities or ambitions lie in the direction of a career as biological specialists; (3) those who are looking to a liberal preparation for the profession of medicine; and (4) those preparing themselves as special teachers of science in colleges and high schools. The present course seems to me to provide practically for only the first of these groups, and our attendance in the natural history course is consequently principally made up of a certain percentage of the class, most of which go to the literary departments of the University. While I think the present natural history course is well adapted to the wants of these students, at least in its zoölogical and entomological features (with which alone I have anything to do directly), and should be maintained in their interest, I should be glad to see diverging elective courses arranged for the last one or two years, leading towards medicine, towards the natural history specialties, and towards biological teaching. The special features of these courses would consist almost wholly of laboratory practice and technical reading—like the special course in chemistry—and would consequently involve little or no additional teaching force.

Respectfully submitted,

S. A. FORBES,

Professor of Zoölogy and Entomology.

CHEMISTRY.

PROFESSOR WILLIAM MCMURTRY, E. M., PH. D., *University of Illinois.*

DR. S. H. PEABODY, *Regent:*

DEAR SIR: In accordance with your request, I have the honor to submit the following report of the condition of the department under my charge:

The number of students in chemistry has been scarcely as great as in previous years, but the work accomplished by the classes has been executed with fidelity and enthusiasm, and in point of quantity has been beyond the standard hitherto attained. Several changes have been made in the course of study prescribed, which in practice have proven to be of advantage to all concerned. In the first place, the course of lectures in elementary and applied inorganic chemistry has been supplemented by a course of experiments in the laboratory illustrative of the principles treated of in the lecture-room, giving to each student an opportunity to make for himself nearly all the experiments usually made in the lecture-room before the class. This has had the effect of stimulating greater interest in the work, familiarizing the student with the use of apparatus, and with the general characteristics of chemical substances, and more thoroughly fixing in mind the facts with which they have to deal. This influence has manifested itself in the work of the present term in the more rapid progress the class has been able to make in the advanced work. It has made necessary the purchase of additional apparatus, but this we firmly believe is more than compensated for in the added advantage gained, while the cost will be ultimately met by continued use.

In the advanced work of quantitative analysis similar satisfactory progress has been made. All the students, without exception, have shown very commendable zeal and industry in their work, with corresponding results. Modifications in the course have proven of advantage here also, and have resulted in materially increased advancement in the students. I can testify to a high degree of satisfaction on account of the hearty way in which they have fallen in with the plans projected, and the manner in which they have carried on the work laid out for them. The work to which three terms have formerly been devoted is now confined to two terms, thus providing an additional term that will be devoted to advanced organic chemistry, synthetic and analytic, thus supplying a want long felt.

An endeavor is also being made to so modify our course of pharmaceutical chemistry as to bring it more in harmony with present practice in the drug trade of the State. The condition of the law, as it now stands, however, with regard to license to practice in pharmacy, offers little encouragement to this. Graduates from the School of Chemistry, with a thorough knowledge of chemical processes and products, of toxicology and the qualities and power of poisons, their detection and their antidotes, and thus practically meeting, by a course of four years of practice in the laboratory, all the requirements of the intent and spirit of the law, are still forced, by the letter thereof, to four years practice in a selling drug store, often with very meagre sales and hence of limited experience, during which time, by strict construction, they are prohibited from filling a prescription or selling a drug. In view of these facts it seems that some modification of the existing statute recognizing the training offered in this line of work is, on all accounts, desirable.

During the year just closing important changes have been made in the internal arrangements of the laboratories. In the assaying laboratory all the old furnaces have been torn away and new and improved ones put in their places. Five new crucible furnaces of the latest and most approved design, have been constructed of brick and iron, and, in the work of the present term, they have satisfied all the expectations had with regard to them. These have been supplemented by two large Judson's steel sectional cupelling furnaces, purchased from Messrs. Richards & Co., of New York, and, under favorable conditions, they are capable of excellent work. Unfortunately, in their installation, we were subject to additional expense, because the single flue with which the assay laboratory is provided proved too small, with all the furnaces connected with it, to supply the necessary draft. After several trials it became imperative to remove at least one cupelling furnace to another flue, and here it is all that can be desired and does excellent work. Our assay laboratory is now, we believe, as well equipped as any in the country.

In the improvements just described provision was made for extension by the erection of additional furnaces, when increase in the number of students may demand it. In case such extension shall become necessary, however, additional flues or increase of the capacity of those already in existence and use will be of primary importance.

In the laboratory for quantitative analysis a new table has been provided which shall be devoted to ultimate organic analysis. In form it is very similar to the other tables and desks of the laboratory. Its top is of soapstone, which is very refractory to the action of heat and of acid or alkaline substances, and it is, therefore, free from the objectionable features inherent in wood tops. The table is furnished with ample gas and water supply, pneumatic troughs and aspirators, shelf space, closet room, in fact with every convenience required in ultimate organic analysis.

Plans are being made for the construction of a table to be devoted especially to the application of electrolysis to chemical analysis. This table and its accompaniments will add materially to the convenience and efficacy of our equipment.

The expenditures of the department, beyond those involved in the improvements just described have been about the same as those of previous years. The usual additions to the permanent stock have been made, while little difference is to be noted in the amount of annual current receipts from students and from other sources. A statement of such expenditures and receipts will be detailed in a supplemental report. For the supplies of the coming year, I would respectfully recommend an appropriation of six hundred and fifty dollars (650.00), $400 for apparatus and $250 for chemicals. An immediate provision of this amount is desirable in order that the material may be secured at reduced rate by importation free of duty, and be in hand before the opening of the fall term.

Respectfully submitted,

WM. MCMURTRIE,

Professor of Chemistry.

MATHEMATICS.

PROFESSOR SAMUEL W. SHATTUCK, C. E.

UNIVERSITY OF ILLINOIS.

S. H. PEABODY, LL. D., *Regent.*

SIR—I have the honor to make the following report upon the work of the mathematical department in this University.

I class it under four heads:

1. That of the *preparatory year.*
2. That taken by students in the *college of literature and science, etc.*
3. That taken by students in the *college of engineering.*
4. That taken by *post-graduate students.*

The preparatory student occupies two terms upon algebra, fall and winter, and two upon geometry, winter and spring.

The work is that of a good high school though concentrated into less time. The instruction has been given the past year by Prof. Rolfe in the spring term and by Mr. S. W. Stratton in the fall and winter terms. I believe that it has been well done.

If a third term could be given to algebra with justice to the other studies of the year, I should advise it, as the younger and poorer students need considerable time to have the new concepts become fixed in the mind, and as many examples must be worked to gain this object.

The mathematical studies in the *college of literature and science* occupy three terms of the freshman year; in the *college of natural science*, two terms; and in the *college of agriculture*, one term.

The instruction is the same for the students in these colleges. It has for its object the promotion of "habits of mental concentration and continuity of thought," "to develop the capacity to form and combine abstract conceptions, and cultivate the deductive reason."

I conceive the above to be the leading object, but the possible and expected applications to surveying and advanced studies are not overlooked.

The fall term is taken up with *plane and spherical trigonometry.* Two classes are taught, on account of the numbers, and to meet the requirements of divisions in other studies.

The winter term is taken up with *conic sections and analytical geometry.* A little over one-half of the term is given to the geometrical method of discussing the conic sections; the balance is occupied with the analytical geometry. I have taught these classes.

The third term is given to work in *advanced geometry,*—that is, the use of some of the modern methods, such as *harmonic proportion* and *harmonic pencils, anharmonic ratio* and *involution; poles* and *polars;* the *principle of continuity,* etc. Only the students of the school of *ancient language* are required to take the work of this term.

I understand that a third term of mathematics is desired for the chemical course, and that the term be given to the calculus. If this be granted, I suggest that the study be substituted for advanced geometry in the college of literature and science.

I believe that the change can be made with advantage to the departments concerned, as it will make their mathematical studies of the proper standard in name as well as in reality.

But I trust that as the University develops, instruction will be given in the so-called modern methods, both in geometry and algebra.

The instruction in this term has been given in the past by Prof. Sondericker, and will be given the coming term by Assistant-Prof. Talbot.

This arrangement has been had in order that I might have the engineering students in their study of advanced algebra, as that study is so intimately connected with the calculus.

The students of the college of engineering have one term of *trigonometry*, two of *analytical geometry*, one of *advanced algebra*, two of *calculus* and two of *descriptive geometry.*

The object aimed at in this course is to enable the student to meet the requirements in his engineering studies.

The greater part of the time is necessarily taken up with the theory of the studies, and the applications to geometrical magnitudes necessary to illustrate and fix it in the mind.

The geometrical concepts have the advantage over others of being familiar ones and representing all others of magnitude. It seems an open question whether additional applications in mechanics and astronomy might not be brought in with advantage. The leading objection to such a course with the present programme of studies is, that a portion of the more advanced work would not find room.

In the scheme for the present year, the following applications in mechanics are among those made by the class in calculus:

Problem of a body falling freely near the earth's surface.

Motion of a body down an inclined plane.

Problem of a body falling from a distance toward the earth; *Velocity of fall; Limit of possible velocity; Time of fall.*

Problem of the *cycloidal pendulum.*

General formulas for the coordinates of the *centre of gravity* of any mass.

Center of gravity of a *homogeneous body; center of gravity* of a *plane area; center of gravity* of a *solid of revolution:* Examples.

Center of gravity of an *arc*, of a *surface of revolution.* Examples.

Properties of Guldin. Examples.

In the first term of *descriptive geometry*, besides the theory of the elements, many applications are required; among these are, sections of solids, shadows on oblique surfaces, development of surfaces, and intersection of surfaces.

The student is required to give in addition to the recitation, eight hours per week in drawing applications.

In the second term, the different methods of projection are treated with the usual problems in curves and surfaces. In addition to the recitation, the student is required to give five hours each week to the drawing and construction of problems and applications; among others, the shade of different forms of surfaces on other surfaces, the position of the line of shade; also elementary problems in perspective. Assistant Prof. Talbot teaches these classes.

The work in post-graduate studies is mainly confined to assigning works to be read and holding a written examination for standing; though students have been guided to some extent in advanced reading.

I may be permitted to say that the students in mathematics, in this University, when they go to other institutions, even the best of the eastern ones, find themselves of equal rank with others.

This statement must be limited to those of the Engineering Course, as the general student is not taken as far by several years as he may study in some of the eastern institutions.

I trust that one of the good things of the future which the University will have, is a full four years' course in mathematics.

Respectfully submitted,

S. W. Shattuck,

Professor of Mathematics.

MODERN LANGUAGES.

PROFESSOR EDWARD SNYDER, M. A.

S. H. PEABODY, LL. D., *Regent:*

DEAR SIR—The instruction in the Department of Modern Languages extends over two years of German and two of French. In the course of Literature and Science, one year of French and two of German are required. In the Engineering courses two years of either are prescribed, and in the other courses the requirements vary somewhat.

The first year's German, in two divisions; the second year's German, and the second year's French—four classes—are taught by me. Miss Helen Gregory has charge of the first year's French, which is also divided in two classes.

The first two terms of the first year in French and German are spent in a thorough study of the grammar (Cook-Otto's German Grammar and Bôcher's-Otto's French Grammar). In the third term the reader (Evans-Otto's German and Bôcher's-Otto's French) is used, a good review of grammar by topics is had, and weekly translations are required.

In the first term of the second year's German, "Klemm's Deutsche Literaturgeschichte" is read, containing a synopsis of German literature, biographies of leading authors (in German) and specimens of their writings. In the second and third terms Körner's "Zriny," Schiller's "Wilhelm Tell," Goethe's "Sphigenie anf Tanris," and Lessing's "Nathan der Weise" were read.

In the first term of the second year's French, Pilodet's "Literature Française Contemporaine" is used; Corneille's "Cid," Racine's "Athalie," Molière's "Le Misanthrope," and about two-thirds of Laboulaye's "Paris in Amèrique," were read in the second and third terms.

In both the second year's classes weekly translations or compositions are required through the year, and one recitation is given to their correction and analysis.

As to the methods of instruction in the first year, all that the time allows is done to make the study of grammar a thorough discipline, not only in the language studied, but also in its analogies, differences and relations to English grammar and syntax. A strenuous effort is made to give to the students, through the medium of these languages, the analytical and synthetical drill and discipline aimed at in the study of Latin and Greek.

In the second year special attention is given to translation, which means to express in good English what Goethe or Corneille, Schiller or Molière, said in classic German or French. The authors furnish the thought or idea, the student's task being to render it as nearly and fully as his command of language may permit.

All difficulties of construction and wording are carefully discussed and explained, and by this means a valuable review of the difficulties of grammar is obtained.

French or German is spoken in the classes during the last two terms,—that is to say, the corrections in pronunciation and translation, and the questions in construction from the teacher, as well as the answers from pupils, are in the language read. By this means a fair amount of practice is obtained, without taking time from reading or composition.

In conclusion, the undersigned begs leave to suggest that whenever the number of students necessitates a further division of classes, a separation of the students in literary and technical courses may be brought about. This need not be applied to the first year, for the students of the technical courses need certainly all the drill and discipline they can get from a thorough study of the grammar and syntax of a foreign tongue; but in the second year a course of reading in scientific prose could be given, which would more directly prepare them for the practical use of the acquired language in their several pursuits.

Very respectfully,

E. SNYDER,

Professor Modern Languages.

ENGLISH LANGUAGE AND LITERATURE.

PROFESSOR JOSEPH C. PICKARD, M. A.

DR. S. H. PEABODY, *Regent.*

DEAR SIR—The work done in the department of English Literature during the past year has been in accordance with the course laid down in the catalogue.

In the spring term of 1885, the seniors studied Whitney's Life and Growth of Language; the sophomores read Shakespeare's Merchant of Venice and some of his English historical plays; the freshmen had Rhetoric as a text-book study. In the fall term the senior class studied the Anglo-Saxon language; the sophomore class Burke, Bacon and Webster; the freshmen class, American authors. In the term now passing, the winter term of 1886, the seniors are reading early English authors; the sophomores, Milton and Wordsworth; the freshmen, British authors from Chaucer to Tennyson.

The aim of the department is to bring the students to a fair knowledge, at least, of the history of the English language and literature through all its periods, and to an intimate acquaintance with a few of the masters of thought and style whose spirits still rule us from their urns.

To secure the best results, it has not been deemed so desirable for the student to know what others have said about an author, (though such knowledge is not undesirable), as for him to have the author speak for himself. Good manners can be better acquired in good society than from books on etiquette. We are nourished by the meat we digest and assimilate, not by advertisements of meat markets. So with literature: if one would be profited by the literary products of any age, or by the words of some master of wisdom, he must transport himself into that age and feel in his own being the pulse of its literary life; he must, as far as he can, enter into familiar converse with the master, and talk with him as friend talks with friend.

In accordance with this idea the attempt is made to carry on the work of this department of the University.

First, the whole period of English literary history, from the birth of Chaucer to the present day, is divided into eras, and selections for reading and study are made from the representative writers of each. Attention is called to the peculiar features of the several eras, and to the characteristics of the greater authors. The first two terms of the freshman year are thus occupied with British and American authors. In the third term Rhetoric is taught with special reference to the second stage in the course, the analytical study of English classics (classics, *first-class* writers) as well as to the writing of essays and orations. This part of the course extends through the sophomore year.

As there is an intimate relation between the literature and the life of a people, as every age "enacts itself twice, first in its acts and events, and then in its writings," the study of the selected classics is accompanied by a study of the times of each writer. In such way have been studied the great prose writers and poets named above, two of them representing the great creative period of our literature, one, the Puritan period, two, the most brilliant age of British oratory, one that of the political and literary revolution in the latter part of the eighteenth, and the beginning of the nineteenth century, and one taken from recent American history.

The course is broken by the junior year.

In the senior year, after the previous study of German has somewhat prepared the way, the original English, or Anglo-Saxon, is studied one term, and this is followed by one term's work in the early English. These studies are required on the ground and in the belief that present English cannot be thoroughly known except by its historical study.

The last term of the course is given to the study of the life and growth of language as illustrated by our own tongue, this seeming to be a suitable closing of the three years' work.

Of English composition, as much has been required as could be attended to properly by a teacher having four hours of class-room work daily. Whenever such work has been required, it has been done promptly and cheerfully by all students in this department. Failing the ability to do more in this line, the attempt has been made to supply the lack in part by constantly watching and criticising what may be called oral composition,—the expression of thought in recitation. To this end—care in composition—oral abstracts of what has been read are daily required. This exercise tests the pupil's mastery of the lesson,—be it essay, or oration, or poem,—and measures and cultivates his power of telling what he knows.

It must be added that numerous lectures, generally brief, are given to the classes upon topics related to the work in hand.

Mention must be made of the excellent work that has been done, this year as in former years, by the teachers of English composition in the preparatory department. The work has been thorough, and the value of the training has been apparent in the later studies of the pupils in this school.

The year now closing has been marked by diligence, attention, earnestness, and corresponding scholarship.

The field of English literature is a world. It is, after all, but a few sheaves that a student can gather in his brief college course. It is to be hoped, however, that his work will be found to have improved his taste, and to have begotten and nourished in him such a hearty love of the best reading as shall ensure him constantly increasing stores of mental wealth; and that even here, indeed, he has attained some degree of that culture which shows itself in widened sympathy, in breadth of thought and in ease of expression.

Respectfully submitted,

J. C. Pickard,

Professor Eng. Lang. and Lit.

HISTORY AND ANCIENT LANGUAGES.

Professor James D. Crawford, M. A.

Dr. S. H. Peabody, *Regent:*

Dear Sir: The course of special historical study covers five terms, three of the junior year and two of the senior.

In the first term the ancient history of the East is taken up, including Egypt, Babylonia, Assyria, Media and Persia, and afterward Greece and Rome are studied. In a single term, of course, only an outline of the history is possible, and the same may be said of each of the three terms of the junior year; yet as far as possible attention is given to manners, customs, government and religion. Special text-books are used, but subjects and eras are studied rather than any particular book, and constant reference is made to the library. I have never yet given out a lesson to be learned by heart in the words of any author, and very few lessons, are given that do not require reading in the library. I consider the habit of looking up topics in various authors as valuable as the information thus gained.

In the second term we study the history of mediaeval Europe from the fall of the Western Empire to the taking of Constantinople.

It is intended to emphasize the connection of events, the continuity and unity of history, and the relations of the mediaeval period to both the ancient and modern times is often dwelt upon. The beginnings of institutions found in modern times are looked for and studied, and the attempt is made to illustrate and explain the modern conditions and relations of nations from a view of their origin and growth.

In the third term the history of modern Europe is studied, to the close of the Napoleonic era, with reference, as far as time permits, to the present state of the nations considered.

I have always tried to impress upon my classes the fact that the work possible in this year of study is but an outline, a preparation for further study, which must be done in order to obtain the most value from the time spent in the required course.

In the first term of the senior year the history of civilization is studied. The condition of man in barbarism is first considered, and the attempt is made to discover the causes and means of his progress through different stages of civilization.

The oriental civilizations follow and then that of Greece and Rome, with comparisons and a consideration of the causes of differences.

I have ordinarily required five or six essays in this term, from each member of the class, on various subjects assigned, connected with the work in hand. The following are some of the subjects given: "Relation of the useful and fine arts to civilization." "Comparison of oriental and Greek civilization," "Arab civilization," "Education and religion as related to civilization," "The civilization of the present compared with that of the past."

The first part of the term's work, to the fall of Rome, has been by lecture and readings upon topics. After this the class has gone through Guizot's "History of Civilization," with parallel reading.

My classes have accepted long lessons and hard work very kindly and have done more reading than I might have sometimes expected when the pressure of other studies is taken into consideration. I do not think the students of this University are surpassed by those of any institution in their readiness to do extra work, in doing cheerfully all they can. I have been almost surprised, sometimes, at the good temper of my classes under pressure that was rather severe.

In the second term of the senior year Constitutional History is studied. After some general considerations on government and its needs and relations to man in society, the study of the English Constitution follows. Though a text-book is used as a basis for this work quite a list of works of reference in the library is given, and considerable outside reading is done. The study of the United States Constitution follows the English, and the connection between the two is shown, America's inheritance in English liberty. This is the concluding term of the course of historical study. The full course is required only in the College of Literature and Science, but all the colleges require the last term, I believe.

In the course of Ancient Languages six terms of Latin and three of Greek are required, and three terms of Latin or French, and three terms of Greek or German are required in addition.

The Latin of the course, either in whole or in part, is taken by students who do not take the Greek, and so are not candidates for a degree in this course.

The number of students in the full course has always been very small owing to numerous causes. From the opposition to the course outside of the University it has never been prominently advertised or known that such a course was provided. The expense of full classes would be no more than of small ones, and I would question whether more prominence might not be given to the department without any injustice done to any other school of the University.

Without any comparison as to the relative merits or advantages of different courses it may be said that there are always many students who want a course in Ancient languages, and there seems no reason why they should not come here as well as to go elsewhere. I have no wish to criticise any opinion or to enter into any discussion in connection with the question of the study of languages, but only suggest that as there is such a course here the public should be informed of it as in regard to other courses, that it may be known that the demand always existing may be satisfied at the University of Illinois. The discouragements of my position during the nearly thirteen years I have been in charge of the department of Ancient Languages have been considerable, sometimes it has seemed unnecessarily so, and if I had not had work in history and in the library which I felt was recognized as worth the doing I should have been tempted many times to give up the struggle, but there has always been the hope of better times for my department, a hope which I still strongly cherish.

For some years past the instruction in Greek has been given by the Assistant in Ancient Languages, and I have reason to believe the work has been very well done. I have myself taught the Latin.

The objects sought in a course in Ancient Languages are so generally agreed upon that it is hardly necessary to go into any explanation as to intentions and purposes, yet I may say that in my instruction I have kept largely in mind the knowledge of English to be gained through other tongues and have endeavored to give what help I could in that dirertion.

I am, sir, yours very respectfully,

J. D. CRAWFORD,

Professor of History and Ancient Languages.

MILITARY SCIENCE.

PROFESSOR CHARLES MCCLURE, U. S. A.

DR. S. H. PEABODY, *Regent :*

SIR—I have the honor to submit the following report of work done in the military department of the University during the past year, together with such recommendations as, to me, seem proper.

The classes under my instruction were composed of the officers and non-commissioned officers of the University battalion; were two in number and each received instruction two hours per week. The course was substantially that prescribed in the catalogue. Text-books used were "Upton's Infantry Tactics," "Wheeler's Art and Science of War," "Kennon's Duties of Guards and Sentinels," besides blue-print notes on "Field Fortifications." Practical instruction in military signaling, sword and bayonet exercise and artillery drill was also given the classes.

The University battalion since the opening of last fall term has contained four companies. During the fall and winter terms five hours per week were given to drill. For the spring term it is necessary to reduce the number to four; but as the companies drill outside, more drill is really obtained—both battalion and company drills being required. A large majority of the students during the past year have taken commendable interest in the drill.

The battalion since last September has been without a "duly appointed medical inspection." The certificates of disability have come from physicians not connected with the University and often not residents of Champaign or Urbana. It is very desirable that the services of some resident physician should be secured for this work. I should further inform you that the University is much in need of a suitable and safe place for keeping the ammunition issued to it by the Ordnance Department, U. S. A.

Very respectfully, your obedient servant,

C. MCCLURE,

2d Lt. 18th Inf. Professor of Military Science and Tactics.

BACCALAUREATE ADDRESS.

Delivered in the University Chapel, before the Graduating Class, Sunday, June 6, 1886, by

SELIM H. PEABODY, Ph. D., LL. D., Regent of the University.

Render unto Cæsar the things which be Cæsar's, and unto God the things which be God's. Luke 20:25; Matt. 22:21; Mark. 12:17.

Jerusalem has ever been renowned as the capital city of a peculiar nation, but never more remarkably than when Christ dwelt therein. From sovereignty to captivity, and from captivity to empire her people had oscillated during a long history and especially during the six preceding centuries. They had been conquered by the Mede and the Persian, the Greek and the Egyptian, and at Christ's advent, although the world's peace was symbolized at Rome by the closed doors of the temple of Janus, for Judea the peace was the peace of captivity, the quiet was that of subjugation under the yoke of the Roman imperators. An hundred years had passed since the city had been captured by Pompey, and nearly ninety since the temple itself had been plundered by Crassus.

In the meanwhile the conquerors had done much to mitigate the severity of their rule. They had builded again the razed walls of the city. Herod had restored the temple with a magnificence far exceeding its glory at any former time, and the daily sacrifice was maintained in its fullest grandeur, and with its most significant solemnity.

Still the Jews mourned their subjugation. Still they hoped to regain their autonomy. Still they looked for the Messiah who should restore their temporal power; who should found an empire more illustrious than those to whose glory they themselves had been compelled to contribute. In their minds and to their hearts these expectations stood with all the certain assurance of prophecy—the counter part of all the grand predictions which had actually been fulfilled. Scarcely, at the final and utter destruction of their city, a generation later, did they learn that the hopes and the expectations which they cherished were but the baseless fabric of a dream.

We can scarcely be surprised to find that when Jesus of Nazareth appeared in Jerusalem, one whose wondrous personality, whose miraculous powers and whose confident assertions claimed kinship with the Father omnipotent—the leaders of the Jews, they who had studied the prophecies and supposed that they understood their import, should seek to apply to this claimant the tests in which they had already placed the implicit confidence of their individual and collective judgment. Time after time, sometimes in disbelief, sometimes in doubt only, sometimes, we may suppose, in the earnest hope that the results would correspond with the promises of their traditions, they came to him with their tests, trials, temptings, to see if perchance this man might not, after all, be their promised deliverer. Time after time they went away confounded, because, while they failed to discover either such evidence of his messiahship as accorded with their conceptions, or such as would convict him of deception and imposture, they were confronted with such manifestations of wisdom, insight and power, as often compelled them to admit that this Nazarene, who spake as never man spake, was infinitely grander than any ideal they had ever conceived. And so when they asked of Christ in the temple whether or no they should pay tribute to Cæsar, we may suppose that some felt that for once they had touched the central thought of their hopes, since the payment of the tribute was the most distinctive evidence of their subjugation and servitude. Others thought in their hearts—as the word hath it, tempting him—"What will He say? Will he continue in this pretense of kingship, whose very essence of sovereignty must refuse to remain tributary to any other earthly potentate? If he consents to pay tribute he is no king. If he refuses to pay tribute we can accuse him, (as falsely they afterward did accuse him) of rebellion against the authority of Rome.

Whatever motive may have caused the question, the answer gave no place for cavil or objection, because it cut straight to the actual condition of affairs. "Bring me a penny. Whose image and superscription is this?" This is to say, "How are you doing business? On what basis do you buy and sell—make and settle contracts? In your daily avocations, what authority do you recognize as dominant here in Jerusalem and throughout Judea?" They say to him, "This money bears Cæsar's image." Then he answers, "If the use of the money which bears Cæsar's image is evidence of Cæsar's rule over you, then, being under the authority of Cæsar, render to Cæsar whatever that authority requires; and remember farther, that as you are subject to the authority of God, you shall render to God whatever that authority requires."

Beyond this he might have said, as he said in substance or in detail so frequently both before and after, "These questions in no way concern me. My kingdom is not of this world. My authority raises no questions of the sword, or of conflict; of tribute or of revenue. If I desire to pay taxes, even the fishes shall bring to me such revenue as I require. These things are not mine. If you owe them to Cæsar, pay them; then turn and follow me."

Concerning this reply, it is evident that nothing can be added by way of argument or demonstration. The case is complete in itself. It must be presented rather as one of those grand statements which, with the terseness of epigram, present a motto for action, a guide for living and for dying.

I shall attempt little more than some illustrations and applications of its two phases: the duty we owe to Cæsar, the duty we owe to God.

1. And first, concerning Cæsar—

To the Jews, and to Christ in his temporal relations as a Jew dwelling at Jerusalem, the word represented simply the power then dominant in that land—the power of Rome. Everywhere about were the evidences of that power; standards, soldiers, centurions, taxes, tribute. Even the money of daily traffic bore the symbols of Roman rule. But in this the galling thing was not so much that the rule was Roman, as that it was foreign. That these were emblems of authority might be endured, but that they represented subjugation seemed unendurable. The question was not so much, shall we pay tribute to Cæsar? as, shall we pay tribute at all?

The answer, as were so many of Christ's answers, was broader than the question. It enunciated the general principle, which would be applicable to all similar queries, as well as to this. In its largest significance the element of foreign domination is eliminated. Giving tribute to Cæsar, paying the tax levied, or any such overt act, means simply the recognition of temporal and civil law, and obedience to its behests. It is, in brief, submission in act and in intent to existing authority.

This includes in its essence the answer to the next question, What are "the things that be Cæsar's?"

The duty of respect for authority and of obedience to law is not only the rational requirement of christian principle, and the outward fruit of christian and manly character, but it is the direct precept of the Holy Scriptures in various places.

Thus Paul in the chapter read. [Romans XIII.]

"Let every soul be subject to the higher powers. For there is no power but of God; the powers that be are ordained of God; Whosoever therefore resisteth the power, resisteth the ordinance of God, and they that resist shall receive the greater damnation. For rulers are not a terror to good works, but to the evil. Wilt thou then not be afraid of the power? Do that which is good and thou shalt have praise of the same. For he is the minister of God to thee for good. But if thou do that which is evil be afraid; for he is the minister of God, a revenger of wrath upon him that knoweth evil. Wherefore ye must be subject for wrath's sake, but also for conscience's sake. For, for this cause ye pay tribute also, for they are God's ministers, attending continually upon this very thing.

Render, therefore, [he concludes] to all their dues; tribute to whom tribute is due; custom to whom custom; fear to whom fear; honor to whom honor. Owe no man anything, but to love one another."

In his own person Paul rendered apology for breaking these rules. The high priest, Ananias, angered at Paul's words, ordered his servants to smite him on the mouth. To whom Paul, rightfully indignant, answered, "God shall smite thee, thou whited wall; for sittest thou to judge me after the law, and commandest me to be smitten contrary to the law." And they that stood by said, "Revilest thou God's high priest?" Then said Paul, "I wist not, brethren, that he was the high priest, for it is written, thou shalt not speak evil of the ruler of thy people."

Again, in his epistle to Titus, Paul says, "Put them in mind to be subject to principalities and powers, to obey magistrates, to be ready for every good work."

And Peter also:

"Submit yourselves to every ordinance of man, for the Lord's sake; whether it be the King which is supreme, or unto governors, as unto them that are sent by him for the punishment of evil-doers and for the praise of them that do well."

Now I apprehend that in regard to these scriptures, whose teachings are too explicit to be explained away by glossing interpretations, there are very many of us who give assent thereto with our tongues, while our hearts rebel against them. In these days the tendencies are too often visible wherein men seek to ignore, or to evade, or to deny the law, and to cast odium or contempt upon those whose duty it is to execute its provisions.

I do not speak of this here and now, because I have any fear that these young men and women who form my peculiar audience, need any instruction for themselves. But these currents of thought, like currents in the ocean, which often beset the unwary navigator and sweep him aside from his true courses and bearings, are similarly insidious in their effects. The public mind needs often to be called to consider these influences, and if you, my young friends, will help in any effort to correct public sentiment, and to keep opinions in their proper channels, there will be no way in which you can better serve the times.

First, then, in rendering honor where honor is due, we ought to cultivate greater respect for the law and for laws. It is true that laws are found upon our statute books that ought never to have been placed there. They were enacted hastily, without due consideration, or to accomplish some peculiar and unfit purposes; or, inadvertently, they may contravene those organic laws which formulate the lawfulness of statutes, and the rights of men. But such laws are few, and for them there is usually some lawful way of repeal or abrogation. Wise men will usually say of even an imperfect or an unwise law, that, being the law, it should be obeyed, and that without the pressure of legal process. General Grant asserted that the enforcement of a bad law was the surest way to its repeal. Laws, good or bad, will never execute themselves. In communities like ours, where the laws are made by the people, or their representatives, their enforcement depends equally upon the popular will, according as public sentiment approves or rejects the principles which are in question. Breaking the law will not lead to its repeal or its abrogation, unless, perhaps, it be a needful step in the testing of the law by lawful means. A man may have very positive convictions in opposition to protective tariffs, but that will not, either in law or in ethics, excuse his activity in smuggling. A bad election law will not excuse the tampering with ballot-boxes. The flinging of bombs charged with fearful explosives will not, in this country at least, make the laws for the protection of life and the security of property less stringent in enactment, or less rigid in application.

There is nothing which proves so conclusively that our civilization and our power of self-government have not in fact reached that stage of development which we are wont to assert for them, as the frequency—it is feared a growing frequency—with which the people override the law, taking its execution into their own hands and out of the hands of those who are lawfully entrusted with its execution. Every instance in which a human being is whipped, or maimed, or spoiled of his goods, or deprived of his life, by the violence of the mob, is an evidence of barbarism as pronounced as is either slavery or polygamy. The assertion that crime cannot otherwise be prevented in any community is an admission that that community has not advanced in civilization enough to protect itself. Good may come to a people by their uprising in the execution of lynch law, but no good that can possibly balance the evil done in the destruction of law itself. The plague in London and the rats in Chicago were destroyed by fire. The French Revolution was one long carnival of lynch law. Mobs and mob law merely expose and cultivate the savage elements that still linger among us. Some are indigenous, some imported. That there is occasion for its display is evidence of deficiency in the law or in its execution. But this is because the people will to have it so, or at least do not will to have it otherwise. If the laws concerning juries are deficient, the people have the power to change these laws. If judges distort law and prejudice justice, other judges who will not emulate their evil practices may be found for their places. Thus do I illustrate.

On a summer evening not many years since, in the northwestern metropolis, a man and his wife went out for a drive, found one against whom they had enmity, forced an altercation upon him, and left him wounded and dying on his own door-stone. The assailant was arrested. Under the provisions of our laws he chose from the nine judges of the Superior Court the one who should try his case, he falsely swearing that the other eight were prejudiced against him. A tale of more than an hundred jurors was exhausted by methods known to the law, and—so was I informed by a leading merchant of that great city—a bailiff found gathered in one saloon the men who, as a jury, should acquit the accused, and, under the rulings of the judge, they did so acquit him. Surely this acquittal was a travesty of justice, and a sorer stab at the integrity and the protecting power of the law than was the original murder. But when, in a subsequent legislature, an attempt was made so to amend the law that some steps at least of this mockery of justice could not be repeated, the amendment was not permitted. The criminal escaped through defects in the law and the administration of justice, and these are not better because the people will it so. When the people of Illinois want better jurisprudence they can have it as certainly as they can have good election laws.

That we may respect the laws, we should respect those who make the laws, and see that they are men worthy of our respect. The customary flippant remarks about those who represent the people in legislative halls are usually untrue and are always unwise. While it is a fact that some weak men and some bad men find their way to represent the people, they are the exceptions. The larger number, and usually the controlling minds, possess honor, integrity, principle and reputation, and do fairly represent those who elected them. Indeed, it may well be questioned whether even those less reputable do not after all fairly represent their constituents. But the failure to give due honor to these places of public trust and to those placed in them, tends to lower in the occupants the tone of lofty principle and of high responsibility which should actuate them. Men soon permit themselves to become time-servers, selfish and mercenary, when they find that the public expects nothing better of them. Sure the public welfare would be better served if all influences could concur to put all legislators on higher planes of ability, and dignity and honor, if by such means there might result a more perfect appreciation of public trusts, and a more perfect discharge of public duties.

If the people were themselves accustomed to view these duties and responsibilities as they ought to be considered, would not more care be taken in the selection of the men who are given the chance to be chosen to public office? Pardon me if I digress and trespass briefly upon ground usually placarded as dangerous.

1. As to legislators. The questions brought before men for their decision and votes are partizan or non-partizan, chiefly the latter. In regard to the first, the man of sense will usually go with his party; first, because it is supposed that he is honestly and from conviction a member of that party; next, because by so doing he obeys the will of the constituents who elected him as their partizan representative; lastly, from policy, for he who does not act with his friends will presently find that he has no friends to act with him. As a rule the legislator who begins by posing as an "independent," either falls presently into line on one side or the other, or finds himself still alone, trusted by neither and hated by both.

But the majority of questions are non-partizan. They are, moreover, very frequently questions upon which neither the general public nor their immediate constituents have any well-defined opinions. To discuss, weigh and settle these questions requires sound discretion and good judgment. The men who are to discharge this duty, no matter by whom nominated, ought to be men of experience, honor, discretion and common sense, who can be trusted with the management of affairs. If more such men could be elected, our legislatures would have shorter sessions, would pass better laws, and would leave less dead-wood on the statute books.

Young men, you who are going into the world with some hope of becoming forces in political as in other matters, this is the sort of politics that I would teach you. Remember that in all constitutional governments, public policy will be controlled by partizan organizations, whether you approve of it or not. Make up your minds that the present great political parties, or their lineal descendants, will rule this country for long, if not for your life-time. Choose, then, whom ye will serve. Choose, deliberately and thoughtfully, that par y whose principles of public policy, exemplified in the light of history and of present events, conform most nearly with your convictions of wisdom, prudence and justice, presuming in advance that in some respects neither will come up to the full measure of your wishes or opinions. When you have settled yourselves, do not change for frivolous reasons, by whims and caprices, and do not be afraid to change when momentous crises come which you recognize as the turning points of the times. Then go into your own camp, whither your convictions lead you, and where, therefore, you belong, and use your best endeavors to elevate its moral tone, improve its methods, broaden its economical views, and to put its wisest, strongest and most honorable men in places of trust and responsibility. Respect your opponents. They may hold their opinions as honestly and as tenaciously as you yourselves will. You should make it a rule to vote whenever and wherever you have a right to vote, and you should use your vote in such a way that it will have its full value in deciding the questions at issue. To refrain from voting is very often to vote silently for the very interests that you would prefer to have defeated. But at the actual election the voter has little choice. The question there to be settled is not usually of men, but of party. The place where individual influence may be efficient is in the earlier stages of political work, when it is determined what men shall represent the principles of the party, and to these points I commend your attention. Finally, remember that all great practical questions have been determined by those who have had the discretion to temper their desires by the possibilities of attainment. Compromise is a word of evil repute, and I shall never advise you to compromise with evil; but worthy men have found it advisable to compromise between what they want and what they can get. I have heard a great deal of rhetoric about aiming at the sun—it is certainly a splendid target—but I never heard that anybody ever hit it.

I have already referred to the majesty of the law as something that should reign with regal authority in every community. I would in every possible way enhance the dignity and the solemnity of law, as the embodiment, the visible presence of absolute justice, until next to God himself nothing should be more worthy to receive the honor and the homage of all men. To secure this end all the processes of law and all steps in the administration of justice should be directed. The statutes which formulate laws and penalties should be made comprehensive and luminous. The methods by which law is practiced and applied should be made simple, direct and inevitable. The bench, if not pure, should be made pure, to be adorned by men learned in jurisprudence, honest and honorable, and removed as far as possible from all bias, personal, partisan, or political. Judges ought never to have been elected. They never should have been subjected to the seductions of political favor, or the pressure of popular opinions. It is not a pleasant sight to see a judge canvassing votes between the terms of court. It is a shame that one should be retired because of just, but unpopular judgments, pronounced from the bench.

It furnishes an unpleasant comment upon the legal practice of to-day, that so much business is, or has to be, carried forward to court of higher or of last resort. If law were the exact science that its votaries and practitioners profess; if courts were rightly administered, and judges were learned and prudent, as we have a right to expect; if the public were satisfied of these things so as to put confidence in the conclusions reached—Cæsar being honorable and honored—the right would be known to be as clearly right when decided by the judge of a *nisi prius* court, as when it has been approved by a series of appeals which has ended before the full-robed nine who sit at Washington. What effect would be produced upon justice and the uncertainty of the law, if after some number, say fifty, or an hundred, or five hundred, of the decisions of a given judge had been reversed by courts of higher resort, that judge should thereupon at once and finally be removed from the bench, and thus the farther travesty of justice by his malpractice be prevented? Do not infer that I refer to the defects of the administration of justice as common. I would arrange in some way to make them less possible.

For in these respects the world does more. Wrongs in action, defects in judgments, differences and disputes, as well between nations as between persons, are more and more frequently adjusted and settled by lawful process. It was a long step towards the era in which right, not might, shall redress wrong, when the two foremost nations of the world agreed to refer their differences to arbitration; and when, the decision being rendered, the defeated party did so render dues unto Cæsar as to pay the award of the arbitrators without farther contention.

