

SECOND BIENNIAL REPORT

[No. 13 in series]

OF

THE BOARD OF REGENTS

OF

THE UNIVERSITY OF MINNESOTA,

TO THE GOVERNOR,

FOR THE

FISCAL YEARS 1881 AND 1882, ENDING NOVEMBER 30TH

Transmitted to the Legislature at the Twenty-third (Second Biennial)
Session, 1882.

MINNEAPOLIS:
JOHNSON, SMITH & HARRISON.
1883.

The present University "charter" was enacted by the legislature February 18, 1868. The first annual report was that for 1868, transmitted to the legislature of 1869. The last annual report was that for 1878. There have been accordingly eleven annual reports, and this second biennial report is No. 13 of the series.

The annual reports of progress of the GEOLOGICAL SURVEY of Minnesota will be found in the annual reports of the Board of Regents, beginning 1872. The annual report of the survey for 1881 was printed separately, no other reports of or to the Board being printed in that year.

THE UNIVERSITY OF MINNESOTA,
OFFICE OF THE BOARD OF REGENTS,
December 28th, 1882. }

SIR:—In compliance with law I have the honor to forward herewith the second biennial report of the Board of Regents for the fiscal years 1881 and 1882, ending November 30th.

Very respectfully,

Your obedient servant,

HENRY H. SIBLEY,
President.

To the Hon. LUCIUS F. HUBBARD,
Governor of Minnesota.

THE BOARD OF REGENTS.

The Board of Regents is composed at this date of the following gentlemen:

The Hon. GREENLEAF CLARK, M. A., St. Paul, whose term expires..	1883.
The Hon. ORSON V. TOUSLEY, M. A., Minneapolis, " " "	..1883.
The Hon. JOHN B. GILFILLAN, Minneapolis, " " "	..1884.
The Hon. KNUTE NELSON, Alexandria, " " "	..1884.
The Hon. JOHN S. PILLSBURY, Minneapolis, " " "	..1884.
The Hon. HENRY H. SIBLEY, St. Paul, " " "	..1885.
The Hon. THOMAS S. BUCKHAM, M. A., Faribault, " " "	..1885.

and ex-officiis,

The Governor of the State,

The Hon. LUCIUS F. HUBBARD, St. Paul.

The Superintendent of Public Instruction,

The Hon. DAVID L. KIEHLE, M. A., St. Paul.

The President of the University.

WILLIAM W. FOLWELL, LL.D., Minneapolis.

OFFICERS OF THE BOARD.

The HON. HENRY H. SIBLEY, St. Paul, President.

The HON. O. V. TOUSLEY, Minneapolis, Recording Secretary.

MR. R. A. DAVISON, Minneapolis, Treasurer.

WILLIAM W. FOLWELL, Minneapolis, Corresponding Secretary.

EXECUTIVE COMMITTEE.

The HON. JOHN S. PILLSBURY, Minneapolis.

The HON. JOHN B. GILFILLAN, Minneapolis.

The HON. GREENLEAF CLARK, St. Paul.

MEETINGS.

The annual meeting is fixed by the charter for the second Tuesday in December. There is a meeting on Commencement Day; other meetings occur as called by the President of the Board.

The Executive Committee meet regularly on one of the last secular days of each month.

The following changes have taken place in the board since the last report:

The Hon. Richard Chute resigned his regency and office of recording secretary, October 20, 1881, upon considerations of health and pressing private engagements. On the 25th day of the same month the Governor appointed the Hon. J. B. Gilfillan to fill the vacancy thus occasioned.

The Hon. A. J. Edgerton, having been appointed by the President Chief Justice of the Territory of Dakota, resigned as regent December 22, 1881. The Hon. Knute Nelson was appointed to fill this vacancy February 15, 1882.

On the 31st day of January, 1882, the Hon. William R. Marshall, after many years of laborious and efficient service as a member of the board, submitted his resignation to the Governor, who, on the 1st day of February, appointed in his stead, the Hon. J. S. Pillsbury.

February 1st, 1882, Regents Sibley and Buckham, upon the expiration of their terms, were re-appointed by the Governor for the usual term of three years.

On the 16th of August, 1882, the Hon. David L. Kiehle was appointed Superintendent of Public Instruction for the State of Minnesota, and became a regent *ex-officio*, succeeding the Hon. David Burt, who, compelled to lay down his work by severe illness, died September 24, 1881. At the annual meeting in December, the board passed, and placed on record, resolutions expressing their appreciation of his long and valuable services and his high character.

On the 29th day of June, 1882, Regent Tousley was granted a leave of absence, and soon after set out for Trieste, Austria, for a residence of indefinite, but not extended duration.

THE GENERAL FACULTY.

The membership of the general faculty at the present time is as follows:

WILLIAM W. FOLWELL, PRESIDENT,
Political Science.

JABEZ BROOKS, D. D., PROFESSOR,
Greek, and in charge of Latin.

NEWTON H. WINCHELL, PROFESSOR,
State Geologist.

CHAS. N. HEWITT, M. D., NON-RESIDENT PROFESSOR,
Public Health and Hygiene.

JOHN G. MOORE, PROFESSOR,
German.

MOSES MARSTON, PH. D., PROFESSOR,
English.

CHRISTOPHER W. HALL, PROFESSOR,
Geology, Mineralogy and Biology.

JOHN C. HUTCHINSON, ASSISTANT PROFESSOR,
Greek and Mathematics.

JOHN S. CLARK, ASSISTANT PROFESSOR,
Latin.

MATILDA J. WILKIN, INSTRUCTOR,
German and English.

MARIA L. SANFORD, PROFESSOR,
Rhetoric and Elocution.

WILLIAM A. PIKE, C. E. PROFESSOR,
Engineering and in charge of Physics.

JOHN F. DOWNEY, C. E. PROFESSOR,
Mathematics and Astronomy.

JAMES A. DODGE, PH. D. PROFESSOR,
Chemistry.

ALEXANDER T. ORMOND, PROFESSOR,
*Mental and Moral Philosophy
and History.*

CHARLES W. BENTON, PROFESSOR,
French.

EDWARD D. PORTER, PROFESSOR,
Agriculture.

WILLIAM H. LEIB, INSTRUCTOR,
Vocal Music.

WILBUR F. DECKER, INSTRUCTOR,
Physics, Shop Work and Drawing.

EDGAR C. BOWEN, U. S. A., PROFESSOR,
Military Science.

WILLIAM A. NOYES, PH. D., INSTRUCTOR,
Chemistry.

HENRY M. WAITT, C. E., INSTRUCTOR,
Engineering and Drawing.

Professor Winchell, although holding the rank of professor, has been so fully occupied with his duties as State Geologist that the Board were obliged some three years ago to relieve him from teaching.

Professor Hewitt's duties are necessarily confined to two short courses of lectures, one on the hygiene of school life to the new students of each year, the other on sanitary science to each senior class. For these he has exacted no compensation beyond his traveling expenses.

The following changes have been made in the corps of instructors since the last report: At the close of the year 1881-82, the Board of Regents detached the subjects of rhetoric and elocution from the chair of English language and literature, and formed a separate professorship of rhetoric and elocution, electing Miss Maria L. Sanford to the occupancy.

At the beginning of the year 1881-'82, Edgar C. Bowen, Captain U. S. A. (retired) was employed to take charge of the department of military science, and to perform the duties of registrar. This department has suffered from the frequent changes in the incumbency due to the regulations of the war department of the general government. It is hoped that the selection of a professor from the retired list will remedy this evil and give this department an uninterrupted development.

Mr. Wilbur F. Decker, a graduate of the Maine State College, was employed as instructor in shop work, drawing and physics at the beginning of the year 1881-'82. Mr. H. M. Waitt, a graduate of the Massachusetts Institute of Technology and afterwards an instructor in the same institution, was engaged as an assistant in the departments of civil engineering and industrial drawing at the beginning of the present year; and Mr. William A. Noyes, Ph. D., a graduate of the Johns Hopkins University, as an assistant in the chemical laboratory at the same time.

At the date of the last report, the professorship of agriculture was vacant, and the board were making strenuous efforts to secure a capable and experienced person to take charge of it. These efforts resulted in the employment in January, 1881, of Professor Edward D. Porter of Delaware college, Newark, Delaware, with which institution he had been connected for some thirty years. Professor Porter brought to the new field the results of a long and varied experience in many lines of practical and scientific research and instruction. His conduct of his department has fully justified the action of the Board in their choice, and has given great satisfaction to the practical agriculturists and horticulturists of the State.

EMPLOYEES.

WARREN UPHAM, M. A., Assistant in Geological Survey.
CHARLOTTE A. ROLLIT, B. L., Assistant Librarian,
JOHN A. GALLOW, Janitor Main Building.
JAMES BOWEN, Green-house man and Janitor of the Agricultural
College.

A number of other persons, mostly students, have been employed by the day or month on the experimental farm and gardens, during the working season.

STUDENTS.

For information as to the enrollment and classification of students, and the number graduated during the period covered by this report, you are respectfully referred to the report of the President of the University hereto annexed. The number of graduations has increased steadily, year by year, but the Board congratulate themselves and the State, not so much upon the number as upon the excellent scholarship and high character of the alumni. The Board have constantly supported the faculties in holding up the standard of graduation. By lowering the standard but a little the list of graduates could have been greatly augmented.

The same report is referred to generally for information in regard to all matters strictly educational.

BUILDINGS.

The present buildings have been kept in good repair at a moderate expense. The means are much needed for constructing a sewer to receive the drainage of the main building and the new structures which it is proposed to erect in its vicinity, and to suitably light the assembly hall for evening meetings.

The last report of this Board set forth in strong terms the need of new buildings to enable the institution to develop at equal pace with the public school system of the State, and with like institutions of neighboring States. The joint committee of the two houses of the Legislature, after a prolonged consideration of the subject on the spot, agreed unanimously to recommend a liberal appropriation for the erection and outfit of new buildings. This recommendation was favorably responded to by the Legislature,

who appropriated the gross sum of one hundred and eighty thousand dollars, in six annual installments of thirty thousand dollars each. The general plans of the several buildings had been submitted to the joint committee on the University, and the Board were prepared promptly to begin work upon them. It chanced, however, that the State Capitol was destroyed by fire, almost at the moment of the passage of the appropriation bill, thus creating a sudden and extensive demand upon the State treasury. Other unusual expenses soon after supervened to delay the payment of the first installment. When the time came for the second installment to be met there were no funds available, and up to the present date the Board have not been able to draw from the treasury a single dollar for the erection of the new buildings.

Advantage has been taken of the delay to mature and elaborate the building plans, and to study the improved methods of lighting, heating and ventilation. A large amount of useful information has been accumulated, which the architect, employed by the Board, has embodied in his designs and specifications.

The law appropriating the funds, while indicating the structures to be erected, confided the order of their erection to the regents. After careful investigation the conclusion reached was that the structures should follow in this order:

- 1st. The Farm House.
- 2nd. The Military building and Gymnasium.
- 3rd. The Engineering building.
- 4th. The Museum.
- 5th. The Library.
- 6th. The Astronomical Observatory.

It was at the same time further agreed that, so far as practicable, the said buildings be grouped around the present main building, and be of a common or uniform size ; also, to be heated from a common source, if practicable.

It is the ardent hope of the Board that the reasons which have deprived them of the use of the appropriations will within a very short period have ceased to exist, and that they may with the opening of the next season, place two or more of the buildings under contract.

At the time of the last visitation by the Joint Committee of the Legislature already referred to, their attention was attracted to certain parcels of land still abutting against the Campus on the northwest, and their judgment was that these should be acquired

if possible. The Legislature of 1881, upon their recommendation appropriated the sum of twenty thousand dollars for the purpose. The negotiations of the Board to secure possession by purchase having failed, proceedings were instituted in the District Court for condemnation under the statute. These are still pending, but will no doubt eventuate in securing a valid title to the property.

The Board have been compelled to submit to the opening of a public street by the City Council of Minneapolis, connecting Fifteenth avenue S. E. and Pleasant street. The nature of the ground, however, is such that no cutting or filling will be needed of a magnitude sufficient to break the contour of the adjacent ground. This bisection of the campus is in a considerable degree compensated for by the contemporaneous vacation of Bluff street, thus making a desirable strip of land on the river bank heretofore cut off by that street continuous with the campus, and also better accomodating the proper location of the new buildings.

THE GEOLOGICAL SURVEY.

The annual report of the State Geologist, Professor N. H. Winchell, shows that this important work has been prosecuted with commendable diligence. Much valuable information has been furnished touching the economic geology of the State, and the interest of men of science has been attracted by many curious problems in geology, whose solution may greatly modify received opinions regarding them.

The final report of the geological portion of the work proper has been in preparation, and one volume is now ready for publication. It contains a large amount of matter of high importance to the State. The Board think that the Legislature will provide for the printing, stereotyping, engraving and binding of a moderate edition at least.

The geological work of the survey has so occupied the time of the limited force in the employ of the Board that but comparatively little has been accomplished on the natural history portion. The Board hope soon to be able to have this work prosecuted, but a considerable time must necessarily be devoted to it.

EXPERIMENTAL FARM.

Report made to Regts.

The investigations of the present professor of agriculture, soon after entering their service, convinced the Board of Regents that a large part of the tract originally acquired for an experimental farm, chiefly on account of its convenient proximity to the campus and buildings, was not adapted to the purposes in view.

Upon their application the Legislature of 1881 passed an act authorizing its sale and the reinvestment of the proceeds "in land of a suitable character and location for experimental farming, to be carried on in connection with the University, and under the supervision of the regents as provided by law."

Under this law the Board proceeded first to the selection of a new tract of suitable character and location, deeming it unwise and not to be intended that the department should, by a premature sale of the old tract, be left without land for experimental uses. After examining a considerable number of parcels of varying desirability and prices, the Board at length decided that the property, known as the "Bass Farm," lying on the Como road, about one and one-half miles eastwardly from the campus, being the northwest quarter of section 21, township 29, range 23, less five acres, combined in the highest degree the qualities implied in the law. They accordingly obtained the refusal of the property at \$200 per acre, and later the actual possession, upon the payment of ten thousand dollars. Other payments were by agreement deferred in such way as to enable the Board to meet them from the proceeds of the sale of the old farm.

Having thus secured a piece of land for a new farm, which it would be difficult, if not impossible, to duplicate in the State, location, exposure, contour and variety of soil, all considered, the next step was towards the sale of the old farm. The land was first carefully surveyed and platted. This consumed some time. The necessity of awaiting the action of the City Council of Minneapolis, which has a jurisdiction over all plats within two miles of the city limits took more time. After being suitably advertised the property was finally offered for sale at public auction on the 11th of October last. On that and the following day 152 lots, and a small triangular piece, containing about two and one-half acres, were sold for the gross sum of forty-seven thousand four hundred dollars. 164 lots were left unsold, partly for lack of time, partly because the title to certain ones can-

not be perfected until the court shall have vacated some portion of "Baker's Addition" which had been re-platted to conform with the extension of University avenue and its parallel streets. These lots it is believed will sell for as much as equivalent areas of the lots sold. The receipts from these sales will pay for the new farm and for a large part of the equipment of buildings, water-supply, implements and stock. The original cost of the old farm was about \$7,500.

It is the intention of the Board, while avoiding any extravagance, to equip this new farm in such a manner as to make it in the highest degree useful and to render it a source of pride and increasing interest and value to the farmers of the State.

Plans for the necessary buildings have been already drawn and discussed.

THE FRUIT FARM.

The report of Mr. Gideon, the superintendent, show the progress he has been able to make in his interesting experiments. The Board are of the opinion that all of the operations of this farm, save those requiring seclusion and a water exposure, can be hereafter carried on more economically on the experimental farm, where they can be seen by students and others interested. Some portions of the fruit farm are not particularly adapted to the purpose, and it happens that those portions have become valuable for building sites for summer residents. It is respectfully suggested that the Legislature authorize their sale and the application of the proceeds to other uses in connection with the agricultural department.

INSTRUCTION.

No material changes have been made in the regular courses of study, since the general re-arrangement of them in 1880.

The work of the faculty has been increased, however, by the opening of certain special courses, chiefly by the voluntary action of some of the professors, for which it is proper that the Board give credit in this report. These are :

I. THE FARMERS' LECTURE COURSE.

For many years the Board had offered to the farmers of the State the opportunity of hearing a practical course of lectures, upon condition that a number not less than 30 should declare in advance their desire to attend.

This condition was never fulfilled until professor E. D. Porter, under authority of the Board, took hold of the enterprise in the early winter of 1882. He was so successful in obtaining the attention and co-operation of farmers, dairymen, nurserymen and others, that over two hundred persons were in attendance on the course. The U. S. Commissioner of Agriculture made the journey from the seat of government to give the opening address. At the close of the course the attendants adopted resolutions of thanks and congratulations for the opportunities enjoyed, and desiring its continuation as part of the regular work of the Agricultural College.

II. THE EVENING DRAWING SCHOOL.

In the fall of 1880 Professor Pike, voluntarily, offered to give a course of free evening lessons in industrial drawing to young mechanics, if the Regents would furnish the room, lighted and warmed. The enterprise was an immediate success, the room being filled to its full capacity.

The course was repeated with the same success in the fall of 1882, and a third is now in operation.

The attendance upon this course is necessarily somewhat local, but it has been found that a considerable proportion of the mechanics are merely temporary residents of the University city. In the first year both of the prize men were non-residents. The strongest expressions of gratitude for the instruction thus given have been repeatedly made by those receiving it.

III. THE COURSE IN SHOP-WORK.

The disappearance of the apprenticeship system of training mechanics has led of late years, both at home and abroad, to the organization of industrial schools in great variety.

The exhibits made by some of these at the Centennial Exposition showed what had then been accomplished and brought into

general view the plans and methods of such schools. It was demonstrated that by a course of regular graded exercises in working wood, metals and other materials accompanied by oral or text-book instruction, a boy could be so trained that in a very short time he would be in possession of the foundation principles and processes of all the crafts. Several well known institutions in this country at once organized and set in operation industrial departments of greater or less magnitude.

The engineering schools generally opened courses in shop work as auxiliary to their scientific instruction, in order to give their students the opportunity of becoming practically acquainted with the nature of materials and the principles of construction.

This Board, unwilling that the University should be in the rear of this most important movement in the northwest, resolved in 1881, to open, albeit in a very moderate way, the course in Shop Work and Drawing.

One thousand dollars were set apart for the purchase of a steam engine, and a small outfit of forges, vises, bench and fitting tools, and wood working tools. A small lathe had been purchased some years before. The course was opened in the fall of 1881, under the supervision of Professor Pike, Mr. W. F. Decker, an expert mechanic as well as a well trained scientific scholar being the immediate instructor. The success of the course fully justified the expectations of the Board and encouraged them to continue it in future operation.

IV. THE SUMMER SCHOOL.

In the spring of 1881, Profs. C. W. Hall and J. A. Dodge offered to open at the University courses of instruction in their specialties to be free to all attendants, it being expected that these would be chiefly teachers. The use of the building, cabinets and apparatus having been granted, these gentlemen, with the assistance of Prof. C. E. Bessey, of the Iowa State Agricultural College, distinguished as a botanist and an author, gave free instruction in botany, chemistry, geology and mineralogy during the month of July to a large body of persons, most of whom were teachers of our own and the neighboring State of Wisconsin. At the annual meeting in December, 1881, this Board adopted resolutions of thanks to these officers who had performed such excellent service without compensation.

Again in the summer of 1882, similar courses were delivered by

Prof. Hall and Dodge, assisted by Mr. J. C. Arthur, a skillful botanist and former pupil of Prof. Bessey. On this occasion, however, they were reinforced by other colleagues offering instruction in additional branches. Professor J. G. Moore gave a course in German, Professor M. Marston in English literature and Professor M. L. Sanford in rhetoric and elocution. The school no longer remained a "Summer School of Science," but became a "Summer School of Science and Literature." The literary instruction appeared to be as much in demand as the scientific. The attendance was largely in excess of that of the previous year.

In regard to these special courses of instruction the Board have to say that they think they may congratulate themselves and the State upon this addition to the privileges offered by the University. But they are also obliged to add that it cannot be expected that such advantages can be indefinitely offered without cost.

When the legislature shall come to consider the amount of support which should be set apart for the institution it will be a proper subject for their consideration, whether some means ought not to be furnished for carrying on this important practical work. The institution is sacredly pledged by the law to adapt its work to the interests of the industrial classes and the Board accept it not merely as a duty but as a pleasure to plan and execute measures calculated to render such service.

FINANCES.

The reports of the treasurers of the University for the last two years are herewith transmitted. These have been carefully examined by the auditing committee, who have compared the vouchers with the entries. The debits and credits having been found correct and properly supported by the vouchers, the committee has recommended their approval, and the reports have accordingly been adopted.

The following statement derived from the report of the State Auditor shows the present condition of the funds of the University:

Permanent University Fund at interest.....	\$601,032.71
Amount cash on hand.....	14,282.85

Total amount of permanent fund... ..	<u>\$615,315.56</u>
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CONCLUSION.

The Board avail themselves of this opportunity to again present to the representatives of the people the needs and claims of the University.

The foundations have been, as we trust, wisely and soundly laid. The rapidity with which the superstructure shall rise will depend chiefly on the means which may be placed at the disposal of the Board.

The Board congratulate themselves and the people on the progress which has been already made, and find in it the best encouragement to future effort.

All of which is respectfully submitted.

TREASURER'S REPORTS.

I.

TREASURER CHUTE'S REPORT FOR 1881.

RICHARD CHUTE, *Treasurer, in account with the Board of Regents of the University of Minnesota:*

CURRENT EXPENSES.

DR.

1880.		
Nov. 30.	To balance from last statement.....	\$5,976 50
Dec. 24.	To cash from State Treasurer.....	4,000 00
1881.		
Jan. 26.	To cash from State Treasurer.....	4,000 00
Feb. 22.	To cash from State Treasurer.....	5,000 00
March 23.	To cash from State Treasurer.....	3,000 00
April 9.	To cash from State Treasurer.....	5,000 00
May 27.	To cash from State Treasurer.....	4,000 00
June 10.	To cash from State Treasurer.....	4,000 00
Sept. 15.	To cash from State Treasurer.....	4,000 00
Oct. 26.	To cash from State Treasurer.....	5,000 00
Nov. 26.	To cash from State Treasurer.....	4,000 00
Nov. 30.	To cash from students' fees.....	930 00

CR.

1881.		
Nov. 30.	By balance, heating account.....	\$3,411 69
	By balance, furniture account.....	262 06
	By balance, expenses, farm and campus account.....	2,972 55
	By balance, fruit farm account.....	73 00
	By balance, incidentals account.....	894 27
	By balance, library account.....	2,497 06
	By balance, repairs account.....	1,867 15
	By balance, salaries for instruction account.....	27,676 25
	By balance, employees and workmen account.....	1,406 05
	By balance, plant house account.....	200 83
	By balance, printing, stationery, &c., account.....	893 54
	By balance, chemical laboratory account.....	685 52
	By balance, apparatus account.....	1,942 52
	By amount carried to new account.....	4,125 01
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		\$48,906 50 \$48,906 50

SALARIES FOR INSTRUCTION.

CR.

1880.		No. Voucher.	
Dec.	24. By E. D. Porter, instruction.....	35	104 25
Dec.	31. By faculty, pay roll salaries.....	41	2,250 00
1881.			
Jan.	17. By W. W. Folwell, house rent.....	57	250 00
Jan.	31. By faculty, pay roll salaries.....	79	2,450 00
Feb.	28. By faculty, pay roll salaries.....	118	2,450 00
Mar.	8. By E. D. Porter, instruction.....	119	200 00
Mar.	8. By E. D. Mayo, instruction.....	122	40 00
Mar.	22. By W. H. Leib, instruction.....	142	90 00
Mar.	31. By faculty, pay roll salaries.....	155	2,450 00
April	30. By faculty, pay roll salaries.....	199	2,450 00
May	24. By W. H. Leib, instruction.....	216	48 00
May	31. By faculty, pay roll salaries.....	234	2,450 00
June	30. By faculty, pay roll salaries.....	282	2,450 00
July	13. By W. W. Folwell, (house rent).....	311	250 00
Aug.	1. By E. D. Porter, instruction.....	320	200 00
Aug.	11. By M. L. Sanford, instruction.....	329	24 00
Sept.	12. By E. D. Porter, instruction.....	365	200 00
Sept.	12. By W. F. Decker instruction.....	366	100 00
Sept.	30. By faculty, pay roll salaries.....	393	2,970 00
Oct.	31. By faculty, pay roll salaries.....	424	2,970 00
Nov.	8. By W. H. Leib, instruction.....	438	60 00
Nov.	30. By faculty, pay roll salaries.....	479	2,970 00
Nov.	30. By Jabez Brooks, instruction.....	489	250 00
To balance to current expense.....			\$27,676 25
			\$27,676 25

EMPLOYEES AND WORKMEN.

CR.

1880.		No. Voucher.	
Dec.	24 By A. H. Nunn, Dec. wages, janitor.....	30	\$ 18 00
Dec.	24 By W. C. Bryant, Dec. salary, janitor.....	31	63 70
1881.			
Jan.	31 By W. C. Bryant, Jan. salary, janitor.....	73	63 70
Jan.	31 By A. H. Nunn, Jan. salary, janitor.....	76	18 00
Feb.	28 By W. C. Bryant, Feb. salary, janitor.....	111	63 70
Feb.	28 By A. H. Nunn, Feb. salary, janitor.....	115	18 00
March	11 By T. E. Trussell, 34 hours labor.....	121	5 10
March	18 By W. C. Bryant, labor to G. Budds, &c.....	124	8 50
March	31 By W. C. Bryant, March salary, janitor.....	149	63 70
March	31 By A. H. Nunn, March salary, janitor.....	153	18 00
April	30 By W. C. Bryant, April salary, janitor.....	192	63 70
April	30 By Alex. H. Nunn, April salary, janitor.....	195	18 00
May	31 By W. C. Bryant, May salary, janitor.....	228	63 70
May	31 By A. H. Nunn, May salary, janitor.....	229	18 00
June	22 By A. H. Nunn, June salary, janitor.....	270	18 00
July	5 By W. C. Bryant, June salary, janitor.....	300	63 70
Sept.	10 By J. E. Gallow, janitor Aug. and July.....	363	100 00
Sept.	30 By J. E. Gallow, janitor Sept.....	392	50 00
Oct.	4 By J. E. Gallow, cleaning building.....	399	45 00
Oct.	4 By J. E. Gallow, sweeping.....	400	24 00

		No. Voucher.		
Oct.	4	By A. H. Nunn, Sept. salary, janitor.....	404	27 00
Nov.	1	By J. E. Gallow, janitor, Oct.....	427	50 00
Nov.	1	By A. H. Nunn, Oct. salary, janitor.....	429	27 00
Nov.	21	By A. H. Nunn, cleaning shop.....	460	3 55
Nov.	21	By J. E. Gallow, cleaning and sweeping....	466	16 00
Nov.	30	By J. E. Gallow, janitor, Nov.....	482	50 00
Nov.	30	By A. H. Nunn, Nov. salary, janitor.....	483	27 00
Nov.	30	By R. Chute, salary as Sec. and Treas.....	485	400 00
To balance to currant expense.....			\$1,405 05	\$1,405 05

EXPERIMENTAL FARM AND CAMPUS.

DE.

1881.			
May	10.	To G. S. Grimes, sales.....	\$100 00
Sept.	29.	To G. S. Grimes, sales.....	67 50
Nov.	30.	To E. D. Porter.....	109 88

CR.

1880.		No. Voucher.		
Dec.	4.	By G. S. Grimes, Nov. pt. pay roll.....	6	\$22 12
Dec.	4.	By G. S. Grimes, Nov. pt. pay roll.....	7	4 32
Dec.	14.	By G. S. Grimes, seeds, rakes and hauling.	16	19 35
Dec.	15.	By P. C. Heath, teaming.....	22	2 55
Dec.	24.	By Thomas Budds, farm hand.....	29	45 00
1881.				
Jan.	13.	By W. Q. Greeley, repairs and shoeing....	47	10 50
Jan.	14.	By Geo. S. Grimes, labor in Dec.....	54	6 57
Jan.	25.	By Chas. Henry, stove repairs, &c.....	62	2 69
Jan.	31.	By Thomas Budds, farm hand.....	75	45 00
Feb.	28.	By Thomas Budds, farm hand.....	113	45 00
Mar.	31.	By Thomas Budds, farm hand.....	151	45 00
April	25.	By A. J. Creigh, horse and buggy.....	177	325 00
April	23.	By Jno. Shulte, harness.....	178	40 00
April	30.	By Thomas Budds, farm hand.....	197	45 00
May	4.	By Arthur Budds, hauling wood.....	205	3 90
May	6.	By J. Townsend, labor in April.....	206	25 50
May	21.	By E. D. Porter, pay roll, &c. for May....	214	84 54
May	31.	By Thomas Budds, May salary.....	227	45 00
June	7.	By J. Donahue, labor on farm.....	240	9 75
June	7.	By H. Winchell, labor on farm.....	241	9 00
June	7.	By S. D. Townsend, labor on farm.....	242	12 60
June	7.	By G. G. Robinson, labor on farm.....	243	20 00
June	7.	By P. C. Heath, labor on farm.....	244	66 00
June	7.	By Joseph Townsend, labor on farm.....	245	39 00
June	7.	By A. E. Doten, labor on farm.....	246	4 20
June	7.	By Eli Larson, labor on farm.....	247	1 20
June	7.	By Galpin & Emerson, labor on campus....	249	3 90
June	7.	By Jacob Schlosser, sodding.....	250	17 00
June	7.	By Merriman, B. & Co., fencing.....	251	32 00
June	7.	By W. J. Dean, scraper.....	252	9 50
June	7.	By J. Trefl, rent of lot.....	253	15 00
June	7.	By E. D. Porter, sundry bills.....	254	25 28
July	2.	By Geo. S. Grimes, labor in May & June..	288	49 04
July	2.	By J. S. Donahue, labor in June.....	289	36 90
July	2.	By N. M. Baker, labor in June.....	290	22 20

		No. Voucher.	
July	2.	By G. G. Robinson, labor in June.....	291 49 41
July	2.	By S. D. Townsend, labor in June.....	292 34 80
July	2.	By A. E. Doten, labor in June.....	293 35 85
July	2.	By J. C. Wilson, labor in June.....	294 19 50
July	2.	By J. B. Gould, labor in June.....	295 33 15
July	2.	By J. Townsend, labor in June.....	296 36 60
July	2.	By P. C. Heath, labor in June.....	297 71 40
July	2.	By Thomas Budds, June salary.....	298 45 00
July	5.	By Arnell & Christlieb, repairing harness.	305 4 65
Aug.	12.	By Edw. D. Porter, labor pay roll for July	331 302 95
Aug.	12.	By G. G. Robinson, balance of May bill....	332 12 85
Aug.	12.	By E. D. Porter, sundry bills	333 66 27
Aug.	12.	By Janney, Brooks & E., tools & h'ware...	334 33 71
Aug.	13.	By Minn. St'd Mnfg Co., haystack cover..	335 14 25
Aug.	13.	By Wyman Elliot, plants, roses, &c.....	336 66 00
Sept.	12.	By E. D. Porter, labor pay roll, Aug....	364 303 85
Sept.	24.	By G. S. Grimes, labor in Sept.....	387 39 00
Oct.	4.	By E. D. Porter, labor pay roll for Sept...	407 196 08
Oct.	4.	By W. Q. Greeley, blacksmithing.....	405 17 30
Oct.	7.	By Geo. Huhn & Co., oil, brushes, &c.....	413 9 05
Nov.	4.	By Jas. W. Queen & Co., mdse.....	430 129 00
Nov.	4.	By E. D. Porter, labor pay roll for Oct....	433 363 52
Nov.	8.	By Geo. Scrumm, horse medicine, &c.....	441 19 00
Nov.	21.	By H. W. S. Cleveland, services as gardn'r.	469 100 00
Nov.	30.	By E. D. Porter, sundry bills.....	490 57 22
		To balance to current expense	\$2,972 55
			<hr/>
			\$3,249 93 \$3,249 93

PLANT HOUSE.

DR.

1881.			
Nov.	30.	To E. D. Porter.....	\$100 35

CR.

		No. Voucher.	
1880.			
Dec.	4.	By W. J. Barrett, Nov. Labor	5 \$19 78
1881.			
Jan.	13.	By W. J. Barrett, Dec. Labor.....	45 16 00
Feb.	2.	By W. J. Barrett, Thermometer, &c.....	86 1 00
Feb.	2.	By W. J. Barrett, Jan. Labor.....	87 18 33
Mar.	18.	By W. J. Barrett, Feb. Labor.....	125 12 60
Mar.	19.	By G. G. Robinson, Feb. Labor.....	137 3 45
April	5.	By W. J. Barrett, Mar. Labor.....	166 21 91
May	2.	By W. J. Barrett, April Labor	202 31 10
June	1.	By W. J. Barrett, May Labor.....	236 30 75
June	7.	By Ellwanger & Barry, Roses.	248 16 66
July	1.	By W. J. Barrett, June Labor	284 52 00
Aug.	1.	By W. J. Barrett, July Labor.....	318 39 35
Sept.	16.	By W. J. Barrett, Aug. Labor.....	381 35 40
Nov.	21.	By W. J. Barrett, sundry bills.....	462 2 85
		To balance to current expense	\$200 83
			<hr/>
			\$301 18 \$301 18

BIENNIAL REPORT

LIBRARY ACCOUNT.

DR.

1881.			
June 28.	To F. Gideon, for damages.....	\$	75
	To Hilyer, for damages.....		25

CR.

		No.	Voucher.	
1880.				
Dec. 24.	By Charlotte A. Rollit, Dec. salary.....	33		\$ 55 00
Dec. 24.	By Geo. W. Keith, periodicals.....	37		140 98
Dec. 31.	By R. C. M'Dillon, periodicals.....	39		24 00
Dec. 31.	By C. C. Curtis, books.....	40		18 22
1881.				
Jan. 26.	By Pott, Young & Co., books.....	63		339 40
Jan. 31.	By C. A. Rollit, Jan. salary.....	74		55 00
Feb. 12.	By Lillian S. Todd, book.....	96		1 50
Feb. 12.	By Lillian S. Todd, labor in Nov.....	97		30 60
Feb. 12.	By Lillian S. Todd, labor in Dec.....	99		34 54
Feb. 28.	By C. A. Rollit, salary for Feb.....	112		55 00
Mar. 22.	By Smith & Nichols, books.....	143		133 00
Mar. 28.	By Lillian S. Todd, labor in Feb.....	145		20 90
Mar. 31.	By C. A. Rollit, Mar. salary.....	150		55 00
April 4.	By E. & J. B. Young & Co., books.....	167		141 64
April 7.	By Lillian S. Todd, labor in Mar.....	168		33 00
April 18.	By Pott, Young & Co., books.....	175		396 50
April 28.	By W. O. Davis & Co., books.....	187		212 00
April 30.	By C. A. Rollit, April salary.....	193		55 00
May 7.	By L. S. Todd, labor in April.....	209		46 38
May 30.	By E. J. Thompson, books.....	223		14 09
May 31.	By C. A. Rollit, May salary.....	231		55 00
June 3.	By G. M. Fist, cyclopedia.....	239		50 00
June 9.	By Lillian S. Todd, labor in May.....	256		18 53
June 11.	By C. A. Rollit, June salary.....	262		55 00
June 15.	By E. & J. B. Young & Co., books.....	265		76 11
Sept. 13.	By Rand, McNaly & Co., atlas.....	376		23 00
Sept. 14.	By C. W. Davison, directory, 1880-81.....	377		6 00
Sept. 16.	By E. & J. Young & Co., books.....	382		109 72
Oct. 7.	By Jesse C. Wilson, dusting books.....	415		24 00
Oct. 12.	By Emily L. Hough, tending library.....	418		6 00
Oct. 12.	By Emily L. Hough, tending library.....	419		5 00
Nov. 1.	By C. A. Rollit, Oct. salary.....	426		50 00
Nov. 21.	By C. A. Rollit, Sept. and Aug. salary.....	464		100 00
Nov. 21.	By E. L. Hough, library work.....	467		7 95
Nov. 30.	By C. A. Rollit, Nov. salary.....	488		50 00
	To balance to current expense.....			\$2,497 06
				\$2,498 06
				\$2,498 06

REPAIRS.

CR.

		No. Voucher.	
1880.			
Dec. 13.	By W. H. Savidge, hardware and lumber	12	\$ 25 89
Dec. 13.	By W. H. Savidge, labor in Nov.....	13	23 70
1881.			
Jan. 13.	By Sykes & Andrews, plumbing	43	11 50
Jan. 13.	By W. H. Savidge, carpenter work	44	18 00
Jan. 14.	By Ball & Naylor, couplings and fittings..	50	17 27
Jan. 25.	By Gallison & Gowen, hardware.....	61	32 93
Feb. 2.	By W. H. Savidge, lumber.....	83	15 73
Feb. 2.	By W. H. Savidge, carpenter work.....	84	19 40
Feb. 19.	By M. W. Glenn, rivets and nuts.....	105	4 69
March 19.	By Cauvet & Reid, pipe, labor, &c.....	133	38 57
March 19.	By W. H. Savidge, carpenter work.....	136	12 20
March 21.	By W. H. Savidge, lumber and work.....	140	27 98
April 5.	By W. H. Chambers, repairing pipes, &c.	163	3 00
April 5.	By W. H. Chambers, rep. hydraulic motor	164	1 10
April 7.	By W. H. Savidge, material.....	169	15 91
April 7.	By W. H. Savidge, carpenter work.....	170	14 90
April 9.	By Ball & Naylor, fittings and labor.....	172	1 80
April 28.	By Sykes & Andrews, plumbing.....	181	12 65
May 2.	By W. H. Chambers, labor in Nov. '81.....	201	6 90
May 4.	By W. H. Savidge, carpenter work.....	203	11 60
June 18.	By W. H. Savidge, carpenter work.....	268	3 70
June 18.	By W. H. Savidge, hardware.....	268	13 73
July 1.	By W. H. Savidge, carpenter work.....	285	44 00
Aug. 1.	By W. H. Savidge, carpenter work.....	319	71 26
Aug. 13.	By Sykes & Andrews, gas machine.....	337	10 24
Aug. 16.	By Tyler & Leighton, lumber.....	340	24 04
Aug. 17.	By A. R. Miller, locks, &c.....	345	13 37
Aug. 22.	By Nelson Tenney & Co., lumber.....	351	47 09
Sept. 1.	By Gallison & Gowen, hardware.....	353	5 06
Sept. 1.	By A. A. Pond, labor.....	354	1 85
Sept. 13.	By Nelson, Tenney & Co., lumber.....	373	126 31
Sept. 13.	By Michael Lyons, plastering.....	374	75 50
Sept. 13.	By Sykes & Andrews, hose, reel, &c.....	375	40 40
Sept. 17.	By Cauvet & Reid, labor.....	386	3 10
Oct. 1.	By Gallison & Gowen, hardware.....	295	20 08
Oct. 1.	By Gallison & Gowen, hardware.....	296	4 50
Oct. 4.	By Spink & Co., mdse.....	403	67 26
Oct. 4.	By Nelson Tenney & Co., lumber.....	408	5 04
Oct. 5.	By Hagen & Kelley, painting, &c.....	411	572 50
Nov. 5.	By Gallison & Gowen, hardware.....	435	6 95
Nov. 18.	By Gallison & Gowen, hardware.....	456	3 36
Nov. 21.	By Geo. Huhn & Co., mdse.....	458	26 90
Nov. 21.	By Jno. Speedy, paper hanging.....	471	175 00
Nov. 23.	By Harvey Wales & Co., paper and border	473	180 80
Nov. 23.	By DeLamatic & Bailey, castings.....	474	5 00
Nov. 30.	By A. H. Nunn, labor.....	487	3 80
	To balance to current expense.....		\$1,867 15
			\$1,867 15
			\$1,867 15

BIENNIAL REPORT

PRINTING, ADVERTISING, POSTAGE, &c.

1880.	CR.	No. Voucher.	
Dec. 8.	By Johnson, Smith & Harrison.....	8	6 25
Dec. 15.	By Johnson, Smith & Harrison.....	21	41 50
Dec. 24.	By Minn. Tribune Co., printing.....	36	8 00
1881.			
Jan. 13.	By Minn. Tribune Co., printing.....	49	21 25
Jan. 18.	By Kirkbridge & Co., stationery.....	58	8 69
Feb. 12.	By H. J. Crist, advertising.....	94	2 60
Feb. 12.	By Edgar Nash, postage.....	95	15 00
Feb. 28.	By Ariel Association, advertising.....	107	30 00
Mar. 19.	By Evening Journal, advertising.....	130	5 30
Mar. 29.	By Eagle Publishing Co., printing.....	135	7 50
Mar. 26.	By Geo. H. Keith, postage.....	144	13 95
April 8.	By Johnson, Smith & Harrison, printing and stationery.....	171	28 00
June 1.	By Ariel Association, advertising.....	235	30 00
June 9.	By Geo. H. Keith, postage..	255	40 00
June 10.	By Minnesota Tribune Co., printing....	258	42 50
June 10.	By Minnesota Tribune Co., printing....	259	9 00
June 10.	By Minnesota Tribune Co., printing....	260	347 90
June 28.	By Edgar Nash, postage.....	274	6 00
June 28.	By Geo. H. Keith, postage.....	276	43 48
July 6.	By Hennig & Kruekenburg, printing	310	4 00
Sept. 1.	By Johnson, Smith & Harrison, printing..	356	5 75
Sept. 16.	By Pioneer Press Co., advertising.....	385	55 50
Oct. 4.	By Minnesota Tribune Co., printing.....	406	49 50
Oct. 7.	By C. D. Whittall & Co., stationery	414	4 37
Oct. 26.	By Eagle Publishing Co., printing.....	423	4 00
Nov. 9.	By Davidson & Ross, printing.....	443	15 50
Nov. 15.	By Minnesota Tribune Co., printing.....	450	24 00
Nov. 16.	By Johnson, Smith & Harrison, stationery.	458	24 00
	To balance to Current expense.....		
			\$893 54
			\$893 54
			\$893 54

GEOLOGICAL SURVEY.

1880.	CR.	No. Voucher.	
Dec. 1.	By balance from last statement.....		\$21,347 42
Dec. 4.	By cash, Warren Upham, salary for Aug..	4	100 00
Dec. 10.	By cash, Jas. W. Queen & Co., merchandise.	9	18 00
Dec. 10.	By cash, Mayhew Bros., carribon, skele- ton, &c	16	16 00
Dec. 15.	By cash, Geo. Huhn & Co., merchandise...	20	75
Dec. 18.	By cash, Warren Upham, expenses on survey trip.....	23	15 74
Dec. 24.	By cash, N. H. Winchell, salary for Dec...	25	200 00
Dec. 24.	By cash, Warren Upham, salary for Dec..	26	100 00
Dec. 24.	By cash, C. M. Terry, salary for Dec.....	27	100 00
Dec. 24.	By cash C. L. Herriek, salary for Dec.....	28	75 00
Dec. 31.	By cash, B. Quaritch, books,	38	174 92

1881.		No. Voucher.	
Jan.	21.	By cash, C. L. Herrick, ink, pens, &c.....	60 1 65
Jan.	28.	By cash, O. E. Garrison, field work....	68 50 00
Jan.	31.	By cash, N. H. Winchell, salary for Jan....	69 200 00
Jan.	31.	By cash, Warren Upham, salary for Jan....	70 100 00
Jan.	31.	By cash, C. M. Terry, salary for Jan.....	71 100 00
Jan.	31.	By cash, C. L. Herrick, salary for Jan.....	72 75 00
Feb.	1.	By cash, N. H. Winchell, sundry expenses..	81 7 73
Feb.	1.	By cash, C. M. Terry, field expenses.....	82 39 50
Feb.	28.	By cash, N. H. Winchell, salary for Feb. .	108 200 00
Feb.	28.	By cash, W. Upham, salary for Feb.....	109 100 00
Feb.	28.	By cash, C. L. Herrick, salary for Feb.....	110 75 00
Mar.	19.	By cash, J. W. Floyd, maps.....	129 5 00
Mar.	21.	By cash, N. H. Winchell, sundry expenses.	138 4 05
Mar.	21.	By cash, N. H. Winchell sundry expenses..	139 8 25
Mar.	21.	By cash, C. W. Hall, traveling expenses, &c..	141 46 96
Mar.	31.	By cash, N. H. Winchell, salary for Mar....	146 200 00
Mar.	31.	By cash, W. Upham, salary for Mar.....	147 100 00
Mar.	31.	By cash, C. L. Herrick, salary for Mar.....	148 75 00
April	4.	By cash, C. M. Terry, half month services.	156 50 00
April	4.	By cash, S. M. Williams, vellum, &c.....	158 8 42
April	28.	By cash, C. W. Hall, sundry bills	185 11 10
April	30.	By cash, N. H. Winchell, salary for April.	189 200 00
April	30.	By cash, Warren Upham, salary for April.	190 100 00
April	30.	By cash, C. L. Herrick, salary for April ...	191 75 00
May	7.	By cash, N. H. Winchell, sundry bills, &c..	207 27 45
May	7.	By cash, N. H. Winchell, expenses to St. Paul.....	208 3 30
May	25.	By cash, Warren Upham, field expenses. .	218 7 50
May	30.	By cash, W. M. Howling, mounting birds..	221 48 00
May	30.	By cash, W. M. Howling, mounting birds..	222 7 00
May	31.	By cash, N. H. Winchell, salary for May..	224 200 00
May	31.	By cash, Warren Upham, salary for May..	225 100 00
May	31.	By cash, C. L. Herrick, salary for May....	226 75 00
June	13.	By cash, N. H. Winchell, petty expenses..	263 20 51
June	15.	By cash, Jno. Mulliman, specimens.....	264 2 80
June	30.	By cash, Warren Upham, salary for June	281 100 00
July	5.	By cash, Whitall, Tatum & Co., mdse.....	304 189 10
July	6.	By cash, Lillian S. Todd, copying.....	307 9 50
July	6.	By cash, Hening & Kruckenber, mdse....	309 6 00
Aug.	3.	By cash, N. H. Winchell, July salary.....	321 200 00
Aug.	11.	By cash, Jas. Keating, dressing stone.....	324 20 00
Aug.	11.	By cash, N. H. Winchell, petty bills..	325 5 11
Aug.	11.	By cash, N. H. Winchell, car fare, &c.....	326 3 43
Aug.	11.	By cash, J. W. Kindred, buffalo skin.....	328 12 00
Aug.	22.	By cash, R. H. Prosser, work in museum..	350 8 51
Sept.	1.	By cash, J. H. Paut, locks for museum case.	352 44 50
Sept.	5.	By cash, Warren Upham, salary for July..	358 100 00
Sept.	5.	By cash, C. L. Herrick, salary for June....	359 75 00
Sept.	5.	By cash, N. H. Winchell, salary for Aug....	360 200 00
Sept.	12.	By cash, N. H. Winchell, petty bills and express.....	367 6 85
Sept.	12.	By cash, Jas. A. Dodge, analysis of mineral.	368 41 00
Sept.	13.	By cash, H. V. Winchell, services in field work.....	372 40 00
Sept.	26.	By cash, Jas. Keating, dressing stone. .	389 6 00
Sept.	26.	By cash, Jas. Keating, dressing stone.....	390 7 00
Sept.	30.	By cash, N. H. Winchell, Sept. salary.....	391 200 00
Oct.	4.	By cash, N. H. Winchell, postage and expressage.....	397 31 49

BIENNIAL REPORT

		No. Voucher.		
Oct.	4.	By cash, Thomas Cahill, abstract.....	402	5 00
Oct.	26.	By cash, S. M. Williams, merchandise....	422	3 32
Nov.	1.	By cash, N. H. Winchell, salary for Oct....	425	200 00
Nov.	5.	By cash, W. Upham, expense in field work..	434	73 26
Nov.	8.	By cash, W. M. Howling, mounting animal..	439	26 25
Nov.	9.	By cash, N. H. Winchell, petty bills.....	442	13 85
Nov.	14.	By cash, Warren Upham, salary for Aug. &c..	448	300 00
Nov.	19.	By cash, N. H. Winchell, salary for Nov....	457	200 00
Nov.	21.	By cash, F. B. Cornell, labor.....	468	36 00
Nov.	26.	By cash, C. S. Sheldon, taking observations..	478	22 00
Nov.	30.	By cash, Warren Upham, salary for Nov....	480	100 00
To balance to new account.....			\$26,756 72	
			\$26,756 72	\$26,756 72

CHEMICAL LABORATORY.

DR.

Mar.	14.	To cash, Jas. A. Dodge, on account.....	\$285 97
July	27.	To cash, Jas. A. Dodge, on account.....	100 00
Nov.	7.	To cash, Jas. A. Dodge, on account.....	125 06

CR.

1880.		No. Voucher.		
Dec.	3.	By cash, A. A. Pond, zinc, coal, &c.....	3	2 20
Dec.	15.	By cash, Geo. Huhn & Co., merchandise....	19	12 80
Dec.	23.	By cash, J. H. Paul, wall case.....	24	8 50
Dec.	24.	By cash, C. L. Sidener, asst for Dec.....	32	15 00
1881.				
Jan.	13.	By cash, A. R. Miller, anvil, vice, &c.....	48	6 83
Jan.	20.	By cash, A. A. Pond, charcoal.....	59	6 16
Jan.	26.	By cash, E. B. Benjamin, merchandise....	64	98 41
Jan.	31.	By cash, C. F. Sidener, assistant for Jan...	78	15 00
Feb.	25.	By cash, Noyes Bros. & Cutter, mdse.....	106	17 37
Feb.	28.	By cash, C. F. Sidener, Feb. services.....	116	15 00
Mar.	18.	By cash, Noyes Bros. & Cutter, chemicals..	126	8 14
Mar.	19.	By cash, Elmore & Richards, merchandise..	131	9 08
Mar.	19.	By cash, Hagertis Bros. & Co., merchandise..	132	17 50
Mar.	19.	By cash, Sykes & Andrews, pipes, fitting, &c..	134	37 36
Mar.	31.	By cash, C. F. Sidener, mch services.....	154	15 00
April	4.	By cash, A. A. Pond, merchandise.....	157	4 50
April	4.	By cash, E. B. Benjamin, merchandise....	162	20 84
April	30.	By cash, C. F. Sidener, April services.....	196	15 00
May	18.	By cash, Geo. Huhn & Co., merchandise....	213	9 38
May	31.	By cash, C. F. Sidener, May services.....	230	15 00
July	1.	By cash, C. F. Sidener, June services.....	283	15 00
July	5.	By Cash, A. A. Pond, coal.....	301	2 00
July	5.	By cash, Noyes Bros. & Co., merchandise..	303	7 71
July	19.	By cash, C. F. Sidener, services in full to July 1st.....	313	30 00
Sept.	6.	By cash, C. F. Sidener, July salary, as asst..	361	30 00
Sept.	12.	By cash, E. S. Kitchell, merchandise.....	369	4 00
Sept.	13.	By cash, Geo. Huhn & Co., merchandise....	370	136 50
Sept.	16.	By cash, Elmore & Richards, merchandise..	383	88 20
Sept.	16.	By cash, E. B. Benjamin, merchandise....	384	182 52
Oct.	4.	By cash, J. W. Queen & Co, merchandise..	398	25 25
Oct.	4.	By cash, Bullock & Crenslaw, mdse.....	401	45 42

		No. Voucher.		
Oct.	4.	By cash, C. F. Sidener, Sept. salary, as asst.	409	30 00
Nov.	1.	By cash, C. F. Sidener, Oct. salary, as asst.	428	30 00
Nov.	4.	By cash, Whitall, Tatum & Co., mdse. . . .	432	44 77
Nov.	14.	By cash, Jas. A. Taylor, material and labor.	446	131 72
Nov.	21.	By cash, Geo. Huhn & Co, merchandise. . .	459	4 45
Nov.	30.	By cash, C. F. Sidener, Nov. salary, as asst.	481	30 00
To balance to current expense.			\$685 52	
			<u>\$1,196 55</u>	<u>\$1,196 55</u>

APPARATUS ACCOUNT.

DR.

1881.			
Mar.	23.	To cash, C. W. Hall, on account, for use.	\$50 00

CR.

		No. Voucher.		
1880.				
Dec.	2.	By cash, Smith & Nichols, merchandise. . .	2	5 80
Dec.	10.	By cash, R. & J. Beck, merchandise.	10	162 15
1881.				
Jan.	14.	By cash, C. A. Bjorsell, labor on plates. . . .	51	42 52
Jan.	14.	By cash, W. A. Pike, paid for drawing, &c.	52	8 90
Jan.	17.	By cash, Jno. H. Bara, for drawing.	56	9 60
Jan.	26.	By cash, American Steam Gauge Co., in- dicator, &c.	65	94 50
Jan.	26.	By cash, Jas. W. Queen & Co., merchandise.	66	10 75
Jan.	26.	By cash, Gust E. Stechest, merchandise. . .	67	4 68
Feb.	12.	By cash, Kirkbridge & Co., merchandise. . .	102	27 56
Feb.	28.	By cash, C. A. Bjorsell, drawing	117	29 48
April	4.	By cash, Elmore & Richards, merchandise.	160	72 51
April	4.	By cash, R. & J. Beck, microscopic, &c. . . .	161	122 16
April	28.	By cash, C. W. Hall, paid for reports, &c. .	182	23 60
April	28.	By cash, C. W. Hall, coral, freight, &c. . . .	183	13 50
April	28.	By cash, J. P. Pyle, transit, level, &c.	186	175 00
Sept.	15.	By cash, S. J. McCarthy, tongs, shovels, &c.	378	100 00
Oct.	5.	By cash, Janney, Brooks & Co., mdse.	410	142 89
Oct.	7.	By cash, A. R. Miller, merchandise.	416	182 14
Nov.	7.	By cash, J. H. Kerrick & Co., engine and boiler	436	475 00
Nov.	14.	By cash, Louis E. Fritche, iron tanks, &c. . .	449	147 25
Nov.	17.	By cash, H. F. Nachtrieb, services	454	1 28
Nov.	17.	By cash, American Tool and Machine Co., set of templates.	455	53 95
Nov.	21.	By cash, American Tool and Machine Co., merchandise.	472	55 80
Nov.	30.	By cash, A. L. Stafford & Co., iron and labor	486	31 50
To balance to current expense.			\$1,942 52	
			<u>\$1,992 52</u>	<u>\$1,992 52</u>

BIENNIAL REPORT

ENLARGEMENT OF CAMPUS.

DR.

1881.			
April 16.	To cash, from State Treasurer.....		\$10,000 00
June 10.	To cash, from State Treasurer.....		5,000 00
Aug. 9.	To cash, from State Treasurer.....		5,000 00

CR.

1881.			
Dec. 1.	By balance from old statement.....		\$ 365 37
1880.		No. Voucher.	
April 22.	By cash, Jas. Cullen, 1 lot.....	176	\$1,800 00
April 23.	By cash, J. S. Coughlin, 4 lots.....	179	1,550 00
May 4.	By cash, Jno. S. Pillsbury, 4 lots.....	204	1,350 00
May 14.	By cash, Wm Constans, undivided ½ 5 lots.	212	1,445 00
May 26.	By cash, J. W. Johnson, 4 lots.....	219	1,000 00
May 26.	By cash, Board of Education, 1 lot.....	220	200 00
June 3.	By cash, W. J. Davidson, undivided ½, 10 lots.....	238	1,607 50
July 18.	By cash, Steward, Hill & L., real estate....	312	2,750 00
July 25.	By cash, J. S. Pillsbury, 1 lot.....	315	350 00
July 26.	By cash, W. Young, administrator fee to several lots.....	316	1,206 50
July 29.	By cash, J. B. Gillilan, abstract.....	317	3 00
Aug. 5.	By cash, Jno. G. Lennon, undivided ¼ of 3 lots.....	322	2 00
Aug. 5.	By cash, Jno. T. West, undivided ¼ of 3 lots.	323	298 37
Aug. 11.	By cash, Abby E. Watson, heirs' interest in one lot.....	327	203 82
Aug. 15.	By cash, Elisha A. West, 1 lot.....	338	325 00
Aug. 15.	By cash, J. Guilford, tax title to 1 lot.....	339	14 45
Sept. 8.	By cash, J. N. House, 2 lots.....	362	738 94
Oct. 11.	By cash, J. Guilford, (assignee) interest in 10 lots.....	417	67 43
Oct. 12.	By cash, Jno. C. McCain, 1 lot.....	420	375 00
Nov. 8.	By cash, Mary A. Charles, part of 2 lots... By balance on account.....	440	153 00
			\$4,196 62
			\$20,000 00
			\$20,000 00

INCIDENTAL ACCOUNT.

DR.

1881.			
Feb. 12.	To cash, telephone exchange.....		\$ 15
Nov. 21.	To cash, Backus (books).....		1 00

CR.

1880.		No. Voucher.	
Dec. 1.	By cash, W. C. Bryant, sundry bills.....	1	\$15 80
Dec. 14.	By cash, James Jennison, writing.....	15	8 90
1881.			
Jan. 13.	By cash, James Jennison, writing.....	46	10 15
Jan. 14.	By cash, W. A. Pike, paid for express- age, &c.....	53	7 72
Feb. 2.	By cash, Jas. Jennison, writing.....	85	12 90

		No. Voucher.	
Feb.	3.	By cash, Telephone Ex. Co., Nov. rent.....	89 4 15
Feb.	3.	By cash, Telephone Ex. Co., Dec. rent.....	90 4 45
Feb.	12.	By cash, C., St. Paul. M. & O. R. R. Co., freight.....	93 3 09
Feb.	12.	By cash, C. M. & St. P. R. R. Co., freight..	100 6 60
Feb.	12.	By cash, W. W. Folwell, expressage, freight, &c.....	101 16 82
Mar.	7.	By cash, Ball and Naylor, oil, &c.....	120 2 25
Mar.	18.	By cash, P. Phillips, Jr., office work.....	123 4 40
Mar.	18.	By cash, Hawes & Smith, merchandise.....	127 22 41
Mar.	18.	By cash, J. Jennison, writing.....	128 4 10
April	4.	By cash, Jas. Jennison, writing.....	159 18 50
April	12.	By cash, American Ex. Co., diplomas and express.....	174 35 75
April	28.	By cash, W. A. Pike, sundry bills.....	180 10 44
April	28.	By cash, C. W. Hall, sundry bills.....	184 13 89
May	2.	By cash, J. Jennison, writing, &c.....	200 15 60
May	12.	By cash, Telephone Ex. Co., Feb. rent....	210 4 30
May	12.	By cash, Telephone Ex. Co., March rent..	211 4 15
May	23.	By cash, W. A. Pike, expressage.....	215 3 20
May	24.	By cash, W. H. Leib, music.....	217 3 48
June	1.	By cash, J. Jennison, writing.....	237 15 10
June	9.	By cash, Telephone Ex. Co., Jan., April and May bills.....	257 13 50
June	10.	By cash, Jabez Brooks, petty expenses....	261 7 15
June	16.	By cash, F. Danz, music.....	266 60 00
June	18.	By cash, J. Jennison, writing.....	267 10 60
June	24.	By cash, C. W. Benton, expenses in exam- inations.....	271 33 80
June	28.	By cash, C., St. P., M. & O. R. R. Co., freight.	272 2 06
June	28.	By cash, W. R. Hoage, drawing.....	273 17 30
June	28.	By cash, C., M. & St. P. R. R. Co., freight..	275 5 60
June	28.	By cash, Hattie A. Smith, writing.....	277 3 44
June	28.	By cash, W. W. Folwell, petty expenses and bills.....	278 22 70
June	28.	By cash, W. W. Folwell, petty expenses and bills.....	279 5 74
June	29.	By cash, Maria L. Sanford, petty expenses and bills.....	280 21 00
July	1.	By cash, J. F. Downey, petty expenses and bills.....	286 40 05
July	2.	By cash, B. Phillips, office work.....	287 22 40
July	5.	By cash, Hawes & Smith, merchandlse....	306 9 85
Aug.	16.	By cash, W. R. Booth, dinner for regents..	341 6 50
Aug.	16.	By cash, Kirkbridge, Wales & Co., mdse..	342 12 50
Aug.	16.	By cash, C. W. Hall, freight, fare, &c.....	343 11 10
Aug.	16.	By cash, C. W. Hall, petty bills.....	344 4 47
Aug.	18.	By cash, Jno. S. Clark, car fare, &c.....	346 10 42
Aug.	18.	By cash, Woodward & Roswein, stakes...	347 10 00
Sept.	1.	By cash, Johnson, Smith & Harrison, fill- ing out diplomas.....	355 14 00
Sept.	2.	Telephone Ex. Co., June and July bill.....	357 8 15
Sept.	13.	By cash, Emily L. Hough, writing, &c.....	371 21 15
Sept.	15.	By cash, J. F. and W. C. Bryant, cleaning buildings.....	380 70 00
Sept.	24.	By cash, A. T. Ormond, petty bills and ex- penses.....	388 42 35
Oct.	1.	By cash, J. E. Gallow, soap, cham. skins, &c.	394 5 88
Oct.	6.	By cash, N. W. Telephone Co., Aug. bill...	412 4 15
Nov.	3.	By cash, Jno. G. Moore, car fare, &c.....	431 24 27

BIENNIAL REPORT

		No. Voucher.		
Nov. 7.	By cash, Berry & Onion, merchandise.....	437		8 30
Nov. 16.	By cash, N. W. Telephone Co., Sept. bill....	451		4 45
Nov. 16.	By cash, N. W. Telephone Co., Oct. bill. . .	452		4 00
Nov. 21.	By cash, G. J. Backus, office work.....	461		3 15
Nov. 21.	By cash, C. M. Webster, writing.....	463		7 90
Nov. 21.	By cash, C. M. Webster, writing.....	465		8 80
Nov. 21.	By cash, W. W. Folwell, petty bills.....	470		69 49
Nov. 30.	By cash, R. Chute, petty bills.....	484		21 15
	To balance to current expenses.....		\$894 27	
			<u>\$895 42</u>	<u>\$895 42</u>

SALT LAND SALES.

DR.

1880.			
Dec. 1.	To balance from last statement.....	\$8,426 08	
Dec. 10.	To amount received from First National Bank, Fergus Falls, being interest, to July 1st, 1881, on certificates issued	1,138 17	
Dec. 10.	To amount received of First National Bank of Fergus Falls, being amount in full, due on certificate No. 12. to B. Haavstrich, for the nw¼ ne¼ sec. 24, township 133, range 44	170 00	
1881.			
Jan. 26.	To interest, from L. L. Kalness.....	18 84	
June 23.	To interest, from J. J. Haggerman.....	941 23	
July 13.	To interest, from G. B. & C. J. Wright.....	146 48	
July 25.	To interest, from J. Olson.....	17 73	
Oct. 29.	To amount received from First National Bank, Fergus Falls, for interest collected to July 1st, 1882, on certificates issued	1,009 36	
Nov. 10.	To amount received from First National Bank, Fergus Falls, interest from Tosten O. Moe.....	25 16	

CR.

Nov. 30.	By balance, to new account.....	\$11,893 05	
		<u>\$11,893 05</u>	<u>\$11,893 05</u>

LAND SALE FUND.

DR.

1880.			
Dec. 1.	To balance, from last statement.....	\$528 42	

CR.

1881.			
Nov. 30.	By balance, to new account.....		\$528 42

WATER SUPPLY.

DR.

1880.
Dec. 1. To balance, from last statement..... \$176 48

CR.

		No. Voucher.		
1881.	Feb. 1.	By cash, W. H. Chambers, water pipe, &c.	80	\$112 25
	April 11.	By cash, E. B. Preston & Co., hose fixtures.	173	161 30
	Nov. 30.	To balance, to new account.....	97 07	
			<u>\$273 55</u>	<u>\$273 55</u>

STUDENTS' FEES.

DR.

1881.	Feb. 12.	To cash, received from W. W. Folwell, fees.....	\$70 00	
	June 28.	To cash, received from W. W. Folwell, fees.....	15 00	
	Sept. 29.	Te cash, received from W. W. Folwell, fees.....	500 00	
	Nov. 21.	To cash, received from W. W. Folwell, fees.....	5 00	
	Nov. 21.	To cash, received from W. W. Folwell, fees.....	340 00	
			<u>\$930 00</u>	<u>\$930 00</u>
By balance, to current expense account.....				

HEATING AND FURNISHING, OLD ACCOUNT.

CR.

1880.
Dec. 1. By balance, from last statement..... \$300 53

DR.

1881.	Nov. 30.	To balance to new account.....	\$300 53	
			<u>\$300 53</u>	<u>\$300 53</u>

HEATING ACCOUNT.

DR.

1881.
June 28. To cash, 5 cords pine to Budds..... \$10 00

BIENNIAL REPORT

CR.

		No. Voucher.	
1880.			
Dec. 14.	By cash, Armstrong & Truesdell, wood....	14	\$698 88
Dec. 14.	By cash, Ball & Naylor, steam gauge.....	16	5 50
Dec. 24.	By cash, W. H. Chambers, Dec. salary, as engineer.....	34	35 00
1881.			
Jan. 14.	By cash, Armstrong & Truesdell, wood and coal.....	55	408 06
Jan. 31.	By cash, W. H. Chambers, Jan. salary....	77	35 00
Feb. 2.	By cash, T. E. Trussell, hauling wood.....	88	9 53
Feb. 12.	By cash, T. E. Trussell, hauling wood.....	98	6 23
Feb. 16.	By cash, Armstrong & Truesdell, coal and wood.....	103	199 04
Feb. 28.	By cash, W. H. Chambers, Feb. salary....	114	35 00
Mar. 31.	By cash, W. H. Chambers, March salary....	152	35 00
April 5.	By cash, J. A. Townsend, hauling wood, &c.	165	21 00
April 30.	By cash, W. H. Chambers, April salary....	194	35 00
April 30.	By cash, Armstrong & Truesdell, wood and coal.....	198	96 25
May 31.	By cash, W. H. Chambers, May salary....	232	35 00
May 31.	By cash, Ball & Naylor, Bronze tongs.....	233	3 50
July 2.	By cash, W. H. Chambers, June Salary....	299	35 00
July 6.	By cash, C. Bicknell, mason work.....	308	26 45
Aug. 11.	By cash, Armstrong & Truesdell, wood....	330	1,317 75
Aug. 22.	By cash, W. H. Chambers, extra labor....	349	50 00
Nov. 12.	By cash, W. H. Chambers, month service.	445	52 00
Nov. 25.	By cash, Armstrong & Truesdell, wood and coal.....	476	272 50
	To balance to current expense account.....		\$3,411 69
			<u>\$3,421 69</u> <u>\$3,421 69</u>

BUILDING ACCOUNT.

DR.

1880.		
Dec. 1.	To amount, from old statement.....	\$6,291 10

CR.

		No. Voucher.	
1881.			
Nov. 23.	By cash, H. Downs, stone and labor.....	475	\$174 77
	By balance to new account.....		6,116 33
			<u>\$6,291 10</u> <u>\$6,291 10</u>

FURNITURE.

DR.

1881.			
Nov. 21.	To cash, Bryant, for stove.....		\$5 00
		CR.	
1880.		No. Voucher.	
Dec. 14.	By cash, Wheaton, Reynolds & Co., drawing tables.....	17	\$46 50
1881.			
Jan. 8.	By cash, Folds & Griffith, merchandise.....	42	10 93
Feb. 4.	By cash, Wheaton, Reynolds & Co., book case, &c.....	91	40 00
Feb. 4.	By cash, J. S. Eeckman, reading desk....	92	18 20
Feb. 16.	By cash, Gallison & Gowen, step ladder....	104	2 45
April 28.	By cash, R. S. Jones, work on directory....	183	5 80
July 5.	By cash, Barnard & Cope, use of chairs....	302	12 00
July 19.	By cash, De Coster & Clark, merchandise.	314	45 00
Aug. 18.	By cash, Folds & Griffith, matting.....	348	15 36
Sept. 15.	By cash, W. W. Parker, frame and glass....	379	11 85
Nov. 10.	By cash, Leonard, Thompson & Bates, flag.	444	35 00
Nov. 14.	By cash, Folds & Griffith, merchandise....	447	9 75
Nov. 26.	By cash, Weeks, Littlefield & B., chandeliers.....	447	14 22
	To balance to current expense account.....		\$262 06
			<u>\$267 06</u>
			\$267 06

EXPERIMENTAL FARM FUND.

DR.

1880.			
Dec. 1.	To balance from old statement.....		\$671 87
		CR.	
1881.			
Nov. 30.	By balance to new account.....		\$671 87
			<u>\$661 87</u>
			\$671 87

FRUIT FARM.

CR.

No. Voucher.

1881,			
Oct. 26.	By cash, P. M. Gideon, labor.....	421	\$73 00
		DR.	
Nov. 30.	To balance to current expense.....		\$73 00
			<u>\$73 00</u>
			\$73 00

II.

TREASURER CHUTE'S REPORT FOR DEC. 1881, AND
TO JAN. 16TH., 1882.RICHARD CHUTE, *Treasurer, in account with the University of Minnesota.*

CURRENT EXPENSE.

DR.

1881.		
Dec. 1.	To balance from last statement.....	\$4,125 01
Dec. 16.	To cash from State Treasurer.....	5,000 00
1882.		
Jan. 5.	To cash from State Treasurer.....	1,000 00

CR.

Jan. 16	By balance, heating account.....	\$ 156 00
Jan. 16.	By balance, experimental Farm and Campus.....	373 27
Jan. 16.	By balance, incidental account.....	115 92
Jan. 16.	By balance, library account.....	416 13
Jan. 16.	By balance, repairs account.....	416 51
Jan. 16.	By balance, salaries for instruction account.....	3,220 00
Jan. 16.	By balance, employees and workmen account.....	146 50
Jan. 16.	By balance, plant house account.....	6 00
Jan. 16.	By balance, printing, stationery, etc.....	121 50
Jan. 16.	By balance, chemical laboratory account.....	54 85
Jan. 16.	By balance, apparatus account.....	835 26
Jan. 16.	By balance, amount carried to new account.....	4,263 07
		<hr/>
		\$10,125 01 \$10,125 01

SALARIES FOR INSTRUCTION.

CR.

		No. Voucher.	
1881.			
Dec. 31.	By cash, salaries for instruction for Dec.	528	\$ 2,970 00
1882.			
Jan. 6.	By cash, W. W. Folwell (house rent).....	538	250 00

DR.

Jan. 16.	To balance to current expense account.....	\$3,220 00	
		<hr/>	
		\$3,220 00	\$3,220 00

EMPLOYEES AND WORKMEN.

CR.

		No. Voucher.	
1881.			
Dec. 14.	By cash, J. E. Gallow, sweeping.....	513	\$16 00
Dec. 24.	By cash, A. H. Nunn, Dec. salary Janitor.....	522	27 00
Dec. 24.	By cash, J. E. Gallow, Dec. salary, Janitor....	525	50 00
1882.			
Jan. 12.	By cash, J. E. Gallow, sweeping.....	551	16 00
Jan. 16.	By cash, R. Chute, services.....	561	37 50
Jan 16.	To balance to current expense account.....		\$146 50
			<hr/>
		\$146 50	\$146 50

EXPERIMENTAL FARM AND CAMPUS

		CR.	No. Voucher.	
1881				
Dec. 5.	By cash, E. D. Porter, labor pay roll for Nov...	494		\$189 80
Dec. 6.	By cash, W. Grimshaw, carpenter work.....	499		6 00
1882.				
Jan. 3.	By cash, E. D. Porter, labor pay roll for Dec...	529		165 62
Jan. 6.	By cash, A. R. Miller, merchandise.....	536		11 85
Jan. 16.	To balance carried to current expense.....		\$373 27	
			<u>373 27</u>	<u>373 27</u>

PLANT HOUSE.

		CR.	No. Voucher.	
1881.				
Dec. 6.	By cash, W. Grimshaw, carpenter work.....	500		\$6 00
1882.				
Jan. 16.	To balance to current expense account.....		\$6 00	
			<u>\$6 00</u>	<u>\$6 00</u>

LIBRARY ACCOUNT.

		CR.	No. Voucher.	
1881.				
Dec. 6.	By cash, A. C. Bausman, binding.....	501		\$125 30
Dec. 24.	By cash, Geo. H. Keith, books P. order.....	523		148 38
Dec. 24.	By cash, C. A. Rollit, Dec. salary.....	524		50 00
1882.				
Jan. 12.	By cash, Mrs. J. Swain, books ..	550		72 75
Jan. 12.	By cash, Smith & Nichols, books.....	557		16 25
Jan. 12.	By cash, A. C. Bausman, covering books	560		3 50
Jan. 16.	To balance carried to current expense account		\$416 13	
			<u>\$416 13</u>	<u>\$416 13</u>

INCIDENTALS.

		CR.	No. Voucher.	
1880.				
Dec. 5.	By cash C. M. Webster, writing.....	495		\$ 6 60
Dec. 6.	By cash Ed. Hammon, dinner for Regents	496		6 65
Dec. 10.	By cash N. W. Telephone Ex. Co., Nov. bill....	507		4 00
Dec. 12.	By cash Chas. Henry, merchandise ..	511		1 00
Dec. 20.	By cash J. C. Hutchinson, travelling expenses..	514		12 42
1882.				
Jan. 5.	By cash Berry & Onion, merchandise	531		14 25
Jan. 9.	By cash B. Brown, carriage ..	542		4 00
Jan. 12.	By cash N. W. Telephone Co., Dec. bill,.....	552		4 00
Jan. 12.	By cash S. B. Ramsley, dinner for Regents.....	555		13 00
Jan. 12.	By cash J. S. Pillsbury, A. J. Edgerton's ex- penses.....	556		51 00
Jan. 16.	To balance carried to current expense account.....		\$115 92	
			<u>\$115 92</u>	<u>\$115 92</u>

GEOLOGICAL SURVEY.

		CR.	No. Voucher.	
1881.				
Dec. 1.	By balance from last statement.....			\$26,756 72
Dec. 20.	By cash W. Upham, field expenses.....	515		3 81
Dec. 21.	By cash C. S. Sheldon, taking observations.....	516		4 00

BIENNIAL REPORT

	No. Voucher.		
Dec. 21. By cash N. H. Winchell, petty bills expenses...	519		14 50
Dec. 23. By cash N. H. Winchell, salary for Dec.....	520		200 00
Dec. 23. By cash W. Upham, salary for Dec.....	521		100 00
1882.			
Jan. 9. By cash C. E. Young, printing.....	543		4 75
Jan. 16. To balance to new account.....		\$27,115 78	
		\$27,115 78	\$27,115 78

REPAIRS.

	CR.	No. Voucher.		
1881.				
Dec. 6. By cash W. Grimshaw, carpenter work.....	498		\$ 9 00	
Dec. 7. By cash Roseveare & Co., pipes, &c.....	504		100 48	
Dec. 7. By cash Hagan Kelly, labor.....	505		131 51	
Dec. 21. By cash Merriman B. & Co., flag staff.....	518		4 80	
1882.				
Jan. 6. By cash M. Lyons, plastering &c.....	537		12 37	
Jan. 9. By cash Gallison & Gowen, merchandise.....	541		1 10	
Jan. 10. By cash Wheaton, Reynolds & Co., floor, &c....	544		116 60	
Jan. 11. By cash J Patterson, season work.....	549		15 50	
Jan. 11. By cash Nelson, Tenney & Co., lumber.....	553		16 50	
Jan. 11. By cash Farnham & Lovejoy, lumber.....	554		8 05	
Jan. 16. To balance to account current expense.....		\$416 51		
		\$416 51	\$416 51	

PRINTING, STATIONERY, ADVERTISING, POSTAGE.