So, too, is it an omen of good when a nation's wrongs, ancient, aggravated, and grievous, find chance and scope for redress in the enactments of a legislative body. I know not, my friends, how the events and debates now progressing in the Parliament of England appear to you, but I have watched them with exceeding interest, and with earnest hope, growing daily into a confident expectation that, if not at once, they will at no distant date bring about a reasonable and fair solution of the questions which have so long been discussed concerning the Irish people, and a joyous release from their accumulated wrongs. I have been astonished, as I think you must have been, at the wonderful acumen, fertility of resource, and firmness of purpose which Mr. Gladstone has exhibited. I have admired the wisdom with which he has tempered the larger purposes which he surely must have cherished, to meet conditions which could not be changed, and prejudices which could not be removed. To me he shows a notable example of that good sense which thankfully accepts that which is within his reach, and bides the time when something better may be secured.

English conservatism is strong, as it has a right to be. Her ancient forms of jurisprudence and of parliamentary government are as venerable as her forests or her cathedrals, yet the reforms which Mr. Gladstone has aided in establishing during the fifty-four years since in 1832 he first entered Parliament, and the obstacles, moss-covered and hoary with age and precedent, which during that time have been removed from the way of England's progress, are too numerous to be here rehearsed, and ought to be too many to be forgotten. They include the repeal of the corn laws; the disestablishment of the Irish church; the abolishment of purchase of promotion in the army, and two or more extensions of the elective franchise, and to my mind the best feature of all is that each of the steps which he has induced England to take has been taken without tumult, by peaceful processes following the education of the public mind or the enlightenment of the public conscience.

The Home Rule bill may fail to-morrow, or this month, but its principles will prevail. I do not profess to know more than another what results may grow out of this beginning, but I can not but believe that it will engraft a new scion upon the English constitution, from which will grow an organic structure not unlike that of the United States of America, in which each fragment of Great Britain and Ireland will have control of its own domestic affairs, while all will be joined in an indissolubly united kingdom, whose imperial parliament will deal with all matters of common interest. When that is accomplished, and many of us may live to see it, several improvements will have been made in the processes of government by legislation which our Americans may wisely borrow. If nothing else, I believe we shall have been shown how to right gigantic wrongs, introduce radical changes into the system of government, and to keep step with the onward march of the civilized legions, without resort to war, destruction, and carnage. For one, I could wish that the hands on the dial which tell the hours of Gladstone's waning life were set backward thirty years.

Render unto God the things which are God's. My young friends, what hath God done for you? Look out now on this beauteous earth, on this glorious June day, full of throbbing life, and joy, and hope, and mark the surroundings. Behold all nature jubilant under glowing sun and sky of blue, with song of bird, and hum of bee, and perfume of flower, luxuriant with waving grain, and early fruit, and promise of profusion in the budding year. Recall to your minds your capacities of body and of mind, coördinated to be sustained by these benefits, and to appreciate these delights. Remember your own joyous young lives, as you stand now in the glorious freshness of opening manhood and womanhood, pausing to scan the field before you plunge into the conflict. Think of the circumstances amid which you move, that though not sensible to the eye and ear, and so not comparable with these sights and sounds, are yet more worth to you as the invaluable portion of the heritage which you may accept and enjoy. Consider the citizenship which is open to admit you in this free and grand republic, which we fondly claim presents for capacity and ambition facilities for advancement unknown under any other sky. Regard the endowments of mind and heart, memory, thought, will, affection, conscience, by which your life is distinct above all other lives that surround and delight you. Recount the generous provision that the State and nation have made for you, that you might make the broadest and the best development of your native capacities. Sit down here and complete with deliberation and care an inventory of all that you have and expect to attain, of all that you are and hope to be, and then tell me if it be not true that, made, endowed, and environed as you are, your place in nature and in life can scarcely be lower than that which the angels are presumed to occupy.

"For thou hast made [man] a little lower than the angels, and hast crowned him with glory and honor; thou hast put all things under his feet." [Ps. VIII: 5.]

It is worth your while, sometimes, to climb to some lofty height where you can scan a wide view; where you may fill your lungs with the pure ether, and cause the generous currents of your blood to tingle to your finger tips with expanding energy and refreshed life. So would I lead you to Pisgah's lofty summit and bid you look over into the promised land, yours to enter and to possess, full of all possibilities and delights to him who has the secret of mastery over himself and them.

Whence come to you all these benefits? and,

"What will you render to the Lord for all his benefits toward you?" [Ps. CXVI: 12.]

I answer with the psalmist:

"O praise the Lord all ye nations; praise him all ye people. For his merciful kindness is great toward us, and the truth of the Lord endureth forever." [Ps. CXVII.]

But the tale of God's mercies is not yet complete. That which has been enumerated, that which you have delighted to gaze upon from the pinnacle of Pisgah—beautiful, glorious and yours to enjoy—that is all of the earth, and will some day vanish from your enfeebled vision. Beyond the valley, on the far side of this promised land—and I pray for each of you that the journey thither may occupy you many happy years—there stands another eminence, overlooking a dark and chilly river, from whose farther shore no footstep hath returned, through whose mists no eye has seen. Yet have we this account of the land beyond, whose confines are separated from the borders of our present life by but the breadth of a breath.

Listen: [Rev. XXII: 1, 3, 4, 5.]

"And he showed me a pure river of water of life, clear as crystal, proceeding out of the throne of God and the lamb.

"And there shall be no more curse, but the throne of God and of the lamb shall be in it; and his servants shall serve him, and they shall see his face.

"And there shall be no night there, and they need no candle, neither light of the sun, for the Lord giveth them light; and they shall reign forever and ever."

This also doth God offer to you to have and to enjoy: the materialized expression of a condition of happiness and joy, not otherwise recognizable by your comprehension.

Again lift your voices with David and sing: [Ps. CIII: 2, 3, 4.]

"Bless the Lord, O my soul, and forget not all his benefits.

"Who forgiveth all thy iniquities; who healeth all thy diseases.

"Who redeemeth thy life from destruction; who crowneth thee with loving kindness and tender mercies."

Such temporal and spiritual blessings hath God prepared for you. I know not how much thereof you will choose to accept. You may, if you will, shut out the song and the sunshine, with all visions of blue sky and laughing water. You may so act as to bar out all the glorious prospects of worldly success, which now beckon to you with alluring gesture, by such wrong doing as others as capable and as promising as yourselves have chosen to perpetrate. You may turn your feet into paths that will lead far away from the New Jerusalem. What you will choose you only can determine.

Now what doth God demand of you? What things that are God's should you render unto God? What do you possess that is not God's?

This is God's demand, as formulated by his Son Jesus Christ: [Mark XII: 29, 30.]

"Hear, O Israel, the Lord thy God is one Lord!

"Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind, and with all thy strength.

"And thou shalt love thy neighbor as thyself."

To love the Lord with all one's heart, soul, mind and strength, is to give one's self wholly to the Lord, and to consecrate one's energies in his service. But you will say, "what am I commanded to do? What avocation shall I undertake? Must I become a preacher of his gospel?" Yes. Possibly as its accredited messenger, preaching formally as God's minister; but certainly by the voices of your daily walk and conversation.

Beyond that I can not tell you that this directs you to any definite calling. The directing finger of Providence alone can point out to you the pathway you must travel.

The chroniclers of early discovery relate that the hale old sea-captain, Sir Humphrey Gilbert, called out from the deck of his foundering ship, "Be of good cheer, we are as near to heaven by sea as by land—and the frigate's lights went suddenly out." So I believe a man may in all his energies be consecrated to the Lord, and ought to be so consecrated, as well in one occupation as another, provided that both be alike lawful and just. We may believe that God's providence has determined that all forms of progress on this earth shall go forward. God has ordained that ships shall furrow the sea; that ways shall be multiplied by which men shall go to and fro on the land; that electric lights shall burn; that the earth shall yield her increase, as well from mine and wave as from forest and soil; that machinery shall sing its busy hum; that science shall be developed; that knowledge shall increase, and withal that the knowledge of his name and his gospel shall be carried to all the inhabitants of the world. We must believe that all these are but parts of his great design, and that it is his will that divers men shall pursue divers occupations in the progress of those designs. He best fulfils the command who anchors his purposes and his will hard by the will of God, and exerts all his energies to do that will in the place assigned to him.

What is required of you? Hear again the word, as spoken by the mouth of his holy prophet. [Micah 6: 8]:

"And what doth the Lord require of thee, but to do justly, and love mercy, and to walk humbly with thy God?"

Here might I pause, close the book, and leave this seed, falling, I hope, on good ground, to germinate and bear fruit. Bear with me a little longer, while I indicate a few points of duty, whereby, in doing them, you may the better render unto God the things that are God's.

1. Let me urge the duty of continued self-development. The requirement to use all your heart, soul, mind and strength in God's service, also means that that all shall be *all* it can be. That all your powers of effort and of action, all your capacities of affection and for will, shall be kept growing in symmetry, in healthfulness, in activity and in efficiency. To this end you should care for your bodies, keeping them pure and holy, the temples of God, which temples ye are. That your minds should be kept under constant and vigorous culture. No matter what the kind and stress of your occupation, keep a little time for study or reading. If your past work has been well done, you have barely reached the point where reading may be most profitable. Keep your minds enlivened and aroused by sympathetic contact with the great minds, past and present, whose thoughts are garnered for you in books. Keep yourselves ever under control; your thoughts pure, your affections chaste; your appetites under subjection, your wills obedient. In brief, make yourselves best, and make the best of yourselves.

2. Remember ever the duty of helpfulness to mankind. The State has been at cost for your education. The State will look to you to see if this expenditure pays. You are asked to make the best of yourselves, not simply on your own account, but because in this way only may you be the better in your places, and thus the more fully render to man and to God your rightful service. You have been advised to keep your lights trimmed and burning. Do not worry about their brilliance, but see that your candle does rest on a candlestick, that it may give light to all that are in the house.

Go quietly about your appointed work. Learn its duties, immediate and collateral. Do them fully, not looking to the recompense of reward, but thankful that you have the place and the chance to show your capacities and to prove your training. Be faithful; be patient; trust the results to Him who cares for sparrows and clothes the lilies. I would have you each become a power in the community where your lot may be cast, and that because I believe that when you have attained such a place of influence your power may be efficient for good. To gain this, which surely is a laudable ambition, be cautious, wise, prudent, and modest in assumption, but vigorous and efficient in action when the opportunity is found. Take care not to waste yourselves.

Remember, too, that in no slight sense you go out as representative men and women. You will be counted as persons who have enjoyed large advantages of education, and you will be expected to show the culture and to assume the responsibilities of education. You will be more in the eye of the public than you would have been otherwise—more subject to criticism and cavil. Many things will be deemed unpardonable in you which would be overlooked in others. A. Barton is only a simple fellow, who passes unnoticed through the crowd. Amos Barton, Master of Arts, is a person to be tested and proven according to the stamp he bears. No matter how the nation treats its dollars, the people reading the image and superscription which you bear will test you, it may be, with acids or ringing blows to see if you are good metal, and with scales to try if you are full weight. Your Alma Mater adorns you with her emblems, and expects you to bear them forth with knightly consecration, to defend them with knightly fortitude. She entrusts them to you with the confidence of a mother whose dearest affections cling to her sons and daughters, and she charges you to suffer no stain or evil to befall them. Render to the University the things that are hers—honor, homage and fidelity.

I wish, in closing, that I could put into fitting and enduring language the affectionate thoughts and wishes that turn towards you this day, my young friends of the graduating class, from all who know you—citizens, college-mates and instructors. I wish I could show to you how our hearts will go out with you, sharing in your aspirations, rejoicing in your joys, sorrowing in your misfortunes, if misfortunes come, and glorying in your successes. You will be most heartily welcomed in the great and growing brotherhood of the alumni of this University.

For myself, this occasion has a peculiar, almost a solemn interest. Now for the fortieth time, in humbler or in larger ways, I come with a company of young men and maidens, with whom I have enjoyed extended, kindly and intimate relations as teacher and pupils, to the threshold over which they must pass out into active and earnest life, while I remain to serve them who shall follow. The numbers of this long procession I cannot count. I find them scattered in every city, I might almost say in every hamlet in the land, and their cordial greetings are most welcome to my heart. Many of them lie buried on New England hills or on western prairies, and some in the furrows where war plowed and scarred the southern soil. They are to be found in places of honor and of responsibility; in all stations and all ranks of useful life; but if any has ever come to serious disgrace it has been fortunately kept from my knowledge. Will you accept my personal and heartfelt welcome to the ranks of this army of my pride and affection.

And now may the grace, and mercy, and peace of God, beyond what mortal tongue can speak or mind conceive, be and remain on each one of you in the life that now is and in the everlasting life that is to come, through the intercession of Jesus Christ, our Savior and our Redeemer.

FARM PAPERS.

BY G. E. MORROW, PROFESSOR OF AGRICULTURE.

CORN CULTURE.

The readiness with which varieties of corn cross-fertilize, and the fact that variations in type can be more readily seen and perpetuated by selection of seed than in the case of any of the small grains, have caused great difficulty and confusion in the nomenclature and description of varieties, especially of the Dent varieties, so generally cultivated in Illinois. The influence of soil and climate in modifying characteristics is especially noticeable in corn. Very few of the Dent varieties have their minor characteristics so firmly fixed that one can with certainty identify samples submitted to him from different neighborhoods. Often there is great lack of uniformity in the ears produced on adjacent stalks, more difference being found than between selected ears of varieties known under different names. Persistent selection with reference to one type is the only method of avoiding this, and so long as there remains so much difference of opinion among farmers as to what constitutes the best type, it is hardly to be expected that any variety, however carefully it has been bred, will long remain uniform in minor characteristics after it has been generally disseminated. When different varieties are grown on the same or even on adjoining farms, more or less modification from cross-fertilization is to be expected.

In recent years we have tried more than 100 named and unnamed varieties, finding many of them nearly the same, and the large majority either unnamed or known only by the name of some one, or some locality, by whom the variety had been introduced or from which it had been obtained.

A most gratifying conclusion from the trials, as well as from examination of hundreds of exhibits of corn at State and other fairs in Illinois, is that almost every locality in the State in which corn-growing is a leading feature of the farming, has varieties excellently adapted to the local conditions of soil and climate, in many cases so desirable that it is at best doubtful if it would be wise to discard these for any of the much praised varieties occasionally introduced at high prices by seed dealers.

Something of disappointment has invariably come as the result of a trial of any new variety, if it has been advertised as much superior to any other. We have not found any one variety which is with confidence to be named as "the best," even for the University farms; certainly not for any large portion of the State.

It is well known that, as we go from the north to the south, we find an increase in the size of the corn grown, in stalk and ear, in cob and kernel; as, also, a noticeable increase in the time required to come to maturity. There are exceptions to the rule, but it is so generally true that it is extremely rare that a variety is found satisfactory at first when removed even 100 miles north or south of the locality in which it has been produced or acclimated. Varieties grown as well adapted for the main crop in one locality may do well as "early varieties" in regions further south. So varieties used in central Illinois, when early maturity is especially desired for any reason, may be well adapted for general culture further north. Caution should be exercised, however, in the introduction of such varieties, and in no case is it believed advisable to discontinue the cultivation of a variety which has proved fairly satisfactory simply because some other variety has gained a great reputation in some other locality.

Our trials have emphasized the fact that it is rarely wise to seek to develop any one quality to the greatest possible extent. Thus very large size of ear is secured only at sacrifice of early maturity. Extreme earliness in ripening never goes with large ears.

The results of chemical analysis here and elsewhere, and observations in the field and in feeding, show little ground for a common belief that there are important differences in any respect in the quantity or quality of Dent corn of different colors. It is believed equally marked differences can be found between varieties of the same color as between those of different colors.

For central Illinois generally we like a variety which produces fairly thick, short jointed, moderately low stalks, bearing the ears low on a short shank, the ear to average about nine inches long, two and one-half inches in thickness, retaining this thickness with little variation until near the tip; with 14 to 20 rows, well filled at each end; with as little open space between the rows as is practicable; the kernels to be rather thick than thin, and somewhat wedge-shaped. Because of ease in husking, smooth kernels are preferred to rough ones. A cob of moderate diameter is preferred to one either very large or small. A variety with remarkably small cob we have never found so productive as is desirable. Selected ears of a good variety may give a bushel, 56 pounds, of shelled corn from 65 pounds of ears, but this cannot be expected of the entire crop. When well dried, however, there should be no difficulty in getting a bushel from 68 pounds of ears.

Almost invariably farmers have selected their seed corn, in case of Dent varieties, in such a way as to fix the characteristic of producing but one ear to each stalk. The tendency to production of twin ears is much greater in some seasons than others. In some few varieties the habit of producing several ears has become the rule. It is believed possible, and probably desirable, to fix the habit of producing two ears as a rule. Our soil and the corn plant seem abundantly able to do this, and it seems probable the total product can be increased in this way. The advantage in husking is with the single large ear, but an increased yield would more than counterbalance this. We are testing this matter with a favorite variety.

It is well known that the character of both stalk and ear may be considerably changed in a very few years by selection. In three years we have made white the color of a very large majority of the ears in a variety which, when received, produced white ears only in very rare cases. This gives additional encouragement in attempts to increase productiveness by increase of number of ears.

PERCENTAGE OF BARREN STALKS.

The extent to which the yield of corn is reduced by barren stalks is greater than is often supposed. This loss varies from year to year, as well as in different varieties. Violent storms when the corn is in bloom may prevent the fertilization of many ears. This we cannot easily control. But it is strongly believed that the productiveness of any variety may be increased by preventing fertilization by the pollen of barren stalks by removal of the tassel from these, or by cutting away the stalks entirely so soon as it is discovered that no ear is to appear. This course is impracticable in general field culture, but can be applied to small plats especially designed for seed.

Examination of several varieties grown in 1886 on the University farms shows an unusually large percentage of barren stalks, with marked variations between varieties in the same field. It is believed a violent wind and rain storm, when the later varieties were in bloom, is largely the cause of the surprising percentage of barren stalks in several varieties. The two varieties making the best showing are much earlier in maturing than either of the others.

In noting the results as shown in the table following, it should be borne in mind that many of the stalks not counted barren produced ears of very little value. The first three varieties were planted in hills; the last four in drills. All are dent varieties, counted valuable. The average of barren stalks in the seven varieties is over 14 per cent. Examination of a single variety in a former year showed only 8 per cent. of barren stalks:

Variety.	No. stalks.	No. with one ear.	No. with two ears.	No. barren.	Per cent. barren.
Murdock	500	462	7	31	6.2
Smith's Mixed Dent	500	451	17	32	6.4
Leaming	500	414	7	79	15.8
Champaign Yellow Dent	500	412	30	58	11.6
Burr's White Dent	500	362	12	126	25.2
Champaign White Pearl	500	394	8	98	19.6
Monticello	500	384	44	72	14.4
Averages	....	411+	18−	71+	14.1

DESCRIPTION OF VARIETIES.

Leaming.—For three or four years past we have grown this variety more largely than any other. It has been widely disseminated and has been greatly praised and equally strongly condemned. Originating or improved in southern central Ohio, it naturally is not well adapted for northern latitudes. On the University farm it is productive and matures well in any fairly favorable season. Its bright yellow color, and its firm, well-shaped kernel are in its favor. Its cob is rather large at the butt, and the ear usually tapers more than is desirable. Selection has somewhat improved it.

Champaign.—We have given this name to a yellow dent grown by us for the first time in 1886, but which has been grown by a few good farmers near Champaign for a number of years. It has not been very carefully selected so far as uniformity of type is concerned, but has, as general characteristics, a comparatively short, thick ear, uniform in diameter; the kernels of good depth and shape. The best ears impress one as remarkably desirable.

Murdock.—For a number of years past we have regarded this as the best of the smaller and quite early-maturing varieties which we have tested. In appearance and general characteristics it resembles somewhat the Pride of the North, and North Star, but is larger than either of these varieties. It matures in from two to three weeks less time than the larger varieties grown commonly, and yields fairly well, in many cases, however, lacking ten bushels per acre of the yield of our "main crop" varieties. It is well liked by us for early fall feeding. In 1886 we began feeding cattle with it August 15,—and for very late planting, if this should become necessary from any cause. The ears are small to medium in size, exceptionally well formed; the kernels of only moderate depth, but especially firmly fixed and solid in texture, remarkably heavy for bulk. This variety has been somewhat largely distributed, and we have had many favorable reports from it. In favorable seasons it has given good results as far north as central Minnesota.

Burr's White, and *Monticello.*—These two varieties of white Dent corn have been grown in this vicinity for a number of years. The first is the result of selection by the farmer whose name it bears. The history of the other is not known. They much resemble each other, and are good representatives of the type of white corn which seems best adapted to this region. The ears are of good size, and both varieties yield well, maturing as early as large varieties can be expected to. The cob of the Burr's White is the smaller, as will be seen by reference to a table given elsewhere. This variety made a conspicuously bad showing in 1886 in the matter of barren stalks. This is believed due largely to more direct exposure to a wind storm. It will also be noticed that the Monticello gave quite the largest percentage of stalks producing two ears.

Champion White Pearl.—This variety has not sustained, with us, the reputation claimed for it. Resembling those just described, it is somewhat later in maturing, the ears are lighter; more space between the rows and between the kernels.

Smith's Mixed Dent.—This variety was obtained by us from Marengo, in the northern part of the State, three years since. It is the earliest maturing variety we have; has the smallest stalks. The ears average smaller than the Murdock, and lack uniformity to some degree. By selection, first of white kernels, then of white ears for seed, the large majority of the ears are now white. This is one of a class of varieties which would seem desirable for the northern part of the State, but too small for general field culture in central Illinois.

Peyton's Small-cob Yellow Dent.—This variety came to us from the originator, in southern Illinois. In some respects it is of extraordinary interest. It has the smallest cob of any variety we have found, with a noticeably long kernel. In one or two cases we have found the length of kernel equal to the diameter of cob, while in ordinary varieties the cob is usually twice as thick as the kernels are long. We do not count this variety valuable for us. It is not especially early in maturing, the ears are small and there is more open space between the rows of kernels than with any other variety grown by us.

If it seems that these descriptions would indicate that none of the varieties are of any special merit, it may be said that the introducers of some of them, and some seedmen, have given descriptions much more flattering to them—in some cases so much so that it has not been easy to recognize the corn as sent out, from the description given. It is believed the best of the varieties named compare favorably with the best known in adaptation to central Illinois.

SUGGESTIONS AS TO CULTIVATION.

The following suggestions as to cultivation of corn, most of which are in accord with generally accepted practice, may be made from our experience in field culture and special trials:

Early planting is desirable, but this may be easily overdone, and overpromptness in planting may be worse than late planting. It has been advised to "plant by the thermometer" rather than "by the almanac." It is wiser, however, to consult both. With us, from the first to the middle of May usually covers the most desirable season for planting. Very rarely have we found any good result to come from planting in April. Until the season has so far advanced that the temperature of the soil is 55° or more, there is little reason for planting if early in the season. On the other hand it would be safe and wise to plant even if the soil were near the freezing point, if planting had, from any cause, been deferred until June. Early in the season there is danger of still lower temperature; later, it is almost certain that there would be a marked increase in warmth in a few days.

Shallow planting is wise early in the season; deeper as the season advances, if there be appearances of dry weather. Given sufficient moisture and reasonable temperature in the soil, the soil well pulverized and brought in direct contact with the kernels, and there is no good reason for covering corn more than one inch. In practice it is usually wiser to plant deeper, else many kernels would be insufficiently covered.

More corn can be grown in drills than in hills. The plants are better distributed over the surface, the roots reach a larger supply of plant food, the stalks are more readily reached by the sunshine and air, and there is less probability of considerable areas being left without any stalks. The practical objection to drill planting is the greater difficulty in keeping the crop free from weeds. Our practice is to plant in drills on broken sod or other land reasonably free from weeds. In such land we prefer one stalk 12 inches apart to a larger number at greater distances.

An irregular or uneven "stand" is one of the chief causes of light yields. Even with good seed, a favorable season, land in good condition, the planting carefully done in proper season, a considerable percentage of the kernels fail to produce matured stalks. The probable losses from birds or "ground game," insects, and accidents in cultivation are serious. Poor seed or an unfavorable season may make this loss much greater. Replanting is unsatisfactory. It is at least an open question whether it would not be wise to plant more thickly than it is desired to have the corn stand, and cut out the surplus after the first or second cultivation.

The smaller varieties may safely be planted more thickly than the larger ones. Planters adjustable to plant at different distances are desirable on this account. Increasing the number of kernels per hill makes too much difference. With hills four feet apart each way there would be 2,722 hills per acre; at three feet eight inches apart there would be 3,240; an increase of about 19 per cent. An increase from three to four kernels per hill would be an increase of one-third. It is easily possible to plant corn too thick, but an uneven or insufficient "stand" is a much more common evil. With varieties of ordinary size, planted in hills three feet eight inches apart, it is believed better to have three stalks to the hill. This will give 9,720 stalks per acre, and of these 10 per cent. or more will fail to produce good ears.

Fall or early winter plowing is preferred to spring plowing, but there are many cases in which this is not practicable. Aside from any gain in condition of the soil, one great advantage from fall plowing is that in case of unfavorable weather in spring there is less danger of the planting being unduly delayed, or the ground being worked when too wet. In the case of grass land, or that to which barn-yard manure has been applied, deep plowing is not desirable on our soil. The depth of plowing is, however, often overestimated.

Getting the ground in good condition before or immediately after planting is a great saving of after cultivation. The best time for killing weeds or grass is as soon as possible after they have started to grow. Harrowing, either before or after the corn appears, is often wise. We do not practice harrowing after the corn has well started its growth. If the ground is dry and somewhat rough the roller is used.

Much corn land is insufficiently cultivated; more often the work is not most wisely done, and sometimes more is done than is necessary. The chief objects of cultivation while the crop is growing are to loosen and pulverize the soil, so the roots can more readily penetrate it and obtain plant food from it; to destroy or prevent the growth of weeds or grass; to prevent the surface becoming hard or "baked" when wet, and to have the loosened surface soil act as a mulch, checking evaporation in dry weather. Aside from the destruction of weeds, frequent cultivation of our porous prairie soils is less necessary than with more compact, tenacious clay soils. In all ordinary cases cutting or mutilating the roots is an evil; to some extent a necessary one, but to be reduced to a minimum. There are cases in which root pruning may be beneficial, but these are exceptional. Deep cultivation, especially close to the plants, should be given, if at all, while the corn is small. The later cultivation should be shallow. In 1885 we cultivated 40 acres, and in 1886 20 acres without the use of the shovel cultivators, mainly using the "Tower cultivators," which do not stir the earth more than two inches in depth. In each case the result was quite satisfactory. We make no effort to continue cultivation to the latest possible time.

HARVESTING THE CROP.

A practically successful corn husking machine, taking the corn from the stalks as they stand in the field, would be of almost incalculable value to the farmers of Illinois. Not comparable with this, but still of very great value, would be a satisfactory machine for cutting the corn-stalks, either before or after the corn is removed. There are few greater losses in the agriculture of Illinois than that which comes from the common practice of leaving the corn-stalks in the field. It is probably abundantly safe to say that the value of the corn-stalks on an acre, carefully preserved and wisely fed, is equal to that of a ton of hay. The inconvenience of cutting and harvesting the crop has largely prevented its being utilized.

When the fodder is to be fed there are advantages in the medium-sized varieties, and in thick planting. Good results come from cutting both fodder and corn with suitable machine, and feeding stalk and grain together. Corn can be cut and shocked earlier than many suppose, without injury. The fodder is very much better when cut early. Husking as soon as the corn is sufficiently matured has many advantages over doing the work later in the season. More can be done in a day. The weather is more pleasant, and more value can be secured from the stalks.

SELECTING AND KEEPING SEED.

The best time at which to select seed is in the early fall, before the crop is harvested. No harm will result if it be selected before fully matured. Selecting in this way, the character of the stalk and the comparative time of ripening can be observed—points impossible to determine after the crop is harvested.

The one essential in keeping seed corn, is to have it thoroughly dried before extreme cold weather. Artificial heat, to a reasonable degree, in drying; keeping in a warm room; keeping the ears singly or in small clusters; these and many other things are helpful, because they better secure the desired result—getting rid of the surplus water so it will not freeze.

CORN IN A ROTATION.

The rotation of crops thought desirable for the University farms, subject to variation, is corn, two years; small grain, one year; grass and clover, three years, followed by corn again. Manure is applied as far as available, either on the sod or after the first crop of corn. Other things equal, we have secured better crops of corn the second than the first year after grass. In cases where it has seemed best to grow a third crop of corn, some deterioration has been noticed.

On experimental plats we have found it practicable to keep up a yield on land continuously cultivated in corn, but well manured each year with barnyard manure, equal to that when a grass and clover rotation is followed. The corn on the manured land has made a more vigorous and larger growth of stalks; and also has had many more weeds.

WEIGHT AND SHRINKAGE OF CORN.

The following tables give the actual and comparative weights of selected ears of corn of different dates, with weights of shelled corn and cobs in one set. The corn referred to in the first table was taken from the field before fully matured. It will be seen that there is a marked difference in the percentage of loss between the larger and the smaller varieties, and that there was a very noticeable loss during the week after gathering:

	Picked	Weight Sept. 14	Weight Sept. 22	Weight Sept. 29	Weight Jan. 5	% shrinkage, Sept. 14-Jan. 5	% shrinkage, Sept. 22-Jan. 5
Leaming	Sept. 14	21	19½	18½	16	23.8	18.0
Leaming	" 22	....	20	18½	16	....	20.0
Murdock	" 14	15	14½	13½	13	13.3	10.3
Murdock	" 22	....	14½	13½	13	....	10.3
Smith's Mixed Dent	" 22	....	15½	....	14	....	9.7

The second table shows that, in a favorable season, corn of good quality should have become pretty thoroughly dried by December 1. The ears in this trial were all better than the average of the crop as it came from the field, and were kept in separate lots, hung up in a barn, so that they lost moisture more readily than in the ordinary bin or crib. It should also be kept in mind that corn of these varieties in bulk would not have shown so large a percentage of shelled corn to total weight.

Name of Varieties.	Wt. 25 ears.		% loss in 4 mos.	Wt. corn in 70 lbs. of ears. .	Ave. wt. of ears in lbs.	Ave. wt. of corn on ear in lbs. .	Ave. wt. of cob in lbs. ......
	Dec. 1...	Apr. 3...					
Leaming	22.5	21.5	4.49	58.6	.86	.72	.14
Monticello	22.5	21.5	4.49	57.0	.86	.70	.16
Murdock	17.5	16.75	4.28	58 5	.67	.56	.11
Average	20.8	19.90	4.42	58.0	.80	.66	.14

*A Kernel of Indian Corn.

By T. F. Hunt.

As the science of "existing knowledge" of agriculture increases, and as the comparative scarcity of land creates the necessity of the farmer making the best use of his capital—of knowing what foods and medicines best to administer to his botanical patients—a knowledge of their structure and vital functions may be of much value, if not essential.

Its Structure.—Figs. A and B represent a magnified longitudinal and cross-section of a grain of Indian corn or maize. The parts represented are numbered alike in both figures. All the drawings are made from corn of the Dent variety, with the exception of No. 6, Fig. B, which is made from a longitudinal section of a sweet corn kernel.

The sections of the kernel, both longitudinal and transverse, are magnified about 15 diameters, while the enlarged cells (fig. B, 1, 2, 3, 4, 5, 6, and 10,) are magnified 225 diameters. The internal structure of the longitudinal section (fig. A,) is diagramatic inasmuch as the cells are not in the proper scale. For example, about 100 times the number of cells (in outline) represented in drawing occurs in the actual kernel. Bearing this in mind, it is thought that the drawing is a reasonably accurate representation of a section of Indian corn.

The Pericarp.—No. 1 and 2 represent the *Pericarp*, the outer part (No. 1) being called the *Epicarp*, and the inner part (No. 2) being called the *Endocarp*. These coats consist of very thick-walled elongated tubes of woody fiber; or cellulose. The enlarged drawing (fig. B, Nos. 1 and 2) shows a cross section of these tubes. It will be seen that in the *Epicarp* the tubes are regularly arranged and are all hollow, while in the *Endocarp* they are irregularly compressed, and many of them are completely filled up, being thus rods of woody fiber rather than tubes.

The Cellulose of a grain of corn is only a small portion of the whole. Recent authorities give it at less than 2 per cent., or about one pound in a bushel of corn. This is not easily digestible, if at all, and considered as a food, is unimportant. Let us see what this tough, fibrous, close fitting coat is like on other seeds; also whether they all had the same tailor. We shall find that the seeds

*The illustrations used in this paper were drawn by T. F. Hunt at the University of Illinois, for *The Prairie Farmer*, at the suggestion of the editor, Orange Judd.

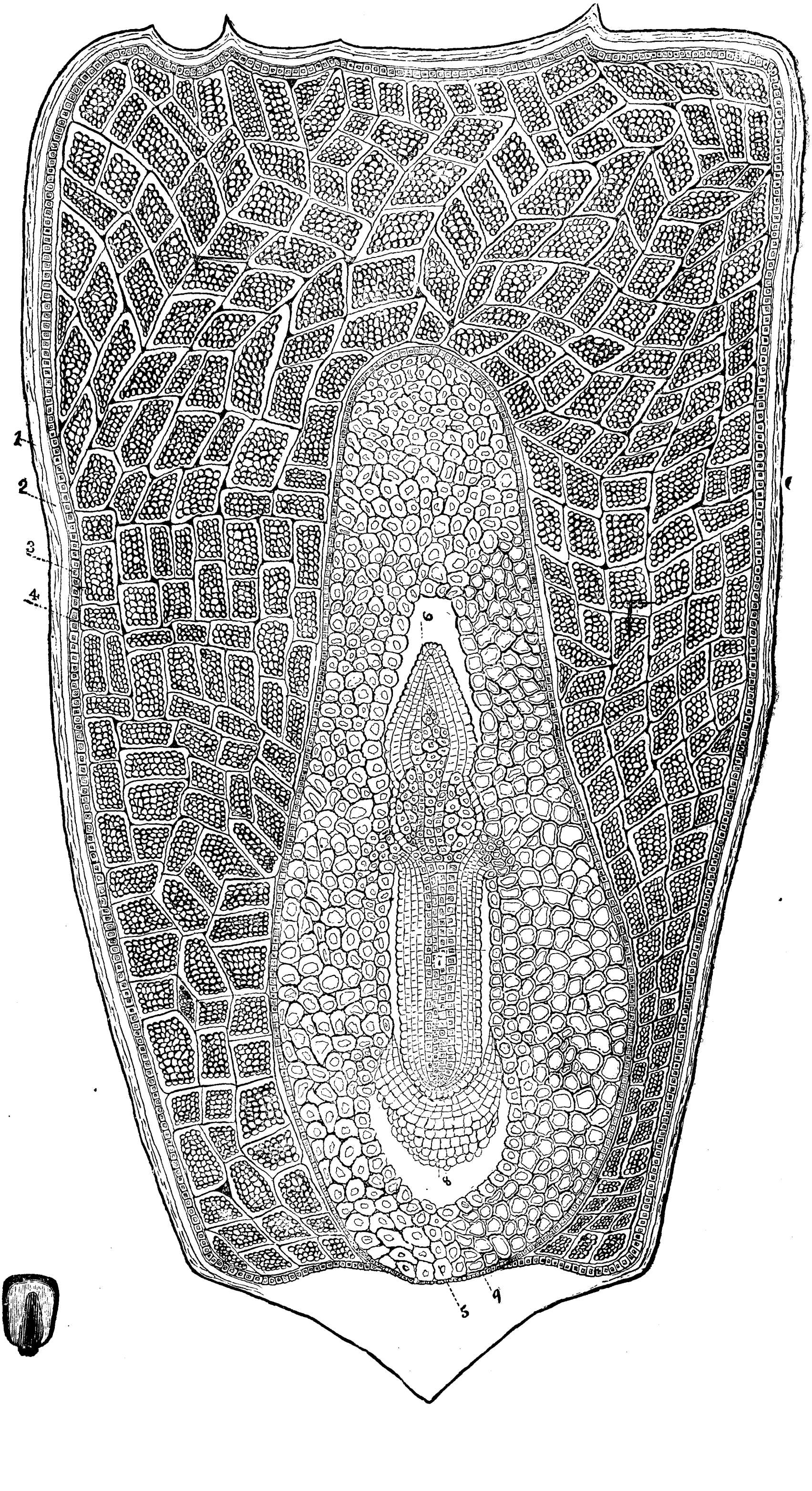
of each family of plants wear clothes often of a very different pattern. The *Pericarp* of a grain of maize corresponds to the hard, thick shell of the hazelnut; to the fleshy, pulpy and succulent portion of the currant and gooseberry; to the combined edible portion and stony covering of the seeds of the plum, peach, cherry, etc.; to the pulpy and stony coverings of the walnut and butternut, and to the burrs of the buckeye and horse chestnut. In those fruits like the plum and peach, and also in those like the walnut, the stony covering of the kernel is the *Endocarp* and the pulpy covering the *Epicarp*.

The Testa or outer covering of the seed proper (Fig. B, No. 10) is little developed, being composed of thin-walled, loosely-joined cells. It is here that the separation takes place when corn is hulled. As a rule, where the seed is covered with a hard or tough *Pericarp*, the *Testa* is insignificant, as in the hazelnut, walnut and stone fruits; where the *Pericarp* is fleshy and succulent, the *Testa* is hard and resisting, as in seeds of berries.

The Envelope.—We now come to that curious envelope of gluten cells, called by some writers the *embryonic envelope*. Whether it is really a portion of the embryo, I have been unable to decide from the section that I have examined. The cell contents are much the same in structure and composition, being composed chiefly of nitrogenous and fatty substances, which are highly nutritious. According to M. Mége-Mouries, who has studied this envelope in the wheat, it contains a special ferment called *cerealine*, which possesses the property of rapidly changing starch to sugar. Payen and Persoz attribute this action to a nitrogenous substance called *Diastase*, while Saussure thinks it due to a soluble nitrogenous body in the gluten, called *Muciden*. It may be that an unorganized ferment, as variously described by these writers, aids in the process of germination in the seeds, as well as adding to its digestibility, but it needs further investigation to establish the fact.

Starch.—Within this envelope of gluten cells is a framework of thin-walled cells of cellulose filled with irregular but characteristic six-sided (in outline) grains of starch (No. 4, figs. A and B). This part of the seed, called the *Endosperm*, is largely developed in the grasses and cereals (*Gramineæ*) and is a very important food product, starch, of which it is almost wholly composed, being the chief constituent of all our vegetable foods. Indian corn contains 68 per cent. of starch. Different seeds have characteristic forms and sizes of starch grains, many easily identified under a powerful microscope,

Relation of Parts.—The relation of the various parts of the *Embryo* (Nos. 5, 6, 7, 8, 9, figs. A, B) of maize and other grasses has puzzled many botanists and is still a subject of controversy. Suffice it to say at present that 7 is primary root, 8 its root-sheath, 6 the *Plumule* or stem end of the plant, 5 the *Scutellum*, and 9 a row of cells much like those surrounding the *Endosperm*, but they are smaller. The *Scutellum* surrounds the rest of the *Embryo*, and according to Sachs, when germination takes place remains within the *Endosperm* as an organ of absorption until the *Endosperm* is consumed. The cells of the *Scutellum* (Fig. B, 5) are spherical and thick-walled, and are filled with nitrogenous matter similar in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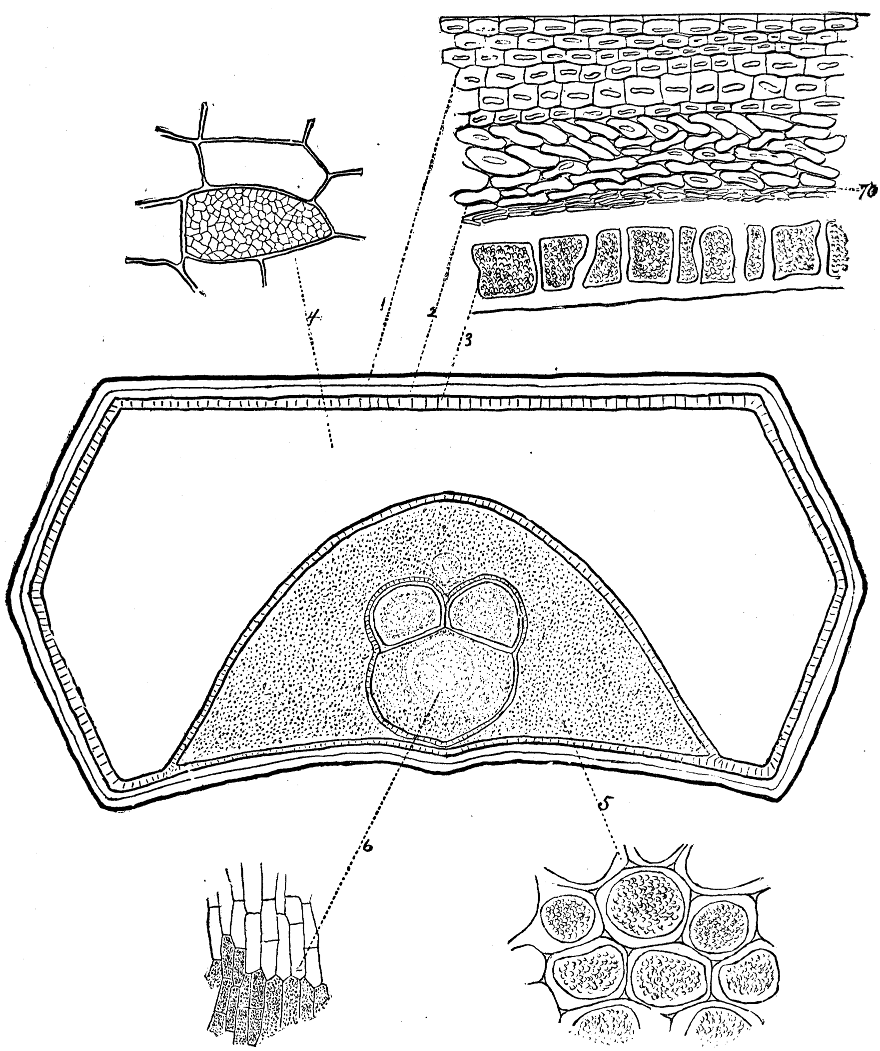
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chemical and physical properties to the contents of gluten cells (3). The cells of the *root* and *plumule* are smaller than those just described, and are thin-walled and filled with fine granules of nitrogenous matter. In these cells is found the vital and vegetative portion of the seed. Here is the substance that under proper conditions of heat, moisture, oxygen and light, moves, appropriates food and increases in size, or, in other words, grows. This substance is *protoplasm*. It is common to every living thing, high or low, plant or animal, and is alike in all, to every chemical and physical test within the knowledge of man.

Such in general, then, is a grain of Indian corn, or maize, which of all our grains is the most variable in character, is cultivated under the most different conditions, is applied to the most varied uses, is cultivated over the widest geographical range (unless, possibly, barley), and is applicable to the most dissimilar conditions of agriculture.

Grasses—Varieties and Culture.

Every year's experience and observation increases my appreciation of the admirable adaptation of the soil of much of Illinois to the growth of the best class of grasses as well as clovers. The quality of the product is every way satisfactory and the quantity is certainly remarkably large—good treatment being taken for granted. This adaptation is a matter of vast importance, for the grasses hold a place in the first rank in the crops of the stock and dairy farm. Meat or milk is most cheaply produced when the chief—often where the main food of the animal is grass.

There are thousands of varieties of grasses, widely varying in size and value, but all with some like characteristics. In popular language we exclude the grains, which are true grasses, but include the clovers, which are not really grasses. American farmers use but few varieties. This is not, on its face, certain evidence of mistaken policy, for adaptation to soil, climate and systems of farming must be considered. A less number of varieties is needed when the grass crop is part of a rotation, than when the land is devoted to permanent pasturage. Even on stock and dairy farms the permanent pasturage system is not wise as a general rule in our western agriculture, although there is much land which can most profitably be devoted to this use. By the use of grass in a rotation, the farmer is able most cheaply and conveniently to maintain in good degree the fertility of the soil and its best condition for grain crops. In old grass fields the grasses are often finer and of better quality, but often the yield is less.

On the University farms we have fields which have been in grass a dozen years or more, and in one or two cases this will probably continue to be their use, but the larger part of the land is purposely cultivated in a rotation, usually of six years, with grass and clover occupying half the land and time.

The value of any variety of grass will depend largely on its composition, digestibility, palatability and, other things equal, the quantity produced. Reasonable adaptation to the soil and climate is presupposed. Some varieties are best suited for pasturage and others for meadow. Grasses for either should be hardy and productive. For a pasture-grass, a compact sod, large quantity of leaf, comparative fineness both of leaf and stalk, growth early or very late in the season, are especially desirable points. For a meadow-grass compactness of sod is not so essential; a greater proportion of seed-stalk is allowable, and the season of growth is comparatively unimportant. A few varieties are fairly well adapted for both purposes.

VARIETIES.

Timothy (*Phleum pratense*) stands at the head of the list in its widespread use and general popularity. A little coarse in straw, not very compact in sod, it is productive, weighs well for bulk, has a good value by chemical analysis, is fairly digestible and palatable. It will probably long maintain its place as the leading meadow-grass of the United States.

Blue Grass (*Poa pratensis*), commonly called Kentucky Blue Grass (and that of Illinois is the same), is in many respects almost a typical pasture grass. It forms a remarkably compact sod, apparently improves indefinitely with age, starts to grow early in the spring, has a mass of leaves with only small seed-stalk, grows well in the late autumn, and is perhaps unequalled in value as a winter grass. Its weakest point, probably, is its slight growth in dry weather. It makes palatable and nutritious hay when well handled, but the yield is too small for profit. It has little value in a rotation where the grass does not remain at least three years.

There are intelligent farmers who dissent from the statement that the common blue grass of Illinois is the same as that which has become so famous in Kentucky. In some cases this dissent comes from calling some other grass blue grass; in others from observing it as grown on soils of different quality. I have found stalks of this grass growing in an Osage orange hedge-row on the University grounds which measured five feet, four and one-half inches in hight. Grown on thin, very dry soil, in a dry spring, the seed-stalks may be less than one foot long. Aside from some slight modifications from differences in soil and climate, it must be insisted on that the grass is the same. A more surprising fact is that some Illinois farmers still consider this grass a troublesome pest.

Red top (*Agrostis vulgaris*) probably ranks next in general use. It is especially well adapted to wet lands, forms a compact sod, yields abundantly, and is moderately nutritious and palpable—much less so either for pasture or as hay when allowed to mature before use. For well drained land it has little claim to recognition, because better grasses will give at least equally good yields, but it will probably do fairly well on land too wet for any satisfactory growth of any other good grass.

Orchard grass (*Dactylis glomerata*) is both over-praised and abused. It grows in tufts, never making a compact sod, is coarse in leaf and stalk, becoming harsh and woody as it reaches maturity, and is not, at best, of first rank in composition and palatability. On the other hand, it starts growth very early, grows with great rapidity after cutting, withstands drought well, is adapted to a wide range of situations, and is of fair quality for winter pasture or hay, if grazed or cut before reaching maturity. It is well worthy of more general trial. When once well established it seems able to hold its place in competition with any other variety. For eight years past I have watched with interest its increasing vigor of growth in a thick and vigorous blue grass sod, on which some seed was accidentally dropped. Where sown as one of a mixture of six grasses and clovers, it is quite the most conspicuous at any time. I have seen no grass which makes equally rapid growth following cutting, and none which withstands drought better. We have it growing in a small pasture, mainly blue grass, but in which there is considerable timothy. While evidently preferring the blue grass, we have not found either horses, calves or sheep refuse the orchard grass, unless it was allowed to approach maturity.

Of other varieties worthy of further and more general trial may be noted the Tall Fescue (*Festuca elatior*), a rapid growing, early maturing grass, of good quality, and much liked in many places where it has been cultivated. Also the Perennial Rye Grass (*Lolium perrene*), a variety greatly praised by English writers, very productive and of good quality, apparently well adapted to our western soil; has done fairly well in our trials.

Johnson Grass, (*Sorghum halapense*), very highly praised by some in the south, is not desirable for us. It is a very large, coarse grass, not certainly hardy in our winters, with its leaves and stalks killed at the earliest frost. We first tested this grass in 1885, sowing a bushel of seed sent us for the purpose by H. Post, Esq., of Alabama. The seed apparently failed to germinate. After some weeks the land was sown with Millet. A few stalks were found fully headed at the last of August, but apparently very few. In the spring of 1886 the land was planted with potatoes. After cultivation of these had ceased, a considerable quantity of the Johnson grass grew vigorously in the rows, some stalks reaching six feet in heighth. At almost the first perceptible frost both leaves and stalks seemed entirely killed.

Bermuda Grass (*Cynodon dactylon*) is another of the grasses probably of great value in the extreme south, but of no use for us in the north.

Of course the annual grasses, the Millets, of which I prefer the German or Golden, for its much greater productiveness, and Hungarian grass are well worthy of more general cultivation not as main crops, but for sowing after an early ripening crop, or to be sown when there is probability of failure of other forage. They endure drought well, yield abundantly and can be harvested in from sixty to eighty days after sowing. In 1885 a small field of strawberries was plowed after the crop had been gathered, and the land sown with common Millet on June 29th. August 27th the crop was cut, being in good condition for hay, the seeds being formed but not yet hardened. In 1886 Golden Millet was grown under like circumstances, the crop being fair but much impaired by drouth. Little gain comes from sowing either Millet or Hungarian grass until the season is well advanced and the soil thoroughly warmed. We have liked the hay well for both cows and calves, and have seen no ill effects when fed to horses, although this has not been done to any considerable extent.

The Clovers are of inestimable value to us. Exceedingly nutritious and very fairly palatable both for grazing and for hay, if the latter be well cared for, they yield largely and stand far ahead of any other of our farm crops in their value for green manuring. For Central Illinois we prefer the common or medium Red clover to the large or Giant variety. This latter has the advantage of being in condition to harvest about the same time with Timothy and gives a much larger yield—the stalk being too coarse to be desirable for food. The Alsike clover is a medium in almost every respect between the Red and White clovers. Perennial and probably less liable to winter-kill, certainly equally palatable and nutritious, it is preferred by some who have tried it, notwithstanding its somewha lighter yield. White clover is not often sown, but is, fortunately, indigenous to our soils. Valueless for hay, it is an addition of great value to any pasture. The great difference of apparent plentifulness of White clover in our pastures is a most interesting feature, not always very explainable.

Almost endless varieties of grasses might be given. Doubtless there are many well worthy of trial, but we are fortunate in having in common use those probably unsurpassed. It is advised that trial be made of little-known varieties but not to the rejection of the well tested ones. Were Timothy, Bluegrass and the clovers now first introduced, we can scarcely conceive of the possibility of exaggerating the great addition they would make to any list of grasses otherwise available.

CULTURE.

The soil and climate of much of Illinois and the west generally is remarkably adapted to grasses. Grasses produced on good soil are, generally, not only more abundant in yield, but better—more digestible and nutritious than those grown on poor lands. Those grown on naturally fertile soil are usually better than those on poor lands highly manured.

Given pure and good seed—and too little attention is given to tests of our grass seed—and a fairly favorable season, and there is not much danger of failure with either grass or clover. I count it most profitable to sow in connection with a small-grain crop, rye being quite the best and oats poorest for this purpose. Early fall sowing of timothy is preferable, although very early spring sowing is often as safe. Clover always to be sown then. Late spring sowing may do well, but there is much risk. All grass and clover seeds are small and should be kept near the surface, but slight covering is a great help. The roller or "smoother" may do this; the frost partially.

The mixture of a large number of varieties has not been enough tried to fully decide its desirability. For Central Illinois, we will probably continue to make Timothy and Red clover the main seeds, adding Bluegrass for permanent pasture, unless we depend on its "coming in," as it so generally does. On the University farms we will make more use of Orchard grass.

We have not found remarkably heavy seeding essential. A bushel of Timothy to five acres, and one of clover to ten acres, has given us good results. Blue, Orchard and Fescue should be sown at much higher rate.

Either grass or clover should get well started in spring before being grazed, but it is a mistake to go to an extreme in this. There is much loss where the grass is allowed to remain without reasonably close grazing. Understocking is only poorer economy than overstocking. It is not proven in the west that either meadows or pastures are helped by having a great growth at opening of winter.

Nearly all grasses lose value as they become fully mature; some become comparatively worthless. Cutting may be too early, reducing the yield, but it is more commonly too late. Neither grass nor clover needs to have the seeds developed to make the best hay. Close cutting is harmful, especially in hot, dry weather. Orchard grass and clover quickly reshade the ground; Timothy quite slowly. A light mulch after cutting would be helpful.

Top dressing is the only practicable method of manuring grass lands. Early fall or early spring applications will do most good. For the latter the manure should be well rotted. The time for general use of commercial fertilizers has not yet come. We have seen no more surprising effects from the application of stable manure than when applied to grass lands. What seems a thin and uneven "stand" may often be caused to make a luxuriant growth and well cover the ground by a liberal coating of such manure.

Grain Yields.

By T. F. Hunt.

The table below gives the yield per acre of the grains therein contained, estimated from the quantity grown on plats varying from one-twentieth to one-eightieth of an acre. The land was moderately even.

The wheat was planted about Sept. 20, 1885; the oats and barley April 12, 1886. The wheat was harvested July 5–10; the barley July 8, and the oats July 18.

Variety.	Species.	Bushels per acre.	Quality.
Indian	Wheat	14.5	Poor
Egyptian	"	19.0	Fair
Martin's Amber	"	22.0	Good
Diehl's Mediterranean	"	27.0	Good
White Victoria	Oats	32.5	Very good
Harris	"	16.0	Very poor
New Brunswick	"	47.5	Good
Welcome	"	46.0	Very good
White Russia	"	44.0	Good
Hutless	"	25.0	Good
Melon	Barley	19.0	Poor
Canman	"	24.0	Fair

The White Victoria oat gives promise of being very valuable, the small yield being explainable on account of thin seeding. The seed was imported from Russia by the Department of Agriculture.

Potato Culture.

By T. F. Hunt.

The object of this experiment was to determine the influence of the size of the potatoes used for seed on the yield and quality. The potatoes were divided into three divisions, comprising large, medium and small, and were cut into pieces having two "eyes" each. These were planted in rows 36 rods long, 5 to 10 rows being devoted to a division. Three acres in all were used. The land was fall broken sod and though a comparatively even piece of land did not prove as desirable as was hoped. It is believed the results obtained with the early Ohio and Mammoth Pearl were the least influenced by external causes, the yield of the Beauty of Hebron being clearly affected by a row of trees. It would appear that the large potatoes as a whole give slightly the best results. The results in themselves are not positive, however, and are given simply as a contribution to a further knowledge of the subject:

Bushels in a Row 36 Rods Long.	Large.		Medium.		Small.	
	1st Quality	2d Quality	1st Quality	2d Quality	1st Quality	2d Quality
Beauty of Hebron	1.9	....	2.4	....	2.47	....
Early Ohio	1.8	.66	1.6	0.4	1.90	.38
Mammoth Pearl	6.96	1.20	6.0	1.0	4.50	.70

MOISTURE IN SOIL.

During a period of quite warm drouth in August, 1886 it was attempted to determine the quantity of water in soil as affected by cultivation and by vegetation. Two samples of one-fourth of a cubic foot each—six inches square and twelve inches in depth—were carefully taken off the prairie soil of the University farm. The "cultivated soil" was at the edge of a plat of strawberries, the surface having been plowed and cultivated after the strawberries had been harvested. At a distance of ten feet the second sample was taken in bluegrass sod. The grass had not made much growth since it had been cut, looked quite parched and had little effect as a mulch. There was no visible moisture in either sample. After weighing, the soil was dried at 100°c and again weighed. The results are given in the following table:

	Wt. ¼ cu. ft. soil.	Wt. after drying.	Water lost in drying.	Per cent. of water.	Wt. water per acre.
Cultivated soil.....	21 lbs. 14.2 oz.	18 lbs. 9.5 oz.	3 lbs. 4.7 oz.	15.06	573,903 lbs.
Bluegrass sod....	20 lbs. 14.6 oz.	19 lbs. 1.8 oz.	1 lb. 12.8 oz.	8.67	313,632 lbs.

It will be noticed the cultivated soil, dried, weighed about 74⅓ pounds, the grass sod about 76½ pounds per cubic foot.

We have found thoroughly dried soil, with like quality with the samples, absorb a little over 33 per cent. of its weight of water, by capillary attraction—a glass tube filled with soil to depth of one foot being placed so the soil at the bottom stood in water. This would give, approximately, 250,000 pounds or 5,000 barrels of water held in one acre of soil to the depth of one foot.

Pig Feeding.

By T. F. Hunt.

Feeding experiments were begun to determine the food value of skim-milk as compared with corn-meal, and the value of shelled corn compared with corn-meal. For this purpose six Poland China barrows, about six months of age, varying in weight from 160 to 204 pounds, and very similar in form, thrift and flesh, were divided into three lots, so arranged that the variations in the lots were as small as possible, the greatest variation between any two lots being 17 pounds. They were housed with small yards adjacent to run in, having previously been on grass, with the addition of ear corn and a limited supply of "slop."

The lots were lettered A, B and C. For three weeks lot A was fed shelled corn *ad libitum*. Lot B was fed the same as lot A, except the corn was made into coarse meal. This was fed dry. Lot C was fed same as lot B, with addition of a fixed quantity of skim, but as much as experience should they would drink without waste. All had water. In order to determine that the results obtained by the addition of skim-milk were not due to individual differences in the pigs, at the end of three weeks the skim-milk was given to lot B instead of C, the food of lot A remaining the same.

Table I—Gives a detailed statement of the gain of each and the gain by lots per week, for periods of three and six weeks, with initial weight.

No. of pig and letter of lot.	Weight in lbs, Nov. 22.	Gain for week ending			Gain in 3 weeks...	Gain for week ending			Gain in 3 weeks...	Gain in 6 weeks...
		Nov. 29	Dec. 6	Dec. 13		Dec. 20	Dec. 27	Jan. 4		
51	204	16	11½	14½	42	6½	11½	1	19	61
54	160	8	12½	12	32½	7½	8	1	16½	49
A	364	24	24	26½	74½	14	19½	2	35½	110
56	180	12½	4½	10	27	8	7	7	22	49
55	192	13	6½	14	33½	9	9	5½	23½	57
B	372	25½	11	24	60½	17	16	12½	45½	106
52	179	20½	7½	8½	36½	1	6	0	7	43½
53	202	27½	9½	15	52	2	9½	4½	16	68
C	381	48	17	23½	88½	3	15½	4½	23	111½
Average	188	16¼	8⅔	12⅓	37¼	5⅔	8½	3⅙	17⅓	54½

Table II—Gives a detailed statement of amount of food eaten.

	For week ending						In three weeks.		For week ending						In three weeks.	
	Nov. 29.		Dec. 6.		Dec. 13.				Dec. 20.		Dec. 27.		Jan. 4.			
	Corn.	Milk..	Corn.	Milk..	Corn.	Milk..	Corn.	Milk..	Corn.	Milk..	Corn.	Milk..	Corn.	Milk..	Corn.	Milk..
Lot A	80	....	81½	....	109½	....	271	....	94½	....	105	....	80	....	279½	....
Lot B	72	....	81	....	98	....	251	....	81½	126	83½	126	85	126	250	378
Lot C	72½	162	74½	126	96	126	243	414	89	....	98	....	78½	....	265½	....

Table III—Gives gain per day for periods of three and six weeks, of the lots, and also the gain produced by the different foods given.

	First 3 weeks.	Second 3 weeks.	Six weeks.	Remarks.
A	3.547	1.690	2.619	
B	2.880	2.166	2.500	
C	4.213	1.095	2.655	
Corn-meal	2.880	1.095	2.000	The same food, but different
Corn-meal and skim-milk	4.213	2.166	3.190	hogs during the two periods.

Table IV—Gives pounds of food required to produce a pound of pork.

	First period of 21 days.	Second period of 21 days.	Forty-two days.
Pounds of shelled corn to pound of pork	3.627	7.873	5.004
" corn-meal " "	4.148	....	....
" skim-milk " "	13.600	....	....

TABLE V—Gives amount of dry food eaten, gain made, pounds of dry food required to produce pound of pork, and nutritive ratio of food eaten.

Lot.	Record of 21 days.		Pounds of solids to pounds of pork.	Nutritive ratio......
	Solids eaten.	Gain.		
A	230 lbs.	74½	3,020	1:8
B	213 "	60½	3,520	1:8
C	248 "	88½	2,802	1:5

VALUE OF SKIM-MILK.

By reference to Table IV it will be seen that for a period of three weeks it required 4.148 pounds of corn meal to produce a pound of pork, and that 13.6 pounds of skim-milk, when fed with corn meal, produced a pound of pork; 3.25 pounds of skim-milk being, in this case, equivalent to 1 pound of corn meal. It does not at all follow that when fed alone, or with some other food, or in some other proportion, the same result would be obtained. Under other conditions the result might have been less or more favorable to the skim-milk.

At the time the experiment was being conducted corn at this place was worth 28 cents a bushel, or, not considering the cost of grinding, ½ cent a pound. The skim-milk was, therefore, worth 15 cents per hundred pounds.

The changing of the milk from Lot C to Lot B clearly indicates that individual differences can not account for the increased gain when milk was given, although it is evident that no exact statement can be made in regard to these lots for the last period of three weeks, because the pigs had been previously under dissimilar conditions on account of differences in diet.

SHELLED CORN VS. CORN MEAL.

Referring again to Table IV, it will be seen that for a period of three weeks it required 4.148 pounds of corn meal to produce a pound of pork, while it required 3.637 pounds of shelled corn to produce a pound of pork, or .511 pounds less in the latter case. One bushel of shelled corn produced 15.4 pounds of pork; when ground it produced but 13.5 pounds.

Referring to Tables I and II it will be seen that lot A ate 271 pounds of shelled corn and gained 74½ pounds, while lot B ate 251 pounds of corn meal and gained 60½ pounds. The pigs fed on shelled corn, therefore, not only gained more in proportion to the amount eaten, but they ate more and gained more absolutely, as well as relatively.

The fact of the pig eating more, and apparently having the ability to eat more shelled corn than corn meal, is a possible explanation of this better relative gain. A smaller proportion of the food eaten was necessary to supply the waste of the system.

DECREASED GAIN DURING FATTENING.

The decreased gain during the process of fattening, for the amount of food consumed, is illustrated in the case of lot A, in Table IV. During first period of three weeks it required 3.627 pounds of corn to produce a pound of pork, or 15.4 pounds of pork to bushel of corn. During last period of three weeks it required 7.873 pounds of corn to produce 1 pound of pork, or 7 pounds of pork to bushel of corn. For the period of six weeks it required 5 pounds of corn to produce a pound of pork, or 11.2 pounds of pork per bushel. As these hogs were in a marketable condition at the end of the first period, it would, other things equal, have been better economy to have sold them at that time. Although this is only an illustration of a well established fact, the result was probably to some extent affected by the weather. During the first period of three weeks the weather throughout was comparatively mild, while during a portion of the last period the weather was intensely cold, the thermometer reaching 20° below zero.

NUTRITIVE RATIO.

By reducing the amount of corn and corn meal consumed 15 per cent.—the per cent. of water found to be contained in a sample analyzed for the purpose—and estimating 10 per cent. for the solids contained in the skim-milk—the average per cent. of solids in skim-milk—it is found, as shown in Table V, that for corn meal, with a nutritive ratio of 1:8, it required 3.520 pounds of solids to produce a pound of pork, while for corn meal and skim-milk, having a nutritive ratio of 1:5, it took 2.802 pounds to produce a pound of pork, or .7 of a pound less in the latter case.

An important difference in the effect of foods is in their respective proportions of proteids, fats and carbhydrates, or nutritive ratio. It would appear, so far as this experiment goes, that a food with a nutritive ratio of 1:5 is better for hogs than one of 1:8, but it must be borne in mind that digestibility plays a very important part in foods, and it is presumable that the solids of milk are more digestible than those of corn meal. There is another element, probably as important, if not more so. It is the same point that was mentioned in considering the effect of corn meal and shelled corn; namely, the amount eaten in a given space of time. When milk was fed with corn meal more solid food was consumed in the three weeks than when corn meal was fed alone. A less proportion of the food eaten was necessary to supply the normal waste of the body. The palatability of food, therefore, is important, by increasing the amount an animal will consume in a given space of time.

Cattle Feeding and Management.

The great increase in the number of cattle within the last few years, not only in the States and Territories of the further west, but in many of the older States, has caused, or has been followed by, considerable changes in management. The competition is greater and the margin for profit is less than in former years. The fat cattle markets in 1886 have been less satisfactory than for many years past.

Satisfactory profit from beef production will usually result from one of two courses: The production of animals of fair to good quality at less than the average cost, or producing animals of very high quality, even at comparatively large cost. The latter course is and will be followed by some breeders and feeders; usually men of intelligence, much experience or abundant capital. The great mass of the fat cattle sent to our markets will not be of this class. It is not wise for many farmers, with their present circumstances, to attempt the production of such cattle. Preparing for market beeves which have been well but cheaply reared and fattened, and which, if not thoroughly ripened or finished, give wholesome, nutritious and palatable beef for the great mass of middle-class consumers, may give larger net profit to many farmers than would attempts with ordinary facilities and little experience to produce beeves of the highest quality.

The actual and relative cost of land, grass, grain, labor, buildings, etc., will properly modify practice. Of recent years the great markets show more uniformity in the number of cattle received at different seasons, and something more of uniformity in the qualities to be found. For some years to come, however, a large number of grass-fed cattle may be expected to be sent to market during the summer and autumn months from the great grazing regions of the west. So far as is practicable, it is wise for feeders on the farms of the older States to send their cattle to market when they will not be in competition with these grass cattle. It is doubtful whether the farmers of Illinois, for instance, can compete with the western cattle without fairly liberal grain feeding. But it also seems true that the once common plan of almost unlimited corn feeding for a year or more to cattle in open fields has ceased to be profitable.

The mass of Illinois-bred steers of good quality are marketed at from thirty to forty-two months of age. Steers four years old or more, a few years ago so commonly fed, are becoming more and more rare in the best feeding districts of the State, and as yet comparatively few are slaughtered much before two and a half years. We have not reached the time when what is known as "baby beef" is generally profitable to the producer.

There has been a marked depreciation in the selling-price of breeding-cattle of all breeds. Breeders of these, as well as feeders of cattle for beef, have had to more carefully study cost of production than during times of higher prices.

In the management of the herds of pure-bred cattle on the University farms, and in the feeding of beef cattle raised or purchased, especial attention has been given to economy of production—much more than to possibilities of production. Some facts and observations from our experience in these attempts to produce breeding and beef cattle of satisfactory quality by simple and comparatively inexpensive methods are submitted:

CALF REARING ON SKIM-MILK.

For four years we reared a score or more of calves each year, using skimmed milk entirely after they were from one to two weeks old, and are sure that the practice is very desirable for very many farmers. We have not been able to secure so rapid growth or so plump and attractive appearance for the calves as when they suckle their dams or are fed whole milk. Nor do we secure maturity in so short a time. In other words, we believe pure milk is the best possible food for a calf; but satisfactory results and often greater profits result from using the cream for butter-making and feeding the skimmed milk.

The change to skimmed milk should not be made suddenly. Care should be taken to have the milk of uniform temperature when fed—better below than above that of fresh milk. It is better to feed three times a day while the calves are young; and better to feed each calf separately than several together. A good device by which the calf can draw its milk as nearly as possible as it does in suckling is better than to have it drink from a pail or trough. The use of linseed oil meal, better heated and thoroughly mixed with the milk, is desirable. The calves should be encouraged to eat grass or good hay and some grain or meal—oats being preferable—as soon as may be. Large quantities of milk at long intervals are not nearly as good as smaller quantities more frequently given and accompanied by other food. The milk should be continued until the calves are five or six months old.

With such treatment we have produced calves weighing 350 to 400 pounds at six months; 600 to 700 pounds at one year; 1,000 to 1,100 pounds at twenty months to two years old, on grass, and 1,500 pounds at thirty-three months, after two to three months of grain feeding. These are not great weights; not so large as have often been reported from like feeding, but they are not unsatisfactory, and, with butter selling from twenty to twenty-five cents, these weights from skim-milk rearing are believed to represent greater profit than giving the calves all the milk from their dams.

With our cows and heifers it has been impossible to decide that those reared on whole milk were larger or more symmetrical, when mature, than those fed on skim-milk, although the latter require somewhat longer time to fully mature than do the former.

Our practice is to have the calves dropped at all seasons, the hot months being least desirable, but for rearing on skim-milk the preference is given to those dropped in the autumn. With comfortable quarters these will make almost or quite as much growth when young as those dropped in the spring. They can be weaned at the time when they can go on grass, and will come to the second winter robust and in good shape for the change to dry feed. Spring-dropped calves must go into winter quarters soon after weaning.

For some reasons it is desirable that heifers should calve in the spring. Fall-dropped cow calves can be so bred as to drop their first calves in the spring, when they are about thirty months old; which we have found the most desirable age.

GRAIN FEEDING ON GRASS.

On few questions connected with cattle feeding is there greater difference of opinion than concerning the profitableness of feeding grain to cattle while they are on pasture. Sir J. B. Lawes has recently stated that the cheapest increase of live weight he can secure is that made by his cattle when on pasture. If this be true on his very high priced land, about twenty-five miles from London, it certainly is still more true in any such region as central Illinois, where land is low in price, compared with labor, and where the pastures are good. In favorable seasons the pastures on the University farms will nearly carry a steer to the acre during five months grazing—the steers about equally divided between yearlings and two-year-olds. Steers which have been grazed without grain usually increase in weight faster when placed on grain rations than do those which have had grain with the grass.

On the other hand, feeding grain with the grass makes a less acreage of pasturage necessary; a larger gain can be secured in given time; the cattle may be kept ready for market at almost any time; there is less probability of "shrinkage" from changes in weather or in food.

Allowing cattle to graze on good grass and clover is not only a natural, but is an unsurpassed mode of feeding in such a region as ours, so far as the comfort, health and thrift of the animals are concerned. Obviously sudden changes of food should be avoided; hence grain feeding may almost always be profitably continued for a time after the cattle are placed on the pastures; and begun before they are taken from them in the fall. Equally clearly is it true that if the pasture is insufficient from any cause it should be supplemented by either other green food or grain.

Bearing in mind that the discussion is as to methods of producing cattle of fair to good quality with regard to economy in use of labor and foods, our trials have not shown it profitable to feed yearling steers, designed to be sold when thirty to thirty-six months old, grain when on grass; nor to feed grain during the best of the season—say from middle of May to first of August—to steers designed to be sold during late fall or early winter.

With us cattle may usually be put on pasture about May 1st, and left until November 1st, without exposure to severe storms or cold.

In 1880 four yearling steers of different breeds made an average gain of 332 pounds during these six months, on grass alone. Four steers of like breeding and about the same quality made an average gain during the same time of only 235 pounds, being fed corn-meal in addition to the grass. In this case the pasture on which the cattle fed meal were kept proved to be inferior to the other in quality and quantity.

In 1882 ten yearling steers of different breeds made an average gain in same six months of 285 pounds, on grass alone.

In 1883 two yearling steers, full fed corn on pasture, made gains of 490 and 525 pounds respectively; while two, selected as of like age and quality, on grass alone, made gains of 400 and 480 pounds each, in the six grazing months.

In 1885 four yearling steers on full feed from April 25, when put on grass, to September 1, made average gain of 284 pounds. Eight steers of like quality and age, on grass alone, in same time, made average gain of 223 pounds.

In 1886 three yearling steers on grass alone, made gains for the five months, from June 1, to November 1, of 240, 255 and 285 pounds each, averaging 260 pounds each, or 52 pounds per month.

Like comparisons can not so well be made as to two-year-old steers, as it is not our practice to keep these on grass alone throughout the season.

In 1881 seven two-year-old steers, full fed during six grazing months, made average gain of 466 pounds, or 77 pounds per month. The greatest gain by one steer was 525 pounds; the least 415 pounds.

In 1882 eight two-year-old steers, with full feeding, made average gain of 380 pounds, varying from 305 to 415 pounds.

In 1883 four two-year-old steers, with like feeding, made average gain of 406 pounds, varying from 375 to 460 pounds.

In 1885, from April 25 to Sept. 1, a pair of full-fed steers, which had been selected as more than usually fine animals, and which had been full fed from Dec. 1 last, made gains of only 105 and 220 pounds each, while eleven steers of about same ages, two-year-olds, but of less desirable quality, made average gain of 293 pounds each, on grass alone, until August 20, when a small ration of green corn, on the stalk, was given them.

In 1886 six two-year-old steers of much more than average quality, on full feed for the seven months from April to November, made average gain of $386\frac{2}{3}$ pounds; the variation in individuals being well shown, the extremes being 230 and 500 pounds. Five steers of about the same age and breeding, but of not quite equal quality, on grass until August 15, after which they were fed corn, in same seven months made average gain of 375 pounds, the extremes being 335 and 420 pounds. In this case the lot of six were in higher flesh at commencement of the season, four of them having been on full grain feed during the previous summer.

The rather surprising comparative results in some of these cases are partially to be explained on other grounds, but may safely be cited as good illustrations of two difficulties in arriving at fully trustworthy results from trials such as those referred to, unless they are made with large numbers of animals or often repeated. These are individual peculiarities and variation in condition. There are striking characteristics dependent on race or breed, but frequently individuals of the same breed and reared under like conditions show equally striking variation. Aside from liability to sickness or accident which may destroy the value of test, one or more animals of a small number may prove to possess unusually good or poor digestive and assimilative power; be noticeably "hearty" or "dainty" eaters.

WINTER VERSUS SUMMER FEEDING.

It has seemed to us so certainly true that little or no profit can now be expected from full feeding cattle in winter, when they are not provided shelter, that we have not tried this plan. We have found it sufficiently difficult to get satisfactory results from winter feeding when the cattle are kept in stables.

During three successive winters we kept bunches of yearlings and two-year-old steers with the shelter of straw-stacks, etc., with abundant straw and corn fodder, some hay and a little corn near close of the winter, and found them weighing no more at the first of April than they did in November or December. They had grown some in frame. The loss had been partly apparent and partly real. A few weeks on pasture in the spring made them show large gains.

Two or three years since a bunch of fat steers were sold November 28, but at request of the buyer they were kept twenty days, during which time the weather became very cold, with two or three storms. The cattle ate almost a hundred bushels of corn, aside from hay and straw and the cost of the labor in caring for them. The total gain of the eleven head was forty pounds.

In 1884 a bunch of steers, after making a gain of eighty pounds in September and ninety pounds each in October, were sold and weighed November 24, just after the first cold storm of the season. They showed a gain of only thirty-two pounds each for the twenty-four days of November.

The winter of 1884–85 was of remarkable severity here. Three good yearling steers, stabled and well fed, made average gain, from December 2 to April 25, when they went on grass, of 178 pounds. A bunch of thirteen calves made average gain, in same time, of 165 pounds. From November, 1885, to April, 1886, a bunch of eight good yearling steers, under like conditions, made average gain of 175 pounds.

We have not found more satisfactory feeding, so far as cost and rate of gain are concerned, than to commence feeding on the pastures as early in the autumn as practicable—when the corn is becoming glazed—feeding at first both stalks and ears; when the stalks become dry, feeding unhusked ears; then the husked ears. With such feeding, two or three-year-old steers have given us average monthly gains of eighty to ninety pounds for three months. If in good flesh when feeding was begun, good steers should be in satisfactory condition for market after ninety days' feeding. Hogs following make good use of all undigested grain dropped by the cattle.

An objection to this method is at once to be seen, in that the cattle are placed on the market at a time of comparatively low prices, from being sold in competition with large numbers of cattle fattened in like way, and, perhaps, with the later shipments of range cattle. Notwithstanding this, we have found a fair profit from such feeding—so much so that only with cattle of exceptional good quality would we continue feeding during the winter.

The following statements concerning two lots of cattle will fairly represent results gained in each of several successive years:

On October 29, 1885, there were sold from the farms ten steers, from twenty-seven to about thirty-six months old, from fair to good in quality, all having some Short-horn blood. As most had been purchased, exact statements cannot be made as to ages or breeding. They had been cheaply wintered; were in good health, but in thin flesh, when turned on grass April 27. A little grain was given them for a few days. Then they had only grass until August 20, when feeding with new-crop corn was begun. At first stalks were fed; then the unhusked ears. Then husked ears. They were kept in a good pasture, fed three times each day, with hogs following. For the first few days the feeding was light. For the last sixty days they were fed, on an average, a little less than one-third of a bushel per day each.

When sold, the average weight was 1,351 pounds. In sixty days the average gain was 157 pounds per head. This is 14 pounds less than a somewhat better lot of steers made with like treatment in 1884. In same time two larger and somewhat better steers in same field made average gain of 182 pounds; two steers somewhat younger, 170 pounds; two high grade Jersey steers, just past two years old, 162 pounds each.

Even at the low prices then prevailing—$4.50 per 100 pounds, after "shrinking" 3 per cent.—this gave a fair profit, especially when taking into account the value of the pork made of the undigested corn passing through the cattle; the manure left on the farm; the greater convenience and less cost of disposing of the corn directly from the field, and the addition of, say, one-half cent per pound to the value of the steers when feeding was begun.

In 1886 a bunch of five good two-year-old steers, with like treatment with lot above described, except that corn feeding was begun August 15, made average gain of 194 pounds from September 1 to November 1, when they averaged 1,464 pounds. A lot of 18 steers of poorer quality made average gain of 165 pounds in same time, then averaging 1,188 pounds. Six still lighter steers made average gain of 160 pounds, averaging 1,066 pounds. These cattle were sold, to be delivered in November, at $4.50 per cwt. for the first lot, and $4.25 for the second.

The following table is a summary of the above statement, giving gains obtained for the last three years during September and October with two-year-old cattle on pasture with corn, previously summered on grass:

Number of Animals.	Year.	Ave. gain Sept. 1 to Nov. 1.
Twenty-four	1884	171
Ten	1885	157
Five	1886	194
Eighteen	1886	165
Six	1886	160

RATE OF GAIN.

In a series of tables following, the weights of a considerable number of cattle bred or fed on the farms at various periods are given, giving some basis for comparison of the rate of gain at different ages, under different conditions and by cattle of different breeds.

The first table gives the weight of all Short-horn bull calves on the farms at this writing, with age of each and the gain per day—no allowance being made for weight at birth. This fact is important in considering the apparent rapid growth of young cattle. It will be noticed the nine head averaged almost exactly six months in age and 470 pounds in weight. Excluding No. 1, not bred on the farms and unusually small for age, the average age is 172 days; average weight 460 pounds.

These calves have had good care, but no attempt has been made to secure extraordinary growth. This is true of all the animals kept or designed for breeding purposes on the farms.

Weights of Short-horn Bull Calves.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	Average.
Age in days	252	236	193	186	183	170	151	148	107	181
Weight	540	560	555	470	440	465	430	440	325	470
Gain per day	2.14	2.37	2.87	2.52	2.40	2.73	2.85	2.97	3.04	2.60

The second table gives the weights at intervals of six months of a lot of yearling steers during summer of 1885. The first four were on full corn feed during this time; the last three on grass only except for a few days at first and last of this period.

Yearling Weights and Gains.

Breed.	Birth, 1884	Weight and Increase.	April 25, 1885	June 2, 1885	July 1, 1885	August 1, 1885	August 31, 1885	October 1, 1885	Nov. 1, 1885	Six months
¾ Hereford	Mar, 15	Weight	690	750	830	880	940	1,045	1,090	......
		Increase	......	60	80	50	60	105	45	400
½ Holstein	Mar. 28	Weight	650	785	860	930	1,010	1,125	1,165	......
		Increase	......	135	75	70	80	115	40	515
Short-horn	Apr. 30	Weight	640	725	790	855	925	995	1,040	......
		Increase	......	80	65	65	70	70	45	400
Ayrshire	Feb. 20	Weight	770	875	910	985	1,010	1,120	1,175	......
		Increase	......	105	35	75	25	110	55	405
½ Hereford	June 15	Weight	715	745	790	805	900	885	945	......
		Increase	......	30	45	15	95	15	60	225
½ Holstein	Mar. 28	Weight	665	750	815	850	945	960	1,000	......
		Increase	......	85	65	35	95	15	40	335
Ayrshire	Feb. 15	Weight	695	775	820	875	945	930	975	......
		Increase	......	80	45	55	70	15	45	280

The next table gives weights of the same cattle as two-year-olds with some additions to the lot. The first six were on full feed, the last two of these not having had grain the previous summer. The last five were on grass alone until August 15. The variations in the gains by different animals, and by the same animal in different months, are very noticeable. In some cases the growth was exceptionally fitful.

The weight of one of the half Holsteins, 1,815 pounds at three days over thirty-one months is the largest we have had, while the weight of the grade Short-horn, 1,540 pounds at twenty-nine months, with two and one-half months grain feeding, is the best with like treatment.

Two-year-old—Weights and Gains.