	CR.	No. Voucher.		
1881.				
Dec. 7. By cash Arlet Association, advertising....	502		30 00	
Dec. 7. By cash Fargo Republican, advertising.....	506		60 00	
Dec. 21. By cash Henning Kruekeburg, printing.....	517		6 50	
Dec. 30. By cash Minn. Education'l Journal, advertising.	527		25 00	
1881.				
Jan. 16. To balance to account current expense.....		\$121 50		
		\$121 50	\$121 50	

HEATING.

	CR.	No. Voucher.		
1881.				
Dec. 12. By cash W. H. Chambers, Nov. salary.....	510		52 00	
1882.				
Jan. 11. By cash W. H. Chambers, Sept. salary.....	547		32 00	
Jan. 11. By cash W. H. Chambers, Dec. salary.....	548		52 00	
Jan. 16. To balance to account current expense.....		\$156 00		
		\$156 00	\$156 00	

CHEMICAL LABORATORY.

	CR.	No. Voucher.		
1881.				
Dec. 5. By cash Geo. Huhn, merchandise.....	493		24 85	
Dec. 24. By cash C. F. Sidener, Dec. salary.....	526		30 00	
1882.				
Jan. 16. To balance to current expense account.....		\$54 85		
		\$54 85	\$54 85	

HEATING AND FURNISHING, OLD ACCOUNT.

CR.		
1881.		
Dec. 1.	By balance from last statement	\$300 53
DR.		
1882.		
Jan. 16.	To balance to new account	\$300 53
		\$300 53
		\$300 53

BUILDING ACCOUNT.

DR.		
1881.		
Dec. 1.	To balance from last statement.....	\$6,116 33
CR.		
	No. Voucher.	
1881.		
Dec. 6.	By cash, W. Grimshaw, addition to plant house 497	\$ 162 50
Dec. 13.	By cash, Smith, Parker & Co., lumber..... 512	79 14
1882.		
Jan. 5.	By Hitchings & Co., pipes, valves, &c..... 532	140 00
Jan. 10.	By George Gray, material and labor..... 546	98 92
Jan. 16.	By M. O'Brien, balance account due on work.. 562	25 00
	By balance to new account	5,610 77
		\$6,116 33
		\$6,116 33

EXPERIMENTAL FARM FUND.

DR.		
1881.		
Dec. 1.	To balance from last statement.....	\$671 87
CR.		
1882.		
Jan. 16.	By balance to new account.....	\$671 87
		\$671 87
		\$671 87

SALT LAND SALES.

DR.		
1881.		
Dec. 1.	To balance from last statement	\$11,918 05
1882.		
Jan. 16.	To cash, amount received of J. S. Pillsbury as paid on building to M. O'Brien.....	25 00
CR.		
Jan. 16.	By balance to new account.....	\$11,918 05
		\$11,918 05
		\$11,918 05

LAND SALE FUND.

DR.		
1881.		
Dec. 1.	To balance from last statement.....	\$528 42
CR.		
1882.		
Jan. 16.	By balance to new account.....	\$528 42
		\$528 42
		\$528 42

BIENNIAL REPORT

WATER SUPPLY ACCOUNT.

CR.

1881.
Dec. 1. By balance from last statement... \$ 97 07

DR.

Dec. 16. To cash from State Treasurer \$500 00

1882.
Jan. 16. By balance to new account \$402 93

\$500 00 \$500 00

ENLARGEMENT OF CAMPUS.

DR.

1881.
Dec. 1. To balance from last statement..... \$4,196 62

CR.

1882.
Jan. 16. By balance carried to new account..... \$4,196 62

APPARATUS.

CR.

1881.		No. Voucher.	
Dec. 5.	By cash, W. F. Decker, petty bills and expenses	491	\$ 11 97
Dec. 5.	By cash, W. F. Decker, freight.....	492	8 55
Dec. 7.	By cash, A. R. Miller, merchandise.....	503	36 00
Dec. 10.	By cash, F. H. Brown, labor.....	508	8 55
Dec. 12.	By cash, B. B. Marshall, mdse and labor.....	509	7 00
1882.			
Jan. 4.	By cash, Sykes & Andrews, pipe, valves, &c...	530	437 11
Jan. 5.	By cash, New England School Furniture Co., merchandise.....	533	30 00
Jan. 5.	By cash, A. A. Pond, furnaces, &c.....	534	183 91
Jan. 6.	By cash, A. R. Miller, merchandise.....	535	16 00
Jan. 9.	By cash, W. A. Pike, sundry bills.....	539	18 10
Jan. 9.	By cash, Gallison & Gowen, merchandise.....	540	60 00
Jan. 10.	By cash, J. A. Tyler, labor.....	545	14 00
Jan. 12.	By cash, North Star Iron Works, castings.....	558	6 25
Jan. 12.	By cash, A. R. Miller, merchandise,.....	559	5 00

DR.

1881.
Dec. 6. To cash received of Prof. Hall for use of apparatus \$ 7 18

1882.
Jan. 16. To balance to Current Expense Account 835 26

\$842 44 \$842 44

III.
TREASURER DAVISON'S REPORT FOR 1882, COM-
MENCING JAN. 16TH, 1882.

ROBERT A. DAVISON, *Treasurer, in account with the University of Minnesota:*

CURRENT EXPENSE.

DR.

1882.		
Jan. 16.	To balance from last statement of R. Chute.....	\$4,263 07
Jan. 30.	To cash, from State Treasurer.....	5,000 00
Feb. 25.	To cash, from State Treasurer.....	5,000 00
Mar. 30.	To cash, from State Treasurer.....	4,500 00
May 4.	To cash, from State Treasurer.....	5,000 00
May 31.	To cash, from State Treasurer.....	4,500 00
June 8.	To cash, from State Treasurer.....	4,500 00
July 3.	To cash, from State Treasurer.....	3,000 00
Sept. 29.	To cash, from State Treasurer.....	8,273 90
Nov. 4.	To cash, from State Treasurer.....	4,107 51
Nov. 30.	To balance from students' fees account.....	1,010 45

CR.

Nov. 30.	By balance, from apparatus account.....	\$678 76
Nov. 30.	By balance, from chemical laboratory account.....	611 54
Nov. 30.	By balance, from College of agriculture account.....	3,613 90
Nov. 30.	By balance, from experimental farm fund account.....	689 77
Nov. 30.	By balance, from experimental farm and campus act.....	989 90
Nov. 30.	By balance, from employees and workmen account.....	3,420 00
Nov. 30.	By balance, from furniture account.....	22 26
Nov. 30.	By balance, from heating account.....	1,133 97
Nov. 30.	By balance, from incidental account.....	2,237 47
Nov. 30.	By balance, from library account.....	1,494 54
Nov. 30.	By balance, from plant house account.....	140 68
Nov. 30.	By balance, from repairs account.....	451 94
Nov. 30.	By balance, from salaries for instruction account.....	28,205 00
Nov. 30.	By balance, from stationery, postage, &c., account.....	24 50
Nov. 30.	By balance, from Prof. Pike's book.....	109 85
Nov. 30.	By balance, carried to new account.....	5,330 85
		\$49,154 93 \$49,154 93

SALARIES FOR INSTRUCTION.

CR.

1882.		No. Voucher.	
Feb. 1.	By cash, faculty pay roll for Jan.....	38 to 54	\$2,970 00
Feb. 23.	By cash, W. H. Leib, instruction.....	29	60 00
Feb. 28.	By cash, faculty pay roll for Feb.....	66	2,970 00
Mar. 31.	By cash, faculty pay roll for March.....	98	2,970 00
May 5.	By cash, faculty pay roll for April.....	103	2,970 00
May 30.	By cash, faculty pay roll for May.....	147	2,970 00
June 30.	By cash, faculty pay roll for June.....	164	2,970 00

BIENNIAL REPORT

		No. Voucher.		
Sept. 16.	By cash, Moses Marston, instruction.....	165		5 00
Aug. 1.	By cash, E. D. Porter, salary.....	172		200 00
Aug. 31.	By cash, E. D. Porter, salary.....	173		200 00
Sept. 29.	By cash, faculty pay roll for Sept.....	206		3,000 00
Oct. 31.	By cash, faculty pay roll for Oct.....	212		3,000 00
Oct. 10.	By cash, H. M. Wait, instruction in civil engineering.....	200		85 00
Nov. 15.	By cash, H. M. Waitt, instruction in civil engineering.....	226		85 00
Nov. 15.	By cash, E. D. Porter, (house rent).....	225		650 00
Nov. 29.	By cash, faculty pay roll for Nov.....	229		3,100 00
Nov. 30.	To balance carried to current expense account.....		\$28,205 00	
			\$28,205 00	\$28,205 00

EMPLOYEES AND WORKMEN.

		No. Voucher.		
CR.				
1882.				
Feb. 4.	By cash, C. A. Rollit, assistant librarian...	57		50 00
Feb. 6.	By cash, W. H. Chambers, fireman.....	58		52 00
Feb. 4.	By cash, J. E. Gallow, janitor.....	59		64 00
Feb. 4.	By cash, A. H. Nunn, assistant janitor....	60		27 00
Feb. 28.	By cash, pay roll for Feb.....	66		225 00
Feb. 28.	By cash, pay roll for Feb.....	66		110 00
Mar. 29.	By cash, C. F. Sidener, assistant chemical laboratory, (Jan.).....	71		30 00
Mar. 31.	By cash, pay roll for March.....	98		335 00
May 5.	By cash, pay roll for April.....	103		335 00
May 30.	By cash, pay roll for May.....	147		335 00
June 28.	By cash, pay roll for June.....	164		335 00
Aug. 7.	By cash, pay roll for July.....	172		185 00
Sept. 4.	By cash, pay roll for Aug.....	173		185 00
Sept. 29.	By cash, pay roll for Sept.....	205		325 00
Oct. 31.	By cash, pay roll for Oct.....	212		400 00
Nov. 29.	By cash, pay roll for Nov.....	229		425 00
	To balance carried to current expense account.....		\$2,420 00	
			\$2,420 00	\$2,420 00

APPARATUS ACCOUNT.

		No. Voucher.		
CR.				
1882.				
Feb. 25.	By cash, Ball & Naylor, merchandise.....	18		7 50
Feb. 28.	By cash, S. J. McCarthy, chisels.....	19		13 20
Feb. 28.	By cash, Littlefield & Son, pipe, &c.....	20		5 13
Feb. 27.	By cash, W. F. Decker, petty bills.....	21		16 59
Feb. 27.	By cash, J. S. McClary, lumber.....	22		4 00
Feb. 13.	By cash, F. H. Brown, material and labor	61		53 90
Feb. 25.	By cash, Jas W. Queen & Co., mdse.....	68		120 89
Mar. 30.	By cash, Jno. G. Moore, statuary and mounting.....	72		33 46
Mar. 30.	By cash, Jewett & Co., merchandise.....	84		30 00
April 3.	By cash, Reed & Johnson, material and labor.....	89		55 09
April 1.	Ball & Naylor, oil and can.....	90		3 10
April 3.	By cash, E. and J. B. Young & Co., books	94		38 40
May 9.	By cash, A. R. Miller, merchandise.....	111		1 83
May 9.	By cash, Jas. W. Queen & Co., mdse....	112		35 00
May 9.	By cash, C. Ginochio, bust.....	113		4 75
May 12.	By cash, S. J. McCarthy, merchandise....	117		4 00

		No. Voucher.	
May	9.	By cash, R. J. Beck, merchandise.....	118 150 20
July	6.	By cash, Wales & Co., picture and frame...	119 11 75
July	14.	By cash, W. H. Leib, services.....	155 90 00
		To balance carried to current expense.....	\$678 76
			<u>\$678 76</u> <u>\$678 76</u>

BUILDING ACCOUNT.

DR.

1882.	Jan. 16.	To balance from the last statement.....	\$5,610 77
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CR.

Dec. 1.	By balance to new account.....		5,610 77
			<u>\$5,610 77</u> <u>\$5,610 77</u>

CHEMICAL LABORATORY.

CR.

		No. Voucher.	
1882.	Feb. 25.	By cash, Geo. Huhn & Co., mdse	13 25 56
	April 11.	By cash, Geo. Huhn & Co., mdse.....	82 13 20
	May 6.	By cash, L. M. Reid, labor.....	105 1 65
	June 7.	By cash, G. Huhn & Co., mdse.	132 19 09
	June 7.	By cash, G. Huhn & Co., mdse.....	133 23 18
	June 8.	By cash, Jas. A. Dodge, labor.....	134 37 50
	June 9.	By cash, Littlefield & Son.....	135 19 20
	June 10.	By cash, E. B. Benjamin, mdse.....	136 19 00
	June 13.	By cash, Jas. W. Queen & Co., mdse.....	137 26 50
	July 5.	By cash, Geo. Huhn & Co., mdse.....	157 5 30
	Sept. 14.	By cash, Whitall, Tatum & Co., mdse	167 35 30
	Oct. 26.	By cash, E. & J. B. Young & Co., mdse.....	177 157 74
	Oct. 27.	By cash, Geo. Huhn & Co., mdse..?	192 88 45
	Oct. 20.	By cash, Richards & Co., mdse.....	193 61 26
	Oct. 20.	By cash, E. B. Benjamin, mdse.....	206 88 09
	Oct. 20.	By cash, E. B. Benjamin, mdse.....	207 4 02
	Oct. 26.	By cash, Bullock & Grenshaw, mdse.....	208 144 21

DR.

Nov. 29.	To cash from E. & J. B. Young & Co., sent in error.....	\$157 74	
Nov. 30.	To balance carried to current expense account.....	611 54	
		<u>\$769 28</u> <u>\$769 28</u>	

ENLARGEMENT OF CAMPUS.

DR.

1882.	Jan. 16.	To balance from last statement.....	\$4,196 62
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CR.

		No. Voucher.	
Feb. 3.	By cash, I. E. Atherton, 1 lot.....	67	\$75 00
Mch. 29.	By cash, Jno. G. Lennon, tax title 1 lot.....	98	3 50
Apr. 17.	By cash, N. D. Plummer, tax title 1 lot.....	97	50 00
May 4.	By cash, J. Guilford, tax title 10 lots.....	99	18 08
June 30.	By cash, E. B. Clement, 3 lots.....	151	356 25
June 30.	By cash, Edith J. Wilson, 1 lot.....	152	25 00
June 30.	By cash, Young & Fessenden, 1 lot.....	153	366 23
June 30.	By cash, E. O. Leonard, 2 lots.....	154	175 00
	To balance to new account.....		3,127 56
			<u>\$4,196 62</u> <u>\$4,196 62</u>

BIENNIAL REPORT

COLLEGE OF AGRICULTURE.

CR.

1882.		No. Voucher.	
Mch. 10.	By cash, E. D. Porter, labor pay roll for Feb....	37	85 00
Feb. 14.	By cash, E. D. Porter, labor pay roll for Jan....	64	202 60
Feb. 14.	By cash, E. D. Porter, cash paid petty bills, etc.	65	189 47
Mch. 27.	By cash, E. D. Porter, labor pay roll for March.	73	60 27
April 4.	By cash, A. R. Miller, glass, etc	88	100 00
May 6.	By cash, E. D. Porter, labor pay roll for April..	108	264 83
June 10.	By cash, E. D. Porter, labor pay roll for May. .	142	540 00
June 30.	By cash, E. C. Cauvett, pipe fittings and labor..	143	578 52
Aug. 1.	By cash, Jno. Schulte, mdse	144	116 25
July 7.	By cash, E. D. Porter, labor pay roll for June..	167	643 58
Nov. 29.	By cash, E. D. Porter, petty bill and expenses at State Fair.....	227	122 12
Nov. 29.	By cash, E. D. Porter, expense at farmers' lecture course	228	721 26
	To balance to current expense account.....		\$3,613 90
			<hr/>
			\$3,613 90 \$3,613 90

EXPERIMENTAL FARM FUND.

CR.

1882.		No. Voucher.	
June 30.	By cash Wm. A. Pike, platting and surveying.....	163	\$308
Sept. 22.	By cash, E. D. Porter, labor pay roll for Aug.	170	490 77
Oct. 27.	By cash, Geo. Huhn & Co., mdse.....	178	5 60
Oct. 18.	By cash, G. W. Sturtevant, surveying, &c....	197	144 25
Nov. 8.	By cash, Geo. W. Chowen & Co. abstract....	210	15 50
Nov. 15.	By cash, E. D. Porter, labor pay roll for Oct.	224	397 52

DR.

Jan. 16.	To balance from last statement.....	\$671 87	
Nov. 30.	To balance carried to current expense.....	689 77	
		<hr/>	
		\$1,361 64	\$1,361 64

EXPERIMENTAL FARM AND CAMPUS.

CR.

1882.		No. Voucher.	
Feb. 25.	By cash, W. Q. Greeley, blacksmithing.....	25	\$25 35
	By cash, Merriman B. & Co., lumber.....	26	11 21
Aug. 9.	By cash, E. D. Porter, labor pay roll for July	196	564 92
Oct. 14.	By cash, E. D. Porter, labor pay roll for Sept.	198	388 42
Nov. 30.	To balance carried to current expense.....		\$989 90
			<hr/>
		\$989 90	\$989 90

FURNITURE.

CR.

1882.		No. Voucher.	
Mar. 27.	By cash, Wheaton, Reynolds & Co., to case of drawers.....	74	\$22 26

DR.

Nov. 30.	To balance carried to current expense.....	\$22 26	
		<hr/>	
		\$22 26	\$22 26

UNIVERSITY OF MINNESOTA.

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GEOLOGICAL SURVEY.

CR.

1882.		No. Voucher.	
Jan. 16.	By balance from last statement.....		\$27,115 78
Feb. 14.	By cash, Jas. Keating, testing stone.....	23	39 00
Feb. 27.	By cash, N. M. Baker, labor.....	24	4 50
Mch. 4.	By cash, S. M. Williams, book.....	31	3 25
Feb. 15.	By cash, N. H. Winchell, salary for Jan.....	55	200 00
Feb. 8.	By cash, W. Upham, salary for Jan.....	56	100 00
Feb. 27.	By cash, N. H. Winchell, petty bills.....	63	24 09
Feb. 28.	By cash, pay roll for Feb.....	66	300 00
March 27.	By cash, N. H. Winchell, petty bills & freight	76	24 60
April 6.	By cash, Warner & Foote, maps.....	83	61 00
March 31.	By cash, Empire Distilling Co., alcohol.....	87	28 80
March 31.	By cash, pay roll for March.....	98	300 00
May 4.	By cash, Wheaton, Reynolds & Co., lumber..	100	16 00
May 5.	By cash, pay roll for April.....	103	300 09
May 5.	By cash, N. H. Winchell express & copying	104	11 53
June 1.	By cash, Driscoll & Forsyth, repair'g. wagon	123	16 25
June 7.	By cash, W. Howling mounting animals.....	124	18 90
May 30.	By cash, pay roll for May.....	147	300 00
July 3.	By cash, N. H. Winchell, petty bills.....	158	10 19
June 30.	By cash, pay roll June.....	161	300 00
Aug. 7.	By cash, W. Upham for July.....	172	100 00
Sept. 8.	By cash, N. H. Winchell for July.....	172	200 00
Sept. 29.	By cash, W. Upham, for August.....	173	100 00
Oct. 23.	By cash, R. & J. Beck, mdse.....	174	19 00
Nov. 1.	By cash, N. H. Winchell, traveling expenses	175	72 48
Sept. 29.	By cash, pay roll for Sept.....	205	300 00
Oct. 31.	By cash, pay roll for Oct.....	212	300 00
Nov. 13.	By cash, Arnell & Christliet, labor.....	213	3 65
Sept. 14.	By cash, Gen. Q. A. Gilmore, services & fght.	223	6 27
Nov. 29.	By cash, pay roll for Nov.....	229	300 00
Nov. 30.	To balance carried to new account.....		\$30,565 27
			<hr/>
			\$30,565 27 \$30,565 27

HEATING.

CR.

1882.		No. Voucher.	
Jan. 16.	By balance, from last statement.....		\$300 53
Feb. 23.	By cash, Brand & Reichard, repairs on engine.....	27	16 63
Feb. 24.	By cash, Armstrong & Truesdell, wood and coal.....	28	249 03
April 5.	By cash, Brand & Reichard, merchandise.	86	14 58
May 11.	By cash, Armstrong & Truesdell, wood and coal.....	116	129 75
Sept. 25.	By cash, M. W. Glenn, material and labor.	171	83 45
Oct. 9.	By cash, C. A. Bicknell, mason work.....	179	29 25
Oct. 6.	By cash, Brand & Reichard, fire, brick, &c.	180	10 75
July 26.	By cash, Armstrong & Truesdell, wood and coal.....	195	300 00
	To balance, carried to current expense.....		\$1,133 97
			<hr/>
			\$1,133 97 \$1,133 97

BIENNIAL REPORT

LIBRARY.

CR.

1882.		No. Voucher.	
Feb. 13.	By cash, Geo. H. Keith, P. O. orders for merchandise.....	1	\$57 79
Feb. 28.	By cash, E. & J. B. Young & Co, books....	10	\$206 00
Feb. 28.	By cash, Gust E. Stechert, merchandise....	11	4 68
Feb. 28.	By cash, J. K. Moore, binding and printing.	12	235 65
Mar. 27.	By cash, Wheaton, Reynolds & Co., shelves.	75	9 00
Mar. 31.	By cash, Gust E. Stechert, merchandise..	80	1 11
April 3.	By cash, E. & J. B. Young & Co., books.....	95	193 48
May 9.	By cash, E. & J. B. Young & Co., books....	110	182 68
June 7.	By cash, C. A. Bausman, binding.....	138	66 00
June 21.	By cash, E. & J. B. Young & Co., books....	139	201 74
June 17.	By cash, E. & J. B. Young & Co., books.....	140	69 15
Aug. 25.	By cash, St. Paul Book & Stationery Co., books.....	141	4 50
Oct. 26.	By cash, E. & J. B. Young & Co., books....	221	156 23
Oct. 30.	By cash, E. & J. B. Young & Co., books....	222	106 53
To balance carried to current expense.....			\$1,491 54
			<hr/>
			\$1,491 54 \$1,491 54

LAND SALE FUND.

DR.

1882.		
Jan. 16.	To balance, from last statement.....	\$528 42
CR.		
Nov. 30.	By balance, carried to new account.....	\$528 42
		<hr/>
		\$528 42 \$528 42

PLANT HOUSE ACCOUNT.

CR.

1882.		No. Voucher.	
Feb. 25.	By cash, Sykes & Andrews, merchandise and labor	5	77 14
Feb. 25.	By cash, Farnham & Lovejoy, lumber.....	6	46 39
Feb. 25.	By cash, Chas. Henry, merchandise.....	7	17 15
DR.			
Nov. 30.	To balance, carried to current expense.....		\$140 68
			<hr/>
			\$140 68 \$140 68

REPAIRS.

CR.

Feb. 24.	By cash, T. H. Hagen, labor.....	4	26 87
Feb. 28.	By cash, J. E. Gallow, bill paid for labor...	14	13 50
Feb. 25.	By cash, M. W. Glenn, labor.....	15	8 85
Feb. 27.	By cash, Nelson, Tenney & Co., lumber....	16	77 53
Feb. 25.	By cash, Geo. Huhn & Co., paint and oils..	17	12 78
Mar. 2.	By cash, Geo. Huhn & Co., merchandise...	30	38 20
Mar. 27.	By cash, Wheaton, Reynolds & Co., lumber.	75	1 56
Mar. 27.	By cash, Nelson, Tenney & Co., lumber....	77	62
April 11.	By cash, Geo. Huhn & Co., merchandise...	81	14 78
Mar. 29.	By cash, J. E. Gallow, petty bills	92	3 95
May 6.	By cash, Janney, Brooks & Co., mdse.....	107	117 60
May 6.	By cash, Nelson, Tenney & Co., lumber....	109	60 07

June 21.	By cash, Gallison & Gowen, labor	145	2 25
June 6.	By cash, Wales & Co., screens, &c.....	146	26 70
July 18.	By cash, Geo. Gray, painting	156	6 75
Oct. 27.	By cash, Geo. Huhn & Co., paint and oils..	182	39 93
Nov. 30.	To balance, carried to current expense.....		
		<u>\$451 94</u>	
		\$451 94	\$451 94

INCIDENTALS.

CR.

		No. Voucher.	
188-			
Feb. 28.	By cash, St, Paul Dispatch, advertising ...	2	\$11 00
Feb. 24.	By cash, Review Pub. Co., advertising	3	3 00
Feb. 25.	By cash, Berry & Onion, Mdse.....	8	13 35
Feb. 28.	By cash, Hermean Soc., use of piano.....	9	6 00
Mar. 7.	By cash, N. W. Telephone Ex. Co., Jan. bill	32	4 00
Mar. 8.	By cash, C. St. P. M. & O. R. R. Co., print'g.	33	2 25
Mar. 8.	By cash, Evening Journal, advertising ...	34	9 75
Mar. 8.	By cash, Tribune Building, postal cards...	35	6 00
Mar. 8.	By cash, W. S. Pardee, stove pipe & zinc..	36	7 50
Feb. 28.	By cash, C. M. Webster, office work	62	17 90
Mar. 20.	By cash, Cushman & Plummer, mdse.....	69	7 40
Mar. 28.	By cash, R. A. Davison, petty expenses..	70	5 50
Mar. 31.	By cash, Burdick & Armitage, printing ..	73	3 00
Mar. 27.	By cash, N. W. Telephone Ex. Co. Feb. bill	79	4 00
April 1.	By cash, Berry & Onion, mdse.....	91	4 45
April 12.	By cash, Louis Dreka, diplomas	96	46 70
May 5.	By cash, C. M. Webster, services as clerk.	101	6 90
May 5.	By cash, Gallison & Gowen, mdse.....	102	7 20
May 6.	By cash, Berry & Onion, mdse.....	106	3 95
May 11.	By cash, Emily L. Hough, servc's as pt. clk	114	26 00
May 11.	By cash, Hawes & Smith, mdse.....	115	1 65
May 26.	By cash, Tribune binding dep., printing..	120	1 50
July 21.	By cash, N. W. Telephone Ex. Co., March and April bill.....	121	8 00
June 1.	By cash, Emily L. Hough, rib'ns for dipl'ms	125	2 40
June 1.	By cash, Emily L. Hough, services writn'g	126	25 75
June 6.	By cash, Wm. A. Pike, expressage	127	8 15
June 9.	By cash, Sykes & Andrews labor.....	128	2 50
May 19.	By cash, Artel Association, advertising....	129	30 00
June 7.	By cash, C. A. Rollit labor.....	130	3 60
June 21.	By cash, Cerry & Onion, mdse.....	131	8 20
June 23.	By cash, Tribune job dep. p'nt cl'nd'rs &c	148	429 50
July 21.	By cash, N. W. Telephone Ex. Co. May bill.	149	4 15
July 26.	By cash, Berry & Onion, mdse.....	150	4 20
June 30.	By cash, W. W. Folwell, house rent.....	159	250 00
June 30.	By cash, Emily L. Hough, services writing	160	22 00
June 30.	By cash, O. V. Tousley, services as sect....	161	150 00
June 30.	By cash, F. Danz, musical comm.....	162	60 00
Sept. 14.	By cash, Barnard & Cope, use of chairs...	166	10 00
July 19.	By cash, Jno. W. Sherwood m'nting maps	168	6 00
Oct. 6.	By cash, Wm. W. Folwell, expenses on trip of inspection of college buildings.	176	107 08
Oct. 20.	By cash, Paul & Sinsheimer, book case ...	183	28 00
Oct. 9.	By cash, C. D. Whitall & Co., mdse	184	2 84
Oct. 9.	By cash, Tribune job dep., printing.....	185	32 85
Oct. 9.	By cash, C. D. Whitall & Co., mdse.....	186	13 05
Oct. 5.	By cash, Emily L. Hough, services	187	18 55
Oct. 5.	By cash, Emily L. Hough, services writing	188	65 40
Oct. 6.	By cash, J. E. Gallow, cleaning building..	189	15 75
Oct. 20.	By cash, N. Bernardini, plaster bust.....	190	6 50

BIENNIAL REPORT

		No. Voucher.		
Oct.	20.	By cash, C. Ginocchio, plaster bust.....	191	4 00
Aug.	26.	By cash, O. M. Laraway, P. M., stamps...	199	42 20
Nov.	2.	By cash, Emily L. Hough, services writing	201	31 00
Nov.	2.	By cash, J. E. Gallow, cleaning building..	202	50 00
Oct.	26.	By cash, R. A. Davison, trips to St Paul &c.	203	10 25
Nov.	4.	By cash, W. F. Decker, petty expenses ...	209	4 70
Nov.	9.	By cash, N. W. Telephone Ex. Co. Sept. bill	214	16 30
Sept.	9.	By cash, Hiscock & Dennison, Gunwood case.....	204	47 00
Aug.	26.	By cash, American Ex. Co., collections....	194	124 65
Nov.	21.	By cash, St. Paul Daily Globe, advertising	214	10 00
Nov.	21.	By Cash, Pioneer Press Co., advertising..	215	19 42
Nov.	22.	By cash, Johnson, Smith & H., printing...	216	17 50
Nov.	22.	By cash, Johnson, Smith & H., printing...	217	9 50
Nov.	23.	By cash, Mpls Tribune Co., advertising...	218	20 00
Nov.	27.	By cash, Berry & Onion, mdse.....	219	7 02
Nov.	27.	By cash, Folds & Griffith, matting.....	220	79 11
Nov.	29.	By cash, Edw'd D. Porter, expenses at State Fair, etc	227	231 35
To balance carried to current expense account			\$2,237 47	
			\$2,237 47	\$2,237 47

SALT LAND SALES.

DR.

1882.			
Jan.	16.	To balance from last statement.....	\$11,918 05
May	26.	To cash received from Nels. Olson Aos, sale of cert. No. 32, sw $\frac{1}{4}$ Sec. 19 T. 136 R. 44.....	598 45
June	20.	To cash received from H. G. Stordock under cert. No. 47, first payment and interest on sale of nw $\frac{1}{4}$ Sec. 14, ne $\frac{1}{4}$ sec. 15, and se $\frac{1}{4}$ sec. 3, T. 135 R. 45.....	693 90
June	24.	To cash received from J. J. Haggeman for interest due on certificates held by him on sec. 35, T. 136, R. 45..	152 32
		on sec. 34, T. 136, R. 45..	152 32
		on sec. 27, T. 136, R. 45..	152 32
		on sec. 2, T. 135, R. 45 .	151 13
		on sec. 11 and w $\frac{1}{2}$ of sec. 12, T. 135, R. 45..	285 60
		on ne $\frac{1}{4}$ sec. 10, T. 135, R. 45 ..	47 60
July	1.	To cash received from J. Gregory Smith under cert. Nos. 36 and 37, payment in full for s $\frac{1}{2}$ sw $\frac{1}{4}$ and sw $\frac{1}{4}$ se $\frac{1}{4}$ sec 13, and n $\frac{1}{2}$ nw $\frac{1}{4}$ and se $\frac{1}{4}$ ne $\frac{1}{4}$ sec. 24, T. 133, R. 44	1,083 58
July	6.	To cash received from Chas. J. Wright	539 70
July	21.	To cash received from H. G. Stordock, under certs. 52, 53, 54, 56, and 57, first payment and interest on sale of se $\frac{1}{4}$ sec. 10, T. 135, R. 45, w $\frac{1}{2}$ nw $\frac{1}{4}$ sec. 1, T. 135 R. 45, e $\frac{1}{4}$ ne $\frac{1}{4}$ sec. 3, T. 135, R. 45, sw $\frac{1}{4}$ and e $\frac{1}{2}$ nw $\frac{1}{4}$ sec. 1, T. 135, R. 45, and w $\frac{1}{2}$ ne $\frac{1}{4}$ sec. 14 T. 135 R. 45	951 21
Aug.	4.	To cash received from H. G. Stordock, under certs. No. 58 and 59, first payment and interest on sale of e $\frac{1}{2}$ ne $\frac{1}{4}$ sec. 30 and nw $\frac{1}{4}$ and w $\frac{1}{2}$ ne $\frac{1}{4}$ sec. 32, T. 135 R 44.....	775 19
Nov.	30.	By Balance Carried to new account.....	17,501 37
			\$17,501 37
			\$17,501 37

STATIONARY, POSTAGE & C.

1882.		CR.	No. Voucher.	
April	5.	By Cash, Beach & Co.....	85	24 50
		DR.		
Nov.	30.	To balance, carried to current expense ac't.....		\$24 50
				<u>\$24 50</u>
				\$24 50

STUDENTS' FEES.

1882.		DR.		
Mar.	16.	To cash of Jas. A. Dodge, students' fees.....	\$120 00	
June	2.	To cash of Jas. A. Dodge, students' fees.....	190 45	
Oct.	7.	To cash of W. W. Folwell, students' fees.....	700 00	
		By balance, carried to current expense.....		\$1,010 45
			<u>\$1,010 45</u>	\$1,010 45

WATER SUPPLY.

		DR.		
Jan.	16.	To balance from last statement.....	\$402 93	
		CR.		
		By balance carried to new account.....		\$402 93
			<u>\$402 93</u>	\$402 93

NEW EXPERIMENTAL FARM.

		DR.		
May	15.	To cash received from State Treasurer.....	\$10,000 00	
		CR.	No. Voucher.	
May	15.	By cash, Edgar W. Bass, first payment on farm.	122	\$10,000 00
			<u>\$10,000 00</u>	\$10,000 00

PROF. PIKES' BOOK.

		CR.	No. Voucher.	
Oct.	6.	By cash, L. Kimball & Co., printing.....	181	\$109 85
		DR.		
		To balance to current expense account.....		\$109 85
			<u>\$109 85</u>	\$109 85

SIXTEENTH ANNUAL REPORT

(SECOND BIENNIAL REPORT)

OF THE

PRESIDENT

OF THE

UNIVERSITY OF MINNESOTA

TO THE

BOARD OF REGENTS.

1880-'81 AND 1881-'82.

THE UNIVERSITY OF MINNESOTA, }
MINNEAPOLIS, MINN., }
DECEMBER, 1882. }

SIR:—I have the honor, in accordance with law, herewith to transmit the sixteenth annual report of the condition and progress of the University. The fifteenth annual report was duly submitted and was by you laid before the Board of Regents, December 22, 1881. It was not however, printed. The statistical portions are accordingly embodied in this report.

I have the honor to be,

Very respectfully,

Your obedient servant,

WM. W. FOLWELL,

President.

To the HON. HENRY H. SIBLEY,

President of the Board of Regents.

REPORT.

To the Honorable the Board of Regents:

The changes in and additions to the Board, and to the Faculty having been exhibited in your own reports, no further statements are necessary. I may be permitted, however, to express my deep sense of the confidence which has been for so long a term of years reposed in me by the Board, and my thankful appreciation of the earnest and faithful services of all my colleagues of the Faculty, not only in the conduct of their several departments, but in those general and undistributed duties of administration and discipline, the discharge of which is essential to the order and progress of the University. So far as it was the purpose of the Board in reconstructing the Faculty to secure friendly and active co-operation, their success has been absolute. It is my belief that no institution in any of the new states has an abler faculty or one which works in more perfect harmony.

The ranks of the alumni have been swelled by the accession of two large and well instructed classes. The degrees conferred since the last printed report are:

	1881.	1882.
Masters of Arts.....	1	1
Masters of Science.....	11	11
Bachelors of Arts.....	10	11
Bachelors of Science.....	7	10
Bachelors of Literature.....	1	1
Bachelors of Agriculture.....	28	34
Totals.....	28	34

The list of names with residences of these graduates are given in appendix A, p—.

THE FOLLOWING TABLE SHOWS THE NUMBER AND KIND OF DEGREES WHICH HAVE BEEN CONFERRED BY THE UNIVERSITY:

	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	Tot.
Bachelor of Arts.....	2	1	3	4	9	5	8	4	10	11	57
Bachelor of Science.....		1	2	5	3	8	10	9	10	10	58
Bachelor of Literature..			1	.....	3	2	6	4	7	11	34
Bachelor of Civil Eng'g.			3	3	.....	.....	2	.....	.....	.....	8
Bachelor of Mech. Eng'g						1	.....	.....	.....	.....	1
Bachelor of Architecture					1	.....	.....	.....	.....	.....	1
Bachelor of Agriculture.										1	1
Master of Arts.....								1	1	.....
Master of Science.....										1	1
Total!.....	2	2	9	12	16	16	26	18	28	34	163

The whole number of persons graduated is one hundred fifty-four (154), six persons having received two degrees, those in science and engineering, and three bachelors having been awarded masters' degrees after passing the required examinations. No honorary degrees are conferred by this University.

The whole number of women who have been graduated is forty-three (43), viz: Bachelors of Arts, 6; of Science, 15; of Literature, 22; all of whom have completed the same courses of study as the gentlemen alumni, and undergone the same tests and examinations. So far as observed the young women have preserved their health as well as the young men. The records of the registrar's office will show that they have not been inferior in any kind of studies. Their degrees therefore are of precisely the same value as those received by the young men.

ATTENDANCE.

A summary statement has already been communicated to be embodied in the report of the Board. The extended statements, showing in detail the classification and distribution of the students for the two years, 1880-'81 and 1881-'82, are given in appendix B, p—.

The only noticeable feature of these tables is the diminution in numbers of the lower classes, indicating the fact that the preparatory schools have not yet taken up the work formerly done in the preparatory classes which have been dropped off. The discontinuance of the fourth class at the close of the year 1878-'79, was ordered by the Board in expectation that the law for the encouragement of higher education, enacted in 1878, would so stimulate the high schools of the State that they would almost immediately supply a large number of well-prepared candidates for admission. Unfortunately that excellent statute became inoperative after one year through the accident of the omission of the word "annually" in the final copy of the bill. The effect of that one year's work, in filling up the University, was not appreciable.