Breed.	Birth, 1884		Apr. 3, 1886	June 2, 1886	July 2, 1886	Aug. 2, 1886	Sept. 1, 1886	Sept. 30, 1886	Nov. 1, 1886	7 months	Averages, 7 months
¾ Hereford	Mar. 15	Weight	1,340	1,335	1,385	1,440	1,445	1,540	1,590	......	......
		Increase	......	95	50	55	5	95	50	350	......
½ Holstein	Mar. 28	Weight	1,410	1,515	1,575	1,640	1,690	1,740	1,815	......	......
		Increase	......	105	60	65	50	50	85	650	......
Short-horn	Apr. 30	Weight	1,220	1,305	1,395	1,445	1,500	1,550	1,615	......	......
		Increase	......	85	90	50	55	50	65	575	......
Ayrshire	Feb. 20	Weight	1,310	1,295	1,360	1,415	1,395	1,515	1,540	......	......
		Increase	......	—15	65	55	—20	120	25	230	......
½ Hereford	June 15	Weight	1,150	1,285	1,350	1,400	1,495	1,520	1,590	......	......
		Increase	......	135	65	50	95	25	70	440	......
½ Holstein	Mar. 28	Weight	1,200	1,345	1,400	1,500	1.570	1,600	1,700	......	......
		Increase	......	145	55	100	70	30	100	500	386⅔
Ayrshire	Feb. 15	Weight	1,125	1,190	1,300	1,300	1,290	1,350	1,460	......	......
		Increase	......	65	110	0	—10	60	110	335	......
Grade Short-horn	....	Weight	1,125	1,140	1,250	1,275	1,285	1,405	1,540	......	......
		Increase	......	15	110	25	10	120	135	315	......
Short-horn	....	Weight	935	1,000	1,120	1,125	1,130	1,235	1,325	......	......
		Increase	......	65	120	5	5	105	90	390	......
½ Holstein	....	Weight	1,070	1,140	1,270	1,270	1,300	1,400	1,490	......	......
		Increase	......	70	130	0	30	100	90	420	......
½ Holstein	....	Weight	1,140	1,205	1,340	1,355	1,345	1,430	1,555	......	......
		Increase	......	65	135	15	—10	85	125	415	375

The following table gives a summary of the two preceding ones, also the gains of the same cattle during five winter months, which are comparatively small, although the cattle were well fed and comfortably stabled:

Breed.	1884.	1885.		Gain 6 months	1886.			Gain 7 months	Gain 1 year	Total gain 1½ yr.
	Birth	April 25	Novemb'r 1		April 3	Gain 5 mos.	Novemb'r 1			
Ayrshire	Feb. 20	770	1,175	405	1,310	135	1,540	230	365	770
¾ Hereford	March 15	690	1,090	400	1,240	150	1,590	350	500	900
½ Hereford	June 15	715	945	225	1,150	210	1,590	440	650	875
½ Holstein	March 28	650	1,165	515	1,410	245	1,815	405	650	1165
½ Holstein	March 28	665	1,000	335	1,200	200	1,700	500	700	1035
Shorthorn	April 30	640	1,040	400	1.220	180	1,615	395	575	975
Average	....	......	......	380	......	186⅔	......	386⅔	573⅓	953⅓

The next table gives weights and gains of three steers in 1885. The first two were grain fed, the last on grass alone until August 20. The first steer had made fine growth as a yearling, when he had been made very fat. His unsatisfactory gain as a two-year-old is shown:

Breed.	Birth	Apr. 25, 1885.	June 2, 1885.	July 1, 1885..	Aug. 1, 1885.	Aug. 31, 1885.	Oct. 1, 1885..	Nov. 1, 1885.	7 months...	Average 7 months...
Shorthorn	May, 1883....	1,405	1,400	1,485	1,490	1,510	1,550	1,625	......	......
		......	5	85	5	20	40	75	220	......
Shorthorn	April, 1883...	1,330	1,370	1,450	1,510	1,550	1,650	1,685	......	......
		......	40	80	60	40	100	35	350	......
Shorthorn	March, 1883.	1,380	1,410	1,525	1,490	1,525	1,710	1,730	......	......
		......	30	115	35	35	160	20	350	306⅓

The next table gives the weights and gains of another lot of cattle representing different breeds and showing better average results. It will be remembered these figures are all given as showing the results secured, not as indicating that they are considered remarkable:

Weights and Gains of Two-year-olds, Grain Fed.

Breed.	Weight and increase.	April 1...	May 1...	June 3...	Oct. 1...	Nov. 2...	Seven months.	Average, 7 months.
Short-horn	Weight......	1,375	1,405	1,530	1,730	1,710	....	....
	Increase....	....	30	125	200	—20	335	....
Short-horn	Weight......	1,150	1,205	1,300	1,470	1,550	....	....
	Increase....	....	55	95	170	80	400	....
Short-horn	Weight......	1,150	1,275	1,350	1,600	1,690	....	....
	Increase....	....	75	75	250	90	540	....
One-half Holstein......	Weight......	990	1,060	1,155	1,350	1,465	....	....
	Increase....	....	70	95	195	115	475	....
One-half Holstein......	Weight......	935	1,015	1,130	1,340	1,385	....	....
	Increase....	....	80	115	210	45	450	....
Native	Weight......	890	940	1,050	1,280	1,355	....	....
	Increase....	....	50	110	230	75	465	....
Native..................	Weight......	850	880	985	1,150	1,200	....	....
	Increase....	....	30	105	165	50	350	....
Jersey	Weight......	900	945	1,000	1,150	1,205	....	....
	Increase....	....	45	55	150	55	305	415

VARIATIONS IN WEIGHT.

Variations of weight, from causes not fully under control of the feeder, may be so great as to make comparisons from weighings at short intervals of little or no value. The quantity of food, but more especially of water in the stomach of a full grown steer or cow, may cause variation of weight of fully 100 pounds. Keeping animals from food and water before weighing will best remove this source of variation, but unless the fasting be carried out for such time as to cause discomfort to animals and irregularity in feeding, it will not entirely do this. We have practiced weighing without fasting, making all weighings at as nearly same time of day as is practicable.

As a rule the weighings are made monthly. Sometimes there appears a strikingly large gain followed by a small one, or even, in rare cases, by slight loss the next month. In weekly or daily weighings these variations would be much more apparent, especially as when weighing on platform scales no account is taken of variations of less than five pounds.

Weighings made soon after any marked change of temperature are often misleading. The "shrinkage" following a severe storm is often remarkable. So, too, extreme heat may have unfavorable effect. The latter part of July, 1885, was almost unprecedentedly hot in this region. Most of August was pleasantly cool. Nearly all our cattle showed comparatively light gain in weight for July; while some, apparently, had made more than ordinarily large gains during August. Several yearlings, on grass alone, showed increase of more than three pounds daily.

Frequently cattle lose weight for from one to three weeks when turned on even good pasture in the spring, and again when put on dry feed in the fall.

The accompanying table illustrates some of these points. It gives the weights of several bull calves for ten successive days in August, 1886, and also shows gains for the months of August and September, and of two for October. During the time of the daily weighings the weather was warm and dry. The calves were kept in stable during the day and in a small pasture at night, and were weighed in the morning before watering. It will be noticed that four of the five show a large gain from August 12 to August 13. The only explanation to be given is that there was a refreshing rain during the night of August 12. The calves were all well fed, and the small gains are to be attributed in good part to the unfavorable effects of the hot weather.

Date.	Short-horn bull......	Short-horn bull......	Short-horn bull......	Holstein bull......	Jersey bull......
August 3	590	655	785	650	450
" 4	600	655	790	635	450
" 5	605	660	785	620	440
" 6	615	665	790	645	445
" 7	605	660	785	655	445
" 8	615	670	790	660	450
" 9	605	665	785	655	445
" 10	610	660	780	655	450
" 11	615	670	790	655	450
" 12	610	665	790	650	455
" 13	625	685	800	660	450
" 15	630	695	810	660	465
Sept. 1	665	700	830	735	500
Oct. 1	725	770	875	785	......
Nov. 1	......	......	960	885	......

BREED CHARACTERISTICS AS AFFECTING FATTENING.

We have fed pure-bred or grade Ayrshires, Devons, Herefords, Holsteins, Jerseys, Shorthorns and "Natives," but only small numbers of some of these. We have not yet sufficient data to make it advisable to dogmatize as to comparative merit. Individual peculiarities have sometimes outweighed breed characteristics. The well-known differences in form and size have been always noticeable; as have, in less degree, differences in earliness of maturity. We have not found the remarkable differences in gain, either actual or in comparison with food eaten, that have been claimed by partisans for or against different breeds.

We have not found the largest gains always made by the cattle of best quality. Frequently the steers which do best on grass fail to do best on grain.

The best steer fattened on the farms for several years past was a cross-bred Hereford-Shorthorn; the next best was a pure Shorthorn. Several half Holstein steers have made more than usually large gains, and have been of fair quality. No case is recalled of a steer of really good form and quality which had not a good proportion of the blood of some well known breed, but large gains have been made by animals of unknown breeding, but evidently mainly of "unimproved" stock.

SOME GENERAL CONCLUSIONS.

The following conclusions are believed to be confirmed by our experience. They are to be understood as applying to present conditions in Central Illinois:

1st. Increase of weight in cattle is most cheaply secured by pasturage without any grain, during the best part of the season.

2d. Feeding whole corn in the autumn months to cattle on the pasture is the least expensive method of fattening cattle.

3d. Under like conditions, young animals make largest gain in proportion to food eaten.

4th. The largest gains may be expected from animals in thin flesh if in good health. It is difficult to secure rapid gain in weight during long continued feeding.

5th. It is not profitable to feed grain to yearling steers on good pasture, if it is designed to keep them another year and fatten for general market.

6th. Apparently from 30 to 36 months are the most profitable ages at which to sell cattle fattened on this system—unless those of greater age can be bought at a price which gives no profit to the grower.

7th. The differences in animals of like breeding and under like treatment is often greater than those between typical animals of different breeds.

8th. Under the prevalent methods of wintering stock steers in the western States little or no gain is made in weight during winter. It is difficult, if not impossible, to secure, under good conditions, gains in winter which shall nearly equal those made in summer.

9th. Calves reared on skim milk, with addition of some meal, may make entirely satisfactory growth and beef animals of good quality.

10th. Economy of production is quite as important as maximum product, especially in times of low prices.

CONTROLLING SEX IN BREEDING.

For several years past different suggested modes of controlling sex in breeding domestic animals have been kept in mind in the cattle breeding on the University farms.

One result of these observations has been to suggest an explanation of some of the many positive statements that a given theory had been proven correct. In several cases we have had a noticeable series of calves of one sex—so noticable in number that, had the cows been bred in accordance with any one method or theory for controlling sex, there would have been a natural disposition to pronounce the theory proven true or false.

At times there seems a striking tendency to the production of animals of one sex, either as the progeny of the sire or of one or more females. The Short-horn bull Oxford-Mazurka 40,199 gave us nearly three heifer to one bull calf for three successive years. On the other hand, a majority of the calves of his get during the last few months he was in use were bulls. Three Short-horn cows in the herd have given six, five and four calves of the same sex in succession; then dropped one of opposite sex.

We have not found that reliance can be placed in the theories that sex can be controlled by service near commencement or near close of heat; before or after milking, or by having the animals coupled of different ages. On the other hand, we have not, in a series of years, been able to say positively that what is known as the Stuyvesant theory has been proven incorrect—unless cases of production of twins of opposite sex be counted violation of the theory.

This theory is that conception at alternate periods of heat will produce offspring of different sex. The method of application is: A cow having produced a calf, and it being desired to have the next of the same sex, the cow should be served at the second, fourth or sixth heat, until she stands to the service. If a calf of the opposite sex be desired, she should be served at the first, third or fifth heat.

It is not held that our observations prove this theory correct; simply that we have not found, with certainty, exceptions to it in our herds. It not infrequently happens that the manifestations of heat in a cow are so slight or pass away so quickly that they may not be detected; hence this theory may be incorrectly held to have been sustained or its correctness disproved.

A test has been made of the theory that the sex of the young can be controlled by half castration of the male—it frequently being stated that semen from the right testicle will produce only male, that from the left only female offspring. The left testicle was removed from a boar pig. Three sows afterward bred to him produced litters in each of which were pigs of both sexes in nearly equal number. The castration was done when the pig was quite young, and no other boar could have had access to the sows. In this case the result was directly at variance with the theory.

STARTING A HERD.

The present time of depression in prices for pure-bred cattle is believed to afford an unusually good opportunity for farmers to engage in breeding such of the breed of their choice. It is quite generally recognized that it is good economy to make use of a pure-bred bull. The purchase of even one or two females will enable one—with ordinary good fortune—to secure a fair-sized herd in a comparatively few years. Such a purchase may result in loss. The cows may die, fail to breed, or produce only bull calves. Two cases of reasonable success are noted from the University herd of Short-horns.

We have recently sold, for beef, a Short-horn cow thirteen years old. She had failed to produce a calf in two different years; one calf died soon after birth; only three of her calves were females. Of these the first was sold as a heifer, and the third was killed by an accident when a young cow. Notwithstanding all this, we have sold her descendants for $1,350, in no case receiving more than $125, and have eleven on the farms, certainly, even at present low prices, worth $1,100.

Another cow gave us her first heifer calf in the spring of 1881. We now have eight female descendants, six of them in calf—as is the old cow—and four young bulls. Of young bulls descended from her, sales have been made to an amount which nearly or quite repays the cost of keeping all during these years.

While these cases are not to be classed as ordinary ones, they are not especially remarkable. They are given as offering some encouragement to young farmers hesitating whether it may be safe to invest in the foundation for a herd of pure-bred cows. Of course the rapidity of increase with sheep, and especially with hogs, is much greater—so great that there seems little reason why almost any farmer may not have a stock of pure-bred animals of these classes.

WOOL—ITS STRUCTURE AND STRENGTH.

BY WM. MCMURTRIE. E. M., PH. D., *Professor of Chemistry.*

The study of the structure of the wool fibre, its several physical properties, its length, its fineness, its strength and elasticity, and the relation of all these properties to the conditions of breeding, feeding and management, as well as the influence of the latter upon the quantity of wool that may be produced from any given flock, are subjects that should engage the serious attention of every intelligent wool-grower, and they are of as great importance and as worthy of his consideration as the study of plant nutrition and the several economic sources of plant food are to the successful grain-grower or the horticulturist. But it is largely true that in this country the quantity of wool that may be produced has been the most favored consideration, and among growers of fine wools and breeders of marino sheep, large carcasses, heavier fleeces, increased yolk, complete covering of the body, and in some cases numerous folds of the skin have been the more important points to be attained. With these secured, all else that might be desired is expected to come, and indeed without the knowledge of the breeder much does come. Of course the breeders of fine wool desire that the wool shall be fine, but beyond this quality little enters into their estimate of the value of the staple. All the qualities named have their place and value, but it still remains most important at this stage of the advance of the great wool-growing industry to inquire into the influence of all these important conditions upon the quality of the staple produced or the physical properties of the fibre, on which the manufacturer must wholly depend in the choice of his stock.

It has been our good fortune to make a detailed study of the physical properties already named as exhibited in the staple from various sources, and the results of this study have been embodied in a voluminous report to the Commissioner of Agricu ture. It is believed that some brief abstracts from these results will be of interest and value for presentation here, because the work has largely been carried on at the University of Illinois.

It will of course be impossible at this time to present even a limited outline of the methods that were followed in this study, or to give any extended description of the character of the examinations made further than may be needed to make the results clearly understood. For the greater data we can only refer to the detailed report now in press at the Government Printing Office.

STRUCTURE OF WOOL.

If we take a tuft of woof in the hand we find it composed of a bundle of fibres similar in many respects to hairs, yet differing from these latters in several important particulars. If we separate from the tuft a single fibre and draw it between the fingers, we find that in one direction it draws very much more readily than in the other. Pull it with sufficient strain and before it will break it will stretch from one-third to one-half its length, and thus prove to be more or less elastic. If we cleanse a tuft of fibres, and by any convenient means mix the fibres so that they become more or less interwoven, and then pound or otherwise bring the fibres into close contact with each other, we find that the mass will soon become closely matted to a degree dependent upon the extent of manipulation, and the breed from which the wool was taken. We say it has felted. If we stretch a small bundle of fibres and then snap it while under tension, we find it will give a more or less clear ring, according to its quality. By its appearance and feel we determine whether it be fine or coarse.

All these means enable those engaged in the woolen industry to arrive at their appreciation of the value of any given lot of wool. The minute structure of the fibre has as a rule little value for, or at least has received but little of attention from, the practical wool-grower, buyer, or manufacturer. And very naturally; for neither education, habits of work nor absolute necessity have intervened to lead them to such study.

For proper examination and study the fibre must be suitably prepared and "mounted" upon a glass slip ordinarily used with the microscope, and because of the "crimp' common to it, the fibre should be subjected to sufficient tension to remove the crimp and bring the entire portion of it within the plane of the glass slip, and thus render it possible to bring a larger length within the focus at the same time, or to make examination and comparison of several fibres side by side simultaneously. For this purpose we have made use of a very simple device, which consists of supporting the slip at each end by thick blocks. Drawing a fibre at random from the tuft, which has previously been cleansed with ether, a small weight, such as an iron nail, is attached to each end, and the fibre then laid across the slip. When several fibres have been thus prepared and laid across, they are brought together as closely as possible, by means of a needle. Then a drop of a mixture of glycerine and alcohol is placed upon the fibres thus arranged, a cover glass is placed over the whole, when it soon becomes ready for examination and study. Other media than the mixture of alcohol and glycerine may be used, but we have found the refractive power of this to be about what is needed to secure the best development of the several details of minute structure, so that in our late work we have used it to the exclusion of all others.

To diminish the transparency of the fibre it is often desirable to submit it to the action of analine or other dyes. I have used with very great advantage a weak solution of silver nitrate in ammonia. The wool is digested in this solution a few minutes, then taken out, washed, dried, and gently warmed for some time. It quickly turns drab, and renders the fibre much more opaque. But in the use of this substance, great care must be observed not to make it too strong, because then the fibres may be made too black. Upon the whole, however, I think that, with suitable mounting media, staining may be avoided.

If, now, when the wool is thus prepared and mounted for examination, it be brought within the focus of a good microscope, its external characteristics become manifest. It is presented to the vision as a broad band with nearly parallel edges, the latter sometimes provided with slight projections, often erroneously called serrations, while the surface is covered transversely with irregular lines. And we find, too, that some of these lines are connected with the serrations seen at the edge of the image. The fibre is generally transparent in white wools, opaque in colored wools, while some of the long wools exhibit through the middle of the image a portion much less transparent than the remainder, indicating a difference in the structure in that portion. It is important to observe in this connection that a perfectly neutral substance should be used for the mounting medium or the fibre will become distorted and in time disintegrated.

But if the fibre be placed for examination in some tolerably strong caustic alkali or acid the fibre swells and the transverse lines already mentioned become more marked, ultimately showing that they represent the edges of scale-like appendages or coverings which, by longer continued action and with the aid of heat, may be completely separated. With care in manipulation it will appear that these scales, which are infinitely thin, are attached to an equally thin membrane or skin surrounding the fibre. If sulphuric acid (oil of vitriol), not too strong, be used to produce the disintegration, and during the operation slight abrasion be applied by pressure upon the cover glass, and careful movement, this skin with the scales attached will slip away from the body of the fibre and may be studied separately. It is found upon all wools, but may be obtained separately more readily from the down wools than from the others.

The scales upon the wools of different breeds appear to have a more or less characteristic form, and it has been believed that the forms manifested could be made a basis of differentiation of breeds. It appears, however, that more study in this line will be needed, and that even if it can be applied, long practice in examination will be needed to detect impurities of blood in this way. At the same time there is no doubt of the value of the indications sometimes afforded.

In the long wools the scales are more or less angular, the edges broken, and the general form irregular, especially in the coarser fibres. In the short and medium wools greater regularity prevails; the edges are more definitely curved and have more tendency to extend around the fibre, while at the same time they are more nearly parallel. With this regard the long wools differ to a marked extent from the down and merino wools, the latter really being very similar. In crosses, or in merinos tainted with long wool blood, these peculiarities in the form of the scales are often apparent, and, as already intimated, sometimes significant. So strongly have we been impressed by this fact that we once took occasion (?) the exclusion from a breeding flock of animals in whose wool they occurred, although the record of the animals and their pedigree could furnish no intimation of taint of impure blood. We earnestly believe that this offers a valuable field for study and investigation, and that such study should be vigorously prosecuted in the interest of breeders of fine wooled sheep.

We may not dwell at greater length here upon these external characteristics of the fibre, and may pass to a consideration of the internal structure. We have already said that if the fibre be subjected to the action of tolerably strong acid it swells, the edges of the adherent scales rise, the scaly membrane may be removed, and after longer continued action we find that the body of the fibre suffers disintegration. At first indistinct lines or striations appear throughout the length of the fibre. After some time slight abrasion reduces it, and we see it break down and separate into what are apparently elongated cells. At the end of the fibre, or rather at the end of the portion under examination, these first partially separate and sway to and fro in the supporting liquid, and finally become detached and float away. When thus separated they appear spindle shaped, that is, pointed at both ends and larger in the middle portion, while at the same time they are more or less flattened. In the natural condition of the fibre they overlap each other, and doubtless communicate the property of elasticity so peculiar to wool. The body of the fibre consisting of these elongated cells we have termed the *fibro cellular* portion or tissue.

In the study of the merino wools, and of most of the pure down wools, the fibres are all very transparent, especially when supported or mounted in the volatile oils or the balsams. But under the same circumstances we find that through the central portion of the long wool fibres there runs a more opaque portion. If a fibre showing this peculiarity be treated on the glass slide for some time with sulphuric acid or a concentrated alkali, the former being the safest, it will break down, the scaly cuticle and the fibro cellular tissue will be separated and finally dissolved, while the cells of granular matter will remain behind. This matter differs materially from the remainder of the fibre, and its presence in the fibre is believed to impair its strength. It may be partially removed at least from the end by such solvents as turpentine and the balsams, and doubtless by some others, especially the essential oils. The fibro cellular tissue is not thus soluble. When the granular matter is thus dissolved away there remains a net work of cell walls which enclosed it.

The granular matter is found particularly in those wools that are very white when cleaned, and lacking in lustre, and it is especially common to the wool of the Cotswold breed. It is not always confined to the central portion of the fibre, but may be distributed throughout the body of the fibro cellular tissue. It is not common to the pure downs and merino wools, though it is sometimes found in the former. In the wool of the Oxforddown it is especially abundant. Its general absence in the best bred and undoubtedly purest strains of Merino wools would seem to indicate that its presedce in wools of this breed may be accepted as proof of contamination with long wool blood at some period of the pedigree of the animal upon which it was produced. This is another relation that should be further carefully studied.

The cross-section of the fibre also constitutes an interesting subject for study. For this purpose the fibre must be cut off at right angles with its longitudinal axis, in extremely thin sections, and to effect this properly the greatest care must be observed. In our own we have proceeded as follows: The fibre is first supported in paraffine. A tuft is drawn from the stock and carefully cleansed with ether or benzine, and then immersed in melted paraffine. To free it from all bubbles of air, etc., it is then drawn between the fingers repeatedly until the paraffine is hard. The immersion is now repeated and the tuft again drawn between the fingers. A third immersion generally proves sufficient. A hot rod is then thrust into a block of paraffine deeply enough to admit a portion of the prepared tuft; the latter set vertically within the paraffine thus melted, and held perfectly upright until the paraffine has become sufficiently hard to support it. Care must be observed that at the time of inserting the tuft the paraffine in the cavity is not hot enough to melt that surrounding the tuft. When thus prepared the block of paraffine is placed in the section-cutting instrument, of which there are very many forms, and the thinnest possible sections cut off at right angles with the tuft. The slices of paraffine supporting the sections of the fibre may then be mounted in oil for examination, or if the sections are sufficiently thin the paraffine may be dissolved away and the sections themselves mounted in any suitable medium. Sometimes, in order to make the outlines more distinct, it is desirable to steam the fibre before supporting it in the paraffine, and any of the anilines may be used for this purpose.

When we come to examine these sections with the microscope we find that they are nearly circular, showing that the fibre has a form approaching cylindrical, but they are seldom, if ever, perfectly round, and are of almost infinite variety of form. Of the wools of the several breeds, that of the Merino is probably the most regular, varying from nearly circular to elliptical.

If the sections thus cut off are submitted to the action of sulphuric acid, they soon begin to suffer disintegration, and the several parts may be separated. By this means we find, as before, that the fibre proper consists of two essential parts, the shaft of fibro-cellular tissue and the covering of scale-supporting membrane or cuticle bearing the scales. This constitutes the structure of nearly all Merino wools and many of the *pure* down wools. But we have seen that through the middle of the image of long wool there runs a more opaque portion, and this appears also, of course, in the cross-section, as an irregularly defined spot in the center of the section. The coarse wools may therefore consist of the shaft of granular matter resembling pigment, though differing in its distribution from the pigment of colored wools, the shaft or cylinder of fibro-cellular tissue, and the scaly cuticle.

We conclude, therefore, that the wool fibre is a more or less cylindrical shaft, surrounded by a scaly cuticle, or at least scales attached to each other or to a supporting membrane, and that this cylinder in its normal condition is of nearly uniform diameter throughout its length. Very often, however, we find considerable variation with this latter regard. Sometimes we find the fibres contracted at certain parts of the shaft, often gradually, but quite as frequently suddenly, so that the contraction presents the form of a notch in the side of the image as viewed through the microscope. At other times enlargements occur, so that the fibre may be almost doubled in size. The contraction is known as *atrophy* and the enlargement as *hypertrophy*. Many observations have shown that when the animals have been in perfect health through the year, and have been well fed and cared for, these forms do not occur, and that these forms may be accepted as indications of the condition of health of such animals. They impair that quality known as evenness, and then their production should therefore be avoided as far as possible by close attention to the food and shelter provided for the flocks.

Neither wool-growers nor manufacturers have any difficulty in fixing a general classification of wools. The differences are sufficiently distinct to separate the *long* from the *short* wools, and the *coarse* from the *fine*. And when we examine the external minute structure of the fibre with the microscope similar differences are apparent. A practiced eye may at once distinguish between the wool of any long-wooled breed and that of the short-wooled breed; but there is greater difficulty in distinguishing between the wools of these two great classes, a difficulty especially marked when we compare the several classes of fine wools established by the commercial graders. All the long wools, the Cotswold, Lincoln and Leicester, have very much the same external structure. In the same way the *pure* downs and marinos approximate each other so that in the latter case the main difference, perhaps, is found in the fineness. If in the practice of breeding we produce a cross between the long and the short wooled breeds, the external characteristics of both appear in the progeny, and similar characteristics appear in the wool, so that those of either blood will be maintained in the wool of the descendants for several generations, and are more indelibly impressed upon the Merino race by crosses with the long-wooled races than with any others. In many cases, therefore, microscopic study of the fibre becomes more valuable in the determination of the purity of the pedigree, than any general indications can possibly be. The tendency of all animals to deterioration and to revert to the inferior stock makes such distinctions permanent. It appears to be a fact that the introduction of *pure* down blood to the Merino causes less marked differences, and these differences should have less of influence for evil than taints of long wool, still they are frequently apparent in variations in the fineness of the fibre, producing sometimes very uneven staple. We cannot further discuss this point here, but enough has been said to indicate its importance.

FINENESS OF WOOL.

In wools, as in connection with all other materials, fineness is a relative term, and it may here be fairly represented in the diameter of the fibre, if the latter be considered a cylinder, though it is never perfectly round. The German authorities have been accustomed to measure this in the diameter of the fibre by various means, using single fibres, but the favorite mode in use and recommended by the best authorities consists in measuring the breadth of a band of several fibres brought into close contact, or in the area of cross section of a bundle of fibres when pressed together. But it would seem that for one accustomed to the use of the microscope in the study of fibres, either of these mechanical means must prove defective. However closely the fibres may be brought together in this way, there must always remain interstices between them often large enough to admit additional fibres. Undoubtedly the most accurate degree of fineness must be represented in the absolute area of cross section of the individual fibre, that for a sample in the average area of a large number of individual fibres. And with the apparatus now available for making cross sections of the fibres the matter of measurement of their areas becomes one of much less difficulty than formerly. For instance for this purpose, prepare the cross sections as already described, project the image upon paper of uniform thickness, trace the outline of the section, cut out the form in the paper, following the outline, and carefully dry and weigh the piece; compare the weight of the piece thus obtained with that of another from similar paper, and of standard area, and from the data thus secured calculate the area of cross section of the fibre under measurement. This method, which it seems to us leaves nothing to be desired in the way of accuracy, is necessarily laborious and tedious, In our own work, on account of the very nearly cylindrical form of the fibre, we have considered it quite sufficient to measure the diameter of the fibre as represented in the width of image seen with a microscope of high power. The wool to be examined with this regard was mounted in a state of nature, without cleansing, in Canada balsam, and then with a microscope having a magnifying power of about 400 diameters and an eyepiece micrometer, the widths of the images measured. For each sample the following method in detail was followed: First, a small tuft was drawn at random from the sample under examination; this was placed upon the table and cut into three or more parts, according to the length of the staple. Each one of these parts was then mounted after the manner just described. Each slide supporting a part was properly labled and numbered, and three of the fibres upon it; the diameters or widths of images of thirty were carefully measured. The average of these thirty measurements were taken to represent the fineness for the part, and the average of the measurements for all the parts to represent the fineness of the sample. For the latter, therefore, from 90 to 150 measurements were always taken. In this way, as in connection with other properties, it has been our good fortune to study the wools of the leading breeds of the United States, that is to say, the Cotswold, Lincoln, Oxforddown, Southdown and Merino.

This property of fineness establishes in a general way the classification of the wools of different breeds, but of course it never enters into minute comparisons except as between wools from different animals of the Merino race. As between the four principal breeds studied, these range from finest to coarsest—Merino, Southdown, Lincoln, Cotswold. In the Merino wool, although the weight of fleece secured constitutes most frequently the important consideration and is made the subject of special prize at the fairs and shearings, fineness at the same time should and does form a no less important term of comparison. All other things being equal, the finest wool is of course the best. Conditions which modify and increase the fineness should be studied with the greatest care. In some cases it appears that it is not altogether consistent with the greatest vigor of constitution, but it does appear that it may be modified to a marked degree by breeding and by care. Selections in breeding should be made with this regard as carefully as with regard to size and form of carcass or to strength of constitution, and are as likely to afford satisfactory results.

In the American Merino the fineness will vary from 5 to 15 per centum of the average diameter of the fibre, and this variation may be ascribed to differences in the condition of the animal as regards health, nutrition, and the care it receives. Continued good health, good food, protection from the inclemencies of the weather, show their influence in the production of very even staple of the best quality, while deficiency in either respect will leave its impress upon the fibre in the way of the variations we have referred to. It is an interesting fact that the fineness of the fibre throughout its length forms a fairly good record of the condition of the animal producing it at the several stages of growth, any defection being shown in the diminished diameter of the fibre. These facts teach an important lesson that need not be expressed.

My study of wools was extended not only to the Merino wools of the present generation both of this country and Europe, but to the flocks of 1815, those of the celebrated breeders Wells and Dickinson. The results of the measurements show that the wools of the Wells and Dickinson flocks were even coarser than the long-wooled Merinos of the present decade, showing that the American system while it has increased the weight of the fleece many fold has also improved the fineness. But in the latter the variations throughout the length of the fibre show the necessity for greater care in the management of flocks. The same remark applies in comparing the American with the foreign product. Whether or not it be due to any more abrupt changes in our climate than in that of Europe, it is nevertheless a fact that while the American product is fully as fine it is not always as even throughout its length or from fibre to fibre.

German records have shown that the weight of the fleece in Merino breeds increases with advancing age until the third or fourth year, after which there is a gradual decline in the weight of the fleece. Measurements of fineness show that the fibre also grows coarser with increase in the age of the animal.

There is another condition in the American Merino that has an important influence upon the uniformity of fineness throughout the fleece, and because of the discussion it has aroused, we naturally hesitate about approaching it. In the examinations we have made, very considerable attention was given to the fineness of the fibre upon the top of the folds in the Merino skin as compared with that produced upon smooth skin. In the former we find many fibres more or less resembling hairs, and the average of all samples show the fibre to be much coarser upon these parts than elsewhere, and often as coarse as the fibres of the ordinary coarse wools. The introduction of such wide variations in the quality of the fibre raises the question that it seems difficult for breeders to decide: Can these disadvantages be counter-balanced by increased weight of the fleece due to the wrinkles or folds? There is at any rate no question of the following facts:

1. Wool from the tops of wrinkles is much coarser than that from between them and from smooth skin.
2. The coarser fibres are about as coarse as the ordinary coarse wools.
3. The fibres are more or less heavy, are stiff and harsh, lacking in pliability, and hence undesirable in fine goods.
4. The wool upon the wrinkles is much less dense and is shorter than that upon the smooth skin.

There may be conditions of breeding, such as hardier constitution, heavier fleece, etc., that must be taken into consideration in the improvement of common flocks, but the results just described show that growers of fine wools should seriously consider the desirability of excluding from their flocks these greatly wrinkled animals.

The relation of the "crimp" of the fibre in Merino wools to their fineness has always been a subject of more or less discussion among those interested, and in the course of our examinations, having ample material, we took occasion to develop it. In the case of such sample of Merino or Southdown wool examined, the crimp was carefully determined and stated in the number per inch of length of the staple in the sample, and after the fineness had been determined, the two data were compared. Taken as a whole, the figures show that the fineness varies directly according to the closeness of the crimp, and that with this condition the fiber as a rule is much finer than in case of more open crimp; that with increase in the number of crimps per inch there is a decided decrease in the average diameter of the fibre, so that in this condition all interested in the staple have here a ready means for the general determination of its value as regards fineness.

More definitely it appears that with different crimps per inch the fineness in the Southdown and Merino wools vary about as follows:

Number of crimps per inch.	Fineness in Centi-millimeters.
12	2.8 to 3.27
14	2.2 " 2.8
16	2.2 " 2.6
20	2.1 " 2.24
22	1.8 " 2.0
25	1.8 " 1.9
26	1.7
30	1.5

These relations are by no means absolute but they agree closely with the results of our determinations and measurements. It must be observed, however, that while these are the indications afforded by the averages of our results and therefore establish a general rule, they do not altogether agree with those obtained for individual samples. It frequently happens that there is no relation whatever between the fineness of the fibre and its crimp, so that a grade made upon this indication alone might be exceedingly irregular as regards this quality of fineness.

There seems also to be some relation between the density of the fleece and the fineness of the fibre. Thus in a series of samples from two sets of fleeces, the one set being much closer or more dense than the other, the following results were obtained in centimillimetres, by measurement of fineness. For the dense fleeces: Rams, 2.151; ewes, 2.119; Loose fleeces: Rams, 1.916; ewes, 1.974.

The loose fleece therefore appears to produce the finer wool. Of course these results were obtained from only a limited number of samples and can only be an indication of what may be expected from further study in the same direction, but the fact is worthy of the attention of growers of fine wools.

One other consideration relative to fineness and we must have it. This is the relation of the section of the country in which the wool is grown to this quality. In the later part of our work it was deemed desirable to apply the methods of investigation already devised to this question. To this end collections of samples of merino wool were made from as nearly as possible all the wool growing sections of the United States, the principal aim being to secured material from animals directly descended from the pure Vermont stock. The earlier work had shown that the highest degree of fineness was attained at about the age of two years, and contributors were requested to send samples from animals of this age and from as near the shoulder as possible. Twenty samples from rams and twenty samples from ewes were taken in each locality, and this number was believed to sufficiently represent the average of the entire flocks. Samples were thus secured from all the states named below, and presumably represented the best wools obtainable. The figures of the following table are averages of all the measurements taken for each State, and are represented in centimillimetres and ten thousandths of an inch:

	Centimillimetres.	Ten thousandths of an inch.
Pennsylvania	1.711	6.729
Texas	1.837	7.226
California	1.883	7.407
Illinois	1.902	7.782
Vermont	1.979	7.801
New York	2.034	8.034
Wisconsin	2.048	8.085

The variation in these figures is by no means wide and is scarcely sufficiently decided to lead to the conclusion that any influence whatever is had upon this quality by the several different sections. The differences may have been due to differences of judgment in collecting the samples, or even in the part of the fleece from which the wools were secured. The variation from the average amounts to from about 5 per cent on one hand to about 11 per cent on the other.

From all our study with regard to the fineness of fibre of wools we deduce the following conclusions:

1. It is affected by breed—and with this regard the wools of the several breeds stand in the following order from coarsest to finest: 1, Oxforddown; 2, Cotswold; 3, Leicester; 4, Lincoln; 5, Hampshire; 6, Southdown; 7, Merino.
2. It is to some extent related to sex, but with this regard each breed is a law unto itself.
3. It differs from one part of the fleece to another but no general rule can be established on this point. In the majority of cases, however, the shoulder wool is finer than that from the side, which in turn is finer than that from the hip. The belly wool is almost invariably finer that that from other parts.
4. The age seems to be without marked influence in the Merino breed, but in the coarse wools the fineness seemes to decrease with increase of age, that is to say, with advancing years the fibre seems to become coarser.
5. The fibres from the tops of the wrinkles or folds is decidedly coarser and less even than that from between them and from the smooth skin, and animals with numerous and large folds in the skin should, as far as possible, be excluded from flocks devoted to the production of *fine even* wools.
6. A relation prevails between the number of crimps per inch and the fineness of fibre in Merino wool, and while this is not absolute in all cases, it may serve as a general indication of the quality in question.
7. Loose fleeces in Merino wool appear to contain finer fibres than the dense fleeces.
8. To some extent the fineness of Merino wool seems to be affected by the section in which the wool is grown, but the differences are not so marked or so distributed as to indicate that they are due to climate, or to anything more than the natural variations occurring in different lots of wool, or possibly to slightly different care in the management of the flocks.

STRENGTH AND ELASTICITY OF WOOL.

In the study of the comparative fineness of the fibre we are only upon the threshold of the work of fixing the ultimate value of the staple in all its relations, industrial and commercial. While many of the commercial grades are established upon this quality alone, manufacturers and consumers alike are interested in knowing to what extent any given lot of wool will be able to resist the wear it must be subject to in its various applications, and the power necessary to this must be found, and find expression, in the ultimate strength, or generally the strength and elasticity of the fibre as variously produced or treated.

Strength is the power to resist strain, and stretch the elongation produced by strain, limited only by rupture. Elasticity is the power to return to original condition after elongation due to strain. Strength may therefore be represented in various ways: that is, it may be represented in units of weight necessary to rupture, or units of weight necessary to produce any stretch in percentage of original length. Elasticity may in general be fairly represented in the percentage of stretch suffered previous to rupture. But the stretch may be of two kinds. If, for instance, a fibre be submitted to strain not sufficient for rupture, it will stretch. If this strain be removed the tendency will be to return to its original length, but this return will be incomplete. The fibre will have permanently stretched, and will have *set*. The difference between the *total stretch* and this permanent stretch constitutes the elastic stretch. It is upon data of this kind, and the relation between them, that we must depend for an appreciation of the ultimate value of wool.

These data with regard to wool are obtained in the following manner: A dynamometer is constructed in which a wheel is delicately mounted to avoid friction as far as possible by pointing the extremities of its axle, and inserting these in conical boxes, so that the wheel is really supported upon points. Fixed to the axle is a pendulum, or lever, weighted at its lower extremity. Over the periphery of the wheel passes a light chain, which supports at one end a screw clamp. Underneath this clamp, and in the same vertical plane, is a second clamp fixed to a rod, which may be moved up and down by a screw motion at the base of the instrument. Attached to the clamp is a horizontal indicator, the point of which during the motion of the clamp may pass over a scale engraved upon a frame supported by the upper clamp. The frame bears upon one arm a scale graduated to millimetres, and upon the other arm a scale graduated to one-fiftieth of an inch. The end of the pendulum, or lever, may move over a scale upon an arc graduated to grammes and fractions of grammes by experiment. To test the strength and elasticity of a fibre it is fixed in the clamps, which are exactly 20 millimetres apart. By means of the screw motion strain is very gradually applied, and the pendulum moves from the vertical and furnishes the resistance. As the strain increases the fibre stretches, the clamps become more widely separated, and the degree of separation is measured by movement of the indicator attached to the lower clamp over the scale upon the frame attached to the upper one. To secure a fair average for wool 30 fibres must thus be tested from each sample.

Now the determination of the ultimate strength and elasticity may be made in two ways. First, and in order to record the true elasticity, a certain strain is applied, say sufficient to produce elongation of one millimetre. The strain is then relieved, and the fibre allowed to regain as far as possible its original length. When the contraction appears to be complete the strain is applied, and the total stretch and the permanent stretch are recorded. Strain is again applied until stretch of two millimetres is produced, when it is relieved and the contraction observed. Such experiment is repeated until rupture is effected. In the record, therefore, we have strain, total stretch, and permanent stretch or set. It is plain that the difference between the total stretch and permanent stretch or set represents what we ordinarily understand to be elasticity.

Second.—Since the relation between the total stretch and the elasticity is so close, the former may be accepted as fairly representing the latter quality in comparison of a large number of samples. The very much quicker method of testing may then be used, that is, to apply the strain gradually and continuously until rupture is effected, observing and recording the strain and total stretch.

An illustration of the tests made by the first method, and the mode of recording them for a single sample, is illustrated in the following, giving the results for 10 fibres of Cotswold wool having an average diameter of 4.412 centimillimetres.

Strain....	Total stretch...	Permanent stretch...	Strain......	Total stretch...	Permanent stretch...	Strain.....	Total stretch...	Permanent stretch...
Fibre No. 1.			*Fibre No. 6.*			*Fibre No. 11.*		
17.50	1.00	0.25	11.75	1.00	0.25	22.00	1.00	0.25
20.00	2.00	0.75	14.50	2.00	0.75	26.00	2.00	0.75
21.25	3.00	1.00	16.00	3.00	1.00	27.50	3.00	1.25
22.50	4.00	1.75	16.50	4.00	1.75	28.75	4.00	1.75
23.75	5.00	2.25	17.75	5.00	2.25	30.00	5.00	2.25
26.50	6.00	3:00	20.50	6.00	3.00	34.50	6.00	3.25
30.50	7.00	3.75	21.75	6.25	....	38.50	6.75	....
Fibre No. 2.			*Fibre No. 7.*			*Fibre No. 12.*		
14.50	1.00	0.25	20.50	1.00	0.25	21.75	1.00	0.25
17.50	2.00	0.75	21.75	2.00	0.75	24.50	2.00	0.75
18.25	3.00	1.25	22.50	3.00	1.00	25.75	3.00	1.25
18.75	4.00	1.75	23.50	4.00	1.75	27.25	4.00	1.75
19.75	5.00	2.25	25.25	5.00	2 25	29.25	5.00	2.50
21.50	6.00	3.00	28.25	6.00	3.00	33.25	6.00	3.25
22.75	6.50	....	33.50	7.00	3.75	36.75	6,75	....
....	....	....	37.50	7.75	....	....	....	....
Fibre No. 3.			*Fibre No. 8.*			*Fibre No. 13.*		
18.75	1.00	0.25	15.25	1.00	0.25	19.50	1.00	0.25
20.75	2.00	0.75	16.50	2.00	0.75	22.50	2.00	0.75
22.00	3.00	1.25	17.25	3.00	1.00	24.50	3.00	1.25
23.50	4.00	1.75	18.00	4.00	1.75	24.25	4.00	1.75
24.75	5.00	2.25	19.50	5.00	2.25	26.75	5.00	2.50
27.50	6.00	3.00	22.75	5.75	....	29.75	6.00	3.25
31.75	7.00	4.00	....	....	....	32.75	6.50	....
Fibre No. 4.			*Fibre No. 9.*			*Fibre No. 14.*		
17.50	1.00	0.25	20.75	1.00	0.25	13.75	1.00	0.25
20.00	2.00	0.75	22.50	2.00	0.75	17.25	2.00	0.75
20.50	3.00	1.00	24.50	3.00	1.25	19.25	3.00	1.25
21.50	4,00	1.75	26.00	4.00	2.00	20.50	4.00	2.00
22.50	5.00	2.25	27.50	5.00	2.50	21.50	5.00	....
25.00	6.00	3.00	30.25	6.00	3.00	....	....	....
29.25	7.00	3.75	35.50	7.00	4.00	....	....	....
31.50	7.50	....	37.25	7.75	....	....	....	....
Fibre No. 5.			*Fibre No. 10.*			*Fibre No. 15.*		
16.00	1.00	0.25	10.25	1.00	0.25	21.00	1.00	0.25
18.75	2.00	1.00	12.50	2.00	0.75	24.50	2.00	0.75
20.75	3.00	1.25	13.50	3.00	1.25	26.25	3.00	1.00
22.50	4.00	1.75	14.50	4.00	1.75	27.50	4.00	1.75
23.50	5.00	2.25	14.50	5 00	2.50	28.75	5.00	2.50
25.75	6.00	3.00	15.75	6.00	3.25	33.00	6.00	3.25
29.75	7.00	....	....	....	....	36.75	6.75	....

The results obtained in a series of tests by this method were tabulated and reduced by my friend and colleague Prof. N. Clifford Ricker, so that the samples of wools of any breed could be compared not only with each other but with wools from other breeds, or even with different kinds of material as well. In this work all the results of this series of tests were specially tabulated, and from them curves were plotted, the idea being to secure averages corresponding with the several units employed. Thus first it was necessary for each sample to determine for the purposes of the comparasons the average tensile strains required to produce in permanent stretch, in even and half millimetres, from one-half millimetre to the maximum produced, while for the total stretch they were computed for each successive millimetre. For each sample tests of ten fibres were taken, and the averages secured in this way for the sample above represented, 189 Cotswold, are the following,—stretch in millimetres, strain in grammes:

For permanent stretch:

Stretch	0.25	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00
Average strains	19.58	20.81	22.96	24.25	25.36	26.76	28.89	31.84	33.05

For total stretch:

Stretch	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
Average strains	19.58	21.13	23.55	24.83	26.20	29.38	33.86	38.28

To determine averages for each breed represented the averages obtained above were collected for ten samples, and corresponding reductions made. But in order to compare results for different samples and secure averages for a class or breed, the fibres must be theoretically reduced to a common diameter, which for convenience was assumed for the material under examination to be four centimillimetres. Any other diameter could equally well be assumed. For reduction of all fibres to this uniform diameter Prof. Ricker made use of the following proportion and formula:

$$D^2 : 4^2 :: S : S^1$$

$$\text{or,} \quad S^1 = S \frac{16}{D^2}$$

In which:

4 = the assumed common diameter of the fibre.

D = the actual diameter of fibre for the given sample.

S = the actual tensile strain on the fibre in grammes, producing a certain elongation, total or permanent.

S^1 = the tensile strain in grammes that should be required to produce identical elongation in a fibre 4 centimillimetres in diameter.

The strains must be to each other as the squares of the diameters of the fibres, supposing the section to be of similar form.

Now if the average diameter of the sample under consideration be substituted for D in the formula, and the decimal value of $16/D^2$ be found, it will of course be a constant for that sample. Multiplying the observed strains for the sample by this decimal, we obtain strains corresponding with a diameter of 4 centimillimetres. Then by tabulating, etc., as before, the averages are completed. Comparing in this way the averages of samples from different parts of a single fleece, the following conclusions were arrived at.

1. Fibres taken from the shoulder having common diameter and equal weight are considerably stronger than the average for the fleece.

2. The shoulder is therefore the most valuable part of the fleece by weight.

3. The relative economic values of the different parts are as follows, from greatest to least: shoulder, side, hip, belly.

4. Fibres taken from the side closely approximate the average for the entire fleece.

5. The belly is much the least valuable part of the fleece.

Of course these deductions may be modified by applying the same method to a large number of fleeces belonging to different breeds or even of the same breed, as the general results given in another part of this paper will show. Modifications due to age and sex of the animal represented would doubtless also occur. With all the results we already have, further tests must therefore be made with a sufficient number of samples of the same kind to definitely determine the relations here shown. In fact, more extended results determined and represented in a slightly different way do show that this relation varies decidedly in different sexes of the same breed, for while in ram's wool the order ranges hip, shoulder, side, in the ewe's wool it ranges hip, side, shoulder. These conclusions cannot therefore be accepted as absolute for this breed, nor for wool in general, but they are of interest as illustrating the application of the method to the sample in question.

Applying the same method to the results for the five different breeds the wools of which were made the special subject of study, averages were obtained which led to the following conclusions:

1. Southdown wool is much stronger than that of any other of the breeds considered.

2. It is consequently more valuable, pound for pound for manufacturing purposes, where only the weight of the goods is to be taken into account.

3. And if the manufactured goods are made of the same weight, those composed of Southdown wool should be much stronger and more durable for the same cost.

4. If all are to be of equal strength the Southdown fabrics will be considerably lighter and cheaper than others, allowing greater profit provided the wool is produced at the same price per pound.

5. Cotswold wool is the weakest, requiring more weight for equal strength.

6. From these averages the wools of the five breeds rank in economical value as follows, from greatest to least: Southdown, Oxforddown, Merino, Lincoln, Cotswold.

7. In point of strength, Merino wool closely approximates the average value for the five breeds considered. Its economic value would therefore be a mean between those of the Southdown and Cotswold.

Comparing the relations between the total, permanent and elastic stretch produced by various strains, we reach the following conclusions:

1. The permanent stretch increases nearly as fast as the total stretch.
2. The elastic stretch increases about half as fast as the total.
3. Consequently the elastic stretch only changes about half as fast as the permanent stretch.
4. The permanent and elastic stretch are equal, as an average, when the total stretch equals about 4.3 millimetres or 21.5 per cent. of the original length of the fibre.

To better comprehend the significance of these values we may compare them with similar values for other materials the strengths of which have been determined. We may thus compare it with wood, ivory, whalebone, the metals, iron and steel, but to render this comparison more readily intelligible it becomes necessary to change the average tensile strains in grammes on fibres of wool 4 centimillimetres in diameter to corresponding strains in pounds per square inch of section of fibre. This may be done as follows:

The common diameter of fibre being 4 centimillimetres, the area of right cross section is 12.5664 square centimillimetres. One gramme on a fibre having this area of cross section corresponds to $\frac{10000}{12.5664}$ grammes per square millimetre of section, or $\frac{10 \text{ kelogrammes}}{12.5664}$ 0.795773 kelogramme per square millimetre of cross section of fibre.

One kelogramme per square millimetre of cross section corresponds to 1422.308 pounds per square inch of section (Thurston, Materials of Engineering, I. 308). Consequently one gramme of tensile strain on a fibre 4 centimillimetres in diameter exactly equals a strain of 0.795773+1422.308=1131.834 pounds per square inch of section. Therefore if all the general average tensile strains for wool already found be multiplied by this coefficient we shall obtain their corresponding values in pounds per square inch. As this multiplier is a constant, it does not affect the relative values of the different kinds of wool at all. The results of this reduction are as follows: the permanent and total stretch given in millimetres, and the respective corresponding relative resistance or strains in pounds per square inch of section.

Permanent stretch........	0.25	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
Résistance	21.720	22.659	24.527	25.805	26.667	27.911	29.416	32.439	35.065	36.024	41.300

Total stretch..................	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
Resistance.	21.233	24.018	25.465	26.723	38.285	31.024	34.736	34.804

Since in the tests of wool made the length of fibre used was 20 millimetres, if the results for stretch be multiplied by 5 we obtain expression in per cents. of length which is more convenient for comparison with other materials. If the figures thus obtained and those just given are compared with corresponding values for wrought iron, cast iron and steel made by the United States Testing Board, published in Thurston's Materials of Engineering, Vol. II, pp., 351, 352 and 398, the following conclusions are reached:

1. The tensile strain for wool is about one-half that required to produce the same per cent. of total stretch in a wrought iron bar of equal cross section.

2. A permanent set commences in wool at about 59 per cent. of the amount of strain required to originate a set in a wrought iron bar, or at about 37 per cent. of the ultimate tenacity of wrought iron of good quality.

3. For steel the corresponding value is 34 per cent.

4. The ultimate average tenacity of wool appears to be nearly double that of average cast iron of equal cross section, about four-fifths that of good wrought iron and a little more than one third that of good steel.

5. The maximum stretch of wool is much greater than that of either metal, being 1.75 times that of wrought iron, 12.8 that of cast iron and 4.5 times that of steel.

6. The permanent stretch or set of wool appears to commence only when the total stretch equals nearly 5 per cent. of the original length of the fibres, which is at least ten times greater than the corresponding value for either metal.

7. Wool has more than twice the strength of toughest wood; $1\frac{1}{7}$ times that of bone; 4 times that of white pine; 2.7 times that of whalebone; and nearly twice as much as soft brass wire, phosphor bronze, annealed iron wire or steel wire rope.

The comparative values of wool may farther be expressed, and very conveniently, in the *moduli* of *elasticity* which may readily be determined from the data above given. The term *modulus* of *elasticity*, much employed in the discussion of the resistance of materials, may be defined in either of two ways:

a. It is the ratio between the elongation of a bar of any material (whose section is a square unit and its length a linear unit of similar denomination) and the tensile strain producing that elongation. Its numerical value equalling the quotient of the strain by the elongation. The length of the bar is usually one inch, its section a square inch, and the strain is taken in pounds,

b. It is the tensile strain in pounds which would theoretically stretch a bar of one square inch section to just twice its original length, neglecting the reduction of section which occurs.

The definition first given is that most frequently employed and is the one here intended.

The formula for calculation of the modulus of elasticity is

$$E = \frac{1131.834\ S}{\frac{5\ E}{100}} = 22637 \frac{S}{E}$$

in which:

E = the required modulus of elasticity.

S = the tensile strain on a fibre of wool 4 centimillimetres diameter.

1131.834 S = strain or fibre in pounds per square inch.

E = corresponding total elongation in millimetres. Since the length of fibre tested is 20 millimetres we have 5 E = per cent. of stretch placing the original length of fibre at 100—.

Applying the above formula to the average strains corresponding to the different elongations of fibre for wool of different breeds, we obtain the values of modulus of elasticity given in the following table. Since the numerical value of the modulus of elasticity evidently increases directly as the amount of strain required to produce a certain elongation of fibre, it follows that the most resistant fibres will have the greater modulus. The following are the values in question:

Stretch	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00
Oxford	486689	269263	186149	144592	121106	109250	105948	101700	95904
Lincoln	372374	200335	139367	108826	92131	84774	81686	81351	....
Southdown	523813	310802	223349	173850	147637	134454	128512	....	....
Merino	395237	233250	169775	138819	118616	109486	100992	91537	....
Cotswold	345662	186753	130236	101865	86155	78700	75801	73343	....
Average	424664	240175	169775	133613	113138	103412	99246	87010	....

From the above it appears:

1. The modulus of elasticity for Merino wool is pretty nearly the average for the five breeds considered.

2. The value of the modulus diminishes very rapidly as the stretch increases, the relative values for the general average being as follows:

Stretch per cent	5	10	15	20	25	30	35	40
Value of modulus	100	57	40	32	27	24	24	21

3. The relative numerical values of the modulus for the different breeds are arranged in the following order from the greatest to the least: Southdown, Oxforddown, Merino, Lincoln, Cotswold.

Comparing these values of moduli of elasticity of wool with similar values for wrought iron, cast iron, steel, wood and other materials computed from data already referred to ("Thurston, Materials of Engineering" II, 351, 352, 398) by dividing elongation per inch of length by corresponding strain in pounds per inch of cross section, we arrive at the following conclusions:

1. The values of the moduli of elasticity for the average of wool are much smaller than for either of the metals examined, but remain much more nearly uniform under increase of stretch and strain.

2. If the maximum value of the modulus of elasticity for the average of wool be taken as unity, the relative values for other materials will be as follows: White pine 4; strongest woods 4; silk 3; brass wire 34; phosphor bronze 33; copper wire 40; cast iron, average 37; wrought iron, average 59; steel, average 67.

This relatively low value of the modulus of elasticity for wool does not affect its tensile strength, as it results from the much greater stretch produced in wool by the same strain than in almost any other material, but it only permits it to stretch more and with a smaller proportional permanent stretch than other materials, thus rendering it much better adapted to the manufacture of clothing, etc., than if the modulus were several times greater or the stretch smaller.

In the consideration of these relations developed by Professor Ricker, it must be borne in mind that they are based upon the results of a small number of tests, and that they must suffer some modification when the same methods are applied to the results of more extensive work. We have here presented only a brief abstract of the methods and results, and for further information must refer to the detailed report upon "Examination of Wools, etc.," published by the U. S. Department of Agriculture.

In a very much more extended series of experiments, and with much more material, the second method of testing was used, that is, to apply the strain gradually and continuously until rupture was effected, observing and recording the strain and total stretch. We have already seen that the stretch taken in this way may fairly be accepted as representing the elasticity because of the very close and uniform relation existing between the total stretch and the elastic stretch, and though the percentage of stretch may diminish with increase of length of fibre tested, and some difference also prevail between the total and elastic stretch, yet if the same length to be tested be used in all experiments, the results must after all be comparable and thus satisfy the needs of the investigation.

We have further seen that in order to properly compare different wools with each other, the observed strains must be reduced to theoretical strains for fibres of assumed common diameter or common area of cross section, and determine the relation between these strains and the total stretch as expressed in the modulus of elasticity. And when so many tests are to be considered as were made in the portion of our work now under discussion, the calculation needs to be somewhat simplified, and formulæ slightly different from those already given, or at least a combination of some of them in a single formula becomes necessary.

The determination of the theoretical strain for the common diameter of 4 centimillimetres, involves the use of the formula already given. $S^1 = S\frac{16}{D^2}$

The *ultimate tensile resistance*, expressed in pounds per square inch of cross section, may be obtained from the observed averages of fineness or diameters and strains, by formula deduced in the following manner:

Assuming, of course, cylindrical form of the fibres,

Let S = the average ultimate tensile resistance (strain) in grammes for the specimens or classes tested.

Let D = the average diameter of fibre for the specimen or class, in centimillimetres.

When the area of cross section of the fibre in square centimillimetres will become $\frac{\pi D^2}{4}$

In a square millimetre there are $100 \times 100 = 10{,}000$ square centimillimetres. Hence 1 gramme per square centimillemetre = 10,000 grammes = 10 kilogrammes per square millimetre, and since 1 kilogramme per square millimeter = 1422.30786 pounds per square inch, 1 gramme per square centimillimetre = 14222.0786 pounds per square inch of section of fibre. Applying these values in the above formula, we obtain the expression for the ultimate tensile resistance in pounds per square inch.

$$R = \frac{4\ S + 14223}{\pi D^2}$$

Or

$$R = 18109 \frac{S}{D^2}$$

The practical application of this formula is as follows: Take the average results for fineness of strain for the Cotswold breed, 4.196 centimillimetres and 30.44 grammes respectively.

Then

$$\frac{18109 + 30.44}{(4.196)^2} = 31272 \text{ lbs.}$$

The same formula may be applied to any fibre, sample or class of samples for which we have the average diameter and the average ultimate resistance or strain required for rupture. The results of such calculations furnish data upon which to base absolute comparisons of the strength of the fibre in the different classes.

The *modulus of elasticity*, or the ratio of the stretch to the strain required to produce it, is determined in the same way as before. That is, we divide the corresponding average tensile resistance ($=18109 \frac{S}{D^2}$) in pounds per square inch by the percentage of stretch suffered previous to rupture. Then if the resistance be represented by R and the percentage of stretch by P, and the modulus of elasticity by E, the formula becomes

$$E = \frac{R}{P}$$

Applying this formula to the figures for Cotswold wool above obtained we have

$$E = \frac{31272}{.3545} = 88214.$$

For a given percentage of stretch, the modulus of elasticity will increase with increase of ultimate resistance, and conversely for a given ultimate resistance it will decrease with an increase in the percentage of stretch. The greater the ultimate resistance required to produce a given stretch in the fibre, the greater must be the modulus of elasticity. Hence we have here an expression for the ultimate economic value of the staple that will admit of almost absolute comparison between wools of the same kind at least, and even to a large extent between all kinds, or between wool and other materials. If we arrange the wools of the breeds we have studied in the order of their moduli of elasticity from highest to lowest, they range as follows:

Breed.	Modulus of elasticity.
Southdown	114315
Merino	102100
Leicester	101681
Lincoln	95636
Cotswold	88214
Oxforddown	87630

A Cotswold-Merino cross examined has a modulus of elasticity of 109953.

The following table will illustrate the method of collecting all the general averages to show the relations between the results of the tests, and the breed, sex, and portion of fleece from which the sample was taken. At the top of this table we present these general averages for the several breeds studied, and for *all* samples examined. Below this we present the averages for Merino wool, showing relation between sex and portion of fleece, and the qualities and data represented.

Averages of all Results for each Breed.

Breed.	No. of samples tested	Length of fibre—inches	Fineness.		Strain—grams	Stretch—per cent	$\frac{D^{12} \times S}{D^2}$	$18109 \frac{S}{D^2} = R$	$E = \frac{R}{P}$
			Centimilli-metres	Th'sandths of inch					
Cotswold	109	5.156	4.196	1.6519	30.44	35.45	27.663	31.272	88.214
Leicester	1	9.75	3.879	1.5271	28.70	28.05	25.201	28.522	101,681
Lincoln	36	3.785	3.707	1.4594	25.66	35.35	29.876	33.807	95.636
Southdown	46	1.351	2.936	1.1559	12.78	22.95	23.181	26.286	114.315
Hampshire	2	2.188	3.298	1.2984	.....	.....	.....	.....	.....
Oxford	30	2.647	4.365	1.7185	30.43	33.05	25.554	28.918	87.630
Merino	204	1.502	2.131	0.8389	7.35	28.70	25.897	29.302	102.100

Averages of all Results for each Sex and Portion of Fleece of Merino Wools.

Sex and Portion of Wool.	No. of samples tested	Length of fibre—inches	Fineness.		Strain—grams	Stretch—per cent	$\frac{D'^{2}\times S}{D^{2}}$	$18109\frac{S}{D^{2}}=R$	$E=\frac{R}{P}$
			Centimilli-metres	Th'sandths of inch					
Rams.									
Whole fleece	85	1.424	2.215	0.872	7.12	25.30	23.219	26.281	103.671
Neck	17	1.4375	2.644	0.041	....	....	....	....	....
Shoulder	17	1.338	2.171	0.854	6.73	26.85	22.847	25.862	96.320
Side	17	1.281	2.156	0.848	6.29	29.15	21.65	24.503	84.061
Hip	17	1.276	2.297	0.904	8.83	21.87	26.777	30.310	139.613
Belly	17	1.284	2.234	0 188	....	....	....	....	....
Ewes.									
Whole fleece	90	1.491	2.084	0.820	6.42	26.05	23.651	26.767	102.753
Neck	18	1.3125	2.287	0.900	8.59	26.15	26.277	29.744	133.743
Shoulder	18	1.393	2.041	0.803	6.16	27.20	23.666	26.790	98.492
Side	18	1.368	2.054	0.808	5.78	30.80	21.920	24.787	80.476
Hip	18	1.219	2.206	0.868	7.92	22.30	26.039	29.881	133.690
Belly	18	1.306	2.160	0.850	....	....	....	....	....

This table shows, among other things, what we have already observed, that in point of ultimate value as represented in the modulus of elasticity, the Southdown wool takes the lead, and that this is followed by the Merino. These two kinds of wool are most valuable for clothing. Extending the same comparison to the sexes in the Merino race, and the portion of the fleece represented, we find the ram's wool slightly better than the ewe's wool, and as a rule the hip wool better than that from the side and shoulder. On the other hand the highest quality as regards power to resist wear and represented in the modulus of elasticity, does not seem to be consistent with fineness. The coarser wools appear better.

We shall not attempt to present results showing the relation of the results in the different classes to the ages of the animals represented, and in this particular, as in a host of others, we must refer readers to the detailed report already referred to. In connection with the age it will suffice to say that for lamb's wool the modulus of elasticity is almost always high, but in the fully developed animal there seems to be an increase in value with increase of age until a maximum is reached, after which the quality declines. In the Cotswold and Lincoln this arrives at the age of 1 year; in the Southdown at 3 years, and in the Merino at about 4 years.

In the following table are the results of the extension of the above described methods of investigation and reduction to wools of the commercial grades of the markets of Boston and Philadelphia, and to similar series adopted as the standard for the grades of Germany. The lengths of fibre given here are necessarily greater than those given for the wools heretofore described, from the fact that the latter were mostly taken from the bodies of the animals on exhibition in September, and therefore had only about five months' growth. The lengths are all taken in crimp and without stretching the locks.

The relation between the closeness of the crimp and the fineness of the fibre is here apparent, and though there is some variation, it still appears to afford a tolerably fair indication of the fineness, at least the best at hand when a good microscope is not available. Further it appears from this table that the wools of the Boston market, as a whole, are somewhat longer and coarser than those of the Philadelphia market. The ultimate resistance in pounds per square inch and the modulus of elasticity seem to be higher in the Philadelphia grades than in the Boston grades, altogether indicating a generally better quality in the staple.

Comparing the American with the German grades, the Philadelphia grades seem about as fine and strong, the modulus of elasticity possibly a little lower. With the explanations already given, however, these comparisons may easily be made by those interested, and we therefore submit the tables without further comment.

Averages of all results for Commercial Grades.

BOSTON GRADES.

Grades.	No. of crimps per inch....	Length of fibre in inches	Fineness. Centimillimetres.	Fineness. Thousandths of inch.	Strain in gramm.....	Stretch per ct.	$\frac{D^{12}\times S}{D^2}$........	$18109\frac{S}{D^2}=R$...	$E=\frac{R}{P}$..........
Fine unwashed	20	2.335	2.162	0.8511	5.34	27.30	18,279	20688	75785
Fine from dead sheep	20	2.300	1.835	0.7224	4.33	32.40	20.575	23287	71873
Picklock	22	2.083	1.532	0.6031	2.15	32.85	14.656	16588	50495
XXX	22	2.063	1.567	0.6169	2.85	31.85	18.57	21006	65954
XX	20	2.250	1.870	0.7368	4.65	22.30	21.769	24639	110491
X	20	2.156	2.023	0.7964	5.50	28.80	21.502	24336	84500
Between X and No. 1	20	4.625	2.118	0.8338	3.92	14.85	13.981	15823	106550
No. 1	20	2.229	2.203	0.8673	5.72	12.60	18.858	23143	169394
No. 2	16	2.814	2.908	1.1448	11.16	24.05	21.115	23898	99300
Delaine fine	20	3.375	2.084	0.8204	5.36	24.55	19.746	22343	91033
Delaine medium	14	3.375	2.533	0.9972	6.84	25.93	57.057	19395	74394
Combing fine	14	3.917	2.526	0.9944	8.26	21.45	20.713	23443	111837
Combing medium	10	4.781	2.626	1.0338	9.86	22.15	22.87	25884	116860
Combing coarse	....	6.125	3.420	1.3464	17.60	30.75	24.076	27249	88616
Common	....	31.875	3.431	1.3507	15.32	26.70	20.823	33568	88269
New Mexico	....	3.375	2.776	1.0889	13.49	24.00	28.212	32675	136148

PHILADELPHIA GRADES.

Picklock best	26	1.625	1.669	0.6570	3.00	30.75	17.232	19510	63418
Picklock fair	26	1.75	1.658	0.6527	4.60	31.50	26.78	33309	96222
Picklock medium	22	1.25	1.76	0,6929	4.67	27.10	24.122	27299	98442
Picklock low	22	2.00	1.435	0.5469	3.05	22.55	23.699	22533	118900
XXX good	26	2.00	1.687	0.6641	4.23	21.40	23.781	26914	125770
XXX extra	26	2.00	1.494	0.5889	3.44	27.60	24.658	27899	101080
XXX low	22	2.25	1.783	0.7019	5.06	25.65	25.466	28815	113343
XX good	22	2.50	1.655	0.6515	3.70	22.25	21.66	24504	110130
XX clothing	22	2.20	1.859	0.7318	5.03	25.25	23.235	26292	104126
XX low	20	2.00	1.736	0.6874	5.67	23.50	30.102	34067	144970
X good	20	2.00	1.835	0.7224	5.23	21.40	24.851	28126	131430
X fair	20	1.9375	1.932	0.7606	5.05	18.45	21.646	24492	132750
X low	20	2.125	1.911	0.7523	5.03	18.40	22.037	24934	135510
Delaine fine	20	2.50	1.924	0.9574	5.95	32.50	25.717	29110	89570
Delaine very fine	20	2.625	1.946	0.7661	7.22	29.25	30.505	34520	118020
X and above	22	2.00	2.133	0.8397	5.98	29.70	21.03	23802	80141
X and above	22	2.458	1.949	0.7673	4.86	34.20	20.47	23168	67743
X and above	20	2.025	1.983	0.7807	5.60	24.10	22.786	25773	106981
¼ blood good	14	2.75	2.404	0.9464	10.37	29.65	36.143	40904	141170
¼ combing	14	3.4375	2.383	0.9381	9.66	24.10	27.218	30808	127830
Combing, low	....	5.417	3.508	1.3810	20.79	30.50	27.03	30593	100300

Averages for Commercial Grades—Continued.

GRADES.	No. of crimps per inch....	Length of fibre in inches....	FINENESS. Centimillimeters.	FINENESS. Thousandths of inch.	Strain in Grammes ...	Stretch per ct.	$\frac{D'^2 \times S}{D^2}$	$18.109 \frac{S}{D^2} = R$...	$E = \frac{R}{P}$ ....
⅜ blood good............................	14	2.594	2.573	1.0129	8.93	24.80	21.582	24424	98475
⅜ combing	....	2.75	2.563	1.0096	11.04	24.30	26.89	30424	125245
⅜ and ½ blood	10	2.958	2.513	0.9893	10.29	18.00	26.070	29506	163923
½ blood high	20	2.3125	1.791	0.7051	5.85	21.15	29.18	33026	156152
½ blood regular	....	1.8125	2.234	0.8795	6.56	18.95	21.031	33891	125890
Combing, washed........................	20	3.125	2.162	0.8511	6.25	23.30	21.394	24209	103900
⅝ blood................................	20	2.125	1.997	0.7862	4.96	21.30	19.899	22523	105740
Cotts..................................	....	3.25	2.806	1.1047	20.07	32.35	40.784	46155	142619
Saxon, Imported......	26	1.00	1.555	0.6043	2.73	18.25	18.538	20984	114980
Saxon, Domestic	26	1.125	1.328	0.5225	2.11	20.55	19.143	21663	105416

GERMAN GRADES.

GRADES.	No. of crimps per inch....	Length of fibre in inches....	FINENESS. Centimillimeters.	FINENESS. Thousandths of inch.	Strain in Grammes ...	Stretch per ct.	$\frac{D'^2 \times S}{D^2}$	$18.109 \frac{S}{D^2} = R$...	$E = \frac{R}{P}$ ....
Super Super Electa....................	34	1.125	1.923	0.7570	4.43	24.70	19.168	21697	87841
Super Super Electa....................	34	1.00	1.297	0.5499	2.89	18.05	26.632	30140	166981
Super Electa	30	1.75	1.655	0.6515	4.17	27.05	24.359	27571	101925
Super Electa	30	1.25	1.639	0.6452	3.65	22.40	21.739	24606	112146
I Electa	27	1.25	1.662	0.6543	3.45	22.15	19.984	22614	102093
I Electa	27	1.125	1.664	0.6551	4.03	21.45	23.287	26360	122890
II Electa.	25	1.25	1.535	0.6043	3.70	26.60	25.125	28742	106926
II Electa	25	1.125	1.504	0.5921	3.22	19.20	22.777	25782	134285
I Prima.................................	22	1.375	1.705	0.6712	4.43	23.60	24.383	27593	116922
I Prima.................................	22	1.25	1.705	0.6712	3.85	23.80	21.19	23983	100769
II Prima	20	1.375	1.980	0.7511	4.13	27.70	16.855	19082	68889
II Prima	20	1.375	1.794	0.7062	3.96	30.25	19.687	22285	73671
Secunda	16	1.50	2.089	0.8224	5.06	21.20	18.553	20995	99033
Tertia	16	1.25	1.978	0.7787	4.82	24.75	19.711	22308	90133
Quarta..................................	14	1.50	2.257	0.8885	6.28	22.30	19.725	22330	100137
High Pedigree Wool....................	20	1.25	1.953	0.7688	4.08	17.35	17.115	19376	111681
High Pedigree Wool	25	1.25	1.682	0.6621	3.51	24.10	19.85	22466	93222
Pure bred, Ancient Pedigree........	22	1.875	1.894	0.7456	3.18	15.00	14.183	15684	104558
Impurely bred wool	25	1.25	1.661	0.6539	3.08	21.85	17.86	20214	92513
French Ram..............................	16	3.50	2.136	0.8409	6.03	28.40	21.146	23938	84288
Rambouillet.............................	20	3.125	2.120	0.8346	6.50	30.00	23.14	26190	87300
English Merino	16	1.625	1.615	0.6358	3.27	24.90	20.055	22693	91134
Australian Ewe	16	2.125	1.683	0.6625	3.35	21.65	18.924	21414	98910
Roger Ram (French)...................	20	4.125	2.365	0.9311	5.53	26.90	15.918	17905	66562
Rambouillet Ewe	....	1.00	2.487	0.9791	4.38	9.65	11.33	12823	13288
Rambouillet Ewe	16	4.00	2.196	0.8645	6.26	24.55	20.77	23496	95708

MISCELLANEOUS WOOLS.

In the investigation thus far described not enough of material was at hand to study satisfactorily the influence of the various wool growing sections and their climates, etc., upon the quality of the wool produced. And in order to supply this deficiency it was determined to collect from such sections reliable samples of Merino wool, from animals descended from the pure Vermont stock, of about two years of age, twenty samples being taken for each sex in each section. The samples were contributed by careful experts in sheep breeding, and are therefore believed to be the best obtainable. They came from Vermont, New York, Pennsylvania, Illinois, Wisconsin, Minnesota, Texas, and California. All were examined by the methods already described, giving results showing fineness, ultimate resistance and *modulus* of *elasticity*, the principal data upon which estimates of value must be based.

Further a careful study was made of a series of wools contributed by Messrs. Boechtel Brothers, of Willets, Mendocino county, California. These wools were taken from animals produced by the gentlemen named, in the application of a system of crossing the Merino with the Southdown and Shropshiredown breeds. The object of the examination was to determine the influence of this system of crossing, definitely carried out, upon the character of the staple.

The commercial result of this system of crossing is shown in the following table compiled from Messrs. Boechtel Brothers' records:

Fall and Spring..........	Number of days between fall and spring shearing..	Number of sheep shorn..	Annual average of wool per head.....	Annual average selling price..........	Net return per head.	Average of Merino rams' fleeces......	Number of wethers shorn annually ...	Annual average of Southdown fleeces.	Annual average 1st cross, ½ Merino ½ Southdown.......	Annual average 2d cross ¾ Merino ¼ Southdown.......	Annual average 3d cross ⅞ Merino ⅛ Southdown.......	Annual average 4th cross 15/16 Merino 1/16 Southdown....	Annual average 4/8 Sh'pshire ⅛ Southdown ⅜ Merino....	Annual average 9/16 Merino 4/16 Shropshire 3/16 Southd'wn	Annual average ¼ Merino ½ Shropshire ¼ Southdown	Annual per cent. of lambs
			Lb	Cts.	$	Lbs.	Lb	Lb	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
1874-75	367	245	4.60	23⅜	1 22	16⅜	....	4.60	......	......	......	......	......	......	......	60
1875-76	357	409	5.49	16.2	78	16.4	20	4.48	7.86	......	......	......	......	......	......	84
1876-77	366	519	6.19	23.5	1 28	17.4	76	4.49	7.57	......	......	......	......	......	......	97
1877-78	365	628	7.11	20	1 22	17	112	4.50	7.81	11.22	......	......	......	......	......	70
1878-79	366	514	8.67	21.4	1 73	19.2	168	....	7.86	10.36	......	......	......	......	......	90
1879-80	366	635	7.99	25.6	1 86	16.5	228	....	6.61	8.78	11.06	......	......	......	......	88
1880-81	373	551	8.74	26.4	2 04	15	115	....	6.31	9.12	8.75	......	......	......	......	75
1881-82	355	559	8.14	21.1	1 38	14	53	....	5.81	8.52	9.44	10.70	......	......	......	55
1882-83	375	584	8.92	19 13/16	1 48	*13	....	....	6.75	8.88	10.05	10.97	9.14	......	......	90
1883-84	356	711	8.02	17 9/16	1 10	*14.1	....	....	5.72	8.22	......	......	8.27	9.44	8.63	80

* 7 Grade, 1 Merino.

The results here exhibited show the valuable influence of the Merino blood in increasing the weight of fleece in the down races, and it is believed that this system of crossing so intelligently carried out must produce eventually a race capable of producing at the same time large fleeces of good wool for the factory and large carcasses of good mutton for the shambles.

Again, an opportunity was afforded us to make comparison of the wools of the Negretti and the Saxon types, and of these wools with those from American Merinos. These foreign wools were represented by a lot of samples secured from a flock of Negrette sheep just imported to this country, and another lot of samples sent over by Herr Otto Steiger, a noted breeder of Saxon sheep.

It would be impossible here to enter into the details of the results obtained in these three branches of investigation, and we must be content with presenting only the conclusions arrived at from their consideration.

With regard to the Merino wools from different sections of the United States, then, we find:

1. Different fibres in any given sample may vary in diameter throughout their length from 5 to 15 per cent. of the average.

2. Fineness in American Merino wools may vary from 1 centimillimetre ($\frac{1}{2539}$ inch) to 4 centimillimetres ($\frac{1}{634}$ inch).

3. This variation as represented in the extremes is not affected either by the sex of the animal nor by the section. The average of the maxima will reach about 3.3 centimillimetres, and the minima about 1.2 for the American Merino wools generally,

4. The ultimate resistance of individual wool fibres of course depends greatly upon the diameter. But it appears that this will vary from a minimum of 1.5 grammes (say 23 grains) to a maximum of 15 grammes (230 grains).

5. The stretch the fibres will suffer previous to rupture also varies widely, from about 5 per cent., the length tested, to as high as 60 per cent.

6. There seems to be no special relation between the extremes for strain and stretch and the section in which the wool is grown, or the sex and age of the animal producing it. It must in all cases be referred to the individual.

7. With regard to the relation between the crimp of the fibre and the fineness, history repeats itself in this series, and while there is some connection between the two, and the averages of large numbers of samples show that the finer wools have as a rule the closer crimp, the indication is exceedingly unreliable from sample to sample.

8. Age seems to have an influence upon the fineness of the fibre. After the age of one year the wool appears to grow coarser with increase of years.

9. The total stretch the fibre is capable of sustaining previous to rupture seems to increase with advance of age, but the data are not fully definite with this regard.

10. Age has no perceptible influence upon either the ultimate resistance or the modulus of elasticity of the fibre.

11. In the averages of fineness the results are somewhat higher as a rule for the rams wool than for the ewes wool, showing the former to be the coarser.

12. If we arrange the sections represented with reference to the average fineness for all sexes and ages from lowest diameter to highest, they stand as follows:

	Average fineness in centi-millimetres.
Pennsylvania	1.687
Vermont	1.773
Texas	1.837
California	1.916
Illinois	1.926
Wisconsin	1.941
New York	2.034
Minnesota	2.042

13. If they be arranged with relation to fineness of both rams and ewes two years old, they will stand respectively:

	Rams. Average fineness in centimillimetr's		Ewes. Average fineness in centimillimetr's
Pennsylvania	1.48	Texas	1.75
California	1.821	Vermont	1.878
Illinois	1.92	California	1.897
Texas	1.933	Illinois	1.898
New York	1.955	Wisconsin	1.904
Vermont	2.06	Pennsylvania	1.91
Minnesota	2.079	Minnesota	2.005
Wisconsin	2.219	New York	2.098

14. If the sections be arranged with reference to the average fineness for both sexes two years old, they will stand in the following order from finest to coarsest:

	Average fineness in centimillimetres.
Pennsylvania	1.711
Texas	1.837
California	1.883
Illinois	1.902
Vermont	1.979
New York	2.034
Minnesota	2.042
Wisconsin	2.048

15. The influence of density of the fleece upon all qualities is illustrated in the following table:

	Fineness—centimillimetres	Fineness—Th'sandths of inch	Strain grammes	Stretch—pr cent	$\frac{D^2 \times S}{D^2}$	$18109 \frac{S}{D^2}$	$E=\frac{R}{P}$
Rams—							
Dense fleece	2.151	0.846	5.473	39.74	18.926	24421	72027
Open fleece	1.916	0.7543	4.378	42.965	19.086	21802	50280
Ewes—							
Dense fleece	2.119	0.8342	5.113	40.04	18.219	20621	50329
Open fleece	1.974	0.7771	4.581	37.345	18.81	21289	56999

This table shows:

a. That the finer fibre is found in the loose fleece both in ram's wool and ewe's wool.

b. That there is practically little difference in the ultimate tenacity of the fibre in the two kinds of fleeces, the tendency to the greater strength being in favor of the loose fleece.

c. The modulus of elasticity and hence the ultimate value of the wool is greater in the dense fleece than in the open. fleece for ewe's wool, and *vice versa* for ram's wool.

d. The question of the influence of the density of the fleece upon the quality of the wool cannot be considered as fully settled by these results, but the tendency is strongly in favor of the open fleece.

16. Any special relation between the sex and the ultimate seems doubtful. In Vermont, Minnesota, Illinois and Texas, the ewe's wool is stronger, while in New York, Pennsylvania, Wisconsin and California the ram's wool takes precedence with this regard.

17. There appears to be a tendency to higher modulus of elasticity and consequently a higher ultimate value in ram's wool than in ewe's wool.