The legislature of 1881 wisely re-enacted the law with some amendments, and it has been now one year in operation. It will take some time for its effects to be strongly apparent, but they will appear. The people will in time come to understand that the road to the University lies through the high schools of the State, and those schools will feel a pride in conducting the secondary education as a part of the State system of public instruction. In the meantime a large number of youths are at a considerable disadvantage, and the University to which they would gladly resort is unable to serve them.

I would therefore most respectfully renew a recommendation which I had the honor to submit in the annual report for 1875, to the effect, that upon the dropping of the fourth class of the Collegiate Department, the Board reserve the right to open certain auxiliary sections for instructing students found insufficiently prepared in certain branches. My colleagues of the faculty will concur in this recommendation, I think, without exception. Additional force will be lent to it by an inspection of the record as to admissions. Insert A.

ADMISSIONS.

The system of "local examinations" begun in the summer of 1877, was continued in operation in both of the years covered by this report, 1880-'81 and 1881-'82. A larger proportion than usual of the examinees took advantage of the regulation permitting them to divide the entrance examination, and were accordingly examined on the more elementary subjects only. In consequence, a much smaller proportion of the whole number of examinees were admitted to the University.

BIENNIAL REPORT

RECORD FOR 1880-'81.

There were examined at St. Cloud, 6; at Owatonna, 8; at Wells, 3; at Mankato, 7; at St. Peter, 5; at Garden City, 7; at Austin, 4; at Spring Valley, 11; at Rochester, 12; at Winona, 3; at Lake City, 10; at the University in June, 22; in September 38; and at different times in the course of the first and second terms, 12; total, 148. Of this number 72 took the examinations in the common branches only. Of the remainder, 76 obtained admission, few if any, however, without conditions, as follows:

	Gentlemen.	Ladies	Total.
To the Classical Course.....	8	4	12
To the Scientific Course.....	24	4	28
To the Modern Course.....	1	8	9
To Selected Studies.....	4	4	8
	<hr/>	<hr/>	<hr/>
	37	20	57

Of the 49 entering for regular courses, eight (8), four ladies and four gentlemen, obtained an enrollment in the Freshman class before the close of the year.

RECORD FOR 1881-'82.

There were examined in the summer of 1881, at Farmington, 9; at Glencoe, 2; at Stillwater, 7; at Duluth, 1; at Faribault, 6; at Waseca, 9; at Le Sueur, 2; at Spring Valley, 2; at Lanesboro, 2; at Austin, 8; at Rochester, 10; at Lake City, 2; at St. Peter, 3; at Red Wing, 3; at St. Cloud, 1; at Sauk Center, 4; at Litchfield, 2; at Brainerd, 3, at the University in June, 25; in September, 38; in the course of the year 16 more. Total, 155. Of this number 74 were but partially examined. Of the remaining 81, fifty-three (53) obtained admission, as follows:

	Gentlemen.	Ladies.	Total.
To the Classical Course.....	11	2	13
To the Scientific Course.....	11	4	15
To the Modern Course.....	2	11	13
To Selected Studies.....	9	3	12
	<hr/>	<hr/>	<hr/>
	33	20	53

Six gentlemen of mature age were admitted to pursue selected studies without examination. Eleven young men were admitted to the special courses in shop-work and drawing in the engineering department without examinations. The whole number of students admitted was accordingly seventy (70). Four obtained Freshman rank before the close of the year.

It will be proper here to recall the existing regulations in regard to the admission of applicants to the Collegiate Department.

1. Applicants are admitted, as heretofore, upon examination at the University in June or at the opening of the fall term.

2. The General Faculty are required by your resolution to accept the certificates of the High School Board in lieu of examination in any of the subjects requisite for admission. Applicants bringing such certificates for all the preparatory studies will, of course, obtain admission without further examination.

3. Admission upon certificates of superintendents or principals of high schools is discontinued, the High School Board having extended to all high schools of the State the privileges of the examination system organized by them for the high schools working under their supervision by virtue of receiving State aid.

4. There remains therefore but one method of gaining admission—that by examination—candidates having, however, a choice between undergoing all the examinations in a mass at the time of application, and taking them one by one as they complete the several branches in their schools at home.

5. The so-called "local examinations" heretofore held in different parts of the State have become unnecessary since the extension to all high schools of the examination system of the High School Board. The details of that system will be found in the report of that board to the State Superintendent for the last school year.

6. Your resolution of May 10th, 1876, designed to prevent the removal of high school pupils to the University before the completion of their preparatory courses, remains in force. Accordingly no applicant from a district maintaining a high school can be admitted to any regular course in the University until he has progressed as far as his own high school will carry him in his course. The University will not receive an applicant whose high school will further instruct him in his regular work.

INSTRUCTION.

The usual tables exhibiting the work of instruction in the several departments under the heads: subject, text-book, instructor, number of exercises, class, number of students, term, will be found in appendix C., p. An inspection of these tables will bring to light the number and kinds of branches taught in the institution, and what is interesting, when so many branches are actually or virtually elective, the distribution of the students among them. As

public, stated duties, they merely indicate the vast amount of private work by teachers and students in preparation.

The following subjects, included in tables for previous years, do not appear in this report, for the reason that they ceased to belong to the courses of study after the dropping of the "fourth class" of the Collegiate Department:

Greek grammar and reader; Cæsar's Commentaries; Cicero's orations; natural philosophy; physical geography; physiology; elementary astronomy; English composition; English word-analysis; English history; plane geometry; general history; free-hand drawing.

It is proper under this head to make particular mention of the following additional services performed, in most cases voluntarily, by members of the corps of instruction.

I. The Evening Drawing School.

This instruction was opened by Professor Pike in November, 1880, and a course of twenty-five free lessons in mechanical drawing, varied to suit different needs, was given to sixty-four different students. These students were young mechanics, mostly residing in the neighborhood of the University, who gladly embraced the opportunity. At the close of the course they testified their appreciation of this instruction by the presentation of a handsome memorial to Professor Pike.

At the opening of the course Gen. C. C. Washburn offered a prize to the value of twenty-five (25) dollars to that member of the class who should evince the greatest improvement and diligence. This prize, Knight's Mechanical Dictionary, was awarded to Mr. Frank H. Brown, of Monticello, Minn. The second prize, a fine set of draughting instruments donated by Charles D. Whitall & Co., was awarded to Mr. E. C. Amy, of Baraboo, Wis.

The same course of instruction was again opened in November, 1881, and carried on with like interesting and substantial results.

II. The Course in Shop Work.

This was opened in the basement rooms of the Agricultural College building soon after the beginning of the year 1881-2. The space being limited, the outfit was accordingly not extensive, but it was complete as far as it went. It consisted of a wood shop, with benches, and lathe, and wood-working tools; a vise shop, with

benches, vises, files, and other "fitting" tools; and a forge shop, with a steam engine of eight-horse power, eight forges, as many anvils and the necessary forging tools. On account of delays, the wood shop was not used. Ten different young men took the vise or forge work, under immediate instruction of Mr. W. F. Decker, Professor Pike, being in charge of the department, that of mechanical engineering. The results, although on a small scale, were most satisfactory. The work of the young men may speak for itself. The general object of this kind of work is to train young mechanics and mechanical engineers in such a way that they may be competent to understand and test all kinds of fabrics and constructions of wood or metal. It is not the purpose to make tinsmiths or joiners, but to inculcate the principles and methods by which all smithing and carpentry are done.

III. The Summer School of Science and Letters.

This instruction was opened in July, 1881, and the credit of its organization is due, in the largest degree, to Professor C. W. Hall.

The following courses were given:

1. A course of twenty lectures in botany, by Professor C. E. Bessey, of the Iowa State Agricultural College, at Ames, Iowa, well and widely known as a successful teacher, author and investigator. The lectures were accompanied by laboratory work, under Prof. Bessey's supervision, in which the microscope and other instruments were handled and applied by the students themselves,
2. A course of lectures in chemistry by Prof. James A. Dodge, accompanied by laboratory work.
3. A course of lectures in geology by Professor C. W. Hall, chiefly relating to the geology and mineralogy of our State.

These courses began July 5th and continued through the month. The object as announced was "to afford teachers and others interested in the practical study of science an opportunity of becoming acquainted with the methods of original investigation and of teaching from actual specimens."

Forty-four persons, nearly all of them teachers of our own State and of Wisconsin, attended at some or all of the courses. The expressions of satisfaction and of thankfulness for the opportunities thus offered and enjoyed were general and emphatic. The only charge made was a laboratory fee of one dollar. The Board of Regents at the annual meeting in December, 1882, passed resolutions

of thanks to the officers engaged, all of whom gave their instruction without charge.

Encouraged by the success of the previous year, members of the Faculty, Prof. Hall being most active, determined to repeat the experiment. Accordingly in the summer of 1882, the following programme was published, and substantially carried out:

THE UNIVERSITY OF MINNESOTA.

SUMMER SCHOOL FOR TEACHERS.

Courses of instruction in Botany, Geology, German, English, and Rhetoric will be opened at the University of Minnesota, July 5th, 1882, to continue five weeks. The essential features of the plan of last year will be retained, viz.: offering all the work that can be accomplished by those in attendance, and making a single study the leading feature of the course.

The assistance of Mr. J. C. Arthur, for two years Prof. Bessey's demonstrator in botany, in the Agricultural college in Iowa, and subsequently instructor of botany in the University of Wisconsin, has been secured to continue the work in that science so successfully opened one year ago.

The courses to be offered are as follows:

I. Botany, Mr. J. C. Arthur. *a*—Morphology of the vegetable cell. *b*—Special structure of plants considered by classes. *c*—Bibliography and history of botany. *d*—Vegetable histology and physiology. The laboratory work will be a prominent feature of the course, and will be arranged for both advanced students and beginners. The compound microscope will be used, although considerable attention will be given to the examination of both lower and higher plants by the aid of the simple lens. The course aims to present the more important facts of the science, and to start the student along a line of observation, which can be pursued afterward without requiring the oversight of a teacher.

II. Geology, Prof. C. W. Hall. *a*—An outline of descriptive mineralogy. *b*—The rocks and minerals of Minnesota. Laboratory will accompany this course, aiming especially to accustom students to determine our most common rocks and minerals at sight, or by the application of the simplest chemical and blow-pipe tests.

III. German, Prof. J. G. Moore. A course of twelve lessons in the elements of German, especially adapted to the wants of those intending to teach the language. Special attention will be given to the subject of pronunciation and formation of sentences.

IV. English, (two hours per week) Prof. Marston. The course will consist of lectures on the history, philosophy and grammar of the English language.

V. Rhetoric and Elocution, (three hours per week) Prof. Maria L. Sanford. The work in rhetoric will consist of exemplifications of the principles of the subject drawn from the masterpieces of English literature. The aim will be to show how our language has been actually used, and by what means a correct and elegant style can be acquired. About one-third of the time will be given to practice in elocution. Students who have text-books in rhetoric or in English literature, or copies of the work of our standard poets and prose writers will find it an aid to have these books at hand.

The equipment for carrying on the work of this summer school will be ample. The laboratories, museums, the library and the conservatory of the University will be brought into constant use. The only charge for attendance will be a laboratory fee of \$1.00 per week; the lectures are wholly free, and any one or all of the courses may be attended. Good board can be obtained in the vicinity of the University for from \$4.00 to \$6.00 per week.

Although the courses are undertaken principally to offer the teachers of Minnesota the advantages of the State University and its equipment, all others who love study well enough to come and work with us will be heartily welcomed and helped.

Lectures and laboratory work will begin Wednesday, July 5th, at 9 A. M., and close Saturday, July 29th.

MINNEAPOLIS, May 24th, 1882.

Seventy-three persons, sixty-four ladies, and nine gentlemen, mostly teachers were in attendance on these courses. It should be noticed that the summer school of 1882, was not, like that of 1881, exclusively a school of science, instruction being given in the German and English languages, in rhetoric and in elocution. The attendance on the literary instruction was quite as large as that upon the scientific. There are numerous indications that the continuance of these summer courses is greatly desired by the teachers of the State. In what way, if at all, to respond to this demand, will soon be a practical question for this Board. It cannot be expected that individual professors will continue indefinitely to give such instructions without compensation.

IV. The Farmers' Lecture Course.

This course, although it had been advertised in a provisional way for several years, was first actually given in February, 1882. The opening address was made by the Hon. Chas. B. Loring, U. S. Commissioner of Agriculture, on "The Mutual Relations of American Industries." The leading course of lectures was that by Mr. Willis P. Hazard on the breeding and management of cattle. Other courses of various lengths on different subjects of practical interest were given by Hon. T. H. Saunders, Dr. G. A. Dalimere, Mr. J. H. Harris, and Professor E. D. Porter. Over two hundred ladies and gentlemen were in attendance upon some or all of these lectures, not counting a large number of members of other departments of the University. A detailed account of this course will be found in the report of Professor E. D. Porter, to whose intelligence and activity its success was chiefly due. I would respectfully recommend that the report of Professor Porter, together with abstracts of the various lectures, addresses and discussions, be printed with the report of the Board.

The marked success of the enterprise was a matter of great satisfaction to the writer, who in the annual report for 1874, urged the Board to begin a similar one. The number of young men desiring to pursue a full course of study in scientific agriculture is here, as everywhere else, very small. The best service the Agricultural College can now render, is this: to place in the hands of the actual working farmers of to-day the proved results of all the science and experience of the past. The idea of the Farmers' Lecture Course is to bring the practical agriculturists and horticulturists face to face with the men of science, who devote their lives to the application of science to the processes of the farm, the garden, the stable, &c. The discussions which follow the lectures serve to bring out and emphasize the most important practical points.

●

THE EQUIPMENT.

BUILDINGS.

The repairs which were so necessary at the time of the last report, were made under the direction of the Executive Committee in the summer of 1881, and had the effect to greatly improve the

appearance of things. There remain two important items for which the means should be secured as soon as possible. These are:

1. The lighting of the assembly hall and the corridors and stairway leading thereto. This excellent audience room, which it is necessary to use on many evenings of the year, has not yet been sufficiently illuminated. Either gas or electric lighting is needed, and needed at once.

2. The construction of a main sewer which should receive the drainage of the present main building, and that of other buildings to be erected in its neighborhood. The cesspools which have been used, have been a constant source of annoyance and expense, but happily we have not yet been called on to trace the outbreak of disease to them. The situation of the present and proposed buildings is very favorable to the most thorough drainage at a small expense.

Otherwise the buildings will be found in good condition, and I am happy to report that the amount of damage done to buildings and furniture, beyond ordinary wear and tear, is not worthy of mention. The students appreciate the efforts of the Board to provide not merely comfortable but tasteful arrangements, and cheerfully co-operate in abstaining from and preventing damages.

The general condition of the "plant" has not changed since the last reports. Further development of the museums, laboratories, and the library has been impossible for lack of space, and suitable appliances. The response of the Legislature of 1881 to the appeals of the Board, was most encouraging to the Faculty, who expected the immediate enlargement of the facilities of the institution.

The delay of nearly two years in beginning the erection of the new buildings authorized and planned is a fact which it is not my province to complain of or to criticize, but it is simply just to state that the great development hoped and confidently expected has been in consequence postponed. At the same time it must be claimed that the most has been made of existing facilities, and that the delay has been submitted to without petulance on the part of the Faculty.

In regard to the museum it is necessary to remark that the Curator's report will be found in the report of the Geological Survey. The propriety of disconnecting the museum from the other portions of the University equipment, and merging it into the Geological Survey is questionable.

THE EXPERIMENTAL FARM.

In regard to this, there is nothing of educational interest to report. The sale of the old farm and the purchase of a new one will have been discussed elsewhere. The report of Professor Porter, herewith transmitted, is referred to for numerous statements and suggestions which will require your attention.

THE FRUIT FARM.

From the report of Superintendent Gideon, herewith transmitted, it will be seen that he has been deprived of the opportunity of testing the results of his first experiments, by the depredations of thieves. He has not, however, been discouraged.

THE GEOLOGICAL SURVEY.

The annual report of Prof. N. H. Winchell, State Geologist, is herewith transmitted.

The first volume of the final report is progressing toward publication. The field-work of the greater portion of the State has been completed, and the first volume pertains to that portion. The volume will be devoted to the careful description of the geology and topography of the southern half of the State, its soils, forests, and general physical features as dependent on geological agencies. It gives full accounts of its material resources, and particularly of the building stones, with chemical and physical tests that have been made. The field-geology of various counties, with ample maps and illustrations, will make the publication one of great value to the State. It is expected that the volume will be ready for distribution in about six months.

The annual reports of progress of the survey, for the years 1880 and 1881, the former of which has already been printed, exhibit also some of the minor work of the survey. These annual reports embrace important matter relating to the northern part of the State, not yet fully wrought out to completion. They at once show the rate of progress there, and put within the reach of those interested such information as has been obtained in the field, and at the same time preserve from loss the most of the field-notes in case of any accident by fire or otherwise.

During the year the work and plans of the survey have been interrupted in a degree by the lamented death of Mr. C. M. Terry,

who had been engaged for two years as assistant. Mr. Terry's zeal and industry can be seen in the report of progress for the year 1880, on the Hydrology of Minnesota. His maps and unpublished manuscripts and his field notes, which have been put in the hands of Prof. Winchell, will be finally placed in shape for publication.

THE LIBRARY.

The whole number of volumes added in the year 1880-'81 was 573; in the year 1881-'82, 624. Volumes of periodicals were bound and placed on the shelves. With the permission of the Board the titles of these accessions will not be submitted with this report, but be reserved for a later one, when a considerable batch of them will have been accumulated. The compendious catalogue of subjects printed as an appendix to the last report has proved, as was expected, of very great use to students and others using these books. It is now possible to ascertain, with the least possible delay, what the library may contain on any subject. By authority of the Executive Committee, an edition of 1,000 copies on strong Manilla paper, was printed at the expense of the University. Single copies are sold at 25 cents, a trifle above cost, the proceeds returning to the treasury to reimburse the expense of publication. The amount of drudgery undergone by the librarians, in the preparation of the catalogues of subjects and authors, can never be known to any not experienced in library management.

The Board are again urged to devote to the increase of the library the largest sum they can justly spare. Situated as we are far from the great centers of literary activity, having access to no great public libraries, our own library is our almost sole source and fountain of knowledge. If you would reinforce and sustain the talents of your professors, keep them supplied with the best and latest books in their several specialties. A large and rich collection of books will attract and retain able teachers in your service. As was remarked in the last published report, incompetent teachers cannot remain in an institution whose students have access to the best books.

The following donations have been received and duly acknowledged on behalf of the University :

1880-'81.

U. S. GOVERNMENT.

- Through Department of State:
- Reports of the Consuls, No. I. Oct. 1880. 5 v.
 - Reports of the Consuls, No. II. Nov. 1880.
 - Foreign Relations, 1880.
 - Handbook of Paris Exposition, 1878.
- Through Treasury Dept.:
- Report of Secretary of Treasury, 1880. 2 v.
 - Finance Report, 1880.
 - Report of Commissioner of Internal Revenue, 1880.
 - Letter from Acting Secretary. 2 v.
 - U. S. Coast Survey, 1877.
 - Synopsis of Decisions, 1880.
 - Report of Life Saving Service, 1880.
- Through Dept. of Interior:
- Hayden, U. S. Geological Survey, 1880.
 - Entomological Commission, Part II.
 - Bulletins U. S. Geol.-Geog. Survey, 2.
 - Revised Statutes.
- Through Smithsonian Institute:
- Report of Board of Regents, 1879.
 - Contributions to Knowledge. Vol.
 - Miscellaneous Collections, XVIII-XXI. • 4 v.
 - Silk Goods of America, 1880.
- Through Patent Office:
- Report of Commissioner on Patents, 1879.
 - Alphabetical List of Patents and Inventions.
- Through Navy Dept.:
- Report of Secretary of Navy, 1879.
 - Nautical Almanac, 1883.
 - Astronomical Papers, Vol. I, Part III.
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- Through Bureau of Education:
- Report of Commissioner of Education, 1878.
- Through Dept. of Agriculture:
- Report on Cotton Insects, 1879.
 - Diseases of Swine and other Domestic Animals.
- Through Dept. of War:
- Report of Chief of Engineers, 1879. 3 v.
- Through Hon. W. D. Washburn, M. C.:
- Congressional Record, Vol. X, Part 1-5. 6 v.
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 - Messages and Documents, 1879-'80.

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Through Col. C. P. Patterson, Supt.:

Coast and Geodetic Survey Appendix, 1878.

Through Brig. Gen. S. V. Benet, Chief:

Ordnance Report, 1880.

Through Hon. W. G. Le Duc, Comr.:

Report of Commissioner of Agriculture, 1879.

Preliminary Report of the Department of Agriculture, 1880.

Hough, Report upon Forestry, Vol. II, 1878-'79.

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Hon. J. Fletcher Williams, Secy:

Minnesota Historical Society Collections, Vol. III, P. 3.

Eyre and Spottiswoode, London:

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O. S. Munsell:

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H. Stewart, New York:

Irrigation for the Farm, Garden and Orchard.

The Shepherd's Manual.

Ginn & Heath, Boston:

Byerly's Differential Calculus.

Iowa:

Horticultural Society Reports, 1871-'79. 9 v.

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Hon. C. W. Johnson, Minneapolis:

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Gov. J. S. Pillsbury, Minneapolis:

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H. L. Eads, Kentucky:

Shaker Sermons. 2 v.

H. I. Bowditch, Boston:

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Hon. Richard Chute, Minneapolis:

Pitman, Alcohol and the State.

Clark Stewart, Minneapolis:

Stockhardt, Principles of Chemistry.

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 Session of 1879.
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 House Exec. Doc. 1-11, 46th Cong., 1st Session.
 House Misc. Doc. 1-26, 5 v., 46th Cong., 1st Session.
 Senate Exec. Doc., 44th Cong., 2d Session.
 Senate Journal, 46th Cong., 2d Session.
 Senate Exec. Doc. 3-4, 2 v., 46th Cong., 2d Session.
 House Journal, 46th Cong., 2d Session.
 House Exec. Doc., Vols. 9, 13, 16, 17, 20, 25, 26, 7 v., 46th Cong., 2d Session.
 House Misc. Doc., Vols. 1, 2, 3, 5, 6, 5 v., 46th Cong., 2d Session.
 House Committee Reports, 6 vols., 46th Cong., 2d Session.
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 Official Register, 1881.
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 Senate Exec. Doc. No. 12, 45th Cong., 2d Session.
 Senate Exec. Doc., Vols. 1, 5, 2 v., 46th Cong., 2d Session.
 Senate Misc. Doc., Vol. 2, 46th Cong., 2d Session.
 House Reports, Vols. 1-5, 5 v., 46th Cong., 2d Session.
 House Misc. Reports, Vol. 4, 46th Cong., 2d Session.
 House Exec. Doc., Vols. 1, 3, 4, 5, 6, 8, 11, 12, 15, 21, 22, 24—11 v.,
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Annual Report, 1878.
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 Astronomical Papers, Vol. I, Part 5.
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Report of Chief of Engineers, 1880. 3 v.
 King, Geological Explorations, Vol. VII.
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 Report of Chief Signal Officer, 1879.
 Index to Report of Engineers, 1866-'79.
 System of Submarine Mines.
 Maps of Transportation Routes.

Through Hon. W. D. Washburn, M. C.:

Cong. Record, 46th Cong., 3d Session.
 Messages and Documents, Dept. of State, 1880-'81.
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- Messages and Documents, War Dept., 1879. 6 v.
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 " " State Dept., 1879.
 " " P. M. General, 1879-'80.
 Report of Committee on Education, 1879. 2 v.

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Illinois:

- Industrial University Report.

Michigan:

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 Forty-fourth Annual Report of Supt. of Public Instruction.
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- Dixwell, Premises of Free Trade.
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Peabody Educational Fund:

- Proceedings, Vols. 1, 2. 2 v.

E. & H. T. Anthony, New York:

- Robinson and Abney Silver Printing.

Clark & Maynard, New York:

- Prologue to Chaucer's Canterbury Tales.

C. Harlan, Wilmington:

- Elflora of the Susquehanna.

Prof. J. W. Spencer:

- Pre-glacial Outlet of Lake Superior. 2 v.

Prof. Meyrowitz, Columbia, Mo.:

- Hebrew Grammar.

Prof. J. Brooks, D. D., Minneapolis:

- Benton, Thirty Years in the U. S. Senate, Vol. 1.
 Minnesota Debates, 1857. 2 v.
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 Donnegan, Greek Lexicon.
 Mallory, Life and Speeches of H. Clay. 2 v.
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- Western Academician.
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- Rev. E. M. Williams, Minneapolis:
 Paradise Lost, Illustrated by Dore.
- H. L. Gordon, Minneapolis:
 Legends of the Northwest.
- Dr. W. E. Leonard, Minneapolis:
 Ariel, Vols. 1-3.
- W. C. T. U., Minneapolis:
 Richardson, Temperance Lesson. 3 v.
 Colman, Alcohol and Hygiene. 3 v.
- Rev. James McGolrick, Minneapolis:
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Periodicals. The following have been supplied by purchase:

Quarterlies—American Journal of Mathematics, Bibliotheca Sacra, British Review, Edinburgh Review, Journal of Philology, Journal of the Royal Agricultural Society, Journal of Speculative Philosophy, London Review, Westminster Review, Bulletin of the Nuttall Ornithological Club, Mind, Journal of Geological Society, The Antiquary.

Bi-Monthlies—New Englander, Princeton Review, Education.

Monthlies—American Journal of Science, American Naturalist, Atlantic, Century, Catholic World, Contemporary Review, Deutsche Revue, Fortnightly Review, Harper's Magazine, International Review, Library Journal, Magazine of Art, Nineteenth Century, North American Review, Popular Science Monthly, The Portfolio, Van Nostrand's Engineering Magazine, Blackwood's Magazine, Gardner's Monthly, Journal of Franklin Institute, The Analyst, American Miller, American Agriculturist, Botanical Gazette, American Microscopical Journal, Chemical Journal, Canadian Entomologist.

Semi-Monthlies—Ueber Land und Meer.

Weeklies—The Academy, Athenæum, American Architect, American Machinist, Chemical News, Harper's Weekly, Littell's Living Age, Nation, Journal of Education, Nature, Saturday Review, Sanitary Engineer, Scientific American and Supplement, Rural World, Revue Politique et Littéraire, Literary World.

Semi-Weeklies—New York Tribune.

The following have been furnished gratuitously by the publishers, to whom the thanks of the Board are due.

Monthlies—Messenger of Peace, Browne's Phonographic Monthly, Medical Register, Literary News.

Weeklies—Minnesota Mirror, Le Canadien, Labor Tribune, Christian Statesman, Science, Fargo Republican, Lake City Graphic, Justice, The Present Age, Svenska Folkets Tidning, Budstikken, Minnesota Staats Tidning, Real Estate Review, New York Weekly Witness, Farmington Jour-

nal, Union Signal, Folkebladet, Saturday Spectator, Glencoe Enterprise, Sabbath Reading.

Semi-Weeklies—New York Evening Post.

Dailies—Minnesota Tribune, Evening Journal.

REMARKS AND SUGGESTIONS.

The length of this report does not permit me to discuss in detail a number of subjects, which in my opinion should receive early consideration by the Board. Some of these I have already had the honor to bring to your attention. The following enumeration includes some points already mentioned in this report.

1. The discontinuance of the \$5.00 fee collected annually from students and its replacement with a deposit of money to be refunded less any deductions for loss or damages to books, furniture, apparatus, etc.

As a part of the revenue the sum received is inconsiderable, and it appears in some cases that persons paying it construe themselves entitled to commit damages to the amount of \$5.00.

2. The shortening of the University year so that young men may go to the farms and young women to the country schools at the opening of spring.

In the department of agriculture the scholastic work would be done in the winter months and the whole summer reserved for practical out-door operations. In our extreme climate it is impossible to divide days between study and work. That separation must go by seasons.

3. The establishment in some form within the general faculty, soon to become a larger body ill adapted to judicial duties, of a judiciary body or committee, with power under law to compel testimony in grave cases.

4. The provision in some manner, on a limited scale, of a home for young women attending in the University. There is little doubt that other institutions making such provision will attract young women who would, if similar arrangements existed for them, resort to the University.

5. An arrangement with the State Normal Board, and the principals of the Normal schools, by which the students of the University, a large number of whom are to be teachers, may receive instruction by those officers in the theory and practice of teaching.

6. Some permanent arrangement for carrying on the summer schools at the University, which seem to be so much in request, and so useful to the teachers of the State.

7. That authority be given to the general faculty to open in the Sub-Freshman class certain auxiliary sections for the instruction of applicants of insufficient preparation, whom it is undesirable to wholly reject.

8. That the Farmers' Lecture Course be continued, and that as fast as possible the instruction be regularly organized, and the programme published in the annual calendar.

9. That a sewer for the main building, and others to be built adjoining it, be constructed as soon as possible, and that some means be provided for lighting the assembly hall.

10. That the new buildings be begun, and pushed forward as fast as the means can be furnished by the State.

11. That the annual appropriation for the increase of the library be raised to \$3000.

12. That the religious denominations of the State be invited to erect in the neighborhood of the University, but wholly independent of it, and entirely under their own control, "halls" to serve as Christian homes for their youths while carrying on their studies at the University.

13. The favorable consideration of the petition of the students and professors forming the Students' Christian Association of the University, for the designation of a site on the campus, upon which they may erect a building, to include a small chapel, a reading room, &c., for the uses of the association. As the constitution shows, the liberal spirit of this organization is to include all, and exclude none, who sympathize in its Christian work and worship, and desire to co-operate therein.

14. That the Board provide for the publication in their biennial reports of such literary and scientific contributions as may have been made by members of the University. Such publications will render the reports interesting and desirable, and increase their circulation among Universities and learned societies, and what is more, will stimulate the production of valuable papers in the University. The youngest of our American Universities has already placed the scholars of the country under obligations by means of papers it has printed and circulated.

The contributions on geological survey have shown what interest may be added to our reports in the manner specified.

15. The increase of the working force of the University. The

immediate need is a professor of physics, a scientific department of the first importance. A professor of history should probably be the next accession.

16. The increase of the permanent endowment as the chief duty of the guardians of the University in the present generation. Before the close of the present century the institution must, to maintain its place among the foremost, be receiving an income five times that now coming in, and by the middle of the next century ten times as much. A great revenue wisely and economically expended is the one great fundamental requisite of a great University.

Universities are costly establishments, but only those countries which support and nourish Universities take the lead in the advance of civilization.

They are not to be supported, however, in the interest of the small proportion of the people who can be directly educated in them. It is far more the interest of the whole people, which is to be consulted, and all are concerned in the perpetuation of the knowledge of the past, in diffusing the results of science, in original research, and in transmitting the accumulations of culture to the next generations.

In closing this report, I mention as a matter for congratulation, that the general plan of University organization adopted by your Honorable Board in 1871 has been, in the past year, in its essential principles put into operation by the University of Michigan, thus justifying action by you which was thought at the time by some to be premature if not ill-advised.

All of which is respectfully submitted.

APPENDIX "A"

GRADUATIONS.

At the ninth annual Commencement, held June 2, 1881, the following 27 degrees were conferred:

1881.

COLLEGE OF SCIENCE, LITERATURE AND THE ARTS.

Master of Arts.

WILLIS MASON WEST (B. A. 1879.)

Bachelors of Arts.

George Briggs Aiton	St. Peter.
Samuel Gilmore Anderson.....	Eden Prairie.
Otway Wilkinson Baldwin.....	Clear Lake.
William Cullen Bryant	St. Peter.
Herbert Oscar Chowen.....	Minneapolis.
Emily Louise Hough.....	Philadelphia, Pa.
Charles Edward Kent.....	Toledo, O.
William Leslie King.....	Garden City.
Quintin John Rowley.....	Oakland.
Fred Beal Snyder.....	Minneapolis.

Bachelors of Science.

Fred Leslie Bardwell	Minneapolis.
Herbert John Broughton.....	Minneapolis.
Diana Burns.....	Minnetonka.
George Sutherland Grimes.....	Minneapolis.
James Jennison.....	Red Wing.
David Albert Locke	Minnetonka.
Samuel Allen Locke.....	Minnetonka.
Sarah Ellen Palmer	Shell Rock.
William Hines Savidge.....	Cleveland.
Lilla Ruth Williams.....	Brooklyn.

Bachelors of Literature.

Harlow Horace Bonniwell.....	Hutchinson.
Margaret Agnes Campbell	Nova Scotia.
Lettie May Crafts	Minneapolis.
Emma Elizabeth Grimes.....	Minneapolis.
William Edmund Harrington	Hutchinson.
Emma Ernestine Maes.....	Minneapolis.
Bradley Phillips, Jr.....	Hudson, Wis.

The graduations, 33 in number, at the tenth annual Commencement, held June 1, 1882, were as follows:

1882.

Master of Science.

ROBERT HENRY CRAFTS, (B. S. 1877.)

Bachelors of Arts.

James Bennett Gould.....	Eden Prairie.
Frank Healy.....	Preston.
Andrew Franklin Hillyer.....	Minneapolis.
Carrie Warner Holt.....	Chatfield.
Lydia Rossiter Holt.....	Chatfield.
Frances Ada Knox.....	Garden City.
Frank Nichols Leavens.....	Faribault.
Alexander Hamilton Nunn.....	Claremont.
Eli Milton Skiff Pickett.....	Albert Lea.
Charles Myron Webster.....	Red Wing.
Jesse Craig Wilson.....	Dundas.

Bachelors of Science.

George Joseph Backus.....	Red Wing.
William Wyckoff Clark.....	Mankato.
Alice Elizabeth Demmon.....	Minneapolis.
Carrie Delania Fletcher.....	Mankato.
Emma Laura Hendrickson.....	St. Paul.
William Beans Linton.....	Cook's Valley.
Henry Francis Nachtrieb.....	Newport.
Rasselas Hamlin Prosser.....	Spring Valley.
Herbert Paine Shumway.....	Alexandria.
Edward Duffield Neill Whitney.....	Minneapolis.

Bachelors of Literature.

Agnes Virginia Bonniwell.....	Hutchinson.
Grace Webster Curtis.....	Decorah, Ia.
Arthur Edwin Dickerman.....	Decorah, Ia.
Marie Louise Henry.....	Minneapolis.
Mary Eliza Holt.....	Chatfield.
Mary Nancy Hughes.....	Minneapolis.
Richard Hartwell Johnson.....	St. Charles.
Louie Lillian Kilbourn.....	Minneapolis.
Emily Dana McMillan.....	Minneapolis.
Addie Eva Pillsbury.....	Minneapolis.
Harry Amy Strong.....	Decorah, Ia.

APPENDIX "B."

ATTENDANCE.

THE FOLLOWING TABLES EXHIBIT THE ENROLLMENT AND CLASSIFICATION OF THE STUDENTS.

SUMMARY, 1880-81.

COLLEGE OR DEPARTMENT.	CLASS.	Gentlemen.	Ladies.	Total.
Science, Literature and the Arts.	{ Graduate.....		1	1
	{ Senior.....	20	9	29
	{ Junior.....	17	9	26-56
Mechanic Arts.....	{ Specials.....	2		2
	{ Evening Drawing.	62		62-64
Collegiate Department	{ Sophomore, I.	33	20	53
	{ Freshman, II.	49	19	68
	{ Sub-Freshm., III.	43	13	56
	{ Special Students..	21	17	38-215
Totals.....		247	88	335

OR BY CLASSES ONLY.

Graduate.....	1
Seniors—of all Departments.....	29
Juniors—of all Departments.....	26
Sophomores—Collegiate Department.....	53
Freshmen—Collegiate Department.....	68-17
Sub-Freshmen—Collegiate Department.....	56-56
Special Students.....	40-40
Evening Drawing.....	62-62
Total.....	335

THE DISTRIBUTION OF STUDENTS IN THE VARIOUS DEPARTMENTS, CLASSES AND COURSES IS SHOWN AS FOLLOWS:

COLLEGE OF SCIENCE, LITERATURE AND ART.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior.....	{ Classical.....	10	2	12
	{ Scientific.....	7	3	10
	{ Modern.....	3	4	7
Totals.....		20	9	29
Junior.....	{ Classical.....	6	2	8
	{ Scientific.....	7	2	9
	{ Modern.....	3	6	9
Totals.....		16	10	26

COLLEGE OF MECHANIC ARTS.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Special.....	2	.....	2
Evening Drawing.....	62	.....	62
Totals.....	64	.....	64

COLLEGIATE DEPARTMENT.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Sophomore.....	{ Classical.....	13	3	16
	{ Scientific.....	16	3	19
	{ Modern.....	4	14	18
Totals.....	.....	33	20	53
Freshmen.....	{ Classical.....	21	3	24
	{ Scientific.....	24	8	32
	{ Modern.....	4	8	12
Totals.....	.....	49	19	68
Sub-Freshman.....	{ Classical.....	15	1	16
	{ Scientific.....	22	4	26
	{ Modern.....	6	8	14
Totals.....	.....	43	13	56
Special Students.....	.....	21	17	38
Totals.....	.....	146	69	215

Two hundred and thirty-eight (238) students were enrolled as residents of Minnesota, the following counties being represented:

Blue Earth, 8; Brown, 2; Carver, 2; Dakota, 5; Dodge, 5; Douglas, 1; Faribault, 2; Fillmore, 15; Freeborn, 4; Goodhue, 10; Hennepin E., 37; Hennepin W., 65; Houston, 2; Le Sueur, 4; Lyon, 3; McLeod, 4; Meeker, 4; Mower, 3; Nicollet, 7; Olmstead, 6; Polk, 2; Ramsey, 13; Rice, 4; Rock, 1; St. Louis, 1; Scott, 2; Sherburne, 1; Stearns, 3; Steele, 5; Stevens, 1; Wabasha, 6; Waseca, 1; Washington, 2; Winona, 1; Wright, 4; — Thirty-five counties.