18. If we compare the moduli of elasticity of the wools of rams and ewes two years old for the several sections, we find them to range as follows from highest to lowest:

	Rams. Modulus of elasticity.		Ewes. Modulus of elasticity.
Illinois	97962	Illinois	89998
Texas	93169	Texas	87677
Minnesota	70330	Vermont	86249
Vermont	68799	Minnesota	83690
California	67384	Pennsylvania	66226
Pennsylvania	64120	Wisconsin	66036
New York	58263	California	61520
Wisconsin	50361	New York	53936

19. If we compare the averages of the moduli of elasticity for both sexes two years old, we find the sections to stand in the following order:

	Modulus of elasticity.		Modulus of elasticity.
Illinois	91657	Pennsylvania	65275
Texas	90292	California	62600
Minnesota	77010	Wisconsin	58834
Vermont	74782	New York	55875

20. If we compare the average of the moduli of elasticity for all ages and sexes for the several sections, we find them to stand in the following order from highest to lowest:

	Modulus of elasticity.		Modulus of elasticity.
Illinois	91751	Pennsylvania	63795
Texas	90292	California	61972
Minnesota	77010	New York	55875
Vermont	70587	Wisconsin	48446

With regard to the cross-bred wools of Messrs. Baechtel Brothers, of California, the following, among other conclusions, have been deduced from the results:

1. The extremes of fineness vary from 1 centimillimetre ($\frac{1}{2539}$ inch) to 5 centimillimetres ($\frac{1}{508}$ inch).

2. There is an apparent variation in the diameter of the same fibre of from 15 to 20 per cent. the average diameter.

3. There is great irregularity in the numbers occurring above and below the average of fineness, while a predominance of tests below the average frequently occurs.

4. We find in this series an exceptionally high extreme of stretch reaching 85 per cent. the length tested, while the minimum falls as low as 10 per cent. and even 5 per cent. the length tested.

5. In the averages of fineness for the several classes we find less variation than might be expected. Until the Merino blood falls as low as ½ no influence of cross upon the fineness is discernible. And in no case does the variation in the average of fineness appear greater than might occur in animals of pure blood, until the Merino blood is reduced from ¼ to ⅜.

6. With an increase of Shropshire blood there is a regular increase in the diameter of the fibre.

7. As might be expected, a comparatively wide margin occurs in the figures for all qualities, but all are, as a rule, high.

8. The average tensile resistance will vary from 15,000 to as high as 45,000 pounds per square inch of section, and the modulus of elasticity from 35,000 to 125,000. If we compare the general average as regards fineness, ultimate tensile resistance and moduli of elasticity, the grades stand as follows:

	Fineness centimillimetres.	Ultimate resistance pounds per square inch.	Modulus of elasticity.
Pure Merino	2.039	23289	76232
15/16 Merino, 1/16 Southdown	1.695	26032	77706
⅞ Merino, ⅓ Southdown	1.929	22997	100335
¾ Merino, ¼ Southdown	1.923	24911	61600
½ Merino, ½ Southdown	2.394	24051	58718
Shropshiredown	3.60	23938	59606
9/16 Merino, 4/16 Shropshire, 3/16 Southdown	2.122	22919	60441
⅜ Merino, 4/8 Shropshire, ⅛ Southdown	2.437	29774	74495
2/8 Merino, 4/8 Shropshire, 2/8 Southdown	2.358	22938	62500

9. If we compare this table with that of Messrs. Baechtel Brothers, we find that the highest value, as represented in the modulus of elasticity, corresponds with the highest net return for each animal.

10. The variations here noted are no greater than might occur from individual to individual.

11. For the production of medium wools the grade animals here described will yield as good a product as animals of pure blood.

12. These results, taken in connection with the similarity of structure of the fibres in the several breeds shown elsewhere, indicate the possibility of profitable results in the crosses between the down breeds and the Merinos.

13. If we arrange the moduli of elasticity in order from highest to lowest, we find the grade wools stand in the following order:

	Modulus of elasticity.
7/8 Merino, 1/8 Southdown.	100335
15/16 Merino, 1/16 Southdown.	77706
3/8 Merino, 4/8 Shropshire, 1/8 Southdown	74495
2/8 Merino, 4/8 Shropshire, 1/8 Southdown	62500
3/4 Merino, 1/4 Southdown.	61600
9/16 Merino, 4/16 Southdown, 3/16 Southdown	60441
1/2 Merino, 1/2 Southdown.	58718

14. If we arrange the fineness from lowest average diameter in centimillimetres to highest, the several grades assume the following order:

$\frac{3}{4}$ Merino, $\frac{1}{4}$ Southdown.
$\frac{7}{8}$ Merino, $\frac{1}{8}$ Southdown.
$\frac{15}{16}$ Merino, $\frac{1}{16}$ Southdown.
$\frac{9}{16}$ Merino, $\frac{3}{16}$ Southdown, $\frac{4}{16}$ Shropshire.
$\frac{2}{8}$ Merino, $\frac{4}{8}$ Shropshire, $\frac{2}{8}$ Southdown.
$\frac{1}{2}$ Merino, $\frac{1}{2}$ Southdown.
$\frac{3}{8}$ Merino, $\frac{4}{16}$ Shropshire, $\frac{1}{8}$ Southdown.

Other conclusions may doubtless be drawn from these figures. Our object has been principally to simply develop here the true value of the material represented, leaving to others the matter of the practical application of the results; but we believe they offer very much of encouragement to those especially interested in the combination of mutton production with the production of moderately fine wool. Here is simply a beginning of what should be done. The variations in the ultimate value of the staple by the infusion of coarser wooled blood and even in the fineness, is so slight as to appear almost insignificant. The first cross appears to have a marked influence upon the quality of the fibre, but the later crosses appear to produce very nearly an equilibrium with this regard.

Consideration of the results of the tests of German wools developed the following conclusions:

1. In the Negretti wools there appears to be a decrease in diameter of the fibre, from the skin outward.

2. This variation is quite irregular, but may be as great as 20 per cent. of the entire diameter.

3. The larger number of the measurements appear to be below the average.

4. The Saxony wools appear to be finest at about the middle of their length, the variation being about the same as stated for Negretti wool.

5. In the Saxony wools the measurements above and below the average are about equally divided.

6. In the Negretti wools the actual strain varies from an extreme minimum of 1 gramme, (15.435 grains) to an extreme maximum of 11.50 grammes, (117.49 grains).

7. The averages of the extremes of fineness in Negretti wools, vary from a maximum of 2.695 centimillimetres ($\frac{1}{942}$ inch) to a minimum of 1.087 centimillimetres ($\frac{1}{1642}$ inch). The averages vary from a maximum of 2.02 centimillimetres ($\frac{1}{1257}$ inch) to a minimum of 1.546 centimillimetres ($\frac{1}{1642}$ inch). The absolute extremes vary from a maximum of 3.25 centimillimetres ($\frac{1}{781}$ inch) to 0.875 centimillimetres ($\frac{1}{2900}$ inch).

8. In the Saxony wools, the absolute extremes of fineness range from 1.00 centimillimetres ($\frac{1}{2539}$ inch) to 3.375 centimillimetres ($\frac{1}{726}$ inch). The average extremes from 1.208 centimillimetres ($\frac{1}{1202}$ inch) to 2.847 centimillimetres ($\frac{1}{892}$ inch) while the general average is 1.854 centimillitres ($\frac{1}{1369}$ inch).

9. The stretch in Negretti wool varies from extremes of 5 to 40 per cent. the length tested, their averages being 7 to 30 per cent., the general average being 22 per cent. In the Saxony wool absolute extremes of stretch vary from 10 to 58 per cent. the length tested, the average extremes from 27 to 53, while the general average amounts to 40 per cent.

10. The ultimate resistance of Negretti wools varies from say 15,000 pounds per square inch to 32,000 pounds per square inch, with an average of 23,579. The averages of moduli of elasticity vary from 67,038 to 167,367, with a general average of 84,917.

11. The average ultimate resistance of the Saxony wools varies from 17,000 to 41,000 pounds per square inch of cross section, with a general average of 23,225 pounds. The averages of moduli of elasticity vary from 45,000 to 111,000, with a general average of 57,000.

12. Hence it appears that the Negretti wools, both as regards fineness and ultimate strength, are more valuable than the Saxony wools.

13. It also appears that they are, with one exception, finer than the Merino wools from the several sections of this country represented in the investigation here described. And as regards ultimate strength represented in modulus of elasticity, if entered in our tables of comparisons they would occupy the third place. If the Saxony wools were likewise entered in our comparison they would occupy the seventh place.

These are some of the conclusions to be drawn from the results of our extended study of wools of the United States. Many relations still remain to be developed, not only from these results, but from further experiment and investigation. The field entered upon was comparatively new, and there still remains much to be studied that will yield facts of the greatest scientific and practical value. In the results presented here, and in the detailed report already referred to, both breeders and manufacturers must be able to discover relations that naturally escape the investigator. In the ultimate resistance and moduli of elasticity taken by themselves or in connection with the fineness, they have almost absolute standards of value. If these methods and the standards obtained by means of them were extended to actual working processes and material, manufacturers and breeders alike have nearly perfect means for the comparison of their products and exact determination of differences upon which important questions may turn. Control of the products of the woolen industry by this means may become as ready as control in the industry of iron and steel is by chemical analysis, and I firmly believe that its application by breeders of standard flocks, at least in making selections of breeding animals, will do much to improve the quality of our fine wools.

THE FOREST-TREE PLANTATION.

By T. J. Burrill, Ph. D., *Professor of Botany and Horticulture.*

The experimental fruit-tree plantation of the University was begun in the spring of 1871, since which time additional plantings have been made from time to time. It is located upon the east end of what is known as the Experimental Farm, and at present comprises — acres. The land was originally prairie, but had been under cultivation for thirty or more years, mostly in corn. A part, however, had been too wet for tillage, and was used for pasture or meadow. Through this portion, before the trees were set, an open ditch was dug, which rendered the ground sufficiently dry for planting. The soil is the black loam common to the prairies of Central Illinois, but varies in different parts a good deal as to richness. On the highest portions, the wash of many years and the continual cropping without fertilization in any way had left the soil so poor that the common farm crops failed to be remunerative; while parts of the lower situations have a deep vegetable loam overlying tenaceous clay. In no case, however, has manure been applied—probably never had been applied—to any portion of the land upon which the plantation exists. As far as practicable, advantage was taken of this diversity of soil and location in planting, so as to suit the requirements of the several kinds of trees. The area is one hundred rods long from north to south and ——— rods wide. The rows of trees run the long way of the land. An east and west roadway divides the plantation into two equal portions. The kinds of trees originally selected were such as were esteemed of special value or importance, but owing to various causes the list as first made has not been completely filled, while a few other kinds have been added. The following species of trees now exist in the plantation:

1. Abies Picea excelsa .... Norway Spruce
2. Acer dasycarpum .... Soft Maple
3. Acer saccharinum .... Sugar Maple
4. Ailanthus glandulosa .... Ailanthus
5. Carya alba .... Small-fruited Shellbark Hickory
6. Carya sulcata .... Large-fruited Shellbark Hickory
7. Castanea vesca .... Chestnut
8. Catalpa bignonioides .... Southern Catalpa
9. Catalpa speciosa .... Hardy Catalpa
10. Fraxinus viridis .... Green Ash
11. Gleditschia triacanthos .... Honey Locust
12. Juglans nigra .... Black Walnut
13. Juglans cinerea .... Butternut
14. Juniperus Virginiana .... Red Cedar
15. Larix Europæa .... European Larch
16. Maclura aurantica .... Osage Orange
17. Negundo aceroides .... Box Elder
18. Pinus strobus .... White Pine

19.	Pinus Austriaca	Austrian Pine
20.	Pinus sylvestris	Scotch Pine
21.	Pyrus malus	Orchard Apple
22.	Quercus macrocarpa	Burr Oak
23.	Salix alba	White Willow
24.	Tilia Americana	Bass Wood
25.	Ulmus Americana	White Elm

The first official act in the establishment of this experiment was the report of the Committee on Horticulture to the Board of Trustees, November 18, 1868. This committee consisted of Burden Pullen, Samuel Edwards, O. B. Galusha, M. L. Dunlap and W. C. Flagg. The following is taken from the report:

The great feature of these horticultural grounds, and what is of paramount importance at this time to the whole people of the State, is the planting of forest trees for useful purposes. It is a new demand upon their industry and upon their lands, from which they cannot fail to reap the most valuable results.

The new condition of things created by railroads and improved agricultural implements present new industries, both to the cultivators of the soil and to the mechanic, in which they have a mutual interest. The forests are repidly disappearing, or at least those useful trees that have a commercial value, and yet many of the new demands have not been met nor is the old supply likely to hold out. But if the forests of Michigan, Wisconsin, Minnesota and Indiana were adequate to the demand, as a matter of economy in freights, if not in the superior quality of our second growth timber, especially of the deciduous varieties, it is an object to grow them at home rather than to buy them.

Timber for railroad ties, culverts, cars. roadways and buildings, fencing, vineyard stakes. hop poles, stanchions for coal banks, soft wood, like white willow and the poplars for berry boxes, crates and staves. hoop poles. carriage and wagon material, agricultural implements and the multiform wants of the age, make up a demand of most surprising magnitude. that will add to our rural industry and importance that the most sanguine have not heretofore dreamed of.

If we look at this as simply the demand of agriculture, it must be conceded that it is legitimate and ought to be granted without an objection; but we have added to this the claim of the mechanic, who is also largely interested, for it will enable him to compete with those of other States in the supply that commerce demands.

The State that sells the raw products of its soil is never rich, while the States that manufacture for others do well; those that grow the raw material and manufacture it at home are the most prosperous. No doubt the State of Illinois had these facts in view when it established this great school of the industries for the especial benefit of those two classes who create the wealth of the State.

There are in this State about eighty species of forest trees, besides the larger shrubs. With the exception of the oaks. yellow poplar and hickory, we have not drawn largely from our native forests. and to-day we purchase nearly all of our timber. Nearly all of the ash timber used for agricultural implements, a part of our fence posts and a portion of our railroad ties come from other States. Added to these is the greater part of the material for our wagons and carriages, when not wholly manufactured in other States; timber for railroad cars and hardwood lumber for many other useful purposes, that ought to be grown near the place of manufacture.

To bring these useful trees within the bounds of culture and to utilize them is one of the objects of this industrial institution. To teach the people of the State how to add these products of the forest to their other crops, and thus add millions of dollars annually to the wealth of the State, to give labor a wider range and a more comprehensive field for its employment. are objects worthy of such an institution.

Thousands of acres of timber can be planted in shelter belts, to check the winds that come down from the north, with its polar cold, destroying the plants that the genial summer. fanned with the breath of the tropics, has made to flourish on our open plains. Wall in these prairies of central and northern Illinois with belts of conifers and deciduous trees, and we shall have one of the best of climates, genial and equable; and with the best soil in the Union, with a geographical position midway between the two oceans, over which must pass a large part of the commerce of the world, if we are not laggards in the world's progress we may reap from such surroundings a rich reward.

The committee have divided these thirty species of useful forest trees into three classes, according to their supposed value for the demands of commerce and for domestic use. In the first class they include the European Larch, Austrian Pine and Norway Spruce, native trees of Europe, and the Osage Orange, native of the Southwestern States. In the second and third class White Willow, a native of Europe; Black Spruce and Norway Pine, natives of the more Northern States. Thus making up the list with four European, three of other States, and twenty-three species from the forests of Illinois.

Our other native trees of minor importance will find a place in the arboretum, where those of other sections of this continent and of Europe may be tested side by side. It is probable that among them may be found many of value.

FIRST CLASS.

European Larch, Osage Orange, White Pine, White Ash, Austrian Pine, Green Ash, Arborvitæ, Blue Ash, Red Cedar, Norway Spruce.

SECOND CLASS.

White Sugar Maple, Black Sugar Maple, American Chestnut, Shellbark Hickory, Cucumber, Norway Pine, Silver Leaf Maple, Tulip, White Willow, Black Walnut.

THIRD CLASS.

Red Maple, White Elm, Red Elm, Butternut, Catalpa, Hemlock, Basswood, White Oak, Black Spruce, Burr Oak.

The White Pine, Austrian Pine, Norway Spruce and Hemlock to be planted eight by eight feet: all others four by four feet. The former requiring six hundred and eighty trees to the acre, and the latter two thousand, seven hundred and twenty. The above distances to be varied to some extent by way of experiment, to ascertain, by actual trial, the most proper distances for the planting of the several species."

In accordance with this report an appropriation was asked from and granted by the State legislature, from which $1,000 was set apart, March 11th, 1869, for trees and seeds, and W. F. Bliss, Professor of Agriculture, (there being at the time no professor of horticulture,) was authorized to make the purchases. H. K. Vickroy, having been employed as Orchardist and Gardener, assisted in the selection of the young trees, and afterwards, until March, 1874, had the direct superintendence of the forest-tree work. Since March, 1870, the general management of the experiment has been in the charge of T. J. Burrill, as Professor of Horticulture.

Most of the trees were purchased as seedlings, one to three years old, of various nurserymen, and were placed in nursery for about two years. The Larch were planted directly in their forest when one year old, and the first Chestnuts at two years, the Catalpa, Butternut, Black Walnut and Burr Oak were grown in nursery from seed, the White Willow from cutting, while the Box Elder, Chestnut second planting, and the two Hickories were planted as seed directly in the forest. In this latter way were also planted White Oak and Pecans, both of which failed—the former mainly from the depredations of rabbits and mice digging and eating the acorns, the latter by being plowed up by a careless employé. These have not been replanted. The Ailanthus, Honey Locust and Linden were transferred from the nursery about six to eight feet high, and the Apple when four or five years from the root-graft. All of the early planting was done in rows four feet apart, and with the exception of Scotch and Austrian Pine, two feet in the row. At this time it was strongly argued that the trees would make a better upright growth if planted very close, and that the trimmings from time to time would be a source of profit. The later plantings, however, were made in rows eight feet apart, and the trees usually four feet apart. The method of planting for all small trees was as follows:

The ground being put in good condition by plowing, harrowing, and the use of a plank "clod-crusher," a line was stretched the length of the proposed row, when by walking upon the line a straight mark was made, sufficiently distinct for the purpose, after the line itself was removed. Two men went together, one with a spade or shovel, the other with an armfull or basketfull of seedling trees. Guided by the line-mark the former raised a shovelfull of earth, the latter put into position a young tree; the earth held upon the shovel for the purpose was now thrown on the roots, and was tramped down by the man carrying the trees. In this expeditious way the work was well done, and at comparatively little cost. The planting of the larger trees was necessarily attended with much more labor, in excavating a sufficiently large and deep hole, in digging and distributing the trees, and in more carefully filling around the roots, while the result with the small stock ordinarily proved more satisfactory.

The seeds of the Box Elder, Oaks, Chestnut and Hickories mentioned above, were planted in the autumn as soon as gathered; otherwise the planting was all done in the springtime, and intentionally as early as possible. As stated, the Chestnuts and acorns were destroyed by rabbits and mice; otherwise the fall-planted seeds did excellently well. The young trees were cultivated during several summers, usually about five, just as corn is worked. While the trees were small enough, two-horse corn cultivators were used, after which one-horse double-shovel plows. For the first two seasons the rows were also hoed out about twice each year. Some of the later plantings were not so well cultivated, with sufficient indications of the fact in the less satisfactory results.

As soon as the trees shaded the ground, so as to keep down an injurious growth of weeds, cultivation was discontinued, after which very little expense was involved in the management of the plantation.

From time to time the rows were thinned so that the remaining trees stood four to six or eight feet apart, and after about seven years alternate rows were moved. The remaining rows were further thinned in some cases as required. Some of the trees have been trimmed up—the lower branches being cut away so as to leave a clean trunk several feet high; but by far the greater number have been left for the natural trimming which always takes place upon thickly grown trees.

In the spring of 1869 there were purchased 3,000 seedlings of Green Ash, and special pains were taken by the committee to secure another lot of White Ash. The search for reliable seedlings of the latter caused a delay of one year, when 20,000 seedlings, believed to be of this species (*Fraximus Americana*), were secured.

It certainly requires the knowledge and acuteness of an expert to reliably identify this species in the seedling state, though the seeds themselves and the matured trees are quite readily recognized. Without an attempt here to trace the responsibility of the matter, the facts are that these latter seedlings were Green Ash (!) though named in the reports for several years as White Ash. It may be well to state also that after the discovery just stated was made, an attempt followed to get genuine White Ash seed (with the trouble experienced related); an order was made to one of the best nurserymen in the country for a sufficient amount of seed to furnish the required seedlings for the forest-tree plantation. This seed upon arrival was pronounced Green Ash again, but the dealer being confident to the contrary, some of it was planted and Green Ash seedlings appeared. Once more true White Ash seed was gathered, but for some reason, probably because allowed to become too dry, only a small proportion germinated. No White Ash has yet been planted in the forest. The mistake here made is a very common one in the country generally, and is productive, as in this case, of serious consequences. It is the more lamentable because of the easy identification of the seed of the several species of Ash; no nurseryman need blunder in planting.

In a similar way 10,000 seedlings of "black" Sugar Maple (*Acer nigrum*) were purchased of one nurseryman and a like quantity of "white" Sugar Maple (*Acer Saccharinum*) of another. Both proved to be the latter. In this case, however, the distinctions are not so pronounced and the disappointment accordingly less severe. Botanists now usually make the former a variety only of the latter, the recognized difference not being deemed sufficient for specific distinction. Furthermore there is little recognized difference in the trees for timber purposes.

When this plantation was commenced, attention had not been called to the fact that there were two kinds of Catalpa, differing from each other in very important particulars for the purpose of timber-growing as well as other uses. Whether what is now known as the hardy Catalpa shall be recognized as a distinct species (*C. speciosa*, Warder), or not, the difference between this and the typical *Catalpa bignonioides* is immense in all matters of practical value. Unfortunately the latter were used in our first planting. Indeed, the true western type of this tree, indigenous in the Mississippi Valley, though so much better than the eastern variety, was rarely seen in cultivation even in western localities until within six or eight years. We now know that the two kinds are easily distinguishable, and as the seeds are sufficiently unlike, no further mistake should be made. As the records will show the two kinds give very different results in the plantation.

In this connection mention should be made of the difference in *varieties* of many species of timber trees and of the capital importance of attention to these differences in selections for practical arboriculture. The White Elm (*Ulmus Americana*) varies so much that woodsmen have several special names for the kinds, some of which are very valuable for certain uses, while others are worthless. The same may be said of Box Elder, Tulip i. sp. Poplar (*Liriodendron tulipifera*) and Cottonwood. Some differences are due to soil and situation (a thing also worthy of study), but the seed from certain trees gives very different stock from that from certain other trees of the same species; sometimes the varieties grow mixed together in the same region of country, sometimes the distinctions are seen only in trees geographically separated. The so-called Yellow Cottonwood of the Mississippi Valley, the wood of which is readily split and worked, is specifically identical with the almost worthless common Cottonwood (*Populus Monilinoides*) of our part of the country.

As a further contribution to the history of the plantation, extracts from some of the annual reports are here appended together with tables taken from the same. It is interesting to note the estimation placed upon the results at the times reported:

Forest Record for 1871.

Name of Trees.	No. acr's.	No. of trees.	Age of trees when plant'd	Cost of trees.	Cost of plant,g	Cost of culti-vation.	Dis-tance plant'd	Per cent living.	Ave'g gro'th in feet and inches.	Total cost—so far.
Ash, green	¼	1,360	3 yrs.	$27 20	$6 95	$6 19	2x4	.98	.6	$40 34
Ash, white	2¾	14,974	2	149 74	35 63	4 79	2x4	.95	.6	190 16
Catalpa	¼	1,361	2	21 77	4 17	2 53	2x4	100	1	28 47
Chestnut	¼	1,361	2	30 00	6 79	3 95	2x4	.50	.6	40 74
Elm, white	⅛	860	2	4 76	3 95	3 43	2x4	100	1	12 14
Larch, European	2	10,890	1	98 01	21 20	8 50	2x4	.25	.6	127 71
Maple, white.....	⅛	680	3	8 16	6 17	3 89	2x4	.98	1	18 22
Osage Orange...	¼	1,361	2	5 44	4 78	1 30	2x4	.98	2	11 52
Pine, Austrian...	¼	680	9to12 in	30 00	4 40	2 94	4x4	.2	....	37 34
Pine, Scotch	¼	680	1 to 2 ft	30 00	4 25	3 04	4x4	.2	....	37 29
Walnut, white....	¼	1,361	2 yrs.	20 40	3 43	85	2x4	.99	.6	24 98
Willow, white....	¼	1,361	1	8 00	4 67	1 42	2x4	.98	2	14 09
Totals.........	7	36,749	....	$433 48	$106 59	$42 83	....	....	....	583 00

All the above trees looked fine the first part of the season, but during the after part the White Grub (the larvæ of the May Beetle) almost destroyed some of the varieties. They worked mostly on the European Larch and White Ash; in some instances girdling the roots entirely, from one and a half inches below the surface. several inches down; and owing to the season being so dry. the trees could not repair the injury. White Ash two feet high were girdled in the same manner. In the case of the Austrian and Scotch Pines we attribute losing so many mostly to the dryness of the season. The Scotch Pine were never transplanted before, which we think was one cause of so many dying. Chestnuts were injured somewhat by the grub."

Forest Record for 1872.

Names of Species.	When planted...	No. trees...	Age when planted...	Cost trees.....	Cost planting...	Cost of cultivation..	Distance planted.	Per cent. living....	Average growth....	Cost for 1872......	Total cost...
Ash, Green....	1871	......	....	....	......	$2 52	2x4	98	2½ ft.	$2 52	$42 87
Ash, White....	"	......	....	....	......	18 52	2x4	93	3 ft.	18 51	208 69
Catalpa.........	"	......	....	....	......	5 12	2x4	100	4 ft.	5 12	33 59
Chestnut	"	......	....	....	......	75	2x4	4	3 ft.	75	41 59
Elm, White ...	"	......	....	....	......	2 37	2x4	100	3½ ft.	2 37	14 57
Larch, European	Re-pl. '72	4,000	1 year	$30 00	$6 90	30 32	2x4	30	2 ft.	67 22	194 44
Maple, White .	1871	......	....	....	......	72	2x4	98	4 ft.	72	18 95
Osage Orange.	"	......	....	....	......	4 97	2x4	98	5½ ft.	4 97	16 49
Pine, Australian...........	Re-pl. '72	1,000	9 to 12 in..	25 00	6 40	6 82	4x4	30	4 in.	38 22	75 56
Pine, Scotch ..	"	1,000	12 to 15 in..	20 00	3 70	4 20	4x4	20	4 in.	27 90	65 19
Walnut, White	1871	......	....	....	......	5 60	2x4	99	2 ft.	5 60	30 58
Willow, White	"	......	....	....	......	5 67	2x4	98	4 ft'	5 67	19 76
Pine, White...	1872	2,722	12 to 15 in..	122 49	9 85	12 00	4x4	30	3 in.	144 34	144 34
Spruce, Norway..........	"	1,360	"	29 94	7 45	10 12	2x4	98	3 in.	47 51	47 51
		10,083	....	$227 43	$34 30	$109 70	....	....	......	$371 40	$958 13

Forest Tree Record for 1875 and 1876.

	1875.						Acres.	1876.						
Varieties.	Height.		Growth.		Diameter.	Cost.		Height.		Growth.		Diameter.	Cost.	Cost from beginning.
	Ft.	In.	Ft.	In.	In.			Ft.	In.	Ft.	In.			
Norway Spruce	2	8		8		$2 55	¼	4	3	1	6			
White Pine	2	8		11		5 95	1	4		2		1¼	$1 75	$66 31
Austrian Pine	2	8	1	2		2 55	¼	4	8	1	6	2	5 75	362 79
Scotch Pine	3	8	1	2		2 55	¼	5		1	8	2	1 80	99 76
White Ash	11	10	3	2	1 3/5	6 50	2¾	15	8	3	4	1 3/5	1 80	77 39
Green Ash	15		2	8	1 9/10	00 00	¼	17	6	3		1 9/10	5 40	253 46
Catalpa	12		2	6	2	1 15	¼	16		4		2¼	80	46 69
American Elm	12		3		2	50	⅛	13	6	2		2	80	39 09
European Larch	8		3	4	1 2/5	3 50	2	10		3	4	1¾	50	18 10
Osage Orange	10	6	3		1¼	1 25	¼	13	6	4		1½	21 80	246 24
Butternut	8	6	3			1 05	¼	10	6	1		1½	1 25	21 96
Black Walnut	9	2	2	9	1¾	1 05	¼	12		2	6	2	5 50	43 06
White Willow	12	7	3	7	1 3/5	3 50	¼	20		6		2	10 60	18 14
Soft Maple	17	8	1	9	2⅓	55	⅛	21		4	6	2¾	6 20	38 16
Sugar Maple	'3			7		4 25	¼						45	25 42
Chestnut	All	de	ad										3 75	40 86
Box Elder	15	7	3	6	3⅜	But	few	tr	ees.					41 59
Apple – Planting														
Apple – Cultivating							⅛	7	6	1		¾	25 20	
													1 75	26 95
Total cost						$36 90							$95 10	
Tot'l c'st fr'm b'g'ng														$1466 97

"The foregoing table shows the average height and size of the trees in this plantation' the growth during the summers of 1875 and 1876, and the cost of cultivation, together with the total cost of each kind and the whole plantation from the commencement. With the exception of the Chestnut, all the kinds planted are now represented by nearly their full numbers except as removed by thinning, and all are in a healthy, vigorous condition. In 1875 a peculiar blight affected the young leaves and shoots of the Sugar Maple, but its cause was not ascertained. It has not appeared this year, and the trees have recovered. A fungus leaf parasite has made its appearance upon the Silver-leaf Maple, forming black shining patches or scabs sometimes an inch across and often several of them upon a leaf. It does not appear to be very destructive, but evidently reduces the thriftiness of the tree. The disease is by no means new elsewhere, being widely disseminated east and west, but not found, to my knowledge, in this vicinity before. No remedy is known to me except the (all but impracticable) one of gathering the fallen leaves and burning. From the nature of the parasite, this must be a specific where possible to make use of it. The scientific name of the fungus is *Rhytisma acerinum*, Fr. The plantation has been remarkably free from insect depredations. Several leaf eating caterpillars have worked upon the elms and walnuts, but not so as to do serious damage. The larva of a butterfly (*Grapta interrogationis*) has defoliated very injuriously the Elm trees planted singly, as along streets and on the ornamental grounds, and a sphinx larva in like manner the Ash, but upon trees in masses they do not appear to work much.

The only addition made since the last report is a quarter of an acre of Apple, planted four by four feet. I recommend the addition of Box Elder and Honey Locust, the plants to plants to be grown from seed, which can be obtained at little or no cost. The measurements of a few Box Elder are given in the table for 1875. They were planted by chance with the White Ash and were then of the same age and size of the latter; but at the date given the average height of the Box Elder was 15 feet 7 inches, against 11 feet 10 inches for the Ash, and the diameter of trunk one foot from the ground, 3⅜ to 1 3/5 inches.

By the showing of the table, the Willow is now making the most rapid growth, having gained in average height six feet in 1876. Next comes in order the Soft Maple (*Acer dasy. carprun*), four feet six inches; the Catalpa and Osage Orange, each four feet, and the White Ash and European Larch, each three feet four inches. The two first do not furnish very valuable timber, while that of the four following are very useful. From the most reliable information, we know that the wood of both the Osage and the Catalpa is almost proof against decay—the dead logs in their native places lie for ages upon the damp ground, hard and sound, while generations of human beings come and go—a log of Catalpa certainly known to have lain upon the earth in the wet woods of Pulaski county, Ill., during the whole century of our republic, was sawed into boards, and one of them, perfectly sound and receiving a high polish, helped form the collection sent by this University to Philadelphia; a piece cut from the plantation, nearly four inches in diameter, also went with the collection. This was from seed sown in 1869. The Osage Orange wood, perhaps, is still more valuable, while that of the Ash and Larch is highly esteemed. Upon very extended inquiry during the last winter, in connection with the centennial wood collection, it was found that the price of wood as fuel had not increased during the last ten years in our State, and that in more than half of the timbered regions the growth was estimated to be fully equal to the destruction. With our immense supplies of coal, it is doubtful if wood can, for many years to come, be profitably grown for fuel: but the finer and better varieties of trees, such as are named above, may yield a handsome profit, while natural forests are burned to clear the ground.

The Coniferæ, as indicated by the figures, are growing rapidly—the White Pine being first for the last year; the Scotch and Austrian for the year before. The growth of these trees should not be compared with that of the deciduous leafed ones, because of the natural slowness of their growth when young. In after years they will overtake their present rivals. The proportionately great expense of the Larch, Walnut and Butternut for 1876 is due to extra work, pruning and transplanting."

AILANTHUS, (*Ailanthus glandulosa.*)

These trees were grown from seed in nursery, and when two years old transferred to the forest, in 1881. They made a very rapid growth from the beginning, probably surpassing all other kinds in this respect. In four years' time a height of about sixteen feet was attained, with proportional diameter of stem. But during the winter of 1884–5 they were killed to the ground. One large specimen on the University lawn, which had stood unscathed the rigors of fourteen winters, also perished. The following summer prodigious shoots were sent up from the old stocks, some of them stretching up during the single season to the full height of the old trees. The new growth has been suffered to care for itself, and the block therefore looks rough and the two-year-old stems irregular in size and distribution. The average height is now eighteen feet two inches; circumference of stem, ten and a half inches.

Aside from the liability to destruction by frost during specially trying winters, it is questionable whether this species has any value for timber. It certainly does grow wonderfully fast, at least when young, and that, too, on poor soil; but the wood apparently has little value for any purpose.

APPLE TREES, (*Pyrus malus.*)

In 1876–77 an overstock existed in the nursery of "Grimes' Golden" and "Stark" apple trees, root-grafted in 1872. These trees were in excellent condition, but as no market was found for them it was decided to try some as timber trees. One-fourth of an acre was planted in the spring of 1876 with trees four years old, and a similar area, or a little more, the following season, the trees then being five years old. All had been "cut" with a tree-digger in the fall of 1885, but not moved from their place until transferred to the forest. The first were planted four feet by eight feet apart, and occupy a block on the west side of the plantation, where they are exposed to the sweep of the prevailing winds, and they clearly show the effects produced thereby. The outer rows are bent over to the eastward very conspicuously, and the average height is less than would otherwise have been the case. In this block the average measurements now (1886) are: Height, seventeen feet nine inches; circumference of trunk, ten and four-fifths inches. In the second block, planted four by four feet apart, well sheltered on all sides, the height is twenty-two feet, and trunk same size as above. Four or five years after planting the whole ground became shaded by these trees, after which no undergrowth of any kind, except mosses and other low plants, existed. The trees have grown much more erect than they commonly do in the orchards, but the main stem soon becomes divided into too many branches, even when closely crowded. Little can, therefore, be said in favor of the tree for timber. The wood, if of good size and straight grained, is very valuable for purposes where fineness and closeness of grain, together with hardness and susceptibility of polish, are requisites.

Green Ash, (*Fraxinus viridis.*) As has been stated the greater portion of the Ash planted was supposed to be White Ash (*Fraxinus Americana.*) Two acres were planted two by four feet, in one block, and one-fourth of an acre in another block, on, however, similar ground. All proved to be Green Ash. Both lots were planted in the spring of 1871 and in both cases nearly all the trees grew thriftily from the beginning, gaining six inches the first year. Those in the two-acre lot were two-year old seedlings, the others three years old, both from nursery beds. Like the Larch and Chestnut the roots of these young trees were considerably gnawed by white grubs the first season, and the small per cent of deaths may be almost wholly attributed to this cause.

The ground upon which the Ash are growing is rather low and level. For any agricultural crop tile draining would materially improve it. The black, vegetable loam is quite deep, underlaid with tenaceous yellow clay. An open ditch through the lowest portion carries a stream of water during the first half of most summers.

Cultivation by plow and hoes was thoroughly done during the first four seasons and afterwards the plow was run occasionally between the rows. When the trees became large enough for planting in shelter belts, streets, etc., a large number were taken here and there from the rows, beginning in 1875 and continuing ten years. Some time after 1876 whole rows were dug for these purposes, and in 1878 the remaining alternate rows were cut down. The growth of the trees has been exceedingly irregular. Those that get first start gain more and more upon their shaded companions, so that there may often be found two trees of the same age standing side by side, yet one ten to twenty times as large as the other. Evidently this Ash does not succeed well in the shade, though the latter is not dense enough to keep down the conspicuous undergrowth of weeds and many kinds of shrubs. An occasional Box Elder apparently grows as vigorous surrounded by thickly set Ash as though the latter were not present. In nature the Green Ash frequents especially the banks of streams, while the White Ash more commonly grows among other trees on rich bottom land. Does the former perish in the shade and succeed in the open areas of which streams of water furnish an example? In this connection it ought to be noted that sprouts were abundantly sent up from the low stumps left in thining and that these still make a slender but considerable growth. Some of these are now larger than certain specimens of the original planting. There is more undergrowth among the Ash than appears under any other trees. It is indeed very interesting to observe the great number of shrubby and other growths which normally belong to woods. It will be remembered that the land was originally prairie and had been cultivated in farm crop for thirty or more years, yet one now finds here great numbers of raspberry and blackberry bushes, cherry, Virginia creeper, poison ivy, dogwood, elder, grape, red and black haws, red cedar, besides beggar lice, "stick-tights" and various forest-dwelling weeds and grasses.

These are evidently brought by birds, for it will be noticed that the kinds named bear berries or other fruits commonly eaten by birds, or are furnished with appendages by which the seeds or pods adhere to feathers, etc. Great numbers of birds do resort to the plantation for roosting and shelter. The nearest natural wood is about three miles distant.

It is difficult to state what the average size of these trees is, on account of the extreme variation in size. By leaving out the small and ever-to-be-worthless ones, an approximate average size may be stated as forty-one feet for height and a little less than nineteen inches for the circumference of the trunk. In some portions of the plantation, however, the average height is ten feet less. Let it be recalled that the seedlings were two to three years old when planted, and that the trees have now grown where they are fifteen years. The trunks are straight, tall and slender, and either entirely or nearly free from living branches for almost half their height. Owing to the peculiar development of the trees, the distribution is also irregular, wide spaces occurring without valuable specimens, and again a few good trees growing side by side.

At the end of the first year after planting, the three-year-old trees cost at the rate of $160 per acre, while the plantation of two-year-old seedlings cost $85—the difference coming from the greater original cost of the three-year-old seedlings and the greater labor in handling them. It requires at least twice the labor to properly plant a three-year-old tree of this kind than it does one a year younger. At the present time no difference can be discerned in the size of the trees.

Black Walnut, (*Juglans nigra.*)

The nuts were planted in the spring of 1869, in nursery. There is, by some inadvertence, a break in the records concerning the transplanting of these trees, and I have been unable to recall the facts connected therewith. They were not transferred until after 1872, but in the autumn of 1875 they were over nine feet in height, and had been growing vigorously in their permanent place. When transplanted—probably in the spring of 1873—quite a number died, as might be expected of this variety, at four years of age. They were put into rows four feet apart, two feet in the row, but the following year were distributed so as to make, as nearly as practicable, the distance in the row uniformly four feet. They occupy one-fourth of an acre alongside of the Butternuts, on soil of good quality for corn.

In the autumn of 1876 these trees were twelve feet high and exceedingly healthy and vigorous in appearance. They were fairly well cultivated, and the lower branches were trimmed off so as to leave a smooth trunk four or five feet high, but since 1878 no labor has been expended upon them. At this time (1886) the trees are thirty-seven feet high and twenty-five and a half inches in circumference of the trunk. They are making rapid growth, with straight, clean stems and fairly good amount of foliage. The latter, however, is by no means so abundant as in several other species. There is considerable undergrowth, consisting for the most part of shade-loving weeds and grasses, but also various shrubs and climbing vines.

While these trees make a rapid growth, and ultimately obtain great size, it can hardly be claimed for them that they stand at the head of the list for timber purposes. The wood of old, well grown trees is exceedingly valuable. But it is only the wood of large trunks that commands high prices. That of young trees is not specially prized for anything. From seventy-five to a hundred years is not too great an estimate for the time required for the development of this tree into a product of high commercial value, and who can count upon the relative value of kinds of woods a century hence? Then these large trees demand a large area in which to reach the majestic proportions of commercial prominence. As shelter belts we have better trees, and for furnishing the miscellaneous purposes of farm supplies other kinds will be first selected. I do not, however, wish to cast any discredit upon this noble tree—the most prominent representative abroad of our North American forests. Its lofty, feathery crown is worthily worn, and, no doubt, in judicious mixed planting for timber, this regal tree should have its place.