Thirty-three were registered from other States and countries, to-wit:

Dakota Territory, 8; England, 1; Illinois, 2; Iowa, 8; Kansas, 1; Maine, 1; Massachusetts, 1; Michigan, 1; Montana Territory, 1; New York, 1; Nova Scotia, 1; Ohio, 3; Pennsylvania, 1; Vermont, 1; Wisconsin, 2; — sixteen States and countries.

SUMMARY, 1881-82.

COLLEGE OR DEPARTMENT.	CLASS.	Gentlemen.	Ladies.	Total.
Science, Literature and the Arts.....	{ Senior.....	18	14	32
	{ Junior.....	8	7	15— 47
Mechanic Arts.....	{ Senior.....	4	.....	4
	{ Junior.....	14	.....	14— 18
	{ Special.....	.....	.....	.....
Agriculture.....	Senior.....	1	.....	1— 1
Collegiate Department.....	{ Sophomore, I....	39	11	50
	{ Freshman, II....	25	8	33
	{ Sub-Freshm. III	44	27	71
	{ SpecialStudents	24	9	33—187
Totals.....		177	76	253

OR BY CLASSES ONLY.

Seniors—of all Departments.....	33
Juniors—of all Departments.....	19
Sophomores—Collegiate Department.....	50
Freshmen—Collegiate Department.....	33
Sub Freshmen—Collegiate Department.....	71
Special Students.....	47
Total.....	253
Candidates for Masters' Degrees.....	9
Attending Summer School of Science.....	42
Attending Evening Drawing School.....	51
Attending Farmers' Lecture Course.....	191
Grand total.....	546

THE DISTRIBUTION OF STUDENTS IN THE VARIOUS DEPARTMENTS
CLASSES AND COURSES WAS AS FOLLOWS:

COLLEGE OF SCIENCE, LITERATURE AND ART.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior.....	{ Classical.....	8	3	11
	{ Scientific.....	8	2	10
	{ Modern.....	2	9	11
Total.....		18	14	32
Junior.....	{ Classical.....	7	1	8
	{ Scientific.....	1	2	3
	{ Modern.....	0	4	4
Total.....		8	7	15

COLLEGE OF MECHANIC ARTS.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior				
Junior	{ Mech. Engineering	1		1
Special	{ Civil Engineering	3		3
Evening Drawing		14		14
		51		51
Totals		69		69

COLLEGE OF AGRICULTURE.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior	Regular	1		1
Farmers	Lecture	152	39	191
Totals		153	39	192

COLLEGIATE DEPARTMENT.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Sophomore	{ Classical	14	3	17
	{ Scientific	21	3	24
	{ Modern	4	5	9
Total		39	11	50
Freshman	{ Classical	10	1	11
	{ Scientific	14	2	16
	{ Modern	1	5	6
Total		25	8	33
Sub-Freshman	{ Classical	17	2	19
	{ Scientific	21	10	31
	{ Modern	6	15	21
Total		44	27	71
Special Students		38	9	47
Totals		14	55	201

Two hundred and twenty-three (223) were enrolled as residents of Minnesota, the following counties being represented:

Blue Earth, 8; Brown, 1; Carver, 3; Clay, 2; Dakota, 6; Dodge, 5; Faribault, 3; Fillmore, 10; Freeborn, 3; Goodhue, 13; Henne-

pin E., 39; Hennepin W., 60; Houston, 2; Le Sueur, 5; Lyon, 1; McLeod, 1; Martin, 1; Meeker, 5; Mower, 8; Nicollet, 4; Olmstead, 4; Ramsey, 10; Rice, 5; Rock, 1; St. Louis, 1; Stearns, 3; Steele, 4; Stevens, 1; Wabasha, 3; Waseca, 1; Washington, 1; Winona, 1; Wright, 7; — Thirty-three counties.

Thirty students were enrolled from other States and countries, as follows:

Dakota Territory, 7; Florida, 1; Indiana, 1; Illinois, 2; Iowa, 7; Kansas, 1; Massachusetts, 1; Michigan, 2; Montana Territory, 3; New York, 3; Ohio, 1; Vermont, 1; — twelve States and countries.

APPENDIX "C."

WORK OF THE YEAR 1880-81.

THE YEAR BEGAN SEPTEMBER 7, 1880, AND ENDED JUNE 21, 1881.

Subjects.	Text Books.	Instructor.	No. of Exercises	Class.	No. of Students	Term.
MATHEMATICS. PROF. J. F. DOWNEY.						
Analytical Geometry	Olney	Downey	57	Junior...	1	I.
Higher Algebra, 1 §	"	Hutchin on	27	Freshm...	30	I.
" " 2 §	"	Downey	26	"	29	I.
" " 2 §	"	Hutchinson	24	"	29	I.
Differential Calculus	"	Downey	57	Junior...	5	II.
Trigonometry, 1 §	"	"	54	Freshm...	29	II.
" " 2 §	"	"	50	"	27	II.
Algebra, 1 §	"	Hutchinson	54	Sub-Fr...	15	II.
" " 2 §	"	"	50	"	18	II.
Integral Calculus	"	Downey	58	Junior...	3	III.
Conic Sections, 1 §	"	"	25	Sophom...	18	III.
" " 2 §	"	"	12	"	8	III.
" " 2 §	"	Hutchinson	10	"	8	III.
Theory of Equations, 1 §	"	Downey	9	"	13	III.
" " 2 §	"	"	9	"	8	III.
Solid Geometry, 1 §	Wentworth	Hutchinson	53	Sub-Fr...	24	III.
" " 2 §	"	"	52	"	8	III.
ASTRONOMY. PROF. J. F. DOWNEY.						
Practical Astronomy	Loomis	Downey	48	Senior...	8	III
CHEMISTRY. PROF. J. A. DODGE.						
General Chemistry	Barker	Dodge	55	Sub-Fr...	14	I
Theoretical Chemistry	Lectures	"	55	Sophom...	12	I
Analytical Chemistry	Appleton, & Co.	"	55 d. h.*	Sen. Jun.	22	I
" " 2 §	"	"	49 d. h.	"	27	II.
" " 2 §	"	"	30 d. h.	Sophom...	13	II.
General Chemistry, 1 §	Barker	"	55	Freshm...	25	III.
" " 2 §	"	"	55	"	24	III.
Analytical Chemistry	Fresenius	"	55 d. h.	Sen. Jun.	15	III.
" " 2 §	"	"	22 d. h.	Sophom...	7	III.
PHYSICS. PROF. WM. A. PIKE, in charge.						
Mechanics	Peck	Pike	55	Sophom...	14	I.
Sound and Heat	Ganot	"	55	Freshm...	30	II.
BOTANY. PROF. C. W. HALL.						
Elementary Botany	Gray	Hall	57	Sub-Fr...	20	III.
Advanced Botany	Bessey	"	57	Freshm...	37	III.
Laboratory Work	"	"	40	"	37	III.
ZOOLOGY. PROF. C. W. HALL.						
Comparative Zoology	Orton	Hall	56	Soph...	18	III.
Advanced Zoology	Packard	"	56	Junior...	21	I.
Laboratory Work	"	"	20	"	21	III.
GEOLOGY AND MINERALOGY. PROF. C. W. HALL.						
General Geology	Dana	Hall	57	Senior...	31	I.
Economic Geology	Lectures	"	41	"	10	II.
Essays	"	"	30	"	30	I.
Mineralogy	Lectures	"	50	Junior...	33	II.
Blowpipe Work	Brush	"	40	"	33	II.

* Double hours.

Subjects.	Text Books.	Instructor.	No. of Exercises	Class.	No. of Students	Term.
ENGLISH. PROF. M. MARSTON.						
Rhetoric.....	Hepburn.....	Sanford.....	50	Sophom.	38	II.
Elocution.....	".....	".....	11	"	40	I.
Compositions.....	".....	".....	10	"	27	III.
Elocution.....	".....	".....	10	Freshm.	59	II.
Compositions.....	".....	".....	10	"	57	III.
Compositions.....	".....	".....	11	Sub-Fr.	36	I.
Elocution.....	".....	".....	10	"	32	II.
American Literature.....	Royse.....	Campbell.....	15	"	13	I.
Addison, Goldsmith & Burns.....	Hudson.....	".....	53	"	9	II.
Burke, Scott & Wordsworth.....	Hudson.....	".....	56	"	7	III.
How to Write Clearly.....	Abbott.....	".....	84	Freshm.	7	I.
Shakspeare.....	Rolfe.....	".....	57	"	26	III.
Brit. and Am. Oratory.....	Goodrich.....	Marston.....	55	Seniors..	11	I.
Orations and Essays.....	".....	".....	2 each.	"	27	II.
".....	".....	".....	2 each.	"	26	III.
".....	".....	".....	2 each.	"	29	III.
Philos. of Lit. and Crit.....	Lectures.....	".....	30	"	29	III.
Orations and Essays.....	".....	".....	2 each.	Juniors..	38	I.
".....	".....	".....	2 each.	"	38	II.
".....	".....	".....	2 each.	"	38	III.
English Literature.....	Lectures.....	".....	55	"	33	III.
History English Language.....	Lectures.....	".....	55	Sophom.	21	I.
Anglo-Saxon.....	Carpenter.....	".....	55	"	15	II.
".....	".....	".....	56	"	6	III.
Milton.....	Sprague.....	".....	55	Freshm.	14	II.
GERMAN. PROF. J. G. MOORE.						
Scientific German Prose.....	Hodge.....	Moore.....	54	S. & Jun.	26	I.
Grammar.....	Whitney.....	".....	54	Junior..	19	"
Schiller's Egmont, &c.....	Buchheim.....	".....	54	Freshm..	22	"
Composition.....	Comfort.....	Campbell.....	54	Sub-Fr..	17	"
Composition.....	".....	".....	54	Sub-Fr..	14	"
Goethe's, Faust, &c.....	Hart & Buchheim.....	Moore.....	55	Sr & Jun	21	II.
Grammar and Reader.....	Whitney.....	".....	55	Junior..	18	"
Hist. Ballads and Ger. Hist.	Wagner.....	".....	55	Freshm..	20	"
Composition, Exercises, &c.....	Comfort.....	Campbell.....	55	Sub-Frm	16	"
".....	".....	".....	55	"	16	"
Hist. of Ger. Lit., &c.....	Lectures.....	Moore.....	59	Sr & Jun	17	III.
Schiller's Jungfrau.....	Worman.....	".....	59	Junior..	16	"
Lessing's Minna von Barnhelm.....	Buchheim.....	".....	59	Freshm..	16	"
Grammar and Reader.....	Whitney.....	Campbell.....	59	Sub-Fr..	17	"
Grammar.....	".....	".....	59	"	10	"
FRENCH. PROF. C. W. BENTON.						
Bacon, etc.....	Buc.....	Benton.....	55	Senior..	19	I.
Grammar and Reader, 1 §.....	Bocher.....	".....	55	Sophom.	20	I.
"..... 2 §.....	".....	".....	55	"	26	I.
Moliere, etc.....	".....	".....	53	Seniors..	21	II.
Trans. into French.....	Saller.....	".....	".....	"	21	II.
Grammar and Reader, 1 §.....	Bocher.....	".....	53	Sophom.	20	II.
"..... 2 §.....	".....	".....	53	"	23	II.
Petite Histoire.....	Lacombe.....	".....	55	Seniors..	15	III.
Trans. into French.....	Sadler.....	".....	".....	"	15	III.
French Literature.....	Lectures.....	".....	".....	"	15	III.
Grammar and Reader, 1 §.....	Bocher.....	".....	55	Sophom.	27	III.
"..... 2 §.....	".....	".....	55	"	27	III.
La Fontaine Fables.....	Sauveur.....	".....	".....	"	"	III.
LATIN. PROF. J. BROOKS, in charge.						
Horace.....	Chase & Stuart.....	Clark.....	52	Sophom.	19	I.
History of Roman Literature.....	Reference.....	".....	19	"	19	I.
Livy.....	Lincoln.....	".....	53	Freshm.	9	I.
Roman History.....	Liddell.....	".....	".....	"	9	I.
Cicero, 1 §.....	Chase & Stuart.....	".....	52	Sub. Fr..	11	I.
"..... 2 §.....	".....	Hutchinson.....	51	"	12	I.
Livy.....	Lincoln.....	Clark.....	53	Freshm.	26	I.
Roman History.....	Liddell.....	".....	".....	"	26	I.
Livy, 1 §.....	Lincoln.....	".....	56	Freshm.	20	II.
Roman History.....	Liddell.....	".....	".....	"	20	II.
Livy, 2 §.....	Lincoln.....	".....	51	"	12	II.

Subjects.	Text Books.	Instructor.	No. Exercls's	Class.	No. Students	Term.
LATIN (Continued.)						
PROF. J. BROOKS IN CHARGE.						
Roman History.....	Liddell.....	Clarke.....	.....	"	12	II.
Virgil.....	Searing.....	"	52	Sub-Fr.	24	II.
Mythology and Geology.....	Smith & Lidd ⁿ.....	"	.....	"	24	II.
Tacitus.....	Tyler.....	"	55	Sophom.	20	III.
History of Roman Emperors.....	References.....	"	15	"	20	III.
Virgil.....	Searing.....	"	55	Sub-Fr.	19	III.
Mythology and Geology.....	Smith & Lidd ⁿ.....	"	.....	"	19	III.
GREEK.						
PROF. J. BROOKS, D. D.						
Plato—Text.....	Davies.....	Brooks.....	53	Junior..	11	I.
Lectures.....	"	"	2	"	11	I.
Essays.....	"	"	33	"	11	I.
Xenophon.....	Brooks.....	"	56	Sub-Fr.	10	I.
Homer—Text.....	Boise.....	Hutchinson.....	50	Freshm.	19	I.
Essays.....	"	"	57	"	19	I.
Examinations for entrance } and conditions..... }	"	Brooks & } Hutchinson.....	33	"	.....	I.
Homer—Text.....	Boise.....	Hutchinson.....	50	Freshm.	15	II.
Æschylus—Text.....	Woolsey.....	Brooks.....	53	Sophom.	12	II.
Essays.....	"	"	36	"	12	II.
Xenophon.....	Boise.....	"	56	Sub-Fr.	12	II.
Plato—Text.....	Davies.....	"	53	Sophom.	10	III.
Essays.....	"	"	22	"	10	III.
Demosthenes.....	Tyler.....	"	60	Freshm.	18	III.
Xenophon.....	Boise.....	Hutchinson.....	55	Sub-Fr.	9	III.
Examinations for Conditions.....	"	Brooks.....	3	"	.....	III.
MENTAL AND MORAL PHILOSOPHY.						
PROF. A. T. ORMOND, (See HISTORY.)						
History of Philosophy.....	Lectures.....	Ormond.....	55	Senior..	23	I.
Ethics.....	"	"	55	"	26	II.
Natural Theology.....	"	"	15	"	7	III.
Psychology.....	"	"	55	Junior..	30	III.
HISTORY.						
PROF. A. T. ORMOND.						
Ancient History.....	Rawlinson.....	Ormond.....	55	Sub-Fr.	35	I.
Mediæval ".....	Green.....	"	22	Freshm.	49	II.
Modern ".....	Swinton.....	"	23	Sophom.	21	III.
History of Civilization.....	See Political	Science below	.....	"	.....	.....
POLITICAL SCIENCE, ETC.						
MR. WM. W. FOLWELL.						
History of Civilization.....	Guizot.....	Folwell.....	39	Junior..	34	I.
General Philology.....	Lectures.....	"	12	"	37	I.
Civil Government.....	DeToqueville.....	"	26	Senior..	23	II.
Constitution U. S.....	Lectures.....	"	13	"	23	II.
Constitution Minnesota.....	"	"	7	"	23	II.
International Law.....	Woolsey.....	"	1	"	10	II.
Political Economy.....	Lectures.....	"	70	"	28	III.
PUBLIC HEALTH.						
DR. C. N. HEWITT.						
Sanitary Science.....	Lectures.....	Hewitt.....	8	Seniors.	25	III.
School Hygiene.....	"	"	6	Sub-Fr.	30	III.
INDUSTRIAL DRAWING.*						
PROF. WM. A. PIKE, in charge.						
Projections, etc.....	"	Pike.....	57	Freshm.	28	I.
Descriptive Geometry.....	Church.....	Pike.....	55	Sophom.	14	II.
Geometrical Drawing.....	Pike.....	Pike.....	55	Sub-Fr.	16	II.
Mechanical ".....	Pike.....	Mayo.....	25	Evening.	44	III.
AGRICULTURE.						
PROF. E. D. PORTER.						
(Chair vacant first half of year.)						

*All Double hours.

Subjects,	Text Books.	Instructor.	No. Exercises	Class.	No. Students	Term.
CIVIL ENGINEERING.		PROF. WM. A. PIKE.				
Surveying	Lectures	Pike	42	Freshm.	39	III.
MILITARY SCIENCE.		(Chair Vacant.)				
EDUCATION.						
Theory of Teaching	Lectures	Sanford	10	Atlarge	35	II.
MUSIC.						
Vocal Lessons	Selected	Leib	20	Atlarge	75	Year

WORK OF THE YEAR 1881-82.

THE YEAR BEGAN SEPTEMBER 6TH, 1881, AND ENDED JUNE 1ST, 1882.

Subjects.	Text Books.	Instructor.	No. Exercises.	Class.	No. Students.	Term.
ASTRONOMY.		PROF. J. F. DOWNEY.				
Descriptive Astronomy.....	Loomis.....	Downey.....	54	Senior...	7	I
MATHEMATICS.		PROF. J. F. DOWNEY.				
Higher Algebra.....	Olney.....	Downey.....	54	Freshm....	43	I.
Trigonometry.....	".....	".....	34	Freshm....	29	II.
Differential Calculus.....	".....	".....	54	Junior....	8	"
Conic Sections.....	".....	".....	34	Sophom....	42	III.
Integral Calculus.....	".....	".....	54	Junior....	3	"
Plane Geometry.....	Wentworth.....	".....	54	Special....	3	I.
Algebra.....	Olney.....	".....	54	".....	2	"
Plane Geometry.....	Wentworth.....	".....	54	".....	2	II.
Algebra.....	Olney.....	".....	54	".....	2	"
Algebra.....	".....	Hutchinson.....	28	Freshm....	34	I.
Algebra, § 1.....	".....	".....	52	Sub-Fr....	22	II.
Algebra, § 2.....	".....	".....	52	".....	12	"
Solid Geometry, § 1.....	Wentworth.....	".....	55	".....	17	III.
".....	".....	".....	55	".....	17	"
Analytical Geometry.....	Olney.....	".....	13	Sophom....	18	"
CHEMISTRY.		PROF. J. A. DODGE.				
Elementary Chemistry.....	Barker.....	Dodge.....	54	Sub-Fr....	14	I.
Applied Chemistry.....	Lectures.....	".....	53	Sophom....	22	I.
Analytical Chemistry.....	Appleton.....	".....	54	Sen&Jun..	21	I.
Analytical.....	Lab. Practice.....	".....	33	Sophom....	16	II.
".....	".....	".....	55	Sen&Jun..	16	II.
General Chemistry.....	Barker & Lee's.....	".....	53	Fr. Sci....	13	III.
"..... abridged.	Barker.....	".....	54	Fr. C.&M.	16	III.
Analytical Chemistry.....	Lab. Practice.....	".....	22	Sophom....	10	III.
".....	".....	".....	55	Sen&Jun..	17	III.
PHYSICS.		PROF. WM. A. PIKE, in charge.				
Mechanics.....	Goodeve.....	Pike.....	54	Jun.....	2	I.
Elementary Physics.....	Peck's Ganot.....	Decker.....	54	So. C&M..	14	I.
Mechanics.....	Peck.....	".....	54	Soph. Sci.	15	I.
Higher Mechanics.....	Rankin.....	Pike.....	52	Jun.....	6	II.
Physics.....	Atkinson.....	Decker.....	49	Freshm....	14	II.
BOTANY.		PROF. C. W. HALL.				
Botany.....	Laboratory	Hall.....	53	Fr. Sci....	18	III.
".....	".....	".....	53	Fr. C.&M.	18	III.
".....	".....	".....	53	S. Fr. Sci.	16	III.
ZOOLOGY.		PROF. C. W. HALL.				
Zoology.....	Packard.....	Hall.....	56	Junior....	8	I.
".....	Laboratory	".....	56	Junior....	7	I.
".....	Orton.....	".....	53	Sophom....	18	III.
".....	Laboratory	".....	10	".....	18	III.
GEOLOGY.		PROF. C. W. HALL.				
General Geology.....	Lectures.....	Hall.....	56	Senior....	27	I.
Economic ".....	".....	".....	57	".....	6	II.

Subject.	Text Books.	Instructor.	No. Exercises	Class.	No. Students	Term.
MINERALOGY. PROF. HALL						
Mineralogy	Lectures	Hall	57	Junior...	21	II.
"	Laboratory ...	"	22	Junior...	20	II.
ENGLISH. PROF. M. MARSTON, PH. D.						
British Oratory	Goodrich	Marston.....	53	Senior ..	14	I.
History English Language	Lectures	"	53	Sophom ..	9	I.
Milton	Sprague	"	53	Freshm ..	6	II.
Anglo-Saxon	Carpenter	"	53	Sophom ..	8	II.
English Criticism	Lectures	"	30	Senior ..	28	III.
English Literature	Shaw & Lect's.	"	53	Junior ..	28	III.
English Criticism	Abbott.....	Campbell	55	Freshm ..	9	I.
American Authors	Royse	"	54	Sub-Fr ..	10	I.
Addison and Goldsmith	Hudson	"	52	"	10	II.
Shakespeare	Rolfe & Abbott	"	57	Freshm ..	5	III.
Macaulay	"	"	57	Sub-Fr ..	9	III.
GERMAN. PROF. J. G. MOORE.						
Goethe, Faust	Hart	Moore	33	Sen&Jun ..	22	I.
Schiller	Sharfer	"	22	Sen&Jun ..	22	I.
Grammar	Whitney	"	55	Junior ..	16	I.
Schiller's Prose	Buehheim	"	55	Freshm ..	29	I.
Exercises	Comfort	Campbell	55	Sub-Fr ..	15	I.
Schiller, Dramas	Deuzel	Moore	21	Sen&Jun ..	22	II.
Lessing Laocoon	Kratz	"	32	Sen&Jun ..	22	II.
Grammar and Reader	Whitney	"	53	Junior ..	16	II.
German History	Taylor	"	53	Freshm ..	28	II.
Historical Ballads	Wagner	"	53	"	28	II.
Grammar and Reader	Whitney	Campbell	53	Sub-Fr ..	17	II.
Lessing's Prose	Deuzel	Moore	56	Sen&Jun ..	18	III.
Deutsche Lyrik, etc.	Buehheim	"	56	Sen&Jun ..	18	III.
Schiller, Junfrau	Worman	"	56	Junior ..	15	III.
Lessing, Minna von B.	Buehheim	"	56	Freshm ..	18	III.
Reader and Exercises	Whitney.....	Campbell	57	Sub-Fr ..	17	III.
FRENCH. PROF. C. W. BENTON.						
Racine, Andromaque	Jarves	Benton.....	56	Senior ..	19	I.
Moliere, Misanthrope	Joyves	"	"	"	19	I.
Grammaire, Francaise	Noel & Ch	"	"	"	19	I.
Grammar and Reader, 1 §	Bocher	"	56	Sophom ..	20	II.
"	"	"	"	"	25	II.
Chateaubriand	"	"	"	Senior ..	18	II.
Corneille, Le Cid	J. Bue	"	"	"	18	II.
French Compositions	"	"	"	"	20	II.
Grammar and Reader, 1 §	Bocher	"	55	Sophom ..	18	II.
"	"	"	"	"	23	II.
Fenelon, Telemaque, 1 §	"	"	"	"	23	II.
"	"	"	"	"	23	II.
Guizot, Guil. le Conquerant	Dubourg	"	"	Senior ..	22	III.
Mevinee, Colomba	Brette	"	"	"	22	III.
Michelet, Jeanne D'Arc	"	"	"	"	22	III.
Reader and Grammar	Bocher	"	56	Sophom ..	27	III.
Fenelon, Telemaque	"	"	56	"	27	III.
Girardin, La Jote fait, &c	"	"	"	"	27	III.
LATIN. PROF. J. BROOKS, In charge.						
Cicero, Sec. 1	Chase & Stuart	Clark	52	Sub-Fr ..	18	I.
"	"	"	52	"	7	I.
Livy, Sec. 1	Lincoln	Hutchinson	51	Freshm ..	16	I.
"	"	Clark	52	"	7	I.
Horace, Text	Chase & Stuart	"	52	Sophom ..	17	I.
"	Essays &c	"	34	"	17	I.
Exam. for Ent. and Cond.	"	"	"	"	38	I.
Virgil	Chase & Stuart	Clark	51	Sub-Fr ..	23	II.
Livy	Lincoln	"	15	Freshm ..	20	II.
Sallust, Cat. and Jug.	Weate	"	36	"	20	II.
"	Essays, &c	"	20	"	20	II.
Plantus, Capiivi	Harrington	"	35	Junior ..	12	II.
Cicero de Senectute	Chase & Stuart	"	15	"	15	II.
Examinations on Cond.	"	"	"	"	15	II.
Virgil	Chase & Stuart	Clark	55	Sub-Fr ..	21	III.

Subject.	Text Books.	Instructor.	No. of Exercises	Class.	No. of Students.	Term
LATIN. (Continued.) PROF. J. BROOKS, D. D.						
Tactus.....			40	Sophom.	12	III.
Cicero de Amicitia.....		Clark.....	15	"	11	III.
Essays, &c.....		"	12	"	11	III.
Tactus.....		"	10	Senior	3	III.
Virgil.....	Searing.....	"	20	"	3	III.
Examinations on Cond.....		"			18	III.
GREEK. PROF. J. BROOKS, D. D.						
Xenophon.....	Brooks.....	Brooks.....	55	Sub-Fr.	8	I.
Homer.....	Davies.....	"	57	Junior	9	"
Xenophon, Memorabilia.....	Winans.....	Hutchinson.....	55	Freshm.	7	"
Xenophon, Anabasis.....	Boise.....	Brooks.....	51	Sub-Fr.	8	II.
Aeschylus, Text.....	Woolsey.....	"	51	Sophom.	15	"
Essays.....	"	"	45	"	15	"
Xenophon, Mem. and Symp.....	Winans.....	Hutchinson.....	53	Freshm.	7	"
Examination on Conditions.....	"	Brooks.....	7	"	"	"
Xenophon, Anabasis.....	Boise.....	Brooks.....	57	Sub-Fr.	10	III.
Plato.....	Tyler.....	"	56	Sophom.	13	"
Demosthenes.....	"	Hutchinson.....	55	Freshm.	2	"
Exams. for Ent. and Cond.....		Brooks.....	20	"	"	"
MENTAL AND MORAL PHILOSOPHY. PROF. A. T. ORMOND.						
History of Philosophy.....	Lectures.....	Ormond.....	55	Senior...	25	I.
Ethics.....	"	"	54	Senior...	32	II.
Psychology.....	"	"	54	Junior...	24	II.
Natural Theology.....	"	"	20	Senior...	31	III.
Logic.....	Jevons & Lect.	"	57	Junior...	27	II.
HISTORY. PROF. A. T. ORMOND.						
Ancient History.....	Schmitz.....	Ormond.....	22	Sub-Fr.	28	I.
Medieval History.....	Swinton.....	"	22	Freshm.	33	II.
Modern History.....	"	"	23	Sophom.	24	III.
History of Civilization.....	See Political Science, &c., below.					
POLITICAL SCIENCE, ETC. MR. WM. W. FOLWELL.						
History of Civilization.....	Guizot.....	Folwell.....	36	Juniors..	27	I.
General Philology.....	Lectures.....	"	13	Junior..	28	I.
Civil Government.....	DeTocqueville	"	25	Senior..	27	II.
Constitution U. S.....	Lectures.....	"	10	Senior..	27	II.
Mun.....	"	"	6	Senior..	27	II.
International Law.....	Woolsey.....	"	8	Senior..	6	II.
Political Economy.....	Lectures.....	"	49	Senior..	34	III.
RHETORIC AND ELOCUTION. PROF. M. L. SANFORD.						
Orations.....		Sanford...	99	Senior...	33	I.
"		"	99	"	33	II.
"		"	132	"	33	III.
Rehearsals.....		"	99	Senior...	33	I.
"		"	39	"	33	II.
"		"	165	"	33	III.
Orations.....		"	96	Junior...	32	I.
"		"	93	"	31	II.
"		"	93	"	31	III.
Rehearsals.....		"	64	Junior..	32	I.
"		"	62	"	31	II.
"		"	124	"	31	III.
Rhetoric.....	Hepburn.....	"	60	Sophom..	43	II.
Orations.....	"	"	80	"	40	III.
Rehearsals.....	"	"	80	"	40	III.
Elocution.....	"	"	42	"	42	I.
Composition.....	"	"	12	Freshm..	25	II.
"	"	"	12	Sub-Fr..	52	I.
"	"	"	12	Freshm..	23	III.
"	"	"	12	Sub-Fr..	30	II.

Subject.	Text Books.	Instructor.	No. Exercises.	Class.	No. Students	Term.
PUBLIC HEALTH. PROF. C. N. HEWITT.						
Sanitary Science.....	Lectures.....	Hewitt.....	6	Senior...	30	III
School Hygiene.....	".....	".....	6	Sub-Fr..	50	III
INDUSTRIAL DRAWING.* PROF. WM. A. PIKE, in charge.						
Projection Drawing.....	".....	Pike.....	54	Freshm..	11	I
".....	".....	Decker.....	54	Specials.	5	I
Descriptive Geometry.....	".....	Pike.....	52	Soph....	19	II
Geometrical Drawing.....	".....	Decker.....	52	Sub-Fr..	14	II
".....	".....	".....	52	Specials.	10	II
General Drawing.....	".....	Pike & Decker	25	Evening.	51	II
AGRICULTURE. PROF. E. D. PORTER.						
"How Crops Grow".....	Johnson.....	Porter.....	48	Junior... 2	1	I
Horticulture.....	Lindley.....	".....	42	".....	2	I
Agricultural Chemistry.....	Johnson.....	".....	44	".....	1	II
Climatology.....	Lectures.....	".....	26	".....	1	II
Atmosphere and Soils.....	Johnson.....	".....	5	".....	1	III
Scientific Agriculture.....	Johnson.....	".....	48	Senior... 1	1	I
Comparative Anatomy.....	Pendleton.....	".....	26	".....	1	I
Farm Crops.....	Stevens.....	".....	48	".....	1	II
Veterinary Medicine.....	Law.....	".....	42	".....	1	II
Farm Animals.....	Stevens.....	".....	32	".....	1	III
Practical Agriculture.....	".....	".....	Daily 3 Mos.	Special	22	III
CIVIL AND MECHANICAL ENGINEERING. PROF. WM. A. PIKE.						
R. R. Curves, etc.....	Henck.....	Pike.....	54	Jun. C. E.	10	I
Field Work.....	".....	".....	45	".....	10	I
Engr. Drawing.....	".....	".....	52	".....	2	II
Mechanics.....	Rankin.....	".....	54	".....	4	III
Field Work and Drawing.....	".....	".....	54	".....	4	III
Surveying.....	Lectures.....	".....	20	Freshm..	17	III
Machinery.....	Rankin.....	".....	54	Jun. M. E.	1	III
Visc Work.....	".....	Decker.....	20	M. E. & Sp.	4	I
".....	".....	".....	42	M. E. & Sp.	4	II
Forge Work.....	".....	".....	54	M. E. & Sp.	4	III
MILITARY SCIENCE. PROF. E. C. BOWEN, U. S. A.						
Squad Drill School of Soldier	Upsham's In-	Bowen.....	20	Sophom..	36	I
".....	fantry Tac-	".....	20	Freshm..	22	I
".....	tics.....	".....	20	Sub-Fr..	21	I
".....	".....	".....	23	Sophom..	11	II
".....	".....	".....	10	".....	24	III
".....	".....	".....	10	Freshm..	15	III
".....	".....	".....	10	Sub-Fr..	22	III
MUSIC. MR. WM. H. LEIB.						
Vocal Lessons.....	Selected.....	Leib.....	30	At large	75	ALL

* All double hours.

REPORT OF EDWARD D. PORTER, PROFESSOR OF AGRICULTURE.

MINNEAPOLIS, MINN., DEC. 28th, 1882.

To the President of the University of Minnesota:

SIR:—I have the honor to present the following report of the Department of Agriculture of this University:

Condition of the Department when I was placed in charge:

- (1.) Work in both instruction and experimentation had been suspended nearly one year.
- (2.) No students in Agriculture in the University.
- (3.) Farm condemned by the best farmers of the State as unsuited for its purposes, from both character of soil and location.
- (4.) Campus and grounds adjoining College of Agriculture broken, barren and unsightly.
- (5.) A general feeling of uneasiness and dissatisfaction among the farmers of the State and a tendency to criticise the management of the University in this department.

My first year's work consisted in making myself acquainted with

I.

The farmers of the State through their recognized organizations, as the

- (1.) State Agricultural Society.
- (2.) State Horticultural society.
- (3.) State and County Granges.
- (4.) Amber Cane, Dairymen's and Woolgrowers' Association.

II.

To familiarize myself with the past work of the department and the wants of the class for whose benefit it was organized.

III.

To test by personal examination the adaptation of the Experimental Farm, Plant House and grounds to the wants of the Department.

IV.

To devise such plans and make such suggestions as observation and experience deemed necessary to give the greatest efficiency to the Department.

Among the plans proposed and sanctioned by the Board of Regents, were.

- (1.) Sale of Experimental Farm.
- (2.) Purchase of new farm for Experiment Station.
- (3.) Erection of addition to Plant House.
- (4.) Enclosure and improvement of Campus.
- (5.) Establishment of Illustrative Horticultural grounds, and Arboretum on grounds so enclosed and improved.
- (6.) Organization of "Farmers' Lecture Course."

Results of second year of work.

- (1.) As much work of experimentation carried on as the uncertain possession of the ground, and its unfit condition would permit.
- (2.) The employment and instruction in practical agriculture and horticulture of twenty-three students.
- (3.) The instruction in the "Course in Agriculture" of two students and the graduation of one with degree B. A.
- (4.) All the regular organizations of farmers of the State met with, and their good will and co-operation secured and hostility disarmed.
- (5.) The old Experimental Farm has been surveyed, platted, put into the market, and about one-half of it sold, realizing an amount sufficient to purchase and thoroughly equip the new farm.
- (6.) A tract of land admirably adapted for the purpose of an Experimental Farm and Station has been selected and purchased. It has been visited and examined by committees from the State Grange, the County Grange, and the State Horticultural Society, and its selection most cordially approved.
- (7.) The Addition to the Plant House has been completed, and under the careful and intelligent management of Mr. Bowen is accomplishing the objects of its erection, in a manner creditable alike to him and to the University.
- (8.) About 25 acres of the campus have been enclosed by over

4000 feet of neat and durable steel wire fencing, the unsightly hills of sand and hollows have been graded down, over 2000 loads of manure have been hauled, composted and spread, one crop of Hungarian grass has been grown and plowed under for fertilizing purposes, and sown to winter rye, preparatory to permanent seeding to grasses. 230 shade trees, one-half Elm, one-half Box Elder, have been planted, of which 225 are living and in good condition.

(9.) Four acres of the above enclosure have been heavily fertilized, all stones removed or sunk beneath the plow, the ground subsoiled, the city water introduced and distributed so as to irrigate the whole tract, and upon this was grown for illustration every variety of garden vegetable adapted to the climate and soil of Minnesota.

(10.) The public grounds of the University have been kept free from grass and weeds, a portion of the trees have been trimmed, holes and old foundations filled up, walks arranged, graveled and sodded, flower beds and stands made and filled and kept in order for the decoration of the grounds and buildings, walks and roads kept free from snow and mud, and over eight hundred cords of wood hauled from the piling ground to the University furnaces.

(11.) The old farm has been operated, up to the date of sale, yielding in addition to the experimental work, about fifty tons of hay, 150 bushels of oats, and 100 bushels of corn, most of which is yet on hand, and 110 bushels of onions.

(12.) As the new farm is yet in the possession of the tenant under lease from the previous owner, we could only operate certain portions of the ground, and by his permission. But I have seeded down six acres to clover and timothy, have raised 300 bushels of potatoes, 100 bushels of corn, ninety bushels of varieties of seed wheat, have cleaned up and grubbed out eight acres of thicket in fields and along the roads, have levelled the ground, prepared the foundations, and hauled the stone for the commencement of the farm buildings, and under the direction of the Executive Committee have contracted for 500 perches of stone, and they are now being delivered on the ground for next season's work. The farm produced this year under the management of the tenant about 975 bushels of wheat, 1,000 bushels of oats, 300 bushels of potatoes, twenty tons of hay, and 300 bushels of corn, one-third of which belonged to the tenant. A portion of the wheat has been sold and the balance of the crops is reserved for next season's seed, and feed.

(13.) Since the sale of a portion of the old farm, I have had all the fencing removed from the grounds sold, and hauled out to the

new farm, thus saving several thousand feet of fencing, and a large lot of good posts, for future use.

(14.) A very full exhibit of plants, seeds and garden products was made at the State Fair at Rochester, and received the most flattering notices from the press of the State, and the State Agricultural Society passed a series of resolutions, thanking the University for its exhibit, and strongly endorsing the Department of Agriculture, and asking the Board of Regents and the Legislature to thoroughly equip the new experimental station, in buildings, stock and machinery for work that shall give honor to the University, and confer lasting benefits upon the State.

(15.) The Farmers' Lecture Course has been organized, and the results of this first effort were eminently satisfactory. Instead of a membership of thirty, as required before the commencement of the course, 255 persons other than those already in connection with the University were in attendance upon these lectures.

I have caused the lectures of the first course to be reported, and have attached the same to this report, and trust you will find therein much of value that is worthy of preservation.

In conclusion permit me to indicate the line of work in this Department for the ensuing year, and of which I respectfully ask your approval.

(1.) The continuance of our work around the Agricultural College, making the grounds, now prepared for the work, the "Arboretum" of the University, and illustrative of the work in the department of Horticulture, reserving the Experimental work in this line for the Experimental Farm.

(2.) The removal of all the old barns, and stables and houses from the campus.

(3.) The removal of the barn from the old farm to a lot contiguous to the campus, and fitting it up for the University barn, where the teams, tools, seeds and feed, constantly needed on the grounds, may be securely and conveniently housed and protected.

(4.) The immediate and thorough equipment of the new Experimental Farm with all the appliances of buildings, fences, stock and machinery necessary to make it a *First-Class Experimental Station*, and a credit to both the University and the State of Minnesota, and which by its management will command the confidence and respect of all agricultural interests.

As soon as we are prepared to carry on the legitimate work of an Experimental Station, combined with practical and theoretical instruction in agriculture, attention will be attracted to the work,

interest will be excited among farmers, they will see how their sons and daughters and themselves, can be benefited by the work of the University, and our Agricultural class rooms will no longer present a "beggarly array of empty benches."

Permit me to call your attention to another matter in connection with our Experimental Farm.

The acquisition of some additional land, either by purchase or condemnation, for the following reasons:

I.

Within less than five years we shall badly need the additional land for our work.

(1.) We have now 155 acres, 80 acres of this will be used at once for illustrating the best methods of culture and rotation of farm crops; wheat, corn, rye, oats, flax, barley, beans, beets, potatoes, sugar cane and the whole range of grains.

(2.) We shall use 20 acres in experimental plats which can never be used for general farming.

(3.) The remaining 55 acres is in woodland and should not be cleared off, but retained for our buildings, museum, work in forestry, and kept for our sheep range.

(4.) Leaving us *no ground* for permanent meadow or pasturage, no facilities for stock or dairy.

II.

Within five years it will be impossible to obtain suitable land contiguous to the Farm, as it will be all occupied for business or residence purposes.

III.

Land can now be purchased adjoining the Farm and most admirably adapted to our purposes, at a very moderate price.

IV.

One tract of *five acres* is needed to square out our grounds on Como Avenue, this will require condemnation.

V.

Law authorizing the sale of the old Farm, requires money received to be reinvested in the new Farm, and such investment will be the best possible use of the money.

Respectfully submitted,

EDWARD D. PORTER.

FARMERS' LECTURE COURSE.

The management of the Agricultural College have long felt the need of an opportunity for bringing their work more directly to the notice of the agricultural classes of Minnesota's people. While every opportunity has been offered for a full and complete course of instruction, both in scientific and practical agriculture, to the people of the State, very few have seen fit to avail themselves thereof, and while the investigations, experiments, and general accumulation of knowledge by those in charge of the Agricultural College, and fruit and experimental farms proved to be very important and of much value, it was found necessary to adapt means to bring them more directly to the attention of the public.

In order to accomplish this object it was suggested as long ago as the year 1875, that a convention of farmers be held at the building of the College of Agricultural during the winter, and that as many as could be induced to attend the meeting be given not only the results determined by the experiments conducted here, but that prominent educators in special agricultural branches, from abroad be invited to appear before them, and thus, together with mutual discussions and suggestions, make the meeting not only valuable and instructive, but interesting as well. At that time Prof. Chas. Y. Lacy, who was then in charge of the College of Agriculture, attempted to organize a course of lectures upon the plan thus mapped out, but failed for lack of co-operation by the farmers of the State. While the plan was not abandoned it was permitted to "sleep" until the professorship was intrusted to me. I at once set about forwarding the work in this direction, and with the result we have to offer in the present report, quite full minutes of the first of a course of lectures before the farmers of the State, which we know can be made of incalculable value to them, and which we hope to be able to continue from year to year.

The interest manifested and the encouragement given by the agricultural interests of the State warrant further efforts in this direction, and arrangements have been perfected for a more extended course of lectures this present winter, commencing Jan. 16th, and extending through four weeks, the details of which I shall have

the honor to present to you in my next report. The first course was inaugurated upon the 28th day of February, 1882, the first lecture being given by the Hon. Geo. B. Loring, Commissioner of Agriculture of the United States. In introducing Mr. Loring, President Folwell gave the following review of the history of the accomplishments and condition of the agricultural department of the State University, and said:

"This is an important day in the history of the Agricultural College. During the twelve years which have passed since the College was organized, large sums of money have been annually expended and extraordinary efforts put forth to render the department efficient and attractive.

"The average attendance has not much exceeded one student per year. Yet, throughout this whole period, the majority of our students, ranging in number from 200 to 350 per annum, have been the sons and daughters of farmers, who have deliberately turned aside from the doors of this College."

"The meaning of this fact is that the farmers will not have an agricultural education, but prefer to follow a general scientific or literary course of studies. The regents and faculty are powerless to prevent this state of things. Turning to other States and examining the institutions and departments organized under the act of Congress of 1862, we shall find the same fact. That the Agricultural Colleges, or departments connected with State Universities, have attracted but very few students is a matter of notoriety, and is vigorously urged by some as a reason why the Colleges should be separated from the Universities. The separate Agricultural Colleges enroll and instruct large numbers. An inspection of these institutions, however, will show that but a small proportion of the students are pursuing courses of study in Scientific Agriculture with the view of becoming actual farmers. These schools are mostly excellent scientific and technical establishments, carrying on also a considerable amount of classical or literary work. Some of their friends claim in justification that they are thus carrying out the law in its proper intent—that they are, and always ought to be, schools for farmers, not schools of farming.

"This University is such a school, its chief business is the education of farmers.

"It is not then a local, it is a general fact that very few young men can be induced to pursue long and regular courses of study in scientific agriculture. Out of the many reasons for this fact only two may be mentioned:

"(1.) It is the sons of small farmers, who, foreseeing that there will soon be no room for them on the quarter section, go to college. Such persons inevitably choose those callings in which an education is itself a capital. (2.) Should any of them, however, by science and practice, through a term of years, fit themselves for scientific farming, what could they do? Can a man farm without land, animals and machinery? In Europe the graduate of the Agricultural College expects to enter the service of some lord proprietor as a salaried expert or manager.

"We have no such landlords unless they be our "bonanza farmers". Believing in the supreme advantage to a State of a yeomanry of small holders, I cannot wish permanent success to this kind of agriculture—I am convinced that the training of experts in scientific agriculture, by long and graded courses of study, is to be but a small part of the work of the Agricultural College. I am a firm and steadfast believer in agricultural, technical and art education. There is work for the Agricultural College, work of many kinds. If there were time I would like to remark upon that of experimentation, and to commend the excellent service performed by Professor Chas. Y. Lacy, during his connection with this College.

"In order not to be a misnomer the Agricultural College must be a professional school. I never thought it either profitable or honest to give students in general science a homeopathic dose of one or two agricultural studies and dub them "agricultural students." What would be thought of a law or medical school which should undertake to teach ancient history, the theory of equations, or the nebular hypothesis? The Agricultural College may leave to the schools and colleges the general education. The importance of this day to our Agricultural College lies in the circumstance that we are inaugurating a new departure in the proper professional work of the College; not by undoing anything or recalling any advantages heretofore offered, but by adding to our numerous courses of instruction a new one, the "Farmers' Lecture Course." It has long been a wonder with me why the founders of Agricultural Colleges have not taken a lesson from the organizers of law and medical colleges. These colleges have never undertaken the impossible task of combining a general education with a professional course, in a graded course extending over three, five or seven years. What have they done? They have collected a body of students from all classes and grades of society, with all shades and varieties of preparation, and proceeded to instruct them, as best

they could, in the things lawyers and physicians need to know. I cannot commend all that these schools do, but it is plain, I think, that their founders were wise in their generation. Why shall we not derive from them what is good in their system and apply it in agricultural education? Here are on the one hand a goodly number of men of science who actually long for the opportunity to communicate their knowledge to men so much needing to use it. On the other hand a vast body of working farmers, gardeners, dairy-men, etc., are just as eager for the light of science. It is respectfully submitted that it is a suitable function for the Agricultural College to bring these consenting parties face to face. This is what we are doing to-day.

"For many years we have waited for such a consummation. That we see it now is due to the intelligence and activity of Prof. E. D. Porter, who has organized and will conduct the work of the course. The lectures will be open to all persons without fee, examinations or other conditions. The daily programmes will be published in the journals of the city.

"We presume upon the success of this course. There must be many gentlemen and ladies who can make it convenient to attend upon the lectures of the accomplished and distinguished instructors who have been engaged, and announced success this year means a still wider and richer course next year. The board of regents will spare no pains or expense within their reach, to serve and subserve the farmers of Minnesota. They will gladly set the table if the farmers will clear it.

"It is a happy omen that the farmers' lecture course is opened by the United States Commissioner of Agriculture. That the distinguished gentleman now filling that office, should be willing to break away from his multitudinous engagements, and travel 3,000 miles to give us this "send off," may assure us of his interest in and appreciation of our enterprise.

"I have the honor ladies and gentlemen, to present the Hon. Geo. B. Loring of Massachusetts, United States Commissioner of Agriculture."

Thus introduced by President Folwell of the University, commissioner Loring addressed the convention upon the subject of the

"MUTUAL RELATIONS OF AMERICAN INDUSTRIES,"

as follows:

"*Gentlemen:* I have been induced to leave for a time the immediate duties of my department and join you in your deliberations, by

a deep desire to encourage in every way the industry which you represent, and to assure you that the good will of the federal government is with you in all your endeavors. You will not expect me to discuss in a general assembly like this, any one specific question of practical agriculture, surrounded as I am by those whose success indicates a thorough understanding of their business, and whose presence here is a proof of their determination to investigate, and collate, and compare. I read on the fields about me the record of the farmers of the Northwest, and the lesson they have learned by experience, and have taught their country. While I congratulate you on the progress of agriculture here, and the advancement of the farmer in his work, on the tribute which science is constantly paying you, and the growing confidence you feel in the results of scientific examination and experiment, on your skill in managing your crops and in caring for the animals which constitute so large a share of your wealth, I beg you to bear with me while I call your attention to the relations which exist between your controlling industry, and those great occupations which constitute the prosperity and power of the American people.

"The rapid growth of American industry constitutes one of the most important and interesting chapters in the history of civilization. The stories of discovery and conquest, of commercial adventure and military power, have charms which more prosaic occupations are not expected to possess. And yet they all sink into insignificance before the recital of the steady and triumphant march of that vast army of busy and devoted sons of industry who have cleared the land and opened the mines, and chained the waterfalls, and stretched the great highways of travel and transportation over valleys and through mountains, and created churches and school houses, organized cities and towns, and fed and clothed and educated themselves, and have filled the commerce of the world with the fruits of their toil. The chosen career of the American people has been a career of peaceful industry, and their achievements on this field have won the admiration of the world from their infancy to their years of maturity and strength. More than three-quarters of a century ago, Sheridan exclaimed in the house of commons: 'America remains neutral, prosperous and at peace. Turn your eyes to her; view her situation, her happiness, her content, observe her trade and her manufactures, adding daily to her general credit, to her private enjoyments, and her public resources, her name and government rising above the nations of Europe with a simple but commanding dignity that wins the respect, the confi-

dence and the affection of the world.' And contemplating the genius of our institutions and the vital force of our republic. De Tocqueville declared, 'Then will there come a time when there will be seen in North America 150,000,000 of men equal among themselves, who will all belong to the same family, who will have the same point of departure, the same civilization, the same language, the same religion, the same habits, the same manners, and among whom thought will circulate in the same form and paint itself in the same colors. All else is doubtful; but this is certain. Now, here is a fact entirely new in the world, of which imagination itself cannot grasp the import.' Unchecked by war, and defiant of all disaster, this republic has increased in population at the rate of a million a year during the last ten years, rivaling now every country in the world except Russia, and attracting to her shores vast communities of people from those impoverished and crowded nationalities. Thriving states and prosperous towns spring up here like magic. The products of new and fertile lands are borne to the great centers of trade which are created everywhere by the necessities of a teeming population. The civilization which is advancing with such rapid strides from sea to sea is indeed a civilization of thrift, intelligence and morality. Prosperous industry is here the pioneer of education, the cultivated farm and a profitable mill preparing the way for the library and the lyceum, the school house and the meeting house. Conscious of the responsibilities and duties which attend them wherever they go, and proud of that individuality which freedom bestows upon every man who enjoys her influence, this aspiring and industrious people of ours has endowed schools and colleges on every hand, has established more than 70,000 churches, has provided places of worship for more than 20,000,000 of worshipers, and has church property valued at more than \$300,000,000. You will pardon me, I am sure, if I rehearse to you that wonderful development of industry out of which this mental and moral and religious culture has grown, and for the encouragement of which you have assembled in one of the great agricultural centers of the great agricultural section of our country. I would avoid this array of figures were it possible to present in any other way a picture of which every American ought to be proud, and which naturally belongs to a proper delineation of the relations which all our industries bear to each other in their united efforts for American growth and prosperity. In agriculture the increase has been astonishing, and accounts for that vast internal and foreign commerce out of which has grown so much of our financial success. It is not necessary to go back a half century or

even twenty-five years to obtain the most gratifying evidence of our progress in the work of tilling the soil. But starting in 1870, at which time we had reached an enormous production in proportion to our population, and making our comparisons with the returns of 1880, we may learn what may be accomplished in a single decade by a people constantly increasing in numbers and occupying new lands. In 1870 the amount of cotton produced was 4,352,317 bales; in 1880, more than 6,000,000 bales. In 1870 the amount of Indian corn raised was 769,944,549 bushels; in 1880, 1,754,449,435 bushels. In 1870 the wheat crop was 287,745,626 bushels; in 1880, it was 459,667,043 bushels. In 1870 the crop of oats reached 282,107,157 bushels; in 1880, 407,859,033 bushels. In 1870 the tobacco crop amounted to 262,735,341 pounds; in 1880, it amounted to 473,107,573 pounds. The increase of agricultural products was nearly 100 per cent. in these ten years. And in the last year of this decade, from 1879 to 1880, out of this vast increase of our crops and products, our cattle export rose from \$13,000,000 to \$14,000,000; corn from \$43,000,000 to \$50,000,000; wheat from \$167,698,000 to \$190,546,000; flour from \$35,000,000 to \$45,000,000; cotton from \$209,852,000 to \$245,534,391; beef from \$7,000,000, to \$12,000,000; lard from \$28,000,000 to \$35,000,000; and pork from \$5,000,000 to \$8,000,000. Mark, also, the growth of American manufactures in half a century. In 1830 the amount invested in cotton manufactures was a little more than \$40,000,000; the number of spindles was a million and a quarter. The number of males employed was 18,539, and the number of females was 38,927. The amount of cotton used was 77,759,316 pounds. Fifty years have passed away, and the number of spindles has increased to 19,769,147. The amount of cotton used in 1880 was 793,240,500 pounds. The number of persons employed is 181,628, and the amount of capital invested in mills and subsidiary work is more than \$225,000,000. Of our woolen manufactures the statistics are more imperfect. But I have ascertained that in 1840, the capital invested in this enterprise was \$15,765,124, the number of pounds of wool used was 50,808,524; the number of hands employed was 21,342; and the value of the product \$20,696,699. In 1880 the values of woolens, worsteds, carpets and hosiery produced was \$234,587,671; the amount of wool used was 187,616,605 pounds; the wages paid amounted to \$45,959,012; the total value of the materials used was \$145,141,790. The product increased from 1870 to 1880 nearly \$20,000,000. In 1870 the silk productions of the United States were valued at \$12,210,662; in 1880 at \$34,410,463.

Fifty years ago the shoe and leather industry had hardly a national reputation. In 1870, however, there were 4,237 tanneries in the United States, employing 20,784 hands, using a capital of \$42,710,505, paying in wages \$7,934,416 annually, producing leather valued at \$86,169,883 using more than \$9,000,000 worth of bark, nearly 9,000,000 hides, 9,664,000 skins. There were also 3,085 currying establishments, employing 10,000 hands, absorbing \$12,000,000 capital, and producing \$54,191,167. There were, moreover, 3,151 establishments for the manufacture of boots and shoes, employing 91,702 hands, with a capital of \$37,519,019, paying in wages \$42,504,444 annually, using \$8,502,718 worth of leather, manufacturing boots valued at \$50,231,470, and shoes valued at \$93,846,203, with a production valued at \$146,704,000.

The growth of the iron and steel industry has been equally remarkable. In 1810 we produced but 50,000 tons of iron and our largest furnace could yield but 1,500 tons annually. In 1830 the product was 165,000 tons; in 1840, 315,000 tons; in 1848, 800,000 tons; 1860, 1,000,000 tons. In 1880 the iron and steel works of the United States produced 7,265,100 tons, as against 3,655,215 in 1870. The capital invested was \$230,971,884; the number of hands employed was 140,978; the wages paid amounted to \$55,476,785; and the value of all the products was \$296,557,685.

In the manufacture of machinery the capital invested has increased from \$15,000,000 to \$40,000,000 in twenty years, and the annual value of the product is more than \$20,000,000.

The aggregate annual product of the manufacturing and mechanical industries of the United States is now more than six thousand millions of dollars. Of this vast product less than two hundred millions are exported. And of the \$9,000,000,000 produced by agriculture less than 10 per cent. is exported. On the self-supporting power of the American people and on the mutual relations existing between our industries we can dwell as Americans with the most profound satisfaction. I have alluded to the producing power of the American people, but in order to understand the relations which exist between our industries we should not forget our consuming capacity also. Of the \$15,000,000,000 produced by our various industries, nearly \$14,000,000,000 are consumed at home. It is the home market to which the American producer turns most naturally, let his industry be what it may. In fact the law of our largest and most widely diffused industry, agriculture, is the cultivation of those crops which are adapted to a local market, and the occupation of lands lying near that market. Not

yet has this law become universal, it is true; but it applies to all the older and thickly settled sections of our land, and goes with diversified industries wherever they create large cities and towns. Fifty years ago the farmer was compelled to seek his market near home on account of the difficulty which attended the transportation of his crops. But the settling of new and remote lands and improved methods of transportation rendered the growing of the great staples a necessity, and corn, wheat and provisions occupied the farmer's attention, and opened to him remote and even foreign markets for his grains. This frontier farming, however, is but temporary, and must be followed by that systematic husbandry which constitutes the legitimate business of the American farmer and carries him back to those days when agriculture was almost the sole business of the country, and when a farming community was uniformly prosperous, when prudent and industrious. While our large towns and our manufacturing states, therefore, provide markets for a large portion of the products of the pasture and grain fields of the West, they also support that more profitable system which consists in a careful cultivation of the soil and in the economical management of small farms. The trade of this home market to which I have alluded is immense, and the sources of supply in all their variety form an interesting topic for consideration.

New England requires about 20,000,000 bushels of wheat, and produces only 1,250,000. New York uses 30,000,000, and grows about 12,000,000. The supply of this deficiency comes from the West, from the Ohio valley and the prairies west of the Mississippi and the Missouri, and costs from \$40,000,000 to \$50,000,000 in years of good production, but still more in this year of comparative scarcity. To assume, however, from the fact that New York goes West for six-tenths of her wheat supply that wheat-growing is an unprofitable industry there, would be an unsafe and unreliable conclusion. There are eight counties south of Lake Ontario which yielded in 1870 6,089,876 bushels on 377,269 acres, or 18.6 bushels per acre, or more than 50 per cent. above that of Minnesota or Dakota, and somewhat higher than that of California for the same year. Thus, an important part of the deficiency of other counties in New York was supplied by the surplus grown in the Seneca valley and its neighborhood. There is another district lying eastward toward the Hudson, and southward toward the Delaware, that finds a greater profit in the dairy—making a production in butter and cheese worth far more than the grain procured

from the West. Not only are the home wants in the dairy products supplied, but a large share of the 120,000,000 to 140,000,000 pounds of cheese exported from year to year is credited to this district, bringing a vast amount of money from Europe, a part of which only is contributed to the aid of the western wheat-growing. Going still nearer the seaboard, to Dutchess and Westchester and the fruitful land of Long Island, we find more people and less wheat, and a soil devoted to market gardening, yielding under the most favorable circumstances a gross product worth \$1,000 per acre, enough to buy a quarter section of superior wheat land west of the Mississippi. In the immediate neighborhood of New York city the product of market-gardening swells to millions of dollars. Ten years ago the census reported more than a million dollars' worth in Queens county alone, and the present enumeration must, when tabulated, show an immense increase for this suburban district. The neighborhood of Boston and Philadelphia and every other large city is monopolized by market-gardens, and the country about Norfolk, Va., is mainly devoted to fruit and vegetables for northern consumption. The fruits of the country, a perishable commodity, must be produced as near as possible to the point of principal consumption. The domestic fruits alone furnish a trade of large volume and value. New York city has a trade in domestic fruits of more than nine millions of dollars; Chicago, which supplies the great Northwest, has about as much; and the other large cities of the country would swell the total amount to about \$60,000,000, including the great amount now sent from our southern latitudes. Could all the fruits sold in smaller cities and villages be added, and those consumed on farms or village lots be enumerated, it is probable, judging from careful deductions from available data, that the annual value of the fruits of the United States would not fall much below \$200,000,000. Thus, the distribution of farm products is found to arise from a multiplicity of causes, soil, climate, nearness to large cities, prices of land and labor, facility for obtaining labor at required times or seasons, skill in special industries developed by long practice, conservative persistence in time-honored usage, and many other causes, serve to distribute in patches, large or small, the crops which furnish the products of American agriculture. The great cereal crop of the country, Indian corn, which is only exceeded by grass in universality of distribution, constitutes more than 1,700,000,000 of the 2,000,000,000 bushels of grain of 1879. It is found in every state and in every territory with one or two exceptions. Yet this crop

cannot escape the law of special local attraction. The three States, Illinois, Iowa and Missouri yield 800,000,000 bushels, or 45 per cent. of the crop, and only seven states including Indiana and Ohio on the east, and Kansas and Nebraska on the west, have ever any considerable surplus above the requirements of home consumption. The remaining thirty-one states and all the territories produce together but 37 per cent. of the crop, at only the rate of nineteen bushels per acre, but half the rate of the yield of the corn belt. The receipts at the seaboard cities for exportation and consumption, including all kinds of grain, ground and unground, aggregated 352,921,452 bushels in 1879, and 369,559,607 in 1880. The whole eastern movement of western grain, including shipments to interior points on the Atlantic slope, must somewhat exceed 400,000,000 bushels, not more than one-sixth of the total production of an abundant year, and less than one-fourth of the lightest crop the most disastrous season is likely to yield. The relations which are thus established between the agricultural and manufacturing interests of our country, not only affect the material prosperity of the farmer, but they provide him with that social enjoyment upon which the happiness of an educated people largely depends, and rouse him to that energetic action which gives strength to all his powers. The isolation of farm life incident to sparsely settled regions, is one of the trials which the American is anxious to avoid; and when he leaves the outlying farm and secures a home nearer the haunts of men, he places himself within reach of the lyceum and library, and easy and convenient intercourse with his fellow men. The comforts and adornments of his home are increased; and farming becomes to him an occupation analagous to those branches of business which tempt men away from the loneliness of the country to the pleasures and opportunities of the town. The tendency of the rural population of some sections of our country to abandon the exhausted farms and seek lands nearer a populous market, is by no means an element of agricultural decline. It indicates rather a disposition to take advantage of those circumstances which lead to more active industry and more profitable labor. It is the same spirit of enterprise which has induced many farmers to abandon general agriculture and devote themselves to special crops, and has led the casual observer to infer that the cultivation of the soil was being abandoned. I have known the statistical returns of many evidently thrifty and prosperous communities to indicate a reduction of the products of the farm, and to lead to the supposition that because

the cereals and annual products were diminishing the lands were deserted. But a more careful examination has always revealed the fact that it was a change in the industry alone which had taken place, and that those crops which met with competition from the cheap and fertile land of the West had been substituted by the products of the market-garden with all the profit which goes with this mode of manipulating the land. As this system extends, and manufacturing cities and towns multiply, the returns of our farms will be largely increased, and the average yield of our land per acre will be greatly enlarged. It is the intimate relation between agriculture and manufactures which makes general farming what it is, and will gradually make American farming what it should be. Now, the relation existing between the cotton plantations and the market created by American manufactures is so deeply interesting to every agricultural association which would consider the wants, necessities and chances of the entire country, that I trust you will allow me to consider it here. Of the total crop of 1870 and 1871, of 4,352,317 bales, 1,110,196 were consumed in the United States. Of the total crop of 1874-'75, 3,852,961 bales, 1,193,005 bales were consumed in the United States, and of the crop of 1880-'81, of 6,605,750 bales, 1,938,937 bales were consumed in the United States. The increase in home consumption during the ten years from 1870 to 1880 was 828,741 bales. This increase is of the greatest importance considering the fact that the expenses on cotton sold in the English market are nearly two cents per pound in freight, port charges and loss of weight, and the average price in 1880-'81 in Liverpool is 6.48 pence, and in New York 11.34 cents per pound, the advantage of the American market being nearly 2 cents per pound to the producer. This important relation will continue to increase in value as American manufactures extend, and the home market is enlarged, and will undoubtedly, produce an increase in the average yield of cotton per acre, and in the ultimate uniformity of the crop in the cotton states, allowance being made for the difference in soil and climate. This, added to a wide diversity in farming which will be adopted, will do much to develop the agriculture of the Southern States. It is, undoubtedly true now, that the cotton belt needs variety of crops to fill the vast unoccupied areas not suited to the cotton plant. Nine-tenths of the superficial area of these States yield no production in agriculture except in a limited degree in pasturage and wool product. But three acres in every hundred are in cotton, which occupies one-third of the breadth of the land actually culti-

vated. The cotton area in 1879 was 14,462,438 acres. The area of ten cotton states is 456,000,000 acres. The cotton crop is not evenly divided in these states. It is almost unknown in the mountain system of the South, slopes as well as summit, and broad table-lands of high elevation, suited only to the products of high temperate latitudes, mixed farming, grain-growing, dairying, and orcharding. It is grown mostly on the alluvial soils of the great rivers, the limestone belt of southwestern Georgia, central Alabama and western Mississippi. In general terms, one-tenth of the counties yielding cotton produce half that crop. The largest average yield per acre, according to the census, discloses the local belt of greatest productiveness as follows: The richest cotton land in the States is on the Mississippi above and opposite Vicksburg. The highest county averages in three States unite to prove the superiority of this district; East Carroll, in Louisiana, Chicot, in Arkansas, and Washington in Mississippi, respectively, stand for the largest rate of production in these States and in the cotton belt, yielding in 1879 but little less than a bale per acre.

Consider now the benefit which the manufacturer derives from his free and intimate relations with the agriculture of the country. On the one hand, drawing his raw material largely from the immense and various resources of our country—iron, cotton, wool, hides—and on the other hand, finding a home market in the great agricultural regions, the American manufacturer possesses opportunities and advantages hardly known to any other country on earth, and illustrating most forcibly the self-supporting power of our people. So closely are these interests united that what affects one naturally affects both. The same policy which has been extended over our mills has been extended also over our fields, and the results in both cases demonstrate its true value. While the American manufacturer has furnished the American farmer with almost all his necessary articles, such as cotton goods and fabrics, shoes and boots, axes, forks and spades, shovels, hoes, harrows, plows, rakes, cultivators, reapers, mowers, wagons, tin-ware, glass-ware, cheaper than they can be purchased in the English market, the American farmer has furnished his products, wool, cotton, provisions and grain, at rates established by our own supply and demand, and not in accordance with the rates fixed abroad. The traffic is free and equal, and it is between parties enjoying equal privileges and opportunities, rates of interest, wages of labor, taxes, social and civil expenses, all being regulated by one system and varying only with different localities. As the two great pillars of

American industry, they have received equal consideration from the government. Not only is a duty laid on goods of foreign manufacture, but there is also laid on all animals a duty of 20 per cent; on wool from 10 to 12 per cent. per pound, and from 10 to 12 per cent. *ad valorem* added; on sugar from 2 to 5 cents per pound; on corn 10 cents per bushel; on barley 15 cents per bushel; on wheat 20 cents; on oats 10 cents; on butter and cheese 4 cents per pound; on tobacco leaf manufactured, 35 cents per pound; and the American farmer may well remember that under this policy the clip of wool in this country has risen from 60,000,000 pounds in 1860 to 250,000,000 in 1870, and that in our advancing agriculture we have devoted to wheat 50,170 square miles, to corn 80,610, to oats 20,500, to barley 2,810, to hay 42,080, the corn and wheat alone covering a larger area than the United Kingdom of Great Britain and Ireland; and these two great producing industries, engaged in supplying each other with all that enters into the material comfort and welfare of life, at the lowest possible rates, may also remember that their products are now transported on American steel rails costing \$60 per ton, as against \$140 per ton when furnished by the rolling-mills of England, and with freight rates reduced accordingly; and let me say you are going to make it still better before your mountains of iron are exhausted. When these two important and fundamental industries united in the work of developing American resources, it is not to be supposed that they who laid the foundations of this union anticipated the great and radical change which has taken place since their day. They could not have foretold the ocean-defying steamship and the land-defying railroad and the time defying telegraph. They could not have listened amid the quiet repose of their luxuriant farms for the busy hum of great cities. But they performed their work well in their day, and generation, and they set an example of industry and foresight which we may well follow. And I am compelled to believe that they anticipated the time when the people of this country would be engaged in mutual industries for mutual support, and when the 12,000,000 of people of their day would become the 50,000,000 of our own, busy and consuming in the great commercial and manufacturing centers, busy and producing in the great agricultural regions, each industry leaning on its fellow, and all united in establishing American supply for American markets and regulating prices in accordance with the wants of American labor and the value of American labor and the value of active American capital. The production of supplies and the existence of a market have

always created a necessity for a system of transportation which constitutes one of the co-operative industries of society. The modern methods of transportation by steam, both on land and water, have given new value to lands, new opportunities to mills, new markets and values to crops, and it may be safely said that the addition of a powerful and a rapid means of transportation has not only given new life to all the old industries, but has added a new one of inestimable value and importance. The labor and expense of exchanging commodities have been so far diminished in our day that every producing industry is now able to employ its time and means to the best possible advantage. No time is now wasted by the manufacturer in traveling from his mill to his market, none by the farmer in transferring his crops from his fields to the consumer.

"No limit is now put to the capacity of the mill, the capital absorbed and the hands employed, by distance and obstacles on sea and land. The farmer whose time and means and horses were fully employed in hauling the crops of a hundred acres to market fifty years ago, can now employ his force at home in increasing the crop of ten times that area of land, while it is harvested and borne to market by machinery. Lands which were once useless to the cultivator are now brought by rail to the very doors of the market required by their crops. And not only is the transporting capacity of each individual increased, but the force which can be retained for work on the land is vastly enhanced, as well as the profit on the crop itself. When, many years ago, the railroad from Springfield, Ill., to the Illinois river was opened, it was announced in a leading newspaper of that day: 'One week before the railroad was finished, corn could be had here in any quantity at 15 cents per bushel; now not a bushel can be had for less than 25 cents.' With a system of farming which I have defined and a system of transportation which we possess, the producing power of American labor and land is almost unlimited.

"The relations which have been established between these active and vigorous industries to which I have alluded, have produced upon society, moreover, a degree of mental energy and general intelligence, never equaled in any age of the world. In the affairs of life now, a man's head is considered to be worth as much as his hand, the relative market value of these two commodities having materially changed since the 'common and concurrent mind' began to assert its supremacy. The necessity for economizing and utilizing labor in every department of business has created a necessity for clothing labor with some degree of intelligence, and out of this

elevation of practical service has grown that active, vigorous and untiring faculty for invention which forms one of the striking characteristics of the present age. Mark the amount of intelligence required to manage and run our railroads—the foresight, prudence and comprehension of the president, the watchful, systematizing power of the superintendent, the activity and self-possession of the conductor, the headlong courage of the engineer, who plunges through mountains and overrides valleys in his career, the laborers who grow intimate with the vast and intricate mechanical forces employed in this great civilizing business, and it is easy to see why it should demand and create intelligent labor, an aggregation of active and untiring intellects, all acting on each other from the highest to the lowest, in a way unknown to slower and more circumscribed systems of travel and transportation. The constant and rapid intercourse of the present day—passage by steam and communication by magnetism, the subjugation and use of mechanical forces in all their might and in all their delicacy, by superior and commanding minds—has inspired and elevates the observant and co-operative masses of men to a degree hardly surpassed by the training of our public schools. While, therefore, the business of life as represented by our railroads and steamships and telegraphs and mills, and improved modes of agriculture, demand intelligent labor, it joins hands with the schools and does its share of the work of education. Before the incessant activity and extended relations created by all the accelerated business methods of modern days: by transportation which opens the markets of the East to the living products of the pastures of Illinois, and carries the laborer in a day from the locality where he is not wanted to the locality where he is wanted, by machinery which creates faster than a destructive and extravagant people can consume, and casts the printed page broadcast over the land, driving the distaff and spinning wheel into seclusion, and avoiding the tedious toil of the hand-press, we cannot, if we would, become stationary in our habits and deliberate under our necessities. To pause now is simply to be trampled upon by the multitude. We must travel by steam, we must send our wool to the mill, our milk to the factory, we must know how much gold there is in Colorado, and silver in Arizona, and coal in Pennsylvania, and copper at Lake Superior; we must have read the last message of the president, the last speech in congress; we must know something about Mr. Gladstone and Gambetta, and John Bright, something about Chili and Peru, and whether the statesmanship of New Jersey or

the statesmanship of Maine is to apply to the adjustment of their difficulties; we must use a steel pen and a mowing machine, and a horse hoe and a tedder, and a horse-rake; we must exchange photographs with our friends, and recognize in every way the marvelous diligence of man in his use of light and heat and air and earth and sea for his own comfort and convenience, or make up our minds to live in the world as not being in it. We must believe in the relations of our industries, the combination of industrial forces which makes modern society what it is, if we would perform our part well, and comprehend the genius of the age in which we live.

“And now, gentlemen, I submit these suggestions with regard to the relations you hold to the business of the country, and the active energies by which you are surrounded, with a deep consciousness of my own inexperience, but with a deep sense, also, of my obligations to the work in which I am engaged. My agricultural labor and observation have been confined to that section of our country in which a hard soil and severe climate have compelled the farmer to toil with the utmost diligence and to calculate with the utmost economy, that section in which small farms and diversified agriculture have always rewarded the industrious and sagacious husbandman. But I see no reason why my education in that field should be inappropriate elsewhere, inasmuch as good cultivation, a wise choice of land, a proper selection of seed, the skillful preparation and use of fertilizers, the breeding and feeding of well chosen animals, are profitable anywhere in this country, and the economy of a farmer's home and a farming community is the same throughout the entire land. I am anxious, as the United States Commissioner of Agriculture, to encourage every step toward systematic and profitable farming, and to support the judicious views of all local authorities who are working in the same field with myself. The business of the department which I represent is largely auxiliary, and can best be conducted by stretching forth a helping hand to all who are endeavoring to increase the products of our soil and to improve the condition of the vast animal kingdom upon which the farmer so largely depends for his subsistence. By the introduction of new seeds submitted to the test of the farmer's experience, and by recording the results of such test for the instruction of the public; by encouraging agricultural education in all its branches; by rousing a vigorous attention to the work of making our farms attractive; by scientific investigations into the quality of soils, the constituents of the various articles of food used by man and the domestic animals; by an

intelligent study of the American forests and tree culture, much may be done to aid the farmer in his work, and much to lead him away from enterprises which are impracticable and visionary. In order to accomplish this I have submitted the important problems which have come before me to accomplished commissioners or to careful investigation on which we can rely. The vine culture and grain growing of the Pacific coast, the supplying of the arid regions with artesian wells, the mode of conducting forestry schools and experiment stations in Europe, have all been submitted to competent agents for examination and report. The question of cattle disease on board the steamers transporting cattle to Europe has been presented to the privy council in England, and much has been done to satisfy the English public that the American animals shipped are free from contagious diseases. I have taken especial care that the seed distributed by the department shall be of the best quality.

"The agricultural department should undoubtedly be the nucleus around which can be gathered those associate industries which depend on agriculture for their existence and, in turn, make agriculture profitable and in many sections possible. Statistical returns of our manufactures, with an illustrative display of their products, would do much to establish a uniform system of land and water carriage among us. Accurate surveys and returns of our mineral lands with the industrial processes employed in working them, are of vast importance. A well organized and consolidated inquiry into the extent of contagious diseases among animals, the best methods of prevention and extirpation, cannot be too thoroughly and promptly organized and without considering for a moment the political status of such a department, I think you will agree with me that the time has come for its organization. An active, industrious, intelligent body of American citizens and producers are entitled to it, as a branch of government whose value cannot be overestimated.