Box Elder, (*Negundo aceroides*). The seed was planted in the fall of 1876 thickly in rows four feet apart, where the trees were to grow. The next spring the rows were thinned with the hoe, so as to leave the seedlings at first one foot apart. Two years later every other tree was removed, usually for transplanting. Alternate rows were dug for planting a part at a time as the trees were wanted from 1881 to 1884. During this time the remaining rows were also thinned to about four feet between trees. The area is about one-fourth of an acre in a long strip adjoining the wet portion planted with Larch. A part of the ground is very wet in the first part of the season; one end is moderately well drained. The trees have done excellently well throughout, and the block has cost less in proportion to size or number of trees than any other. The first year cultivation was thoroughly kept up during the season, and the second year double shovel plows were run in the rows three or four times. After this the shade was sufficient to keep down the weeds, and from that time to the present the ground has been perfectly free from any kind of undergrowth.

The trees are straight, tall and slender, with clean trunks high above one's head, and they are remarkably uniform in size for such close growth. The present average size (ten years from seed) is thirty-one feet two inches in height, and sixteen and one-half inches in circumference of trunk. This plantation is in appearance very excellent, and were the wood worth anything most valuable results might be anticipated. The record is worth consulting in regard to groves and belts for shelter.

Butternut, (*Juglans cinerea*). The nuts were planted in nursery rows early in the spring of 1869, and when the seedlings were transplanted two years afterward they were fifteen to twenty inches high. Ninety-nine per cent. survived and made an average growth the first season of six inches. At the end of the second year (four years from seed) the average height was two feet. In the autumn of 1876 the trees were ten feet six inches in height, and they now (1886, autumn), average thirty feet four inches, with a diameter of trunk of seventeen and one-fourth inches. The soil is rather wet yet not too much so for corn growing, except in specially wet seasons. Probably the trees would have done better on dryer land. As it is no kind except the Larch on wet land has shown so much disease. But there is nothing in common with these two as to the manner of destruction. With the Larch the whole tree assumed a sickly appearance, growth became slow, the foliage thin and fruit (cones) abnormally produced. Finally the dry branches failed to respond to the stimulating influences of springtime and death occurred. In the case of the Butternut the difficulty apparently began with the trunk and seemed to be due to frost. The living bark was forcibly separated in patches from the wood, or not unfrequently cracks occurred through bark and wood toward the center of the trunk. In some cases, however, patches of bark on the trunk or larger limbs died without apparent separation, and various fungi afterward grew out of the decaying parts. Indeed, the trees seem to suffer just as orchard Apple trees have done throughout the Northwest during the last decade. Trees of this species are not usually healthy or long lived in the native woods of the vicinity. It is not common that good saw-logs can be had from them on account of the irregular growth or unsoundness of parts of the trunk. In deeper woods on richer but better drained land the trees appear in much better condition and not unfrequently free from any apparent defects.

These trees for the first five years received good cultivation and were twice trimmed, the lower branches being heavy and spreading. The widest spaces caused by the death of trees as described were filled by transplanting from the thicker rows, but the distribution is still uneven, and not seldom the vacant spaces are now too wide. The shade has never been very dense and considerable undergrowth exists. Altogether the prospect is not favorable for this tree in timber plantations.

CATALPA, (*Catalpa Bignonioides.*)

This is the southern or eastern variety, sometimes called the tender Catalpa. The seed from which the trees were grown were gathered by Hon. W. C. Flagg, from trees planted by himself upon his farm at Moro, Illinois. At this time (1869) and for several years afterward the distinctions which are now known to exist between trees of this genus had not been made out. Since eastern nurserymen supplied the western parts of the country with most of the nursery-grown trees, and since this tree produces within six to ten years an abundance of seed, it need not be surprising that even in the areas in which the hardy Catalpa naturally existed the seeds for planting were mostly gathered from cultivated trees and so from the eastern or tender kind. This was the case with Mr. Flagg and similarly with the University. The Catalpas planted in the early years were all of the tender kind.

This seed was planted in the spring of 1869 and the seedlngs were transplanted two by four feet apart in 1871. Having a crooked and much branched top, this was cut off near the ground in the spring of 1872, and a single shoot allowed to grow from each. This latter often attained six feet or more in height the first season—a straight, clean, unbranched stem. In five years the average height was sixteen feet and the average diameter of the stem two and one-fourth inches. These trees, one-fourth of an acre, occupy a strip of land by the side of the Scotch Pine and upon the same kind of soil.

The present (1886) average height is twenty-eight feet three inches, and the average circumference of trunk twenty and two-thirds inches. None of the trees have escaped injury by frost. Usually the wood of certain annual growths of the trunk is dead and decaying while many of the limbs, not unfrequently the terminal portion of the "leader," have been killed, making the subsequent growth irregular and crooked. When the trees were two and a half inches in diameter every other one was removed and used as grape stakes. They were cut in the spring and immediately driven into the ground by the side of a vine. Notwithstanding the known durability of this wood in the earth, these stakes rotted so badly that many had to be replaced after the first year, while none lasted longer than three to four years. But it must be remembered that the wood was in part already injured by winter killing and that the stakes were used while green. The sap wood soon decays in the earth under favorable circumstances, and since in poles of this size there is a large proportion of sap, it is to be expected that such stakes will soon become more or less reduced by rot. But they last much longer if seasoned before setting in the ground and especially if cut in late springtime when the bark peels readily.

Alternate rows were removed six years after planting, so that the trees now stand about four by eight feet apart.

HARDY CATALPA, (*Catalpa speciosa.*)

The seeds from which these trees came were planted in nursery May, 1876. When two years old the young trees were moved to the permanent plantation and set in rows eight feet apart four feet apart in the rows. From the first these seedlings took an upright growth quite different from those of the tender variety.

The land is the highest and is accounted the poorest in the plantation. It is the same as that occupied by the portion of the European Larch which has succeeded so well. As was the case with the other Catalpa all the young trees grew—not one died in either case. Notwithstanding the transplanting a growth four feet in height was made the first season. Good cultivation was given the first year, but nothing was done with trees or soil the second season on account of the pressure of business in other quarters. The third year again the ground was kept in good order, after which little attention was given to it.

The trees continued from the beginning to grow luxuriantly, forming straight trunks, furnished with coarse and distant, but symmetrical branches. Not a bud or branch has been noticeably injured by frost. The average height is now (1886, autumn,) seventeen and a half feet, and circumference of trunk a little over fourteen inches. This is for six years' growth, or an average of about three feet increase in height per year. Quite a number of the trees, three to five years from planting, have been taken out for transplanting, leaving them, so far as the thinning has gone, eight feet apart each way. The shade is not yet dense enough to keep down all the weeds, but the undergrowth is much less than is the case with the Ash planted ten years before.

The ease of propagation, the freedom from disease and injury, the easy success in transplanting, the wonderful rapidity of growth, the excellent form of the tree and the great value of the wood eminently distinguish this species as for timber plantations. Its home is upon rich "river bottoms," where the trees attain a height of eighty feet and a diameter of trunk of two to three feet, or equal to that of the White Ash. But on poor soil it is probable that the mature tree will be smaller than several of the oaks and other first-class forest trees. From such information as we have the tree can not be said to be especially long lived. In the woods they are often found dead and often lying on the ground. Of the proved durability of the wood on or in the ground, too much can hardly be said. Fence posts cut from old logs have remained sound in wet ground forty years, and old stockades have been examined after double this length of time and the wood still found free from decay except the slow wasting away of the surface portions. A log lying across a creek forming a foot-bridge was known by one man to have occupied its place for sixty years, and his information was that at least forty years before his time the log was used for the same purpose. This log was in 1875 cut into boards one inch thick, the widest of which were eighteen inches of sound wood. The outer edges were more or less decayed and worm-eaten. The wood is soft and coarse-grained, is easily worked and keeps its shape well even when cut green.

For posts, piles and railroad ties, and for many manufacturing purposes the wood might take high rank, but for fuel and special uses many kinds are superior.

Red Cedar, (*Juniperus Virginiana.*)

A few trees of this species were planted when about three feet high in the spring of 1871, on rather dry but rich ground. They stand in a single row about ten feet north of blocks of other trees. They have had except for the first year or two but little attention. The transplanting succeeded well; nearly all the trees lived. They have made a very moderate but steady growth, not, however, appearing very luxuriant or vigorous. The stem usually continues through the head with, however, in numerous cases, competing branches. The head itself is bushy, with close and dense foliage. There is nothing of special promise about them as timber trees on our soil, notwithstanding the recognized value of the wood.

Chestnut, (*Castanea vesca.*)

This has been a failure. In 1871 1,360 two-year-old seedlings were planted, of which one-half died the first season. But the roots were badly gnawed by the white grub which existed that year in great numbers in the soil, and this was kept clear from other vegetation upon which the worms might feed. As the trees were first set two by four feet apart, an attempt was made to make the distribution uniform by transplanting, but the growth continued feeble, and all the trees ultimately died. The land was high and dry adjoining that upon which the Larch has so abundantly prospered. A few trees, however, which were set in nursery survived, and after becoming well established have grown rapidly and continue healthy.

It having been asserted that these trees succeeded better if grown from seed without transplanting, the experiment was tried by planting, in the area first occupied by them, fresh nuts in the fall of 1879. These were badly destroyed by rats and other vermin, but such as were left grew very satisfactorily the following year, During the first winter rabbits cut off many of the young stems, and some died. Growth continued poor, and the number of trees gradually became less. Those remaining were transplanted into one row, and now this remnant of the lot are bushy, poor looking, shrubby specimens of little promise. On the other hand some three or four year old trees received from Mr. C. H. Dennis, of Hamilton, Ill., in 1880, and planted in the arboretum, have done remarkably well. They are exceedingly thrifty, finely proportioned, and gaining as fast as the neighboring ash and elms. No explanation is attempted of the difference. The soil in the latter place is richer. The cultivation was altogether better with those first described.

American Elm, (*Ulmus Americana.*)

Only one-eighth of an acre is planted with this common White, or American Elm. There are four species of Elms native to Illinois. The largest and most abundant is the subject of this report. The next largest, and also next in usual numbers, is the Red, or Slippery Elm, well known for its thick and mucilaginous inner bark. The Hickory Elm is only found in special localities, a medium or small sized tree, known, as the common name suggests, for its tough wood and the peculiar wing-like expansion of bark along the branchlets. The fourth species is found only in the southern part of the State, and from the growth of bark on the branchlets, surpassing the latter in prominence, is called the Winged Elm. It is scarcely more than a tall shrub.

Among these it ought not to be difficult to identify the species with which we are now concerned. Yet such are its variations, so different the appearance of trunk, branches, and foliage, so diverse the characteristics of wood, and withal so many the woodman's names, that many hesitate to put all forms and kinds together as one species. Of the specific unity, however, there can be no question. Many of the observed differences are solely due to the surrounding conditions, as of very wet and of dry soil, of the chemical or physical characteristics of the latter, of the sweep of winds, etc. There is, however, a good deal of variation in the seedlings when grown in the same bed, so he who plants forests should carefully select his stock, the "strain," as florists say of his seed.

The seedlings were two years old when, in 1871, they were placed two by four feet apart in the plantation. All lived and grew rapidly. As they became large enough for the purpose, the most of those to be removed for thinning were dug for transplanting. Gradually the distance apart became four by eight. The trees now measure, fifteen years after planting, a little over twenty-eight feet in height and fifteen inches in circumference of trunk. This is far less than the same trees planted along streets fifty feet distant from each other measure. Even some of those transplanted from these very rows eight or ten years ago are now twice the average size of their thickly set companions. This seems to show that the Elm does not bear crowding well, at least by its own kindred. As a timber tree little can be said in its favor, however much we may admire it for ornamental purposes. There are special uses for its fine-grained, interlocked, fibrous wood, but the demand is limited and precarious.

HICKORIES, (*Carya alba* and *C. sulcata*.)

Nuts were collected of these two kinds, known as the small-fruited and the large-fruited Shellbarks, in the autumn of 1879, and at once planted in the forest-tree rows. Some of the nuts were destroyed by vermin, but the most of them germinated and grew the following spring, making, however, small progress during the summer. During the first winter, and to some extent afterward, many of the young trees were cut off by rabbits. These, however, usually sprouted out again from the stump. The land is high and dry and the soil poor. There is one reason for the slow growth. The Ailanthus and Hardy Catalpa, on the same soil, have shown remarkable vigor. As between the two Hickories, the large-fruited one has surpassed the other, though it is more often found on lower land. The trees are now from four to eight feet high.

HONEY LOCUST, (*Gleditschia triacanthos*.)

Two-year-old seedlings were planted, four by eight feet apart, in the spring of 1882. The average height is now about eighteen feet, and the average circumference of stem six and a half inches. This tree attains lofty dimensions in native woodland, but is not highly esteemed. The wood is coarse-grained, not tough, but exceedingly hard. It is said that it shrinks less in drying than any other native wood. It is not very durable when subject to moisture. There may be special uses for which the hard and conspicuously grained wood would be highly esteemed. It is susceptible of a fine polish, and probably could be advantageously used in furniture making and in joinery.

EUROPEAN LARCH.—Two acres were planted; rows four, and trees in rows two feet apart. The land varies much in fertility and in subterranean drainage. Two-thirds of the area is relatively high, and in the soil no water stands within several feet of the surface at any time of the year, at least for many days at a time. This soil is too poor to grow a fair crop of corn, but would answer satisfactorily for oats. The subsoil is yellow clay, with enough admixture of sand to make drainage fairly good. The northern end of the area reaches down into lower land, where water in a tile drain would run during a large part of the spring and early summer, though it does not stand upon the surface. Sometimes in the spring the wettest portion is so soft that a horse's feet would sink three or four inches in the black and rather mucky soil. The seedlings were one year old when planted in the spring of 1871. During the first year three-fourths of these died, and more upon the high than upon the low ground. All started well, but the roots were badly damaged by the white grub-worm, and the season proved to be very dry, so that during August the dead or dying numbered more than the thrifty trees. Cultivation was diligently kept up during the summer.

The next spring 4,000 more seedlings were purchased and planted in the rows, leaving no spaces of more than four feet. In this way the distribution of the trees was not quite even over the ground, but proved sufficiently so to accomplish the object of thick planting. Again the grub-worm did some damage to the roots, but far less than during the preceding season; none was known of afterwards. Nearly all the trees lived and made a fair growth. Cultivation was kept up during the summer of 1872, 1873 and 1874, but in 1875 the land was so wet during the spring and early summer that it was deemed best not to run the plows. The weeds grew abundantly and made a bad appearance, but they did not seem to materially injure the growth of the trees. At the end of this season, however, it was observed that the trees occupying the wettest portions of the ground looked unhealthy and many were found entirely dead the following spring (1876). Up to this time they had apparently done nearly as well on the low as upon the higher land. Finding that the trees, now five years planted, needed thinning where two feet apart, a considerable number were dug and planted in the vacant spaces, wherever they occurred, including those on the wet ground. Most of these transplanted trees lived and grew without serious check, but from this time on those on the low ground proved more or less unhealthy. Some of them lived to grow ten to sixteen feet high, and then perished. On this ground the trees which lived had less than the normal amount of foliage, the latter was usually yellowish in tint, the branches were slender and wiry, and fruit-cones were abundantly developed. While there are still a considerable number of trees on this lower ground still living, the plantation is anything but attractive or hopeful in appearance. On the higher ground, however, scarcely a tree has died or shown any indication of unhealthfulness. In 1876 part of the work was done in the spring and part in the fall. The trees in two of the central rows were trimmed by cutting off the lower branches so as to leave a clean trunk two and a half to three feet high. The rest of the trees were left untrimmed, with their branches issuing from very near the ground and spreading so as to interlace with each other. The average height of the trees was at this time ten feet. These trimmed rows can not now be picked out, except upon the closest looking for the few remaining dead branches on those not trimmed, and an occasional appearance of the old wounds. But during three succeeding years the growth in height of the trimmed trees was evidently less, and no doubt careful measurements would have shown a similar result for the circumference of the trunks. Unfortunately such measurements were not made. Now the variation in growth in other ways obscure the results, if any. The trimming of the two rows cost about fifteen dollars—money clearly wasted, if nothing further can be said of it.

growths occur in the later years. This shows good results and indicates that more attention ought to be paid to the Hard Maple in artificial timber growing. The wood is in demand at good prices for the finer uses, such as furniture, building, implements, etc. Too much consideration has evidently been given to its slow growth at the beginning. Its unrivalled beauty as an ornamental tree is commonly appreciated and acknowledged.

Soft Maple (*Acer dasycarpum*).

One-eighth of an acre, in a strip twenty-five rods long, was planted with three-year-old trees of this variety, two by four feet apart. They are by the side of the Willows and upon the same kind of soil. Nearly all the trees lived and made an average growth the first year of about one foot in height. They have grown very rapidly each season since. Being larger when transplanted, and almost at once furnishing considerable shade, the ground was easier kept in order than for most others. Cultivation was, however, kept up three years, and there was performed some needless pruning the second year. The only thing done with this block since 1874 has been the thinning to four feet in the rows and the removal of alternate rows, the latter in the fall of 1876. From the low stumps some straggling shoots have arisen; otherwise the shade keeps down every vestige of undergrowth. The trees prune themselves and the dead branches soon fall and decay. The trunks are very tall and straight, of pretty uniform height, but varying a good deal in diameter. The difference in the size (diameter) of the outside trees and those surrounded on every side by others is very striking. These trees cast the densest shade of any of the deciduous trees, with the possible exception of the Box Elder, so that not only are the various shrubs and weeds excluded, but the trees crowd inexorably upon one another. Usually each manages to get a share of the sunlight at the top, but the foliage-bearing branches are mostly confined to an upper stratum of comparatively little depth. The average height is now (1886) forty-three feet eight inches; circumference of trunk, twenty-three inches.

When grown as street trees, subject to bruises and wounds, or on account of any serious check in their progress, wood and bark borers are very common in the trunks, where they do much damage. But in the forest plantation not a sign of these depredators exists. The bark is smooth and the wood straight grained and even in quality.

Burr Oak (*Quercus Macrocarpa*).

In the fall of 1879 acorns of White and Burr Oak were planted as soon as gathered but failed to grow. Two years afterward a quantity of Bur Oak acorns were gathered and at once planted in nursery rows. These grew well the following season. In the spring of 1884 the tap roots were cut with a sharp spade, the earth having first been plowed away on one side of the row. The next spring the young oaks, two to three feet high, were successfully transferred to the forest, where they are again making satisfactory though not very rapid progress.

Osage Orange, (*Maclura aurantica.*)

Two-year-old seedlings were planted two by four feet apart in the spring of 1871. After the end of the first season they were two feet high, all living and promising. The location was well adapted to the habits of the tree except that the Catalpa crowded upon them on one side and Apple trees upon the other. The soil is good corn land, not usually too wet for early planting. In 1876 (six seasons' growth) these trees averaged thirteen feet six inches high, and during the last year had gained from three to four feet. Taking into account the well-known value of the wood, it then appeared, and was so stated in a report upon the plantation, that the Osage Orange gave every indication of standing first upon the list of timber trees. As a farm hedge plant its superiority had been fully established and single trees had often been observed to grow into valuable size with satisfactory rapidity.

After the stems have a diameter of three inches they are highly prized for stakes, proving very strong and exceedingly durable. With increase in size the value likewise increases for posts, paving blocks, etc., and finally for various manufacturing purposes. No other wood serves as well for wagons. For turned handles and other purposes where fineness of grain, hardness and great strength are esteemed, the wood is especially valuable. Added to these uses is that of fuel. The Osage surpasses hickory and maple in this respect.

With such characteristics, combined with rapidity of growth, adaptability to our soils and entire freedom from injurious insects, etc., there is little wonder that the species should take first rank among timber trees. But it is always easy to reach conclusions too soon. The later experience with this block in the experimental plantation is far from the anticipated results. About eight years after planting, the growth became much less rapid, and at this time the trees were slender, with long, straggling branches. In 1876 the average diameter of the stems near the ground was recorded as one and a half inches. In 1886 the average height is twenty-three feet, and the average circumference of stems thirteen inches. Compare this with the Larch, over thirty-three feet high and twenty-four inches circumference of trunk. But the Osage fails in another way; the trunk is neither straight nor symmetrical. The top is divided into long, slender branches, without a distinct leader, and crowding only makes the shoots still longer and slimmer. Then, too—like the Elm and some others—the association in a close plantation seems to injure the development of the individual tree. If judiciously mixed with other kinds, it is quite likely that better results would be obtained, but so far as this experiment affords instruction the Osage planted in a mass by itself, cannot be said to to be highly promising for timber.

The seedlings were at first set two by four feet apart, but were subsequently thinned to twice these distances each way. Cultivation was kept up the first four years, and the side branches were for a time pruned away, to facilitate passage along the rows. The trees are now (1886) very irregular in size, and probably as time progresses will become more so, for the weaker ones are much retarded by the influences of their more successful neighbors. The shade is not so dense as in many other cases. Weeds of numerous kinds still grow in considerable quantity under the trees.

Austrian Pine, (*Pinus Austriaca.*)

These trees, occupying one-fourth of an acre, were planted on a strip of land twenty-five rods long north and south, gently sloping to the north. The soil is good and the drainage sufficient for successful corn growing. The trees were set four feet apart each way. The first planting was made in the spring of 1871, the seedlings, nine to twelve inches high, being obtained from nursery beds. Nearly all died the first year. Replanted in 1872 with a large loss again, but finally nearly all the spaces were filled in 1873. Cultivation and management same as described for Scotch Pine. After gaining a hold upon the soil the young trees began to grow very thriftily. In September, 1875, the average height was two feet eight inches. One year subsequently the measurements proved to be four feet eight inches—a remarkable growth. Alternate rows were taken away in 1878, but no other thinning or pruning has been attempted. The lower limbs are dead on account of the density of the shade, but are so closely interwoven that they form a barrier to a passage among the trees. The trunks are mostly straight and erect, though somewhat swollen at the insertion of the whorls of branches. The average height is now twenty-seven feet five inches, and the average circumference of trunk is a little above twenty inches. These measurements exceed those for White Pine, but fall somewhat short of the ones given for Scotch Pine of the the same age. A fungus disease of the foliage mars the beauty of the plantation and reduces the growth. The leaves on the lower branches are worst affected, and this is the same when a tree stands in an open space by itself. Early in summer the one-year-old leaves begin to show little brown marks more or less numerous, often few, at any part of their length and upon any side. These spots, minute at first, slowly enlarge, and towards autumn a central, black, somewhat elevated papilla may be seen in each. By the end of this second season the leaves are mostly dead and usually fall. Sometimes the leaves of the first year are similarly destroyed, but this is not so common. They should remain on the tree green and healthful three years.

Upon microscopic examination the mycelium or vegetative threads of the fungus is found in abundance, well distributed through the leaf tissues. The black points are fruiting bodies of the fungus, in which two kinds of spores are produced in succession, the last usually maturing after the leaves have fallen from the branches and appear to be fit for distribution about the first of June. Undoubtedly the fresh leaves are affected when wetted with dew or rain, through the germination of these spores upon their surface and the penetration of the germinal tubes into the leaf tissues. No remedies are known. Upon isolated trees some experiments have been made by pulling off the diseased leaves and burning them, as well as all fallen ones. This procedure evidently checked the development of the disease and saved much of the foliage, at least for a time, upon widely isolated trees. Evidently the results can not be practically beneficial if diseased trees, not treated, are near by.

The disease is very common throughout the country, at least in the Mississippi valley, and very often badly injures this justly favorite tree on ornamental grounds. Certain specimens appear especially injured, while others nearly or quite escape.

SCOTCH PINE, (*Pinus sylvestris*).

In the spring of 1871, 1,000 Scotch Pine seedlings one to two feet high were received of Robert Douglas of Waukegan, and at once set four by four feet apart in the permanent plantation. As an experiment with a hope to reduce the cost these seedlings had been grown without transplanting, and no doubt would have succeeded under favorable circumstances.

But the soil becoming very dry and the winds searching and heavy nearly all the young trees died. Not more than two per cent. survived. The next season the enterprising nursery man refilled the order without charge with transplanted seedlings twelve to fifteen inches high, and these were planted as the first lot. Again, owing to unfavorable conditions about two-thirds died, but in the mean time trees were grown in nursery and in 1873 the plantation was completed so that very few vacant spaces remained.

Mr. Douglas writes that these trees were from seeds collected in northern Europe and belonged to what is sometimes called the Riga Pine. This statement is important, for it is well known that *Pinus sylvestris* is a variable tree and for timber plantations the differences are very great. Having once started, these pines grew very thriftily, soon becoming clothed with dense foliage which retained its fresh and healthful, blueish-green appearance throughout the year. The branches were from the first spreading and more or less irregular and the trunk itself is often somewhat crooked. Otherwise the trees are well shaped and form a very attractive block in the plantation. They occupy something over one-fourth of an acre. The soil is like that of the dryer portion of the White Pine—good tilable land, rich enough to grow fair crops of corn and in medium condition as regards moisture. Cultivation was continued until 1875, when, instead of plowing, the weeds were cut with the scythe twice a year. In 1878 alternate rows were cut away. Previous to this a few trees had been taken out for transplanting elsewhere. Upon an average the trees now stand about eight feet apart each way, with some irregularity in spacing. The shade is complete. Not a weed may be found save near the open borders of the lot. Mosses and various fungi start from the matted fallen leaves, otherwise the underspace is free from vegetation. The rugged dry limbs from the lower part of the trunk for the most part still hold their places upon the trees; one needs to carefully choose his way to get through the plantation. The trees now (1886, thirteen or fourteen years after planting) average twenty-nine feet high and rather more than twenty-three inches in circumference of trunk one foot above ground. They are larger than the White and the Austrian Pines, but cannot compare with the former in symmetry of form or value of wood.

WHITE PINE, (*Pinus strobus.*)

One acre was planted to this well known native tree in a strip of land twenty-five rods long, north and south. This land is quite level, sloping gently to the south, and at least one-half of the area is, in spring time and often in the early part of summer, too wet for the best results of tillage. The black soil is from one to two feet in depth, underlaid with rather stiff clay. The trees were planted when twelve to fifteen inches high, four feet apart each way. Of nearly 3,000 of these small trees planted May 4th, 1872, two-thirds died during the summer, while of similar seedlings of Norway Spruce, planted in same way, the same day, on similar soil, not above two per cent. died. The season was a dry one, but it is not easy to explain this vastly greater mortality of the Pines, except as we take account of the nature of the tree. It is comparatively a hard one to successfully transplant; the roots are soft and naked, or furnished with few small fibres. These seedlings were collected in early spring, 1869, and put into close nursery rows, and shaded with lath frames.

Here about eight per cent. died the first year. For experiment the shade was omitted in the case of a few hundred seedlings, and of these thirty-five per cent. died. Having grown in the nursery three years, they were deemed in good condition for transplanting. Knowing the necessity of careful handling, no effort was spared, from the digging in the nursery to setting in permanent place, to secure successful results. Throughout the season the soil was kept in good state of tilth by frequent cultivation.

In the following spring (1873) the vacant spaces were filled from the nursery, and again in 1874 trees were set where needed. In this way the plantation was almost perfectly started, and from the first the living trees have done exceedingly well upon the lower and wetter part of the ground, as upon that of dryer condition. At the lowest part standing water would be found in May, and perhaps in June, within two or three feet from the surface, and for a while, usually in the spring, the surface soil itself was soft and mucky. Yet even here the trees have succeeded admirably. Very few trees have died from any cause since they began their growth in their present position. They are now remarkably healthy and vigorous, and the plantation vies with that of the Larch in beauty and prospective value.

Cultivation was kept up in thorough manner for three years. During the fourth, fifth, and sixth years the weeds were mowed, but little tillage was practiced, mostly because the ground was too wet in the early part of the season. In the winter of 1877-8 the alternate rows were cut down, otherwise no pruning or thinning has been done. The trees now average twenty-four feet and nine inches in height, and seventeen inches in circumference of trunk. The ground beneath is thickly covered with the fallen leaves, and strewn with decaying branches, but otherwise clean and clear from undergrowths of any kind. The dead branches, still holding their place on the trunks, and interlaced through and through, prevent one's passage among the trees, except as a way is picked out in the more open places. The stems are straight, and remarkably uniform in size, and still more so in height.

NORWAY SPRUCE, (*Abies excelsa.*)

A large lot of small seedlings were put in close nursery rows in the spring of 1870, whence they were transplanted two years later, a part to the forest and others into wider and thinner rows in the nursery. None of the latter were afterward transferred to the forest. The former filled one-fourth of an acre. Planted on same day, and in same way as the White Pines which died, ninety-eight per cent. of the Spruces lived—a difference apparently attributable for the most part to the characteristics of these varieties.

When set the little trees were only twelve to fifteen inches high. In September, 1885, they were two feet eight inches high, and a year later the recorded height is four feet three inches—showing in the early years very rapid growth.

The trees are upon the average now (September, 1886,—fourteen years after planting) twenty-five feet high and sixteen inches in circumference of trunk one foot above surface of ground. The surface nearly level, soil is pretty rich, rather too wet for prosperous corn growing.

The area extends down to the open ditch spoken of under Ash trees, yet the Norways have succeeded in this lowest portion nearly or quite as well as where there is less moisture, in this respect vieing with the White Pine.

A large number of these evergreens have been taken out for transplanting, or to furnish decorative material. Unfortunately the thinning was not done very regularly, hence the distances are not evenly spaced. As most of the removed trees were for the use elsewhere of the University, for which no charge was made, the financial returns cannot be exactly stated, but if counted at usual rates the amount would place this block next the Hard Maple in the matter of receipts. Again, this is a temporary and local circumstance, and serves nothing for general guidance as to the profits of tree growing.

White Willow, (*Salix alba*).

On low, level ground, like that on which the Ash stands. Area one-fourth of an acre, rows four feet apart, trees in rows two feet distant. Cuttings were placed in nursery in the spring of 1870. The next spring the rooted trees were planted in permanent position. They were trimmed to one stem in 1872, but being still crooked and straggling they were cut to the ground in May, 1873, after which very vigorous shoots were thrown up and these were trimmed as required.

Trimming was practiced upon these trees more than upon any others, to get a single straight trunk to start with, and then the success attained was notable. After some years, however, the stems became erect and straight. These straight growths often stand now upon a leaned or crooked base. Alternate rows were removed in the autumn of 1877 and some trees were cut from the rows. From the stumps sprouts have been thrown up, but they are slender and poor in growth on account of the shade. This last is not so dense as common, in this respect something like the Ash. A good many shrubs and weeds grow under the trees.

The willows have kept the lead in regard to height, and are now the tallest trees in the plantation. The present average measurements are as follows. Height fifty-nine feet, circumference of trunk twenty-six and a third inches.

Forest Tree Plantation. October, 1886.

	Acres	Distance planted	When planted	Age in years	Average height, feet	Average diameter, inches	Condition	Cost of trees	Cost of planting	Cultivation, etc.	Total cost	Receipts
Ailanthus	2/5	4x8	1881	2	18	3⅓	×	$10 40	....	....	....	....
Apple	⅔	4x4	1876-7	4- 5	18	3⅓	××	50 00	$25 20	$15 00	$90 20	....
Ash, Green	3	2x4	1871?	3	40	6	××	76 94	42 58	190 63	310 15	$35 00
Blackwalnut	¼	2x4	1873	4	37	8	×××	24 00	8 50	21 14	53 64	....
Box Elder	1/5	2x4	1877	Seed..	31	5	×××	2 00	....	11 00	13 00	20 00
Butternut	¼	2x4	1871	2	30	5¼	×	20 40	3 43	24 23	48 06	....
Catalpa, Hardy	⅙	4x8	1881	2	17½	4¼	×××	2 00	5 50	6 50	14 00	8 00
Catalpa, Tender	¼	2x4	1871	2	28	6½	×	21 77	4 17	43 37	69 31	5 00
Cedar, Red	..	....	1871	2- 3 ft.	....	....	××	....	....	....	....	....
Chestnut	¼	2x4	1871	2	....	....	......	30 00	6 79	14 65	57 44	....
Elm, Amêrican	⅛	2x4	1871	2	29	5	××	4 76	3 95	10 39	19 10	7 00
Hickory, Small Nut	3/5	2x8	1880	Seed..	2-4	....	××	3 50	....	6 00	9 50	....
Hickory, Large Nut	3/5	2x8	1880	Seed..	2-4	....	××	4 50	....	9 00	13 50	....
Honey Locust	¼	4x8	1882	2	13	2	××	10 00	6 40	5 00	21 40	....
Larch	2	2x4	1871	1	34	8	× ×××	98 00	21 20	189 44	308 64	2 50
Linden	¼	4x8	1881	6	17	2½	××	10 00	6 40	5 60	20 00	3 25
Maple, Hard	2/5	2x4	1873	3- 7	22	3	×××	20 00	10 60	20 26	50 86	65 00
Maple, Soft	⅛	2x4	1871	3	44	7¼	××	8 16	6 17	11 09	25 42	....
Oak, Burr	¼	4x8	1885	4	2-3	....	××	15 00	6 00	2 00	23 00	....
Osage Orange	¼	2x4	1871	2	23	4¼	××	5 44	4 78	14 14	24 34	5 00
Pine, Austrian	¼	4x4	1872	9-12 in	27	6½	××	30 00	4 40	69 36	103 76	....
Pine, Scotch	¼	4x4	1872	1- 2 ft.	29	7¼	×××	30 00	4 25	48 14	82 39	2 50
Pine, White	1	4x4	1872	12-15 in	25	5½	×××	122 49	9 85	250 45	382 69	....
Spruce, Norway	¼	2x4	1872	12-15 in	25	5	×××	29 94	7 45	34 92	72 31	30 00
Willow, White	¼	2x4	1871	1	59	8¼	×××	8 00	4 57	27 49	40 16	....
Totals	..	....	......	......	....	....	......	$637 30	$192 28	$1029 79	$1846 87	$183 25

In explanation of the above table it may be said that the distance apart is the original spacing of the trees. Most kinds have been thinned. The dimension of the trees are those taken in October, 1886. The present condition of healthfulness and thriftiness is indicated in the column by ××. Here one × stands for poor order, two, fair only, and three ××× in excellent condition and promising appearance. In the case of the Larch, a double indication is required on account of the difference in the plantation on the low and high ground. In the columns of cost, the exact items are put down when known, otherwise approximate estimates are made. When the young trees were purchased, as was the case with all those planted in 1871 and 1872, except the tender Catalpa and Butternut, the exact figure is recorded, but when the seedlings were grown on the University grounds the account of cost was kept with the whole forest-tree nursery—not with the separate rows or blocks of different species. So in the cost of cultivation the amounts named are often obtained by dividing the full amount by the special areas occupied by a single kind. In the column of receipts the amounts are approximate sums. When trees or trimmings were used for the University a definite credit was not usually made, and especially was not to the special kind of tree. The items of cost of the trees and the receipts so far are not regarded as of any importance in the experiment, because they can not be made use of in arranging for another plantation on account of the great variation of prices and circumstances. As already said, the small receipts were almost wholly for trees to transplant. Another time or place there might or might not be such a demand. Certainly no one should count upon such sales as one of the legitimate and regular items of income from a forest plantation. Only in so much as the latter partakes of the nature of a nursery can the sale of living trees be considered appropriate to it.

When not done directly by the University, the trees were cut away in thinning by individuals who took the poles for the work. In this way, while no credit is given for the trees, the removal of those in alternate rows, as described, has really not lost anything which should be charged against the plantation.

In most instances these removed trees were used for firewood; sometimes for stakes or poles.

This matter of receipts in actual experience in central Illinois is very different from the rosy accounts so frequently elaborated on paper. Under present circumstances it seems to me impossible that forest-tree plantations can be profitable as a farm crop on land fit for wheat and corn. For financial returns from the timber, most assuredly the kinds to cultivate must be reduced to a very few. If the hardy Catalpa ultimately proves highly prized for posts and railroad ties, undoubtedly this leads in the promise of satisfactory receipts. In the future the demand for White Pine may easily make this tree most prominent in a plantation for profit. It is idle to talk of growing wood for fuel—except on farms, for home use—with the price of good bituminous coal, delivered, at two to three dollars per ton. The fact is, in Illinois, though the extent of the natural forests has been vastly diminished, the price of cord wood has not advanced during twenty years. Good timber-land, somewhat remote from market, now sells at a less price per acre than uncultivated prairie land of equally good quality. The value of the timber in such places is less than the cost of clearing. It must, however, be recognized that the value of natural forests gives little information as to the worth of artificial plantations. The former may be mainly composed of what is in the locality most prized, but it is usual that a small proportion only of the trees are those commanding the highest price. In the artificial plantation judicially managed the whole may be high priced material; this, too, may be more readily accessible and within easy reach of the market.

Let it be clearly understood that in the foregoing, tree-growing for timber has been the point discussed, and even in this exception is made for home use on farms. But the planting of trees has other and higher claims. Whether or not the actual amount of rainfall is modified by forests, there is not the slightest doubt but that the climate is affected. The temperature is equalized; the extremes of heat and cold are not so great. The air is modified as to the amount of moisture, especially in dry times in summer. The moisture of the soil is better distributed through the year; the running streams are better sustained and also less subject to destructive floods. Heavy winds are greatly checked, much to the comfort of man and animals. Crops are preserved in various ways from the destructive influence of air moving too rapidly. Lastly, trees for the ornamentation of the home area, as well as for the wide expanse of the country itself, can never be neglected by a people whose cultured tastes and educated perceptions give them pleasure in the beautiful and the picturesque.

To one who has no love for trees as such, half their value is lost. He who can see nothing but wood for fuel or for the manufactory in a shady grove, sees nothing but the dullest and poorest side of life—but half lives—has eyes, but sees not. While it must be insisted that the extravagant figures presented by theorists as to the value of timber as a crop are extravagant and by no means a proper basis for business, tree-planting for the many and varied purposes of health, comfort and pleasure, with financial profit as a subordinate factor, should be studied and practiced by individuals, communities and nations. It is to be hoped that the experiment of which this account is made will not be considered worthless if the expenditures are never equaled by the receipts.

There is one reason for uneasiness about this, as there must be about every forest tree plantation. This is so serious that this report ought not to be closed without a word upon it. The danger of fire is a real and imminent one. The areas bearing the Conifers are liable to be burnt over during any dry time, and in autumn after the fall of the leaves the portions devoted to deciduous trees are quite as unsafe. A burning wad from a gun, a spark from a pipe, a negligent use of fire by a houseless tramp, may be sufficient to start a conflagration which shall destroy within a few hours the products of years and decades. The incendiary has an abundant chance for the practice of his most despicable and wantonly criminal art. In Europe there is some protection in the *gens d' arms;* American police beat the thronged streets far away from the farms. Our plantations would not multiply fast if it is understood that a guard must be furnished night and day. It is impractical to gather the fallen leaves and branches. There seems to be little offered but to take the risk. If so, this must be included among the items of obstacles and expenses.

CLIMATAL DESTRUCTION OF ORCHARD TREES.*

BY THOMAS J. BURRILL, PH. D., *Professor of Botany and Horticulture.*

In the line of horticulture nothing has so prominently forced itself upon the attention of cultivators as the death of apple trees, especially noticeable since 1881. The trees of the whole Northwest have similarly suffered. While some varieties are upon the whole less affected than others, it appears that no kinds are fully exempt, and while orchards on certain soils or in certain locations are less injured than others, in no case have they uniformly escaped. In the present paper only those forms of injury are considered which affect the trunks of the trees, though with the death of the latter of course the whole perishes. The indications of unhealthfulness may indeed be first noticed in the tops—the leaves assuming a yellow color, the new growth being poor in quality and quantity. But upon close examination of the trunk evidence of injury is often found, whether or not suggested by the appearance of the upper parts of the tree. Sometimes the injured portions are limited to distinct areas, sometimes the whole body is more or less affected by the destructive processes, whatever they may be.

In studying the matter, four principal kinds of injury have been found, viz: (1) by insects, (2) by rabbits and mice, (3) by blight, and (4) by frost.

Of the first and second nothing is to be said in this place, except to mention the wood-borers and the so-called "woolly aphis" as the insects specially referred to. The third must also be dismissed with a few words. I have elsewhere argued† that the so-called "sun-scald" is really blight, produced by bacteria, and this opinion is here further insisted upon, a large number of recent examinations making it impossible to do otherwise. In this case the bark adheres firmly to the wood, at least until it is quite rotten. Not unfrequently new bark forms beneath the old, and so heals the wound and saves the tree. The injury occurs on any part of the trunk and on any side, but is much more common on the south or southwest side, and a tree that leans to the northeast is much more liable to suffer. This is the reason that many have attributed the damage directly to the sun, and have kept in vogue the popular name.