"The encouragement of all industrial endeavor in this country has a deep significance, growing out of the relations existing between the producing classes here and the system of state and society in which they live. In England, the model farm selected for the inspection of Elihu Burritt, consisted he tells us, of 3,000 acres on which "men of skill and experience who in America would conduct farms of their own and could not be hired at any price may be had in abundance for farmers at from twelve to fourteen shillings or from three to four dollars a week, they boarding themselves." The

wages of manufacturing labor in the great towns of England and France are equally insignificant; an adult earning in England under the best circumstances about eight dollars per week, and in France seventy to eighty cents per day of twelve hours. A careful investigation into the system of small land-holding in France has satisfied Mr. Howard, an agent sent there to investigate it by the Land and Farmers' Club, that such a system is a failure and contrary to the social and civil system there. And Dr. Playfair, speaking of England, says: 'Our country has shown little inventiveness and made little progress in the peaceful arts since 1862.' Not so, however, here. America is the paradise of the small land-owner. Labor is so well remunerated that its earnings constitute a large share of the deposits in our savings banks. The inventive arts are devoted to the business of easy and profitable production. A woman with her needle earns a mere pittance in a long and weary day in which necessary confinement and toil destroy that very physical energy upon which she depends for a subsistence. With a sewing machine she easily earns an ample income. A machinist with the tools of half a century ago could reap but a small reward, and no farmer could afford to pay the current prices for agricultural labor in harvest time were he thrown back upon the scythe, the sickle and the flail. But a man armed with ingenious machinery becomes hundred handed and can earn accordingly. He becomes a part of society in which he can exercise his taste as well as supply his wants. It is not the cost of a mere subsistence that we are to calculate in this country, but the amount of comfort and taste which every man can reach, good food, good clothing, a good dwelling adorned simply or elaborately according to his means.

"Fortune does not smile on all men here, it is true, but when she does smile, the cheer which follows in this country is unsurpassed. Aided by the arts of life which surround him the American takes his place in society, performs his civil duties, pays his taxes, aids his churches, builds his school houses, educates his children, builds and beautifies his home and endeavors to perform his part in life with no recognized barrier between him and the object of his ambition which industry and perseverance cannot overcome. For him, for his opportunity, for his inheritance as a citizen and laborer in this republic, I would encourage every industry, stimulate every mental and moral faculty, and build up and support every institution which can aid him in his work."

The afternoon of the first day was devoted to a lecture on

"THE DISEASES OF DOMESTIC ANIMALS"

By R. W. White, V. S., of Owatonna.

"MR. CHAIRMAN AND GENTLEMEN:—Before commencing to speak on my subject, I would like to speak a few words in behalf of my profession, though I feel that my address will be of little interest to you after hearing such an eloquent speaker as Mr. Loring.

"I am very sorry to say there are so few professional veterinary surgeons in this State. There are not more than six or seven in the State, and there is field enough for that many hundred, and I am very sorry to say that a professional veterinary surgeon is looked upon and classed as a low degraded being, and a bar-room loafer; but gentlemen, that is a great mistake. I will admit that the majority of the men that practice as veterinary surgeons are generally too lazy to work, and are usually addicted to drink, and therefore professional men are looked on as the same kind of individuals. A professional man should be a sober, steady man, and you will find them so as a rule, as it requires more thought and study to diagnose a case in our practice, than in the human being, as our patients cannot speak, therefore it is done principally by symptoms, the same as a child is treated. I do not see why Minnesota cannot educate her own veterinary surgeons as well as to have them come in here from the eastern colleges. We have the facilities as well as the talent and the right kind of young men to educate.

"The first disease of which I will speak, is a disease called "Puerperal apoplexy," or more commonly called milk fever. It is a disease which will be of great interest to dairymen as well as stock breeders, as dairymen generally pick the best milkers they can find, and generally feed well and keep their cows in good order.

This disease always attacks a good milker and a cow in plethoric condition, and most generally after the third or fourth calf, and generally the second or third day after calving, sometimes sooner. The first symptom you will notice will be a shifting of the hind feet or paddling. The breathing will be accelerated, and occasionally she will moan or bellow. The eyes will become amaurotic, and the horns will be hot, the nose dry, and rumination (or quidding) ceased, in a short time the animal will fall down, sometimes she will rise on her feet again, which is a good sign. I have noticed that the majority of those that rise after falling have recovered, but you must always look upon this as a very fatal disease, and should have the attention of a qualified man as soon as possible after you notice those symptoms. After the animal goes down she will soon

begin to show brain disease in an aggravated state, by swinging the head around and resting it on the side, and if the head is drawn from that position it will fall back to the side. Very often they will throw the head violently about and strike the ground or manger and break the horns off. This should be guarded against by packing around the animal well with straw; keep the cow on her sternum or natural position when lying. The pulse is rapid and full, but in some cases weak, and the treatment should be governed according to the pulse; the stomach will very often become filled with gas. The hind quarters are insensible if pricked with a pin, the eyes do not contract or shut on touching the eyeball with the finger, and the pupils will not contract with the stimulus of light. There is obstinate constipation from the first and in very bad cases there will be paralysis of the sphincters, (that is the anus and vulva), and urine and feces passed involuntarily. When this stage is present there is very little hopes of recovery.

"The next disease which I will speak on is a disease called Tubercle. It is found mostly in fine blooded cattle and sheep. It is a disease which is dreaded by the stock breeder, as it is generally one of the finest blooded animals of the herd that shows the disease. The disease is one which is hereditary, and you should never buy a horse or cow without first inquiring into the history of the family to which they belong, and if you find any trace of tubercle you should not breed such an animal on your farm. The symptoms of an animal suffering from tubercle is a dry, hacking cough. The animal may keep in ordinary flesh for a while, but as the disease progresses it will become thin and emaciated, and eventually succumb to the disease. The best thing to be done when the disease is noticed is to fit the animal for the butcher as soon as possible, as treatment is of no avail. Tubercle makes its appearance in different forms; it most generally attacks the lungs, but in some cases it will make its appearance in the glands of the body. In those cases it is termed, scrofulous glands; in the glands of the mesentery of the bowels, it is called *tabes mesenterica*. In those cases the animal would be better destroyed.

"The next disease will be impaction of the rumen (or large stomach). It must be understood that the cow has four stomachs, and the rumen is the first one and the largest. This is a very common disease where cattle are in pastures where there is long dry grass, or an over-feed of dry indigestible food. The first symptoms noticed will be the cessation of rumination, and the nose dry. The animal will very often lie down and emit a low grunt.

The pulse will be nearly natural, if anything a little weaker than common. The appetite will be gone, and on pressure with the fingers at points where the rumen is attached to the walls of the abdomen, the impacted food can be felt, and if pressed in will pit and the impression will remain. As a rule it is not a difficult disease to treat, but some cases where there is great distension with food and paralysis of the coats of the stomach, medicines have no effect. In those cases it will require the attention of an experienced and qualified veterinary surgeon, as they will require the operation of rumenotomy, which is performed by cutting through the wall of the abdomen at the place of attachment to the stomach, large enough to admit the hand, and remove the contents and sew up the wound.

"The next disease which I will bring to your notice will be a disease called fardel bound, (or the impaction of the third stomach). It is quite a common disease, and its causes are the same as impaction of the rumen. This is a disease which is very frequently mistaken for pleura pneumonia, as the symptoms are something similar, but a qualified man can readily distinguish the difference. The first symptoms, you will notice the animal will cease ruminating, will lie down, and will lie well up on the sternum (or breast), and will emit a grunt quite loud, very much like pleura pneumonia. The bowels will usually be constipated, and hard, small, black or dark pieces will pass the bowels; but sometimes it will commence with diarrhœa, and be succeeded by constipation. There is generally after the disease advances, great thirst and inflammation of the stomach, which is shown by the animal grinding the teeth. The pulse is fuller, the grunt that came on by spells is now continuous. I have seen some cases where diarrhœa set in at the last stages, of a most offensive nature, and the animal die exhausted. They are generally very difficult cases to treat, on account of the peculiar structure of the stomach, which is composed of numerous layers or folds of mucous membrane.

"I will speak for a short time on pleura pneumonia in the ox. As I said before, a great many times unprofessional men make a mistake in their diagnosis between fardel bound and this disease, but there is no necessity for such, for there is a great difference between the two diseases. You have altogether different respiration, more labored and shorter, the grunt is louder and shorter, and indicates more pain. The nose is dry, and the horns cold, and on pressure to the affected side the animal will evince pain. It is very seldom it attacks both sides at once. The bowels are consti-

pated as shown by the dark colored feces passed by the bowels. This is a disease which requires urgent treatment, for if left too long before getting proper treatment, there will be an effusion of serum in the thoracic cavity from the inflamed pleura, and if such should be the case you may as well give up the case, as a general rule medical aid cannot save them at that stage. The causes of this disease are very numerous. They may contract the disease by being exposed to a cold storm, not being accustomed to being out in the cold, or they may take it by being removed from a warm barn to a cold (or vice versa) and sometimes it is brought on by the injudicious administration of medicines, by allowing a portion to go down the wrong passage. Cases from the latter cause are generally fatal.

"I will now speak on a few diseases of the horse, as my time will not allow me to dwell any longer on diseases of the ox, and in fact does not allow me to give you the minute details nor the pathology of the diseases I have spoken on.

"The first disease I will speak on is a disease called azoturea. This is a disease which is very common in this country, and especially in horses that are in plethoric condition. You will work your horse regularly for a while, and feed high on grain; then you will let him stand in the barn for four days, or more, feed grain regular while standing, and then at the expiration of four days, or more, you take your horse out and lead or drive him, you think you never saw the animal feel better. After you have gone a short distance you notice the animal gets very stiff and does not drive up as usual, sweats profusely, and wherever the harness touches it forms a lather. You stop him and find him trembling in the flank and breathing very hard, and suffering great pain, and will very often go down on the road and have to be hauled home on a stone-boat or sleigh, and generally lie from two days to four before they can rise on their feet, and then very weak. If you watch till they urinate you will notice the urine will be as dark colored as coffee, and in very bad cases so thick it will be passed with difficulty, and if preserved in a vessel will soon undergo decomposition on account of it containing so much solid material. It is a good sign to see the urine pass in great quantities and dark, as it is a sign that the system is throwing the opaque material off by the kidneys, as those are the glands mostly used in elimination in this disease. The cause of this dark urine is the excessive combustion in the system, from there being an over abundance of rich material in the system, from being fed on rich food and doing no work and getting no

exercise; and as soon as they are driven and exercised there is increased circulation, and consequently a very rapid waste, the lymphatics are over-taxed, and therefore we have congestion of the large muscles of the hips and loins, and some cases the shoulders. On pressure those parts will be found very hard. This is the cause of the loss of power of the legs, and the excessive pain. The treatment of this disease is very simple, as nature as a general rule is performing her work well, and it is a great mistake to go to dosing with medicines which are calculated to act on the kidneys, as you are very apt to over tax the kidneys, and cause derangement.

I will now speak a short time on a disease called embolism of the heart. Gentlemen, this is a disease which I feel at a loss to describe, as it is a disease which is not spoken of in any veterinary work in the world, to my knowledge, therefore I will give you my theory of it. It is a disease which is very uncommon. I think it is more common in this country on account of feeding so much corn. It is not known in the old countries, because they do not feed corn. I have always found those horses affected with it to have been fed heavily with corn, and worked hard in the hot sun without sufficient water, and the animal sweats freely and does not get the fluids in the system replenished, and the blood becomes very thick (or more properly fibrinous) as corn is a great heat producer and no doubt produces fibrin as well. When the animal is first attacked he will begin to hang back and not walk up with his mate, and sweat more easily than common. As the accumulation becomes larger in the heart, the horse becomes weaker, begins to reel and stagger, and shows brain symptoms from not sufficient blood going to the brain; the legs and ears get cold, and very often swellings appear on the breast and belly. In the course of from six to ten days after the first appearance of the disease the horse will drop dead in the stall without a struggle, and on holding post mortem on the animal the embolism will be found in the left cavity of the heart, attached to and surrounding the cords of the heart, and extending into the arteries for two or three feet. As soon as the embolism gets large enough to obliterate the cavity, there is sudden death. The pulse was my only guide in any case I saw, and a very sure guide, too, as it is a very different pulse from any other disease of the heart.

The next disease I will mention is one which every farmer and horseman thinks they thoroughly understand. It is a disease called Strangles or Distemper. It is principally confined to young colts, but may occur in older animals. It generally makes its ap-

pearance in the spring of the year, about the time the colts are shedding their coats and getting their permanent teeth. There are two forms of Strangles, the regular and irregular. The first named is a very simple form to handle, but the latter form requires very great care in the treatment as they generally appear in a very aggravated form, for it is not every man that is his own horse doctor. In place of forming abscesses under the throat and jaws, these abscesses are liable to form in any part of the body, and very commonly form in some part of the internal viscera. I have seen them form in the mesentery of the bowels, and in the lungs, and will be more liable to form in a gland. A very common place is on the breast or shoulder. They will form very hard and large tumors and are very troublesome to get rid of as the walls of the abscess will be found to be from one to two inches thick and a small amount of matter contained in the center. Strangles is not generally a fatal disease itself, it is the sequel to it that is the most dangerous from the fluid portions of the matter or pus being absorbed into the circulation, and causing pyæmia or blood poison, and consequently some more fatal disease sets in. One which is a very common sequel to Strangles is Purpura Hæmorrhagica, which if not properly treated will prove fatal. You will think your colt is doing splendidly and in a short time you will notice the legs begin to swell. The animal appears dull and the breathing becomes more rapid from the pain in the limbs, usually all four legs will swell, and the lips and nostrils will swell, and in the course of twenty-four hours there will be an escape of serum through the skin of the legs, of a reddish color. One peculiarity of the disease is the swellings of the legs terminates abruptly at the upper part of the swelling nearest the body, as if a string were tied around the leg. The blood in this disease loses its fibrin and coagulating properties, therefore the fluid portions escape from the capillary vessels into the subcutaneous tissue and escapes through the skin. On opening the nostril the lining membrane will present a spotted appearance, there will be red patches on the membrane which will sometimes slough out and leave an unhealthy sore. The eyes will have a dull appearance, and will very often swell shut, something like pink-eye. Another very common sequel is laryngitis, that is inflammation of the throat, which is in a great many cases a serious complication, as there is not sufficient pure air taken into the lungs, and that is an essential thing in the treatment of Strangles. A great many valuable colts and horses choke or strangle to death, with this disease, on account of

the swelling of the throat and thickening of the membrane lining the larynx and completely obliterating the air passages. The only treatment that can be adopted in this case is to perform tracheotomy, which is done by cutting into the windpipe or trachea and inserting a tube, this is the tube (showing the instrument) and immediately the tube is inserted the animal breathes as freely as if nothing was wrong with the throat, but he will breathe entirely through the tube and not a breath of air goes through the mouth or nostrils. I have kept this tube in a horse's neck five days and the animal recovered. There is no necessity for an animal to choke or strangle to death if you can apply this method of treatment in time.

There is just one more disease which I would like to bring to your notice. It is a disease called constipation of the bowels. Now this is a disease in which I think there are more mistakes made and more different kinds of treatment adopted, than any one disease in veterinary science. You will find nine times out of ten, when a horse begins to paw and switch his tail, look around at his side and lie down, roll and get up, stand still awhile, go down and roll again, the majority of men will say he is suffering with his water.

Gentlemen this is something I would like to put you right on, if you are laboring under such a mistake. The horse complies too nearly with natural laws to have his urinary organs get deranged. When you see a horse show the symptoms I have mentioned, you can rest assured he is suffering from an affection of the bowels. An animal suffering with constipation of the bowels will lie quietly after the first half hour after the attack, and will lie for hours sometimes if not disturbed; he will occasionally emit a grunt while breathing. Some cases will terminate unfavorably: There will be paralysis of a portion of the bowel, and very hard impaction of the cæcum or blind gut, and never can be removed. Others will die from inflammation of the bowels. I think the reason why people are misled in the diagnosis of this disease, is because the animal will very often stretch his hind legs back, and sometimes so far as to nearly touch the ground with the abdomen, but it is not because he wants to urinate, it is because the pain in the bowels makes him do so and as a rule as soon as you get the pain relieved the animal will urinate freely. I have convinced some very obstinate men of the fact of it not being the urinary organs by drawing the urine away from the bladder with the catheter while they were suffering, but no relief then, so that was conclusive evidence that it was not there. Now, gentlemen, I have

taken up your time and precious time at that, long enough, so I will allow you the privilege of asking any questions you wish, and I will try and answer them as satisfactory to you as I can. You will need to be as lively as possible as it is getting late. One gentleman asked the doctor what he could do to prevent the disease called milk fever in the cow. He was told to keep the animal on spare diet, not feed rich food, neither sloppy feed, or much water for a week before calving, to a cow you have any doubts about. Some good authors recommend giving a mild physic a few days before calving. I think you can dispense with the latter by adopting the former; I have seen good results follow that method. Considerable discussion and various opinions were brought forward, but nearly all to the same effect. Another gentleman asked the question what he could do with a heifer he could not get pregnant. He was told to have the heifer examined carefully and see if there was anything wrong with the os uteri, or opening into the womb, and if that was closed which is very common, it should be opened, and requires a skillful hand. There will sometimes be a hard cartilaginous ring around the os which will make it very troublesome to open, and as soon as you get opening made into the uterus the bull should be allowed to serve her. They should not be operated on only when in heat. I have operated on three and was successful in two cases. There is sometimes disease of the ovaries which cannot be remedied, and the animal cannot become pregnant.

The Doctor then explained how to operate on a cow with impervious teats as that question was asked him, and he showed the instruments to do it with, and he also showed an instrument for removing hernia or breach and capped elbow, those hard, fibrous bunches on horse's elbows caused very often from lying on the calks of the shoe. It is an instrument he got up himself and has proven a success in every case it has been tried.

Professor Porter now made a few remarks and the day's proceedings ended.

The course was continued on Wednesday, March 1st, by

HON. WILLIS P. HAZARD,

of Chester, Pa., Vice President of the American Dairymen's Association. Mr. Hazard spoke both morning and afternoon on the subject of "The Cow," breeds, management, selection, &c. The following is a synopsis of both lectures:

"To properly answer the question, what are the best breeds of cows for butter and milk dairies, the three leading points of yield, profit and food must be considered, and it will be necessary, in this connection, to investigate somewhat the various breeds of cattle.

The best authorities upon the subject all admit that the best strains of milking qualities are derived from the Holstein or Dutch breed, cattle imported into England by the Danes. These cattle have been cultivated by English breeders principally for their beef-producing qualities, on account of the late high price of meat, but the Dutch dairy farmers have improved the breed in the line of milch cows until they have attained to a degree of excellence unsurpassed by any other breed. The Holsteins are now recognized as a very superior kind of shorthorn cattle, remarkably good for milk, both in quantity and quality, and, as working oxen, proving large, strong, high-spirited, having great endurance of heat, and great aptitude to fatten. They are extremely valuable to cross with other breeds. They are peculiarly adapted to this section of the country and pre-eminently to the wants of the general farmer, though if proper attention is not paid to them they are apt to degenerate into large, coarse stock.

"The Shorthorns, or, as they are sometimes called, the Durhams, from the county where they were first widely bred, were first imported in 1815, and have, since that time, become more widely and popularly known than any other breed. They have become acclimated and flourish on common food as well as native cattle. They fat fast, make very powerful and docile oxen, and are naturally excellent in the dairy, giving large quantities of milk, butter, and rich cheese. The Durham and Jersey mixed is an excellent breed, also. The Durham thrives well wherever there is plenty of winter fodder, but is not equal to the Devon or Kerry for stony ground or scant herbage. Next to the Shorthorns, the Devons have been most imported, and claim our attention next. There are two kinds, the North and South Devons, varying in size and color, but similar in most qualities, and both very hardy and vigorous, and weighing from 1,000 to 1,200 pounds. The Devons give only a moderate quantity of milk, but that of very rich quality.

As oxen they have no superiors, weighing from 1,500 to 2,000 pounds, docile and amiable, and affording the choicest meat for the butcher. The introduction of Devonshire clouted cream into this country is strongly recommended as a source of revenue to the farmer. Among the milk breeds prominent in the British Isles, a leading place is occupied by the Ayrshire, so called from the

county of Ayr, in Scotland. They have always been prolific milkers, with rich but gracious quality, especially in proportion to their size, which is small. The usual yield is 600 gallons a year, or 175 pounds of butter, or 430 pounds of cheese. The oxen work kindly and the beef is excellent, though not so tallowy as in some other breeds. As a breed to cross with larger stock, they are highly recommended; the colors should be red and white, splashed and blotched."

"The Jerseys, or as they were formerly called the Alderneys, are noted for the extraordinary richness of their milk and their beautiful form. Though natives of a very mild climate, they stand the rigors of our winters nearly if not quite as well as our own natives, some claiming the American Jersey to be superior to that of the Channel islands. The milk of the Jersey cow is particularly rich, of a deep yellow color, and yielding a rich golden butter of firm grain and fine flavor. It is superior in butyracious qualities to that of any other breed, the amount of cream being from 9 to 25 per cent. The Jersey is not a large consumer, and makes excellent beef when dry, but will probably never become very popular as a dairy cow for the farmer, the first cost being too great for profit compared with other stock. No better stock can be raised than by the use of a Jersey bull with prolific milkers of other stock, and every farmer ought to keep at least one Jersey to every ten cows of other breeds. Every farmer ought to breed for himself, rather than to trust to chance opportunities to buy probably poor stock."

VARIOUS BREEDS.

The Herefords resemble the Devons and make excellent oxen and steers but the cows are not prime milkers. The Galloways, black and hornless cattle from the Scotch Lowlands, are well fitted for cold and rough sections, but their milk is deficient in quantity, though they yield a superior quality of beef. The Kerry cow, emphatically the poor man's cow, are small and very hardy, living well on the slimmest sort of pasture, yielding an abundance of milk of good quality and fattening rapidly. The Swiss cattle are hardy and robust, somewhat like the Jerseys, but coarser, fatten well, and are excellent milkers, yielding from ten to twenty quarts daily, and about 225 pounds of cheese in a season of four months. Having thus given a short sketch of the most prominent breeds, let us enquire what the farmer needs."

- (1.) "He wants a good sized animal which will bring most of its

cost for beef when failing as a milker, (2.) A cow that will come into profit early. (3.) A cow that will give plenty of milk and rich, whether for milk, butter, or cheese. (4.) A cow that will consume the least food for the product gained. (5.) He wants oxen that will be tractable, active, and docile, and that will feed up quickly for the butcher. If there is any one breed that will combine all these qualities, it is the Durham, or the Durham and Jersey mixed. And farmers are in duty bound to raise their own stock more, by selecting the best cow they have or can get, whether native or imported, and breeding them with the best bull of pure stock, of known milking qualities, that they can get. Having decided what breed to raise, the first important step is to know how to choose a good cow."

"See that the cow is as much wedge-shaped as may be: that her escutcheon is good and free from depreciating marks; that the milk veins are large and prominent; that the udder is full in the forward part, and the teats of good size, well separated, and not too projecting toward the sides. The head should be small and slender; the horns thin and open; the eye full, but not too prominent; the muzzle not too broad; the neck long, flat, and narrow; the hips wide, rugged, and high; the thigh long and lean, with prominent veins; the legs slender, with flat bones and small, flat feet. A long and thin tail is a great point in breeding. The udder should be free from hair, flexible, and soft, with no tendency to flesh; the teats well separated, and neither fat nor fleshy, nor too long, and with no tendency to strutting. No cow should be allowed to give milk beyond eight months before calving, the system requiring at least one month's rest. A young animal is indispensable for the dairy either to breed from or to be profitable to the keeper. To determine the milking qualities of a cow, see that the skin is free and thin, the tail fine and long and well tufted, and the veins over the perineum large, varicose, knotted, and more or less oblique. This is a sure test. Guenon's method, based upon the forms of the scutcheons is also an admirable test of milking qualities. The extent of the scutcheon denotes the milking capacity, its form and outline the class, the fineness of the hair and color of the epidermis the quantity and quality of the milk.

"Having made a good selection of an animal, the question arises how to maintain her in good condition for profit, and we will consider the management of the cow.

"She should have abundance of food, that she may consume it as soon as possible; in short she must not have to work too hard for

her living. The pasture should be often changed and when not in pasture, sufficient food should be provided. Roots early in the season require an addition of solid food, such as clover chaff or meal. The best roots are carrots, yellow turnips and mangel wurtzel. Corn fodder, potatoes and sugar beets are excellent. In winter, oil cake and ground oats, steamed or boiled, are good food. No other animal than a horse, should ever be allowed in the pasture with a cow, and the cows should not be allowed to sleep out after August. They should also be regularly curried, and a piece of rock salt should always be where they can find it. The milking cow should be kept free from rapid and considerable changes of temperature, and should not be turned out too early, as cold and chills will occasion her early falling off in her milk. Many breeders think it best to bring the cows in every night in the year. Perfect cleanliness and good ventilation are of the utmost importance in the cow house, and much care should be given to bedding the cattle. Milch cows should be milked at regular hours twice a day and should be fed with hay or meal while being milked, as the feeding engrosses their attention and helps sustain the stomach. The hands should be perfectly dry and clean, and the utmost gentleness should be used. Remember that all nature is alike, subject to the same natural laws, none of which can be safely violated.

The system of selecting dairy cows of Monsieur Guenon interferes with none of the other methods of judging of the merits of a cow, but it offers a nearly infallible adjunct to all the others, and should be learned by every dairyman. It enables him to tell almost exactly the quantity and quality of milk that any cow will give, how long she will probably remain dry and many other important points. Guenon was a poor cowherd near Bordeaux, and first discovered the facts which underlie his system while driving his cows to and from their pastures. He noticed that the hair on the posterior of the cow grows in a different direction (*i. e.* upward) from the hair on the other parts of her body (which grows downward), producing figures which he called "escutcheons," and whose form and extent indicates the essential points in regard to milking qualities. The tufts of hair upon the escutcheon and the color of the skin and its unctuous exudations, are also important elements. Also, there must be considered the breed, size, feed, period of gestation, age, climate and many other things which will be explained.

"Beware of a cow with white, dry skin, and coarse hair on the escutcheon; they may give a large quantity of milk for a time, but

will soon fail and the milk would be deficient in butyraceous elements. The system of Guenon contains ten classes of escutcheons and six orders in each class. The classes are arranged according to the shape of the escutcheon; the orders according to extent. Out of the hundred various divisions, however, but thirty-two are really necessary to be learned. As a rule, never buy a cow in any class below the third order. The size of different cows and their breed, even when the escutcheons are similar, will materially make a difference in the quantity of the yield, though not in the quality. The lower or thigh portions of the escutcheon is much the same in all classes; the vertical portion varies in all the classes and thus demands the most attention. The thigh escutcheon indicates the quantity of milk that the cow will give; the vertical escutcheon, the time she will milk; and the "feel" of the hair and skin indicates the quality of the milk, the Jersey being the standard on this point. Breadth is the criterion of thigh escutcheon; length and breadth of the vertical. The escutcheon also indicates the generative capacity of bulls, according to rules similar to those above. Guenon named his ten classes from the forms of the vertical escutcheon, as follows, the first being the best: Flanders, Left Flanders, Selvage, Curved Line, Bicorn, Double Selvage, Demijohn, Square Cut, Limousine, and Horizontal. The bastard marks on the escutcheons indicate short milking time; in the Flanders, the mark is a small oval in the middle of the vertical escutcheon; in the other classes it is two ellipses on the prominences of the ischium. The udder ovals are unfailing signs of a good cow. Slices out of the thigh escutcheon are bad signs, as are all marks encroaching thereupon. Coarse hair on the udder is also an imperfection. The hair on the escutcheon of a first-class cow is generally darker and more fur like than that bordering it.

"The probable explanation of the cause of the escutcheon is found in the supply of blood to the milk veins. The mammary artery sends blood to the udder, and also sends out branches which supply the skin where the escutcheon grows, and these branches ramify in the direction of the hair; hence it would seem that there is a ratio of cause and effect in this case. It is well known that the escutcheon increases in size until after the second or third milking. This Guenon system has been subjected to the most critical tests by scientific men, and has stood them all successfully. Every farmer and dairyman should understand it."

Thursday, March 2d, was also devoted to Mr. Hazard, who occupied the morning session in giving a lecture of which the following is an abstract on

BUTTER AND BUTTER MAKING.

"Butter is defined by Webster as an 'oily substance procured from cream or milk by churning.' If Webster is right, then we are wrong in denouncing an 'oily' substance as being butter, though, perhaps, many persons have thought they were making and selling butter when they produce an oily or greasy substance and put it upon the market as such, believing it must be butter because Webster says so. Butter, properly speaking, is as far removed from an oily, fatty or tallowy substance as possible. The popular desire of purchasers of butter is to obtain a firm fine grained article, of rich golden color, sweet, nutty, aromatic smell and unctuous taste, and which invites both smell and taste. The object of this essay is to give plain, practical rules for making such butter as will sell itself. Most of them are derived from the practical experience of the farmers in Chester county, Pa., who supply Philadelphia with a "gilt edged" butter at \$1.25 a pound. The best butter pays the best, and it is as easy to make as an inferior article. It elevates the moral tone of the family. The character of the family can be told by the looks of the butter. There are many different ways of making fine butter, yet there are certain cardinal principles which rule in all, and which will produce the same relative results, if carried out with due attention.

The great secrets of making good butter are these: The utmost cleanliness of the cow house; in the treatment of the udder; in the spring house or vault; and in the use and care of the utensils used in the dairy; proper feeding of the cows; careful milking; care of milk and cream in the spring house or vault; churning at proper temperature and evenly working and salting the butter; marketing and packing for market. Bear always in mind that from the time the milk leaves the cow till the butter graces the table, milk, cream and butter must be near the temperature of sixty degrees. Good butter should contain at least 82 per cent. of fat or oil, composed of solid or margarine fat, and liquid or oleine. Winter butter contains sixty-five parts in one hundred of solid fat, summer butter only forty parts, which explains why cream should be churned at different temperatures at different seasons. The proper temperature for churning is fifty-nine degrees for sweet cream, sixty-two degrees for sour, and sixty-four degrees for milk.

Fresh butter is a yellow, slightly acid substance, which liquifies at seventy-nine degrees, and contains seven fatty and volatile

acids, together with an oil formed from oleine and butyrine. Under the influence of oxygen this latter becomes butyric acid, which is the cause of the unpleasant taste and smell of rancid butter. Rancidity can be corrected by washing first in lime water and then in fresh. The quantity of milk required to yield a pound of butter varies from eight to fourteen quarts. The average is nine to ten quarts of milk for two of cream or one pound of butter. As a general rule small cows yield the more butter, large ones the more cheese; a warm and dry climate favors the butter, as does also the morning's milk, while a cool, moist region and the evening's milk best suit cheese production. Cows eight to ten years old will give milk producing 40 to 60 per cent. more cream than the milk of their offspring two years old, though fed alike.

FEEDING FOR MILK AND BUTTER.

With a good lot of cows (for butter cows we recommend Jerseys and Guernseys) the farmer must pay attention to the feeding and watering if he would have good milk and good butter. In summer time the cows should have plenty of good, rich pasture, so that they can fill themselves quickly and lie down and chew the cud and make milk. The pasture should be clear of weeds, as they impart an unpleasant taste to the milk. Shade and pure water should be in plentiful supply, especially the latter, as milk may be poisoned in the udder by the cow drinking muddy or stagnant water. Toward the close of summer and in the fall, feed green corn fodder, sorghum, Hungarian grass, or an early crop of sugar beets. Bran and a little corn meal is good summer fodder. Winter fodder should be the best of hay, as clover and timothy; they should have about ten quarts of bran and corn meal mixed, and carrots, parsnips, mangolds and such roots, to keep their systems open. Corn fodder, shorts, oil cake, pumpkins, etc., are all good, though the former alone will not make good butter. It will pay well to steam or cook the food and to feed hay tea. Turnips and cabbages should never be fed for good butter makers, as they flavor the milk, and the butter is unfit for keeping. It is wrong to color butter artificially, the color should be derived from the food; early cured hay and corn meal will do this. The cow stables should be kept warm, but not with confined air, and should be always sweet; the daily use of plaster or diluted sulphuric acid is recommended.

MILK AND CREAM.

Milking should be done regularly, quietly, thoroughly, yet quickly, twice a day, and as near six in the morning and evening as possible. Great care should be taken to get the last drop; the strippings yield from 10 to 20 per cent. more cream than the rest of the milk, and, besides, leaving the strippings will cause the cow to dry up sooner. Cows should never be driven to the milking shed hurriedly, as it agitates and heats the milk and the cow. The cow must be looked after as soon as she comes in, and if the calf does not take all the milk from her, she must be milked by hand enough to prevent the bag caking. One mess from a feverish cow will spoil a whole churning. If milk froths and foams, the butter made from it should be sold at once. In caring for the milk, a spring house is preferable to a cellar, as the temperature is more apt to be equable and the air is not so confined nor so apt to be contaminated by decaying vegetables, etc., usually stored in a cellar. Wooden pails should never be used for milking or setting milk. The best pans are the tin, painted on the outside and with bails fitted to them. They should be kept perfectly clean and sweet by scalding, rinsing in pure cold water, and exposing the inside to the sun. They should be thoroughly cooled before using.

SETTING THE MILK AND SKIMMING.

Some dairymen prefer deep pans for setting the milk, others prefer shallow; we prefer the latter, say three or four inches deep, as there is more surface to receive the cream and the whole of it will rise. In large dairies, setting the milk in deep cans may be more economical as saving much labor in washing. The milk should not be set more than thirty-six hours, and it is better if skimmed in twenty-four hours, what is lost in quantity being gained in quality. It should be skimmed before it is at all acid or thickened. Above all, do not scald either the milk or cream, though in cool weather the cream should be set in a warm place, as it must be slightly acid before it will make butter. An ounce of fine salt to a three-gallon jar of cream makes it churn quicker. Cream should not stand longer than a week before churning. The milk should be closely skimmed and each time the cream is added to the cream jar the contents should be thoroughly stirred with a wooden spatula and the inside of the jar, above the cream, carefully wiped off.

SPRING HOUSES AND ICE HOUSES.

No farmer can hope to make first-class butter profitably without plenty of pure, soft water on his place. If there is a spring on the farm, he should build a spring house and utilize the running water. Those who do not own a spring should build an ice house, the larger and deeper the better, along the shady side of a hill. Then build a dairy house attached below the bottom of the latter. In the center of the floor of the ice house construct a ditch so that it will receive the drainage of the ice, and sloping to the dairy room, where it should be wide and deep enough to hold the necessary pans. Thus there will always be a supply of cool water to keep the milk at a uniform degree. The spring house should be of stone or brick, with a double roof for ventilation, and with the running spring water conducted in stone or cement troughs large enough to hold two rows of pans and deep enough to let the water be always a little higher than the milk in the pans. The walls should be plastered in all dairy houses and kept scrupulously clean; everything should be removed that will impart impure odors or taint the air. The dairyman should remove his shoes when coming from the barnyard, and, if kerosene lamps are used, they should be fitted with appropriate ventilators. The temperature should never be allowed to range more than from fifty-five to sixty-five degrees, and the dairy should front the north and be well shaded. In a prairie country, a good dairy house can be made near a well, by building a semi-subterranean structure and then keeping a supply of water by means of a telegraph pump.

CHURNING AND WORKING THE BUTTER.

Churning in summer is best done in the early morning, while it is cool; in winter, in a warm place. An even, moderately slow and steady stroke is better than rapid time; fifty to sixty strokes a minute will bring the butter in half an hour. The churn should not be soaked over night, but should be washed just before using. If the butter will not gather, pour in ice cold water. The churn should be as straight up and down as possible, and the dash should stir all the milk at every stroke. Churn fully as often as once a week and as much oftener as may be, and, upon churning, add all the cream upon the milk in the dairy. As soon as the butter has become hard, draw off the buttermilk, and remove the butter into a wooden tray with a wooden paddle, and in working it remember

these rules: The butter is in good condition to work when it cuts clean and smooth, without crumbling, by a cold, wet ladle; it should not be mashed, but worked with a careful, gentle, yet telling pressure; it should not be finally worked until it is dry; it should not be allowed to stand long before working, as it is apt to become streaked and rancid. These rules apply to both hand and mechanical working. The butter should never come in contact with the hand, and should be somewhat sparingly salted and with only the best article. One pound of salt to twenty pounds of butter is a fair average. Butter should never be washed, as all the buttermilk that is necessary can be worked out without destroying the grain of the butter; it makes it insipid and liable to rancidity.

If, however, you do wash your butter, use only soft water. The utmost moisture that should be found in thoroughly worked butter is a very slight dew, and it should be of such a firm consistency as to slice down hardly dimming the surface of a knife blade.

COMPARATIVE PROFITS OF BUTTER MAKING.

Of the four ways of realizing from milk—butter, cheese, condensed milk and milk for family use—butter, if properly made, is the most profitable. Where the milk is sold and the butter is sold, both being near good markets and of good quality, butter at fifty cents pays a better profit, equal to at least ten per cent., than any of the others. It must however be marketed with taste to get the most income. It is practicable for producers of butter in the United States to increase its average price ten cents a pound, and this enhancement would put in their purses \$100,000,000. This is too large a sum to pay for ignorance, carelessness and lack of cleanliness.

The afternoon session was occupied by the speaker of the morning, Hon. W. P. Hazard, upon "The Channel Islands; the People and their Cattle," a very interesting paper, which we cannot print in full, but of which the following synopsis of great interest to the farmer is given:

THE CHANNEL ISLANDS.

From their situation in the British channel, these islands are called the Channel Islands, though more popularly known by the individual names of the larger three of the group, viz.: Jersey, Guernsey and Alderney. These have attracted the attention of

England and America, in recent years, through the merits and beauties of their two famous breeds of cattle, the Jersey and Guernsey breeds.

A stroll through the town of St. Peter's Port will reveal the handsome new market house and hall. Here we have a look at the rural population and products. In the middle of one part of the house are benches, upon which sit a number of women chatting with each other, each holding upon her lap her market basket with its contents, covered with linen or other covering. How gallant and kind it seems to have provided for the female purchasers a place for rest, and to have a social chat. But directly we are undeceived, for when we pass near several of the baskets are uncovered, and the contents are attractively displayed to tempt a purchase. How nicely the golden circles of butter look; how white and fresh the eggs! Ah, then, here the women sell the butter of their own make, and well they understand the art; that's why the circles are nearly double the size of our pound lumps, though they are only half as thick. Well stamped, and of the deep rich color which only Guernsey cows can yield, taste after taste will assure you there is none better. As the herds are not large in Guernsey, each maker can easily bring in her basket the few pounds she has to market.