In one sense the effect of the sun is a cause of the mischief; but it may be confidently asserted that the injury now considered

*From report to the Board of Trustees, December 8, 1885.
†Transactions Illinois State Horticultural Society, XVIII (1884), p. 75.

is in no sense a scald produced by heat. The same thing can be artificially brought about by inoculation with blight bacteria—has been done—and the inoculations succeed as well on the north as on the south side. But the influence of the sun upon the outer bark of trees is well known to every one who has frequented the woods without a compass, and to every one else who has been sharp in his observations. The outside corky envelope, old and dead, is much more deeply cracked and furrowed on the south than on the north side, and it does not usually take long to discover if one looks, especially in early summer, that many of these cracks extend to the living cells, which are thereby exposed to the contagion of blight. So long as the bark of young trees remains smooth, and is otherwise free from wounds, we do not find this affection of the trunks. When trees lean from the sun the rays of heat fall more nearly at right angles to the surface, and are thus more effective in destroying the elasticity of the outer protecting bark. Rains, too, may more readily wash fine material into the cracks, and thus in numerous cases be the means of infection.

Beginning from without, it is not very uncommon for blight to be confined to the living, cellular layer outside of the bast or fibrous layer of inner bark. In case the cambium layer (inside the bast) is not invaded, new bark may be formed and the tree saved, as already said. Evidently, keeping the tree erect or leaning to the southwest, and providing a shield of some kind winter and summer, to protect the bark from drying and cracking, are protective measures, and they are the best we have.

We now pass to the fourth cause of injury, namely, freezing; and shall enter more into detail.

The injury due to frost, so far as the trunks of our trees are concerned, is of two kinds. In one case the wood and bark is split so as to gape open while frozen, though the crack may be closed after warm weather comes again. Sometimes only the bark thus cracks, and then there is left a more or less considerable wound, which becomes much more evident as the new layer of growth pushes out the torn edges. These cracks are much more frequent on the south or southerly side, but sometimes are otherwise located.

Numerous kinds of trees are known to suffer in this way, and among others the following have, in my observation, been quite commonly cracked: apple, sweet cherry, plum, box-elder, hard maple, butternut, iron-wood (Carpinus), chestnut; and occasionally the black walnut, white willow, tulip poplar, oaks and linden have been seen similarly burst. No doubt the list can be greatly extended.

But this form of injury is not nearly so destructive as the next to be mentioned. Trees are rarely severely checked in growth, and probably never, through this cause alone, are killed, though the wound may be deep and long and slow to heal.

The second form of injury by frost is the separation of the bark from the wood, occurring for the most part near the ground, and also usually most common on the side next the sun; but very often, much more so than in the former case, seen on any side or entirely around the trunk. This is the injury which has been most disastrously destructive in the apple orchards throughout a wide area of our country within recent years. It, no doubt occurs in other trees, but I have seen it since specially looking for it, only in apple, butternut and white willow.

When only the bark cracks, in the first form of injury, a bare strip of wood is often exposed by the shrinking of the bark and by subsequent enlargement of the trunk by growth, but this need not lead any to confound the kind of injury directly done by frost with that now considered.

In the latter the bark may or may not be split, usually is not in any conspicuous degree; but separation from the wood is more or less complete over the affected area. Very often there is for months no external evidence of the injury, and the sickly appearance of the leaves, perhaps after mid-summer, first attracts attention. The bark itself is not always killed, and there occurs an irregular growth of wood on the inner side, but separate from the older wood layers. The same sort of separation sometimes occurs between the annual layers of wood, and what are called "wind stakes" are often really due to frost acting in the manner now described. Sometimes these injuries take place in very old and very large trunks, but whether the splitting occurs near the surface and is afterward thickly covered by other layers, or occurs in the heart wood as such, is not known to me.

Having thus endeavored to describe the injuries, I now attempt an explanation, based to a considerable extent upon studies bearing directly upon the problem, but admittedly inweaving more or less of theory, and thus liable to be partially incorrect. In the first place some facts need to be stated. Water freezes at the temperature marked by 32° of Fahrenheit's thermometer, that is the exceedingly minute ultra-microscopical, but solid and firm particles (molecules) composing liquid water, at this temperature arrange themselves in certain regular positions with respect to each other, and cohere so as no longer to be, as before, freely movable upon each other. What was a liquid is now a solid, though the component molecules are not in themselves changed in respect to composition or hardness. They have simply arranged themselves in regular and fixed order, like the bricks of a tower, and a crystal is the result. To attain this arrangement more or less of molecular movement is required, and anything whatever that tends to prevent this movement tends to prevent the water freezing at the temperature stated. Indeed only pure water freezes at the degree marked on the thermometer. If a little salt or sugar is added the temperature must be below 32° Fahr. for crystalization to take place, and the lower, the greater the proportion of salt or sugar. Water, saturated with salt, may be cooled down to 4° Fahr. before ice is formed. When ice is produced on such a solution, it is, as before, the arranged molecules of *water* which form the crystal, the foreign molecules being excluded from the structure. The ice is therefore pure water, save that impurities may be mechanically caught and held among the crystals.

Passing now to another series of facts pertaining to the structure of the solid parts of organic bodies, it may be first stated that water forms an essential part of the texture. In plants with which we are now concerned, all the solid parts are composed of cells usually, only to be seen with the microscope. These cells have walls or sack-like membranes which often enclose various substances more or less mixed with water. Sometimes the cell cavities are full of liquid water, forced up from the earth by the roots.

But aside from this liquid water contained in the cells the molecules of water help to form the solid parts, as of the cell-walls. This last is perhaps difficult to comprehend, but it is exceedingly important that we should understand the fact in order to rationally acquaint ourselves with what takes place when a plant freezes. It has already been said that water is really made of minute *solid* particles called molecules. The substance of the cell-walls, known as cellulose, is likewise composed of molecules, but of more complex structure and undoubtedly of considerably greater size than those of water. In the natural composition of the cell-wall the cellulose molecules may be represented by the bricks in masonry, and the water molecules by the grains of sand in mortar. Between these different kinds of molecules there is a strong attraction or adhesion which binds the whole into a solid substance. There is plenty of water present but no liquid. The water molecules are as truly a part of the structure as are the cellulose molecules. Ripe seeds have *no liquid water* in them, nothing but this water of structure and comparatively little of that; so of the other parts of many plants in certain normal conditions of their existence; while on the other band more than nine-tenths of the weight of rapidly growing shoots is water in both liquid and molecular states.

Let us remember that every solid is made up of invisibly small molecules, and that these are held together by the attraction that exists one for another; that the force or effect of this attraction varies inversely as the square of the distance. This distance, at most, is so minute that *any* variation makes considerable, perhaps very much difference in the result. It is this molecular attraction that binds the cellulose molecules together with the water molecules into a cell-wall. The molecules, however, do not actually touch each other. Each is wondrously endowed with motion and swings back and forth in a limited path of its own, not unlike, on an infinitesimal scale, the planetary bodies; kept asunder by motion, but held from farther separation by attractive force.

In the living plant the swinging water molecules always separate from each other the cellulose molecules to a certain limited extent, but if by any abnormal cause the water molecules are once forced out and the cellulose molecules approach so near to each other that their own attractions are greater than that between the cellulose and the water, the latter can not get back, the organization is destroyed, the tissue fails in its physiological functions, the plant, or the injured portion of it, dies.

There is still another series of facts which, though more familiar, must be included for use in the explanation to follow. It is known to all that bodies shrink in size as the temperature decreases, and expand or swell with heat. The rails of the railway are perceptibly shorter in cold than in warm weather; the mercury in the thermometer sensitively obeys the heat changes upon the same principle.

The tissues of trees form no exception to this rule. The variation in the circumference of an apple tree over four inches in diameter can be readily demonstrated by a common tape line. A box elder stick just cut, three and a half inches in diameter, was found by myself to be a fourth of an inch greater in circumference between zero and plus 70° Fahr. In a large trunk the difference is much greater. It is also well known that water from plus 39° Fahr. to plus 32° Fahr. is an exception to the general rule, and expands as the temperature decreases from the first named degree. In the act of freezing, further expansion takes place, and in both cases with what may be designated resistless force. Iron pipes are split like fragile reeds; the thickness of their walls constitute no safeguard; the iron itself shrinks, the water within expands; bursting follows.

If we should bore a hole in the heart of a tree and fill it with water, exactly the same result would follow upon a decrease of temperature below 32° Fahr. A tape line would indicate a constant decrease in the size of the trunk with the decrease of temperature until relief from the enormous pressure finally came by a longitudinal split. But such splitting does not take place in living trees, no matter how much water they naturally contain, until the temperature is far below 32° Fahr., for reasons already given.

Further discussion upon this point must give place to another peculiarity of the freezing process in aqueous combinations.

When plant tissues—in common with other things containing water in a state of molecular association with other molecules—are subjected to certain low degrees of temperature, the *outside* or *exterior* water molecules first freeze, or arrange themselves to form a crystal. The temperature at which this takes place depends upon the molecular attractions. When the amount of water is sufficient to fill the molecular interspaces to saturation, the crystal begins to form at very little below 32° Fahr.; but when the proportion is much smaller than suffices to equalize the attraction for the water molecules, the crystaline arrangement of the latter begins at the surface of the organic structure only, and at a much lower temperature.

If a limb is cut from a living tree, hardy in our climate, when the temperature is at zero, and has not immediately preceding been much lower, neither the bark nor the wood will ordinarily be found frozen. A separated sliver is still flexible, and no ice crystals can be seen with the microscope; but a drop of water applied to the surface—even soon after the stick has been taken into a warm room—instantly congeals, as it does on similarly cold iron. Yet in this green stick there is forty per cent. of its weight water, *existing there unfrozen at zero*, Fahr., not as a liquid, but capable of being evaporated from the tissues at the temperature of boiling water.

When this water does freeze—in some of our trees at about 12° to 15° Fahr.—a minute, thin plate is first formed on the surface of the structure, or rather multitudes of such thin plates of regular shapes are thus formed near together. With a little further decrease of temperature other water molecules are wrested from their attractions in the woody structure, and arrange themselves beneath those first formed, and in so doing push the latter outward. This escape of some of the water from among the cellulose molecules causes the latter to approach nearer each other, and at the same time to hold with stronger power the remaining water molecules, which only join their fellows in the crystal at a still lower temperature. As, however, the cold increases, the crystal pushes out, not gaining in diameter, but increasing in length by constant additions to its base, just as we may conceive of the erection of a chimney by successively placing bricks under those already laid and pushing upward the whole structure. The final length of the crystal depends upon the amount of water and the degree of cold.

Sometimes the stems of frozen succulent plants may be seen thickly coated with a crust of such crystals a fourth of an inch or more long, but so slender that a magnifier is needed to identify individual ones, the whole presenting to the naked eye a somewhat velvety appearance. Similar crusts are formed in the interior of the tissues on the surfaces of certain kinds of cells, and pushing into cavities caused by the shrinking of the material.

We may now consider that we have the chief facts upon which the explanation of the two forms of injury to tree trunks by freezing rests.

We have compared the splitting of the trunks to the familiar bursting—too familiar—of iron water pipes and water pitchers. It is only necessary that a sufficient amount of water in the liquid state exists in the central parts of the tree, and that a sufficient degree of cold be reached to shrink the woody fibre and congeal the fluid. If the water, though as a liquid in the ducts, cell-cavities, and intercellular spaces, contains substances in solution like sugar, earthy salts, etc., freezing will be more or less below 32° Fahr.; and this is normally the case. If the water exists only in the imbibed state in the cell-walls, a much lower degree than this will be required to produce crystalization, and this is the normal winter state of a hardy and sound tree. It is only in spring-time, or in a spring-like condition of things, that any liquid water exists in such trees.

On microscopic examination in winter, no water, as liquid, can be found in the cell-cavities, or other openings of the living tissues; yet by heat under 212° Fahr., forty per cent. by weight of water can be driven off. It is molecularly distributed among the elementary bodies of cellulose, protoplasm, starch, etc., all of which are much too minute to be seen with our best microscopes, but which as certainly exists as do worlds beyond the reach of telescopes, and both are as certain as human knowledge is at its best.

I append a table of the proportions of water determined by evaporation in an oven kept below 212° Fahr., in the trunks of several trees cut in December, 1883.

Where two numbers are given in a column the first shows the water in the inner portion, and the second in the succeeding ring of growth.

Trees.	Diam. In.	Per cent. of water.—Heart.	Per cent. of water.—Sap.
Hewes' Virginia Crab, No. 1	4	..... 43.05	44.67 .....
Hewes' Virginia Crab, No. 2	4	42.29	42.75 .....
Wilson's Sweet	6	44.30 46.00	42.30 43.80
Box Elder	4	41.92	..... 40.85
Box Elder	5	41.18	..... 31.36
Box Elder	3	..... 33.46	38.18 .....
Soft Maple	4	..... 45.35	38.95 .....

In the spring some of these trees would contain a greater per cent. of water, but I have no figures for the amount. What has now been given may be a surprise to many, and the query would hardly be unnatural, "Why do not all the tree trunks burst when exposed to a freezing temperature?" If, however, the internal wood is sound—rotten wood soaks up great quantities of water—and the spring activities of the roots have not commenced, it is not likely that the trunks of any trees will burst by the swelling of ice formation; whether or not the shrinking of the tissues by cold without concurrent freezing is with us ever sufficient to cause the longitudinal cracks we observe, after the manner of shrinking by drying, I cannot tell. Probably the bark may sometimes part through this cause. The tendency to such cracking by the change in size as the temperature decreases is just as certain as by the change through drying by heat. The only question is as to the amount of contraction by such cold as we have. Probably no trees ever burst until the thermometer marks zero or below, and then usually when the heart is more or less rotten, or after the roots have started to absorb quantities of water from the soil, as in spring-time.

But this cracking open of the bark, or the latter and the wood, does, as stated, comparatively little injury. It simply makes a bad wound without in the least otherwise destroying the vitality or healthfulness of the tree. I shall, therefore, only add an explanation of the crack so commonly occurring on the south side, or that most exposed to the sun.

If this splitting of the trunk can be properly compared to the bursting of a water pipe, how can it be that the points of the compass have anything to do with it. The rupture of an iron tube always occurs in the weakest place, and no amount of thawing and freezing on one side, with the other less subject to such changes, can make any difference in the result. Action and reaction are equal, pressure southward means equal pressure northward, and so of east and west.

Now so far as the outer layer of bark is concerned the south side is the weakest, because of the drying effects of the sun—cracks always being more numerous here than elsewhere—and this difference in strength, slight as it is, should be sufficient to cause the southern crack, if all other parts were exactly equal. Besides this, the center of the heart is commonly nearer the south side, on account of less wood growth on that side.

There is, however, a far more effective cause for the phenomenon. Every change in the temperature of the tissues of a tree affects the quantity of water in the cells and spaces. Indeed, it is largely by such alternating changes of heat and cold that liquid water gets into and accumulates in the trunk of a tree, mainly through the contraction and expansion of contained air. The corky bark is almost impervious to water and air, and forms a kind of sealed tube, whose lower end only is open in winter. If air at first occupies all the cavities in the wood, as it does in summer, and a reduction of temperature occurs, this air very considerably contracts in volume, making a vacuum, or would do so were the spaces not concurrently filled up by an upward flow of air and water from the roots, and through them from the soil. When the air expands pressure is produced, and gases being more mobile than liquids, the air rather than the water is forced down or away in any other direction, leaving another condensation by cold to act as before. In this way the tissues of the south side of an exposed trunk of apple or other tree gains more fluid than those of the north side. The increase of water and the consequent dilution of the dissolved substances causes earlier and greater congealing and its effects.

I submit the following figures, obtained by Mr. Hewes, a student of the University, in April, 1883, from experiments upon a soft maple (*Acer dasy carpum*), about forty feet high and nearly one foot in diameter of trunk.

No. of Observation.	Specific Gravity.	Per cent. of sugar.	Amount of Liquid.
10	N. 1.013 S. 1.011	N. 3.3341 S. 2.6485	
11	N. 1.012 S. 1.008	N. 3.2279 S. 2.0004	For nine continuous observations:
12	N. 1.011 S. 1.0088	N. 2.9569 S. 2.2731	
13	N. 1.006 S. 1.006	N. 4.4967 S. 3.5150	N............3971 c. c. S............7869 c. c.

If the south side of the trunk is well shielded from the sun splitting may occur, and then on any side; but the injury would not be so liable to happen. The condition of the heart of the tree must be an important item in the effect, but the last season's growth, whether vigorous or not, makes little difference.

Passing now to the much more serious injury—the separation of bark and wood—we may say that neither the swelling of the interior nor the shrinking of the exterior layers of tissues can be accredited with the disastrous results, for these crowd the parts together instead of forcing them asunder in a radial direction. Neither is it in any way the undue shrinking of the interior and extension of the outer portions, because no such thing occurs. The heart of a tree freezes first. No change of temperature is sudden enough in the open air in winter to cause the bark and younger wood to freeze before the pure water of the heart wood congeals, popular opinion to the contrary notwithstanding. The very heart of a healthy tree has more water in it, susceptible of freezing, than has the sap-wood and bark, and, if vitality counts for anything, its influence retards the freezing of the outer rather than the inner parts of a tree.

When the thermometer first reached zero in December, 1883. I examined the twigs of many kinds of trees without finding any of them stiffened with ice, except the very immature water sprouts of apple trees and the tall growths of catalpa. The same was true at —6°. At —12° the pith of some last season's growth was hard and rigid, and ice was readily seen with a hand magnifier.

This was observed in apparently fairly ripened twigs of pear—Bartlett and an unknown variety—of some apple trees, of several raspberries, including Turner and Mammoth Cluster, of some shoots of Concord grape (not of those best ripened), of hydrid perpetual roses, etc. On the other hand the wood and the bark of all these, except the water shoots, were still flexible and without ice while the twigs of most trees as a whole were unaffected by ice. At —28°, in a considerable number of instances, the twigs and the separated wood snapped like icicles and were found more or less crowded with ice crystals, yet in a greater number of cases the living parts were still flexible and tough. In very few species was the living mature bark during the coldest period found frozen—never in ripened apple limbs—and these are accounted somewhat tender kinds, such as tulip poplar, the magnolias, various roses, peaches, raspberries, etc. May cherry twigs at no time during the winter were brittle by freezing.

It is, however, essentially certain that the bark of apple trees is forced off by frost—the formation of ice in or near the cambium layer. It has not been my fortune to actually observe the phenomenon for the purpose of verifying the conclusions otherwise reached; it is difficult to find the affected trees or areas until long after the injury is done and the operating cause removed. I venture, however, the assertion that it is the growth of the forest of ice crystals from imbibed or molecular water heretofore described, together with the consequent shrinking of the tissues that pushes off the bark, with or without a radial longitudinal split. Such a crystalline growth does take place in the tissues of plants, and is readily seen by microscopical examinations of frozen succulent stems. The cause is amply sufficient for the result, and the only point upon which to hesitate is, does this kind of ice formation really occur in the tissues between the bark and wood of the apple trees? We may positively say that under the usual favorable condition of things in our climate it does not. It cannot readily be found after a temperature of —28° Fahr. But after all may not the phenomenon occur under certain and peculiar unfavorable circumstances or combination of circumstances?

Having pretty well examined the problem from what the courts call circumstantial evidence, I submit the following as the chief factors in the combination of causes leading to the unwelcome result. If in mid-summer a severe drouth occurs the tree is checked in its growth so far that the stimulating influences of a warm, moist, spring-like autumn starts afresh the activity of the cambium cells, the solution of the stored materials and undue absorption of water puts the tissue in condition to freeze in the manner mentioned, when exceptional cold follows in winter. The more severe the drouth the more the likelihood of such spring-like start in autumn. Florists know very well that to cause a plant to grow out of its season nothing so prepares it as a preceding rest brought about by withholding water. Without such rest the same stimulating influences will not operate. In its normal season maturation may result instead of new growth, under the attempts to secure the latter. There can be no doubt but that apple trees are more or less checked in many situations by the want of water during the dry times of July and August, and more in some soils and situations than others. Neither can there by any doubt of a responsive activity to the effects of a warm and wet autumn. The buds swell and burst into shoots or flowers in many cases, and even fruits are sometimes very conspicuously developed. With a corresponding activity of the cambium and a subsequent hard freeze it is little wonder that damage is done.

The evil consequence then of the summer's drouth is what we should in the first place strive to avoid. This may be accomplished in several ways known to us all, and I may only mention such as the choice of site, deep drainage to favor the penetration of roots into soil likely to be moist in summer, good surface cultivation during dry times, extensive mulching, selection of varieties possessing powers of withstanding drouth. Of these only the first will be here further discussed.

Horticulturists have usually advocated the selection of high and dry sites for orchards, and this more especially throughout the level districts of our western prairie regions. But, in view of what has now been said, is it not probable that an improper choice of location has often been made? It cannot be said that the highest lands are always most susceptible to drouth. The quality of the soil, its absorbing and retentive properties, must also be considered. We know very well that it is not necessarily true that the amount of water in the soil and subsoil in springtime determines the amount held during the summer. A close, tenacious, compact clay, on which, and in which, water stands in abundance in the early part of the season, may become hard and cracked at a later time, when the demand for water by trees is very great. Upon the other hand, a well drained loam, never holding water in the liquid state free from the attractive forces of the particles of solid matter, may under similar conditions retain its moist and friable condition throughout the year. Now it cannot be too strongly insisted upon that cultivated plants in general and apple trees in particular take their supply of water from moist soil from which not a drop of free water can be had by drainage or even by pressure, to far better advantage to themselves than from water in its liquid, molecularly-free state. The water requirements of a tree in full leaf, in warm, sun-shiny weather, is astonishingly great. Experiments upon potted plants show that there escapes upon an average about one and one-fourth ounces of water per square foot of leaf surface each fair summer day. A good-sized apple tree having 25,000 square feet of evaporating surface—by no means a large estimate—according to the above will give off 31,250 ounces of water per day of clear weather. This is substantially 250 gallons, an amazing amount, yet far less than has sometimes been calculated. If so much is given to the air through the leaves, an equal amount must be absorbed from the soil by the roots, the only way that plants of the kind under discussion obtain the water required by them. If at any time the supply is less than the loss, the tree suffers. In woody plants wilting is not so noticeable as is the case with those having herbaceous stems, but the former are nevertheless as much injured by a too great dessication of the tissues. It cannot therefore be very hard to see the absolute necessity of an abundant and constant supply of moisture for trees in midsummer, and that to secure this we must have a deep retentive soil and a full development of active roots. Other things being equal, the deeper the penetration of the roots the more secure the moisture supply.

Now in our western country the lower lands usually have the deeper soil, suitable for roots; the soils are richer in humus, and partially from this better resist the summer drouths, while at the same time the water supply from the deeper layers of earth, by capillary attraction, is usually more continuous the summer through.

Whatever the explanation, the orchards throughout Illinois and the adjoining states on comparatively low sites are upon the whole certainly in better condition than those upon higher hills and ridges. Numerous exceptions occur, but it is believed these can be fairly well explained upon the lines just laid down. It is really neither the low lands nor the high lands that are best, but those affording the best summer supply of moisture, without at other times of the year being too wet. It is well understood that tile drainage favors the retentive capacity of soils for molecularly combined moisture. Naturally or artificially, well drained soils go through the trial times of midsummer in best condition for plant growth. If therefore our low lands are best for orchards, we shall by no means include among these the sloughs, nor anticipate that apple trees will do well with their roots immersed in water. Perhaps the term flat lands, rather than low lands, will usually better express the intended meaning. If it is replied that the hilly regions of the East are preëminently the orchard districts, we have only to answer that everywhere in these favored localities the trees do not suffer from midsummer drouths.

Having thus presented the results of my studies upon this important topic, I wish it to be clearly understood that the general orchard question has not been considered in the foregoing. The prominent and deservedly oft-repeated inquiry as to the best and hardiest varieties has not been touched. What has been said is not even an attempted explanation of what "hardiness" means, nor in what it consists, save as applied to the trunks of trees as stated. It may be worth while, however, to mention that in every case coming under my observation of Ben Davis grafted well up on a hardy variety the whole tree has remained perfectly healthy and continuously productive, while root-grafted trees have perished.

A CONTAGIOUS DISEASE OF THE EUROPEAN CABBAGE WORM (PIERIS RAPÆ), AND ITS ECONOMIC APPLICATION.

By S. A. FORBES, Ph. D., *Professor of Zoölogy and Entomology.*

It is a well-known fact that the lower animals suffer from disease as do the higher. In every subkingdom, down to the very lowest, death from parasitism has been observed, and in most the phenomena of widespread epidemic disease, of virulent contagious disorders, have been noted, if not carefully studied. No diseases known to men are more violent or frightfully destructive than some of the plagues which infest the insect world; where they have, indeed, a fixed place in the economy of insect life, suddenly erecting perfectly impassable barriers against great irruptions of the more prolific insect species. Whenever any species becomes so abundant as to threaten the sources of its own food supply, and so endangers its own continuance, it is a very common event that a contagious disease breaks out among the swarming hordes and ravages like a devouring flame until almost the last individual has succumbed. The army worm, the forest caterpillar, the chinch bug and the cabbage worm are examples of species often so attacked. Better known examples are afforded by the domesticated insects—the silkworm, the honey bee, etc. Silk culture is now in large measure a perpetual contest with the contagious diseases of the silkworm, the entire method of breeding and rearing this insect having been largely revolutionized by the necessity of guarding against one or two of its worst diseases. The so-called "foul brood" of the honey bee is a disease of bee larvæ so destructive that even now, when its character is well understood, there seems to be no better method of controlling it known than to immediately burn everything which it has invaded.

Of course, to any one knowing these facts the inquiry must immediately occur, Why not utilize these natural checks upon insect multiplication, and by artificial manipulation and studied application endeavor to increase their destructiveness, and thus diminish the damage done by insects to agriculture?

When we reflect what we might do, if horses were noxious animals, to diminish their numbers by using every possible artifice to spread glanders among them, or how we might destroy cattle and sheep in myriads, if so disposed, by cultivating the virus of the lung plague and sprinkling it on their pastures or infecting their drink with its baneful germs, we can see no *prima facie* reason why we may not pursue with success a similar policy in respect to the contagious diseases of our injurious insects.

Acting on this idea, I have used such opportunities and time as I could find during the three last years for careful study of insect diseases, and for some preliminary experiments of a practical character with such as promised any useful results. My studies are still in progress, and I shall not attempt anything like an exhaustive account of them or description of their results, but will confine myself here to a single one of the diseases investigated—the most destructive, rapid and easily propagated with which I have experimented.

But first it may be well to introduce this special subject by a brief account of the diseases of insects at large, such as will show you about how the particular malady I have selected for discussion is related to the others.

Contagious diseases may be caused either by plant or animal parasites. If the former, they are called *mycoses*, being always due, as far as known, to parasitism by fungi. *Hyphomycosis, schizomycosis,* and the like, are names applicable to varieties of fungous will serve to indicate the group of fungi to which the disease parasite belongs.

The only animal parasites, known to me, which cause insect diseases worthy of the name of plagues, belong to Protozoa; and to a class of that sub-kingdom now called the Sporozoa, all the members of which are parasitic on animals. The genus Gregarina is the disease, and best known example of the class. A disease caused by such parasites might, I suppose, be called a *sporozosis*.

The insect maladies of this group are distinguished from all others by being, so far as known, the only ones that are directly hereditary, the thing passing from parent to offspring being not merely a constitutional peculiarity, a diathesis, a predisposition, a susceptibility, but the disease germ itself. *Pébrine* of the silkworm is the best known example.

The position of what I here propose to call the white plague of the cabbage worm—the disease to which the greater part of this paper is given—will be sufficiently indicated in the classification which I have outlined, by saying that it is a schizomycosis, not certainly known to be hereditary, but apparently conveyed from year to year by the persistent vitality of the bacteria which characterize it. It is not impossible, however, that it may be directly inherited, since the bodies of insects affected by it are so generally penetrated by its characteristic bacteria that these may be reasonbly supposed in many cases to fill the ovaries and to enter the forming egg.

In studying experimentally on insect disease, it is necessary, in the present state of our knowledge, (1) to determine precisely the symptoms and character of the disease itself, in order that it may be subsequently recognized with certainty; (2) to learn whether it is characterized by bacteria; and (3) whether it is practically contagious. Determining these questions affirmatively, (4) cultures of the bacteria must be made artificially; and (5) these cultures must be used to produce, in healthy insects of the same or other species, a disease characterized by the symptoms and results of the original affection. It is further desirable that (6) second cultures should be prepared from these cases of disease artificially produced, in order that a strict comparison may be made of the bacteria concerned, as they occur both in the bodies of the insects and in artificial culture media. I propose to take up these points *seriatim* with respect to the white plague of the cabbage worm, giving only an abstract of the facts bearing upon each, premising, however, that the proof of our proposition is sometimes partly contained in the paragraph relating chiefly to another.

This disease is distinguishable with great ease and certainty by conspicuous external symptoms, the color alone of affected larvæ being, in fact, entirely characteristic and unmistakable. The natural color of a healthy cabbage worm is a light lively green, sometimes slightly tinged with yellowish, but without any approach to an ashy or milky hue. As the first symptom of the plague, however, the larva commences to turn pale, this paleness increasing more or less rapidly until the color is almost milky white, only slightly tinged with greenish. After death the color deepens to a sooty gray, commonly uniform, but sometimes appearing first about the center of the length of the larva.

In the actions of the insect there is little to indicate any change of state except a gradually increasing sluggishness, slowness of movement, and loss of appetite. These are later to appear than the pale discoloration above mentioned, and even shortly before death a larvæ may show considerable impatience if roughly handled. When the disease is well developed the caterpillar is very feeble, and will remain motionless for a long time; or if it attempt to crawl where some strength is needed, as horizontally on a vertical surface, it may lose its hold with its jointed limbs and cling only by its central prolegs, the fore and hinder parts hanging limp and helpless at right angles to the remainder of the body.

Most commonly an escape of fluid from the vent is among the earlier symptons of the affection, at first greenish or whitish and later a dirty gray or even a chocolate brown. The stomach is almost invariably well filled with food, digestion being evidently suspended during the course of the disease.

The color of the fluids of the healthy larva is a very pale transparent green, the blood containing only lymphoid corpuscles in greater or lesser number; but if a proleg of a diseased specimen be snipped off, and a cover glass be pressed against the cut surface, the droplet exuding will be of almost milky whiteness, or in the latest stages of the disease, a dirty gray. If examined under a high power of the microscope this will be found to contain innumerable myriads of very minute sphericles, varying in diameter, according to the individual, from .5 μ to 1 μ. Usually their average size does not surpass .7 μ. It is the infinite multitude of these which gives to the fluids of the caterpillar their milky look, the blood being so thick with them that little else can ordinarily be seen in it.

The most characteristic *post mortem* phenomenon is the rapid softening, decay and deliquescense of the body, the whole of which may be converted, in an hour or two after death, into a dirty fluid mass which the rotten skin is barely sufficient to hold together. This breaks at a touch, allowing the fluid contents to escape.

I have now demonstrated by a great variety of cultures and experiments that a large percentage at least, and quite probably nearly all of the minute sperical granules abundant in the fluids of the body and alimentary canal of the diseased cabbage worm are genuine bacteria belonging to the genus Micrococcus.

In form the micrococci of the cabbage worm are usually strictly spherical, although in the alimentary canal a patch will occasionally occur in which they are of a slightly oval outline. The micrococci of the fluids of the diseased larvæ seen in the field of the microscope are mostly separate spheres, but a considerable percentage of them are attached in pairs, as if in process of division. Rarely a short chain of four, six or eight may be seen. In the stomach they occur not infrequently in compact patches or zooglœa-like masses. In size the individuals vary from .5 μ to 1.25 μ in diameter, the small forms being commonest in the blood and the larger in the stomach. Individual larvæ differ, in fact, with respect to the size of their micrococci, in some the average of those found in the blood being not far from .75 μ to 1 μ, while in others they barely reach .5 μ. Usually those of the stomach average 1 μ.

The proof of the contagious character of this disease must be derived in part from the phenomena of its appearance, progress, and local distribution and in part from experiments purposely made for its propagation.

That this affection or one very similar to it attacks the cabbage worms of the old world is made likely by a chance remark in Curtis's "Farm Insects," where, speaking of several larvæ of an allied species, *Pieris brassicæ*, he describes cases of disease and death, suddenly appearing among them, precisely like that of our common cabbage worm.

In this country the disease seems to have been first noticed in the vicinity of Washington, in 1879, although little attention was paid to it, and its bacterial character was not then ascertained. In Bulletin 3, of the United States Entomological Commission, (pp. 69, 70), Dr. Riley remarks, while discussing some experiments made with yeast on the cabbage worm:

"An incident connected with these experiments which I made is, however, well worthy of being mentioned, because it shows how very easily single experiments may lead to false hopes and conclusions. A certain proportion of the last-named larvæ—the proportions differing in the different lots treated—perished before or while transforming to the chrysalis state. They became flaccid and discolored, and after death were little more than a bag of black putrescent liquid. I should have at once concluded that the yeast remedy was a success, had I not experienced the very same kind of mortality in previous rearing of this larvæ, and had I not, upon returning to the field from which the larvæ in question were obtained, found a large proportion similarly dying there."

The next observations upon it were made by myself, at Normal, in September, 1883; and during the remainder of that season it was very destructive in the eastern part of the central region of Illinois. That it did not occur at Normal in 1882 is made certain by the fact that the cabbage fields there were frequently visited in autumn by myself and my assistants during the progress of a series of experiments with insecticides upon the cabbage worm, and that nothing of the sort was seen by us.

When first noticed there, its distribution was peculiarly irregular. In certain small fields, for example, not one-half mile distant from those in which the disease was raging violently, affecting one-fourth to one-half of the worms in sight, not a single dead larva could be found by a very careful search. A few weeks later (October 4) larvæ in these fields were suffering as severely as the others, 20 per cent of the worms, on an average, showing signs of illness.

September 27, at Rosehill, near Chicago, I visited fields in which, although the worms were fairly abundant, I could not find a single diseased larva during a careful examination of more than a hundred individuals; while across a road and a half mile away, the disease was fully at work in four adjacent fields, and fully one-fourth of the worms had been attacked. These were in all stages of the disease, many of them being dead and rotten. The identity of the affection with that observed at Normal was established by careful microscopic examination.

From correspondents to whom I had described the cabbage worm mortality at Normal, I received various reports. Prof. A. J. Cook, of the State Agricultural College of Michigan, wrote me, October 2, that about 10 per cent. of the cabbage worms near Lansing were affected by it. Dr. E. R. Boardman, in Stark county, sixty miles northwest of Normal, reported, September 29, that the cabbage worm was there very destructive, but that no appearance of the disease in question was discoverable. October 5 he repeated this observation, but on the 13th of that month he finally found a very few affected larvæ.

D. S. Harris, of Cuba, in Fulton county, nearly south of Dr. Boardman, first wrote me, on the 13th of October, that no disease had appeared among the cabbage worms about his place, nor at adjacent towns, as he had learned by careful search and inquiry, but on the 25th of the month he wrote: "That disease attacking the cabbage worm has made its appearance in Cuba at last. On the 21st I found one full-grown worm sick (head downward), and in about five hours it was dead and decomposed, and several others were affected. To-day it is a difficult matter to find a sound worm on the plants, while the remains of dead worms are numerous."

From Prof. G. H. French, at Carbondale, and Mr. Frank Earle, at Cobden, I learned that the disease had not appeared in Southern Illinois as late as October 29, nor did it occur there during the season. From Champaign, east of me, Prof. Burrill wrote me, October 25, that he had not yet seen any of it in his small garden patch of cabbages, although watching carefully for it; but that an intelligent student had described it as occurring in fields near the town.

In Iowa, to the westward, it seems not to have occurred spontaneously that year, the only appearance of it noted by Prof. Osborn, of the Agricultural College of that State, being the result of an experiment, the material for which I furnished him from Normal. It prevailed there the year following, and wherever it once occurred it continued throughout the season, as far as our observations went.

The facts clearly and positively negatived the supposition that there was anything in the weather or local conditions to explain either the presence or the absence of the disease, and all bore out the hypothesis of a gradual progress from the east westward. The same phenomena of irregular local distribution were manifest the next year (1884). In certain large fields almost daily observed, it was impossible to find a single diseased larva at a time when, half a mile away, the cabbage worms of small patches had been almost wholly destroyed, their blackened bodies, or the shriveled remnants of the same, being scattered everywhere on the leaves.

From the foregoing the conclusion is unavoidable that all the circumstances of the natural occurrence and spread of the disease are consistent with the hypothesis of its contagious character, and wholly inconsistent with any other.

Two attempts were made to convey the contagion by means of diseased larvæ to localities not previously reached by it, one lot being sent October 3 to Dr. Boardman, at Elmira, and one to Prof. Osborn, at Ames, Iowa. The experiment of Dr. Boardman was not wholly satisfactory, for the reason that through an unfortunate delay of the package the worms which I sent him did not arrive until October 22, at which time the disease had appeared spontaneously, in a small way, in his vicinity. Nevertheless he selected, October 23, two lots of twenty-five worms each, all perfectly healthy to appearance, fed them regularly, but exposed all of them to the contagion by enclosing them in two boxes with the dead and sick caterpillars which I had sent him. At the same time he secured ten healthy larvæ in a box by themselves and kept them free from infection. The latter lot all pupated without accident, but were not followed further. The first two lots commenced to show symptoms of disease on the fifth day, and by the eighth day all of both lots were dead except three, only one of which finally reached pupation. Even this pupa, in fact, afterwards died and decayed.

The material sent Professor Osborn, of Iowa, including dead and dying worms, and a mounted slide of the micrococci, arrived October 5, and two cabbage heads were at once infected. On the 7th one of the worms "had evidently succumbed to the disease." The gathering of the cabbages under observation during the temporary absence of Professor Osborn, necessarily interfered with the further progress of the experiment, but he collected such worms as he could from the stumps and fed them in confinement. A number of these larvæ died, and December 28 he wrote me that he had "found micrococci in a number of sick and dead cabbage worms, which must certainly have taken the disease from the ones sent."

Although these experiments, taken alone, could scarcely be regarded as conclusive as to the contagious character of *flacherie*, taken in connection with the culture and infection experiments, to be presently described, we must a least allow them weight as cumulative evidence.

Artificial cultures of the cabbage worm bacteria were made by us duing the three seasons of 1883, 1885 and 1886, those of the first two years being exclusively in fluid media—either in beef broth or infusion of cabbage leaves—and those of the present year in both fluids and solids. The details of the methods used can not be given here, but may be found fully described in the technical papers on this class of subjects, published in the bulletins of the Illinois State Laboratory of Natural History. Here I need only say that every precaution known to the practical bacteriologist was used to secure pure cultures and to guard against unwarranted conclusions. As a result of our culture experiments I now consider it thoroughly established that the characteristic micrococcus of the white plague of the cabbage worm is readily cultivable in animal infusions and in solid gelatine media, and that with due care pure fluid cultures may be obtained in condition for successful use in conveying the infection to other insects. The general prevalence of this disease in the regions under my observation has deterred me from experiments intended to test the practicability of conveying it to healthy cabbage worms by means of artificial cultures, as I could have no security that seemingly healthy insects collected for experiment had not already been freely exposed to it in the field. I have consequently been reduced to the less promising experiment of infecting the food of other species of larvæ with material obtained by cultures from diseased cabbage worms. I say less promising, because my previous experiments for the transfer of other insect diseases from one species to another have repeatedly proven failures, either partial or complete. In the case of the cabbage worm plague, however, (the most virulent and rapid in its action of any insect disease which I have seen,) the result has been much more encouraging. For example, I fed thirty thistle caterpillars (*Pyrameis cardui*) August 11 with thistle leaves dipped in a fluid culture of the cabbage worm Micrococcus, and within forty-eight hours twelve of these were dead, their blood and alimentary fluids swarming with the form of Micrococcus ingested. At the end of four days sixteen larvæ had died under experiment, two had been killed accidentally, eight had pupated, and five were yet alive,—a mortality, due to the affection, of fifty-five per cent. in four days. Solid cultures from these dead larvæ gave again the original Micrococcus of the cabbage worm plague.

The economic value of our bacterial cultures of the white plague of the cabbage worm is very evident. They might be used to introduce the cabbage worm disease in regions where it had not penetrated. They might be kept over winter, cultivated in spring, and applied to the food of the earliest brood of cabbage worms, with a view to set the disease on foot sooner and with greater energy than if left to itself, and they might be used at any time to intensify the disease already existing, so as to accelerate the destruction of the larvæ treated.

Finally, the experiment which I have just described makes it likely that these cultures may be found equally effective for the destruction of other injurious insects—a line of investigation, however, upon which much additional work will be needed before we can announce definite conclusions. Still it must be confessed that the practical advantage of this method of destroying noxious insects is greatly lessened by the difficulty of preparing the material, a technical process requiring a considerable degree of expert skill.

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