The meats of the Guernsey cattle we examined with care, and tasted with relish the Guernsey beef, as we felt anxious to test its quality, to know whether the animal of that breed made good beef. We found it to be juicy, tender and delicious, with a fine peculiar aromatic flavor. The color of the fat is of a deep orange color, much darker than that of the Shorthorn or Devon, and to many would be somewhat objectionable, but only from prejudice. It is even of a deeper yellow than the fat of the Jersey. The meat at the same time is of a deeper red than that of other animals. The animals are driven under an inspector's eye to the public yard, marked, and only allowed to come out to be killed at once by the butcher. The islanders guard their two noted breeds very carefully from any chance of being crossed, and do not allow the cattle even of one island to be imported into the other. This is one of the values of those animals imported into this country, the assurance of the purity of the breed.

THE JERSEY CATTLE.

The cattle of these islands are now famous for their beauty and their merit, and are of late being widely scattered over our whole country. In the native island, where the grass is strong and rich, much like our green grass or blue grass, and clover and lucerne are much used, the cows are led out in summer in the morning, and tethered with a rope or chain to an iron peg driven into the ground by a wooden mallet, and are allowed a space of about thirty feet in diameter. They are changed again at noon. In summer they are milked three times a day—such cows as are flush in milk—from April to August, and during the other months twice a day.

When milked three times the amount of butter is not greater in proportion. As this work is always done by women, who lead them to pasture and to water, the animals become very docile. It is thought an extraordinarily good cow that gives twenty quarts—the quantity being more usually from ten to fourteen quarts—the medium quantity is possibly ten quarts. In summer it requires nine quarts for one pound of butter, and in winter rather less, if they are fed upon parsnips. There are no large herds in Jersey or Guernsey. Ten or twelve is an unusual number; five or six are more frequent, and most every farmer tries to have one or two heifers to sell. Altogether there are nearly 12,000 head in Jersey, and between 5,000 and 6,000 in Guernsey. The sales from the two islands are less than 3,000 each year, the great bulk of them going to England. Canada is beginning to take a few, some go to France, and about 300 come to the United States. America is taking the best, and paying the highest prices, and with the care taken in breeding in this country, we shall soon, and we might almost say now, have finer animals than the islands can show.

GUERNSEY CATTLE.

What we have said of Jersey may with equal justice be applied to Guernsey. About the same attention is paid to breeding their stock, but the farmers are more contracted in their views, and generally, if they can use a bull for a shilling they will not pay five shillings for a much better one. The result of this is seen in the escutcheons, and the hair of their animals. The one is not as well developed as might be, and the other is not as fine. But the Guernsey cow we think is rising rapidly in the estimation of our farmers. She is an animal of larger size, of greater yield, of

greater docility, and yields the richest quality of milk. Her butter is self-colored, even in winter, is firm and of beautiful texture, and her golden milk will color that of from six to ten common cows.

Friday, March 3d closed the exercises of the first week. Papers by Dr. G. A. Dallimere of Faribault on "Diseases' of sheep" and J. H. Sanders of the Breeders Gazette on "In Breeding and out Crossing" of which we can give but very brief abstracts.

THE DISEASES OF SHEEP.

We shall consider this morning two very fatal diseases of sheep, known as diarrhoea, or inflammation of the smaller intestine, and dysentery, or inflammation of the larger intestine, accompanied by infusion of blood. These diseases generally arise from exposing the young animals to cold and improper food, and are very dangerous. In the case of acute dysentery, bleeding is absolutely necessary. Physic should always be given in these diseases. In treating adult sheep for dysentery, give first two doses of epsom salts; then give an astringent. Ginger and gentian with perhaps a grain of strychnine or half a grain of arsenic added, is an excellent tonic and should be administered as soon as the astringent begins to show its effects.

In June and July the gadfly troubles the sheep a great deal, attacking its head and getting into its nostrils and finally into the brain; this is known as botts. Smearing the nose with tar is a good remedy, as the fly will not come near the tar, and so cannot get into the nostrils. Scab is a most dangerous disease, affecting the wool, the flesh and the general constitution. It is a subcutaneous parasite. To cure it, shear the sheep as close as possible, wash thoroughly with soap and water and afterward with limewater and tobacco water, or apply a preparation of one part of mercurial ointment and seven of lard. Another serious sheep malady is turnsick, or hydatid of the head, caused by the presence of a grub in the brain. The remedy is by trephining and removing the grub by the use of the trochar. The speaker concluded by a short dissertation on pink eye, which, he said, he had successfully treated by administering freely enemias, febrifuge and bran mash, using a camphorated liniment and warm fomentation.

"IN BREEDING AND OUT CROSSING."

Cross bred or grade animals are more profitable than full blooded for almost all purposes. The winners of most of the prizes at our fairs are grade beasts. The only

important exception is the thoroughbred horses. There is a constant tendency in nature that animal life shall adapt itself to the peculiar conditions by which it is surrounded. Changing from a condition of scanty sustenance to one of plenty would work great improvement, the contrary course would result in the extinction of the breed. Practical breeders and scientists are agreed that breeding in-and-in is a most pernicious practice; finess of texture and beauty of shape being offset by loss of robustness and power. Cross breeding among members of the same order on the other hand, generally results in a decided gain of power in the offspring. Cross-breeding between members of different orders, however, is generally at the expense of fecundity.

In breeding of thoroughbred stock we have the principle of selection which often results in constitutional weakness and tendency to debility. The in-and-in breeding has been carried so far that there is a sexual homogeneity which promotes healthy offspring. Hence, in securing a progenitor of a herd, never buy a prize animal at a cattle show. A scrofulous taint in offspring will result from such parentage. Breeding in-and-in is not necessarily dangerous until there results a uniformity of type. But in cattle breeding a thoroughbred sire is very much to be desired, and if the previous breeding has been according to nature's rules, and without over feeding or pampering, or in-and-in breeding, there should be and will be no lack of vitality or hardiness. Thoroughbred males always reproduce their own good qualities more strongly than do grade males, hence only a thoroughbred parent should ever be used with a grade parent to produce good results. The experience of the leading sheep men in this connection is that the most profit is obtained from going to England for thoroughbred males to cross with our native sheep, and thus ensuring the continuance of the best qualities of both breeds.

In the afternoon Mr. Hazard read his final lecture, on "Sheep Husbandry", of which the following is a synopsis:

Sheep raising is one of the most important branches of the farmer's vocation, as is shown by the amount of wool raised in the United States, which in 1881 reached 250,000,000 pounds, and which was still short of the manufacturing demand by nearly 50,000,000 pounds. When we consider the many acres in every state well adapted for sheep raising that are not so stocked, or are stocked with cattle many of which are unprofitable, we conclude that farmers are not aware of the profit in sheep. To breed sheep for profit whether for the sale of lambs, for the wool, for

the carcass, or for the whole combined with the enriching of the farm, requires a correct start, and this lies mainly in the proper selection of the breed, having one's market or purpose in view. Nearness to large cities would indicate raising sheep for the mutton, and hence a prolific and fine-meated breed is best.

If early lambs are wanted cross Cotswold-Merinos with a pure bred Southdown ram; if late lambs are wanted, use a Cotswold ram. Farmers living far from market should choose a breed for wool, and the Merinos are preferable. In growing for combing wool, which is done on rich grazing land, the Lincolns, Cotswolds and Leicesters will prove the most profitable. These breeds, however, require care and good feeding to produce well with bright lustre and long staple. For quality of mutton, the Southdown has the tenderest, juiciest and best flavored meat. Mutton costs but one-third the price of pork to raise. The soil should be dry with natural drainage, for wet feet are a prolific source of diseases among sheep. The herbage should be short and rich, but not too luxuriant. Shelter from the sun, either natural or artificial, should be provided in the pasture, and plenty of clear running water should be always at hand. Feeding racks and troughs in the fold are also necessary. Be careful to feed uniformly.

BREEDING.

Good ewes with a large, deep body, broad hips and bright wool—indication of health—and quiet disposition, make good breeders. The ram that will prove the most valuable should be selected for his good shape, clear eye, good character of wool, his having the prominent points of his breed, and not too great a tendency to fat. Good health and shape, a well-knit frame, smooth, an indication of vigor, are better than a fat, heavy ram. A certain amount of in-and-in breeding is of great advantage in securing desired points and qualities; this is best done by constant selection for a few years, of those sheep in the flock which present the points aimed at, and breeding like to like until the qualities are fixed, but never beyond this point.

WASHING AND SHEARING.

Washing sheep frees the fleece from accumulated dirt and makes the wool bright and soft; soft water should be used only; hard water deprives the wool of its grease, and leaves it hard and rough.

The water should be clear also, as muddy water leaves the wool of an unattractive color. After washing the sheep should be turned at once into a green, turfed pasture. In handling the sheep, never grasp it by the wool. June is the best month to wash in. After the animal is thoroughly dried, and the fleece has become soft and oily, select a warm sunny day, that the sheep does not feel the change too much, and with well sharpened shears remove the fleece. The art is in keeping the hand elevated, so as to keep the points of the shears near the sheep's body, thus avoiding cutting the fibre twice and also avoid cutting the skin. Great care should be exercised in preparing the fleece for market, as neatly done up and well packed fleeces always command the highest prices.

The exercises of the second week of the lecture course were opened on Tuesday, March 7, 1882, by Mr. J. S. Harris of La Crescent, on the subject of "Farmers' Orchards." Mr. Harris said:

Ladies and Gentlemen:

After devoting more than one half of my lifetime to the solution of the question of growing the hardy fruits and especially the apple in Minnesota and the Northwest, I am compelled to say that the successful culture of the apple in our state has a greater number and more difficult obstacles to surmount than in any other state in the Union, or than in any other department of labor that requires the cultivation of the soil in this state. Within the last twenty years much time, labor, and capital has been expended in trying experiments, and testing varieties, and while failures many times outnumber successes, some progress has been made, and the time is at hand when fruit culture will become one of the most important industries within this state, not alone as a source of wealth, but of comfort, refinement and happiness, and when all the obstacles are removed or overcome, will reward the husbandman as well or better than the investment of the same amount of capital in any other enterprise. I long since arrived at the conclusion, and have frequently expressed the opinion, that it is possible for nearly every county in the state to produce the more hardy northern fruits in such quantity as to give an ample supply to meet every demand for home consumption.

I purpose at this time to speak only of the apple, and give it as exhaustive a treatment as the time at my disposal and my ability will permit.

(1.) Our state being comparatively new, and our soil and climate somewhat different from that of other and older states, it neces-

sarily follows that we lack experience, and that becomes an obstacle which only time and careful experiment can overcome. The old varieties of apples, our favorites in the Eastern and Middle States have nearly all proved to be unsuited to the more unfavorable localities—and there is but a small list of them that are profitable to plant in the most favored places—therefore we are compelled to plant largely of the Siberian and Astrachan species which have been advanced from the northern parts of Europe and Asia, and these, unfortunately, have some serious defects, and cover but half of the season in which apples are the staple fruit. It has been said that the apple is the king of fruits. In its various species and variety it gives a wonderful range of qualities; size, form, color, texture, flavor and season of fruit, which meets all purposes, and satisfies every taste. No other fruit is like it, and the demand for it exceeds that of every other, and is on the increase yearly. American apples have a world-wide fame, either in their fresh or dried state, and the home demand is increasing beyond the supply even in the oldest apple producing states, and to-day better prices are received for them than when not one-tenth of the quantity was produced. Again, it is a well known fact that the use of fruit as a part of our everyday diet increases as we advance in wealth and civilization. If the farmer out on the frontier provides for his family one peck of apples this year, they will want a bushel next, and the next a barrel. They will never require less but will always call for more, and this call must be answered just as far as means will permit, or the growing appetite will become vitiated, and strive to satisfy itself with things that are hurtful or demoralizing. A farm without an apple orchard of the best varieties is a very poor place to raise children who will honor their parents and give them support and comfort in their declining years, and love the old farm more than any other spot on earth.

There are a few farmers who do not view things in this light, but happily they are few. The end will justify the means, and just so far as we succeed do we promote our own happiness and prosperity and enrich our state. Some apples have been grown in Minnesota, enough to demonstrate the fact that they will grow here, and that if we have varieties adapted and give them the right locations and cultivation our apples would rank with the best for beauty of appearance and superb quality.

SITE FOR AN ORCHARD.

I would select a high location, one that would give natural drainage and a free circulation of air. On such a location the vicissitudes of temperature are less than on low lands. The days are cooler and the nights warmer. Trees always injure most in low valleys and a few feet in elevation may decide whether a man's orchard shall be a success or a failure. My experience is that elevation is of much more importance than aspect, and more especially with varieties that bloom early or continue their growth late into the fall.

A northern aspect is generally considered to be the best, but I should not object to a southern, if I could have it on a good elevation that commanded a free circulation of air, and on some accounts should prefer it to any other if I could give it suitable protection and mulching, of which I will speak in another place. On such an aspect the fruit colors up better and comes to more perfect maturity, and the trees come earlier into bearing.

In low valleys we are more subject to late spring frosts and early ones in the fall. The first will frequently destroy a crop of fruit after the blossoms have appeared, and the latter sometimes causes serious damage to the trees in causing bark burst by arresting the return or downward flow of sap before the trees have fully ripened and discontinued their season's growth. If it should become necessary to plant an orchard in a valley, I should, if possible, select a northern or northeastern aspect and as high and dry elevation as possible.

SOIL.

Soil is another factor that should be considered when planting an orchard. We find in this state a great variety of soils, such as sandy, clayey, loamy, alluvial, etc. A sandy soil is one in which sand in some degree of fineness and sharpness is a principal factor, and is usually quite defective in fertility. If very sandy it parts almost instantaneously with moisture, and trees planted in it are apt to suffer from drouth. It lacks also many of the essential elements that go to make up the structure of the wood and they cannot be permanently supplied by manuring, as all the soluble parts of manure are quickly washed out of it, and hence it would require constant application to keep up the growth. If no other soil can be secured a sandy soil may be improved so as to make it more re-

tentive by the addition of clay, ashes, muck, etc. A clay soil is directly the opposite of sand and is one where clay predominates. Its defects are that it retains moisture too long, is too adhesive, and in dry weather becomes hard like unburned bricks, and in the dry state is impervious to dews and light rains, and when wet requires a long time to become dry enough to cultivate. No fruit tree will do well in such a soil unless it is the plum and shellbark hickory. Such a soil may be ameliorated and fitted for orchardry by underdraining, deep trenching, and the application of sand, ashes, muck, manure, etc. A loamy soil is the one we hear the most about and may be interpreted as being composed of a great variety of mixtures. The true loam is about an equal mixture of sand, clay, and vegetable soil or humus, and is practically adapted for about all classes of vegetation, and is the very best for the orchard—and especially is this the case where lime is held among its ingredients. Alluvial soils are composed of vegetable substances, the sediments of rivers and material washed down from neighboring hills. The valleys of our rivers and streams and the coulees among the Mississippi bluffs are largely alluvial, and it is the richest of all soils and well adapted for garden purposes and many of the farm crops. Fruit trees make a rank vigorous growth in such a soil but they are not so hardy or fruitful, and the fruit is not so high flavored, and does not keep as well as that grown upon soil containing more sand and clay, and less of vegetable mould.

PREPARATION OF SOIL.

It would be useless to plant fruit trees upon our Minnesota prairies with the expectation of growing fruit upon them until they are first broken up and subdued by taking off a few crops; and I doubt if even in our naturally deep soils that would be a sufficient preparation. Few of our farmers plow to a greater depth than six inches, and the roots of trees cannot be confined to that depth from the surface, and when they commence to strike deeper, will find an uncongenial soil that will have a tendency to give them a severe check. Some people recommend digging a large hole eighteen or twenty inches deep and filling it with good soil and compost. This practice might not do serious harm on naturally deep, porous soils, but on clay and clay subsoils it would be disastrous, and much like raising plants in pots without drainage holes in the bottom to permit the escape of surplus water. The safest practice is to have the soil prepared to a uniform depth throughout the whole orchard,

and this is the best and most cheaply done with a plow and strong team, plowing into narrow lands by back-furrowing running the plow ten inches or a foot deep, leaving open dead furrows midway between the rows. If the soil is poor the best fertilizer to use is well rotted barnyard manure applied at least six months before the trees are to be planted.

PLANTING.

Experience has demonstrated that for Minnesota, if not for all the North west, spring is the best and safest season for transplanting. The reason is obvious. A tree or plant is a thing of life as much as an animal, and in order to be able to endure the rigors of winter, must have through its roots a vital hold upon the soil, which it cannot have if planted in the fall with mutilated roots and the root-lets left where the tree was taken from. There is doubtless a circulation of sap during the mild days of winter, and no matter how cold the weather, there is a constant evaporation going on from every bud and twig, and the roots having no hold upon the soil, and no mouths to drink up and take in supplies; this evaporation must greatly enfeeble the tree if it does not kill it outright.

But while I advocate spring planting, I as rigidly hold to the theory that the trees should be secured, dug, transplanted, root and top pruned, if necessary, and heeled in or buried with the roots entirely out of the reach of frost, the previous fall. Trees should not be dug in the fall until the season's growth is entirely completed and the wood perfectly ripened up. Trees for shipping are sometimes dug too early, and the leaves stripped off before they have performed all of their functions. Such will start feebly and make a sickly growth. Digging trees in spring is a practice that ought to be condemned, and I am glad to know that some of our nursery-men are obviating the necessity of it by providing ample cellar room for winter storage. The sap starts as soon as the frost is out of the ground, and bending the tree in the process of digging is apt to loosen the bark and produce sun-scald on the south and west sides of the trees, and a slight bruise will make a dead spot in the bark.

Also trees dug in the spring are more liable to make a later full growth the first year and become black-hearted after the next winter. If the ground is well prepared it is not necessary to open holes larger than to secure the roots without cramping. After the hole is dug and the tree placed just where wanted, and little, if any,

deeper than it grew in the nursery, it should be held in place with one hand while with the other fine soil is worked about the roots, and care should be taken that there is no place where soil and roots do not come in contact. To expedite planting, first lay off the ground and set a stake at every point where a tree is to stand. Next provide yourself with a machine which was described in some agricultural paper several years since, viz: A board five feet long and six inches wide, bore an inch auger hole in the center near each end and cut a notch in one side midway between the ends, and prepare two stakes that will slip easily through the holes. It is used by laying the board down with the notch fitting to the stake and inserting the two stakes in the auger holes. Lift off the board, removing center stake, digging the hole and laying the board back over the end stakes, and setting the tree to have the trunk fit into the notch. After the hole is filled press the earth firmly about the roots with the feet, and finish off by drawing some fine loose soil about the tree leaving the surface loose for two or three feet from the trunk.

MULCHING.

As a general rule if a tree is properly taken up at the nursery, rightly handled afterward, and skilfully planted in suitably prepared soil, it will live. But it is always safe to apply a mulch which will keep the ground moist and of an even temperature. Almost any waste material will answer for the purpose, but the best is leaves from the forest, half decayed hay or straw, or swamp moss. Wood chips and crude swamp muck should never be used, or fermenting manure. The mulching should reach beyond the extent of the roots.

CULTIVATION.

It is as essential to keep a young orchard as clear from grass and weeds as it is any farm crop. In our virgin soil any crop that will not shade or interfere with the trees, and does not require cultivating after the first of July, may be grown until the trees come to bearing, after which time they had better occupy the whole ground. Beans, peas, potatoes and other garden vegetables will pay the best. I have seen good results follow the growing of the smaller varieties of corn, leaving the stalks to stand over winter to help break the force of the winds and retain the snows.

Where crops are taken off just enough manure should be applied to keep the ground in heart, but not enough to make it fat. In plowing and cultivating, great care should be taken not to break or mangle the roots.

PRUNING.

With some varieties pruning seems to be a necessity, but it should be done with great care. Every one ought to know how and when to prune, but it is a knowledge that can only be acquired by careful study of the structure and habits of trees and the peculiarities of climate, and I do not feel competent to lay down any arbitrary rules for it. The idea has been inculcated and advocated by some of the fruit growers of this state that pruning is an unnecessary operation, and it has been acted upon in practice so much that many of our orchards are unsightly objects. I do not believe in the currant bush form for apple trees, but would start the head of the tree at from two and a half to four and a half feet from the ground and keep the tops open and in a symmetrical shape, not allowing branches to cross each other. Sharp crotching or forks should not be allowed, as they are almost sure to split down and ruin the tree when it comes into bearing. Wherever such are inclined to form in trunk or top, one trunk or branch should be removed while yet small and pains should be taken to have all side branches start out from the leader as near as possible at right angles. This system of starting the top also tends to earlier fruiting. By commencing when the tree is small, about all that will be required is pinching off with thumb and finger and removing small twigs which can be done with safety at any time except between the middle of March and the middle of June. If it should become necessary to remove larger branches it should be done about the first of July or in November, and the wound made ought to be covered with grafting cement or paint.

GRAFTING AND BUDDING.

On account of mistakes of our judgment of varieties, blunders of nurserymen, the swindling of tree peddlers, and the Siberian hybrid mania that sometimes induces us to make worthless purchases, it is highly important to be proficient in the art of "budding and grafting," that the worthless may be turned into something valuable. This art is easily mastered and it is hardly necessary for me to spend time to describe the process in detail. The operation of

budding is usually performed on young trees or branches from one to three years old, and can only be done in the growing season. It consists in separating a bud with a portion of the bark attached, from a shoot of the current season's growth of one tree and inserting it beneath the bark of another, binding it in place with a string until it has grown fast. When this bud commences to grow, all of that part of the stock above it is cut away, the bud grows on, and eventually the top or branch of the tree of the same variety as that from which it was taken. The ordinary season for budding in this climate is from the middle of July to the middle of August, but may sometimes be performed as late as the first of September. The buds must be perfectly developed in the axils of the leaves of the young shoots intended to bud from, and the bark must rise freely from the stocks to be budded, and this only happens when the stocks are in a thrifty growing state. The only instrument necessary for the operation is a common two bladed pocket knife, the large blade to be used for pruning away any branches that are in the way of inserting the bud and the smaller for preparing the buds and making the incisions in the stocks. Strings of buss matting, woolen yarn, or cotton twine will answer for tying. Grafting is the insertion of a scion of one variety or species upon the stem or branch of another. The best scions are the shoots of the previous year's growth. Stocks may be of any age from a yearling seedling to a fully matured tree, but of whatever age they should be sound and healthy. The best methods and most commonly practiced are whip grafting and cleft grafting. In whip grafting the stock is better not to be more than two years old, but may answer as large as one-half or three-fourths of an inch in diameter. Upon the stock the grafter makes a smooth even sloping cut an inch or so long, and in the center of this cut he makes a sloping cut downwards. The scion, which should contain two or three buds, is cut on the lower end with a sloping cut downwards and similar in all respects to the one made on the stock, and a slit or tongue is made on it upwards corresponding with that on the stock, and they are then neatly fitted together the tongue of one within the other and the inner barks of both placed in perfect contact at least on one side. It is then firmly wrapped with a narrow strip of waxed cloth to cover the parts united. Cleft grafting is practiced on trees or branches too large for whip grafting, say an inch or more in diameter. In this method the scion is cut in the shape of a wedge. The part cut for insertion in the stock should be about an inch long, one edge a trifle thinner than the other and

with a bend at the shoulder where it is to rest on the stock. The stock is sawed off at the point for grafting, and a sloping cut is made on one side of the stock about one inch and a half long and coming about to the center of the top. The stock is split a little one side of the pith, by laying the edge of a chisel or knife on the horizontal surface, and striking it lightly with a mallet or hammer. The split is kept open by the insertion of a wedge while the scion is inserted with the bud out, and the thinnest side in. Grafts of this kind heal much more rapidly, and are stronger, than when the cut is made horizontally across. In grafting by this method it is more convenient to apply the cement with the hands, being careful that it fits closely and covers every part of the wound.

AGE AND SIZE FOR PLANTING.

In regard to age and size of trees for planting in the orchard, probably the best is short unbranched trees of two years growth from the root graft, and from three to four feet high; such trees will need no pruning when planted, and, if skillfully managed, very little afterward. They can be purchased for much less at the nursery, cost much less for packing and transportation, and are more apt to have all the roots that belong to them. In no case, would I recommend purchasing trees more than three years old, but if the planter grows his own trees the age and size is not so material, provided, proper care is used in digging and setting them. Trees should never be allowed to have their roots exposed while they are out of the ground, even a few minutes exposure to the sun and wind may prove fatal to them. It is best not to plant too early in the spring, or before the soil is somewhat dry and warm, which is about corn planting time.

DISTANCE APART FOR ORCHARD TREES AND PROTECTION.

On this point our fruit growers disagree, different individuals advocating all the way from twelve to thirty feet. The advocates of the closer distance claim quicker returns from the land, and that the trees afford a protection for each other. I do not believe that a first class and fruitful orchard can be grown with such close planting. It is true that they advocate the removal of a portion of the trees when they get large enough to crowd each other, but it would take about as much nerve to cause the removal of a sound, valuable apple tree, as it would to undergo the operation of ampu-

tating an arm that was not seriously diseased, or have a sound tooth drawn. The great danger is that the surplus trees will not be removed until they have injured those which are to remain. In my opinion, the best distance for the prairies would be not less than 25 feet and for timbered lands 30 feet. If planted at these distances other crops may be grown between and pay all cost of cultivation. I should much prefer the greater distance apart, and some variety of timber tree for a protection, which would cost less, and be of more value for fuel, when the time arrived for its removal; but, doubtless, the best trees to plant between, would be evergreens, which can be purchased cheaply, while small, and can at first be set so close as to throw their shade upon the trunks of the trees without the danger of their roots drying out the soil, or exhausting it of the constituents essential for the apple tree. They can always be kept within bounds by severe pruning, or they will be valuable for taking up and planting in some other place.

Upon our prairies, protection from prevailing winds will be absolutely necessary, and for windbreaks any quick growing timber will answer. The belt should be planted before the orchard and be at least two rods wide and four rods from the outside trees of the orchard.

Within this belt and sharing its protection might be planted another belt of spruce, arbor vitæ, hemlock or other varieties of evergreen; but in no case let the orchard come within sixty feet of the windbreak, or it will be robbed of the roots, and snows would be apt to lodge in deep drifts under their lea, nor should the belts be a complete shelter from the winds on all sides or the close atmosphere may develop blight. A belt on the north and west sides will be all sufficient. If the shelter belt is four rods wide, it will take in nine rows of trees, with the rows four feet apart, and it can be planted to serve the double purpose of protection and the growing of valuable timbers for use on the farm. With this end in view, I would plant the outside row with cottonwood; the next with ash, maple, oak, hickory or walnut, the two next with cottonwood, poplar, box elder or soft maple: next with hard wood: next with the rapid soft-growing woods; the next with hard woods, and the last with soft. The trees should be planted from two to four feet distant in the rows, and will require an occasional thinning to give the hard woods a chance to develop. The hard woods will also require thinning in the course of time, but the thinnings will be found useful for fuel and other purposes.

WHAT VARIETIES TO PLANT.

First ascertain where you live and what you are planting for. If you live outside of favored locations, or in the newly settled parts of the state, plant for large apples the Duchess of Oldenburgh, Tetofsky and Wealthy, and of the Siberians the Whitney No. 20, Early Strawberry, Powers' Large Red and Pride of Minneapolis. Is that all? Yes, for the localities mentioned, if you are planting for fruit; but if you dare to risk the blight the Transcendent may be added. In the older and more favored parts of the State plant, in addition to these, the Utter or Cooper, Fameuse, St. Lawrence, Price and Tallman-Sweet and Wallbridge, also try the Wolf River and Scott's Winter in limited quantities. This is a small list, but at present it is hardly safe to add to it anything except of the Siberian species; but no doubt new, hardy varieties will soon be added.

WHERE TO PROCURE TREES.

I do not believe that it makes any material difference where the trees are raised if they are well grown, carefully dug and properly handled afterward, and for that reason should advise procuring them as near home as possible. The worst policy a man can pursue is to order of some traveling vender of whom he knows nothing, even if he is willing to give his personal "guaranty" that his wares are true to name and perfectly "iron clad," and is willing to pledge himself to replace all that fail to grow. Neither would it be policy to purchase a lot of poorly grown, scrubby trees, with sharp forks starting near the ground simply because they are cheap. They would in the end prove to be very dear. The best way is to go direct to the nursery and select just such as you want and see them dug, or send your order to some reliable man who has gained a reputation and is disposed to sustain it at all hazards. If you know of a nurseryman who grows his own stocks and uses for the purpose Minnesota grown seeds selected and saved from the hardest and best apples, by all means encourage him with your patronage. Even if the trees should cost you double on the start they would probably prove the cheapest in the end. It would be better if every man could raise his own trees—roots are of as much importance as the tops—and with a tender and diseased root we can hardly hope to rear a hardy, healthy and fruitful top. We are all watching the efforts of Mr. Peter M. Gideon with much

interest at the State experimental fruit farm, and hoping that his efforts may be speedily crowned with success. The object he has in view is the originating of hardy new seedling varieties that will prove long keepers, by crossing the hardest long keeping apples with the Wealthy and Siberian species. We are also watching and waiting for the testing of hundreds of varieties imported from Russia and Northern Europe and Asia; and this test can hardly fail of giving us some hard and good winter apples. Again, hundreds of the intelligent nurserymen and fruit growers of the Northwest are awake to the importance of the subject, and are engaged in investigating the causes of failure in the past, and experimenting with new modes of propagating, crossing and testing seedlings with as much intelligence as our best stock breeders are in raising thoroughbreds, and the knowledge of vegetable physiology that is now being obtained will enable them to accomplish more in a single decade than in a lifetime a century ago. We have also a State Horticultural Society that, after a long struggle against difficulty, is a live institution, ready, willing and able to help the good work, and it ought to have 1,000 members enlisted for life in the noble work. In view of these things, I believe that before this generation shall have passed away the problem will have been solved, and we shall be able to produce apple trees that are hardy and productive, and will produce fruit of as good quality and will keep as well as that grown in what is now known as the best fruit States. The greater the numbers who engage in these experiments the better is the chance for its speedy accomplishment, and the establishment of this fruit question by the introduction of six varieties of apples as good as the Seek No Farther, Genitons and Baldwins, covering the season from October to June, would be worth \$1,000,000 to the State. With such an end in view and such a prospect before us, let us not pass the time in idle waiting, but arise and do with our might that which our hands find to do.

DISCUSSION AND OTHER TOPICS.

A brief discussion followed, being shortened by the lateness of the hour, and among the points brought out was the following from Prof. Porter regarding the plum curculio. He had had a considerable experience with them and gave this method for their destruction. After trying various plans he had found that jarring was the most effective. Saw off a limb so as to leave a stub, spread

underneath a sheet and hit the stub a smart rap with a mallet. The curculio, which is a small dark looking insect resembling a bit of bark, drops off onto the sheet, and may be killed, and the plum crop thereby saved. Our wild plums are as badly affected as any, and the jarring should begin as soon as the plum is in blossom.

The afternoon session was to have been devoted to a lecture on Strawberry Culture, by J. M. Smith, of Wisconsin, but in his absence the time was given up to a general discussion of that subject.

Mr. J. S. Harris spoke first about soils. He preferred a good loam for the strawberry, also a soil rather moist than dry. The latter gets loose and dries out too quick. For planting the land should be thoroughly cultivated. He had had the best success by summer fallowing the ground for a season. Spread barn yard manure and ashes on it and plow it thoroughly. Plow again in the spring; set the plant so that the crown will be on a level with the soil. Too much hoeing of the plants in the spring injures the surface roots and hurts the crop. Prof. Porter agreed with Mr. Harris that the ground ought not to be cultivated in the spring with a hoe as it disturbed the roots. It is a fibrous plant and has no tap roots. The practice among many eastern growers is to press the bare foot down firmly on the crown of the plant when planting. The distance the rows are set apart is generally three and a half feet, and in the rows one foot. Plants are set each year, and after the bed has fruited it is turned under, and either celery or turnips are planted. One of the best fertilizers is salt. Apply in the spring.

The question of mulching was fully discussed. Mr. Woolsey did not favor any being left on the plants in the spring. Mr. Freeman Smith thought a little mulch left on was better. Mr. Wyman Elliott favored leaving the straw, but poking it away from the crown of the plants.

Mr. Fawcet was considerably astonished at the difference of opinion here on mulching. He cultivated small fruits in Indiana on a limestone soil. Mulched all the way from a half inch to six inches in depth. Lightened up the mulch a little in the spring. The foliage of the plant being wide, it has difficulty in pushing through unless this is done. He thought enough mulching should be put on to cover the soil to prevent freezing and thawing.

Mr. Pearce said that the strawberry crop was one of great importance. Last year he had grown \$200 worth on a quarter of an acre. He had tried many varieties, and the Crescent seedling had scored

more good points than any he had ever tried. He used a cultivator and very sharp hoe; did no weeding, but killed the weeds with the hoe. In regard to mulching he didn't know what to say. He had a plan as follows: After July or August sow clean oats. They will grow two or three feet high, and drop evenly on the plants. One or two things in strawberry culture ought to be observed. Raise the best varieties, and study how you can make the most money from your crop. He exhibited a picture of many varieties which he grew. Mr. Fawcett illustrated his harrow on the blackboard. The plants were put in with a broad dibble, by which the roots had a chance to spread. After the plants were set the harrow was used with great effectiveness in keeping down weeds and loosening the earth.

Prof. Porter said that strawberry growers out here had much yet to learn and instanced several points where there was a chance for improvement. In the first place the growers did not assort their fruit. Big and little berries were mixed together. A strawberry should never be touched from the time it is picked until it goes into the consumer's mouth. He saw hundreds of quarts here last year that were handled several times. Use quart packages for the solid varieties such as Wilson and Glendale. Use pint boxes for softer varieties, and half pint boxes for still softer ones. Always use new boxes, never let a box be used twice. In the field he used little carrying crates in which the picker placed his boxes. It had legs on it and a handle and held ten quarts, and the picker carried it through the field with him and placed his box on it instead of on the ground.

On Wednesday morning, March 9th, the Hon. J. M. Smith, of Green Bay, Wis., appeared and read the following paper on the subject of strawberry culture.

Somebody has said that doubtless the Creator could have made a better berry than the strawberry, but he never did. It is the first and best fruit of the season, and, is a universal favorite with rich and poor alike. It is generally distributed, grows on any soil, except a very wet muck, is everywhere a most luscious fruit and its cultivation should attract far more attention than it does among farmers and market gardeners. Instead of being regarded as a luxury, and an occasional supply appearing upon the table during the season of its ripening, it should be looked upon as a regular and necessary article among the provisions required in the household economy during the entire year.

To the farmer it may, by proper care and attention, be made less expensive than pork and beans, while it is far healthier and surely more palatable.

There are various methods of cultivation, and different varieties require different treatment as well as do those on different soils and in different locations. In the city, on limited garden space, it is better to set the plants near together and cultivate by hand, but on the farm where a quarter of an acre of land, more or less, is not important, it is better to set them far apart and cultivate by horse power. Flat culture and hill culture each have their advocates, but hill culture is generally considered the most expensive and more risk attaches to it. The soils on which strawberries will grow, as before stated, are almost innumerable; but I prefer a light sandy loam which I manure heavily and plow in, after which I add a coating of ashes and harrow thoroughly. Too much attention cannot be paid to the condition of the ground, when the plants are set. It must be well drained so that no water will stand upon it, or it will be impossible to obtain a good crop. If the natural drainage is not perfect artificial drainage must be resorted to. The increase in your crop will pay the cost in one season.

Having properly prepared the ground, the next question is what varieties to plant; and here let me say do not place too much confidence in the new varieties which are being constantly offered by the different growers throughout the country. True it is, that if you could believe the half that is said of them and claimed for them by their originators, they would make fortunes for us in one season, but while their propagators are not necessarily knaves, we know it to be also true, that many new varieties which have succeeded well in their own native soil, have utterly failed when transplanted to a distance, and many varieties fail in a few years in their own soil.

Since the introduction of the Wilson many hundreds of new varieties have been offered to the public, but none have superseded the Wilson for general cultivation; and for general market purposes it stands unsurpassed. For home eating Burr's New Pine is one of the best, but it is not fit for marketing. Seth Baydan's No. 3C is an excellent berry, but a shy bearer. The Crescent seedling bears well on light soils and will bring full crops where the soil is not sufficiently rich to produce a crop of Wilson's at all, but the berries of the Crescent are too soft to ship well and it is not a profitable variety to cultivate for market. The Glendale and Kentucky

are also good berries, the latter bearing nearly equal to the Wilson. The Jucunda is also an excellent berry for eating but succeeds only in clay soil with the highest cultivation, and is too expensive for cultivation for market. I raised some Jucundas once, of which eighteen filled two boxes, but the berry is not financially profitable. For money making, there is no berry equal to the Wilson; for fooling away money almost any of the new varieties will do. In setting plants be sure to press the soil tightly about the roots of the plant. This is absolutely essential to success. But be sure not to press the earth over the crown. Some recommend the removal from the plant of all but two or three leaves and it is, perhaps, well to do so, unless the root is very strong. Use water liberally. It is often necessary too in order get them well rooted, and always in dry seasons, if you expect your plants to be well fruited. After planting there is nothing to be done but to keep them wet and free from weeds, and the earth about them mellow. When the runners begin to come out, say in July or August, spread them evenly around the plant and they will root themselves, giving a number of excellent bearing plants. The Wilson is one of the poorest of prolific varieties, and much care must be taken to place the runners, or you will not secure plants enough to produce a first class crop. Do not let the plants produce fruit the first season. If any blossom pinch them off and confine the entire energy of the plant to producing runners and thus new plants; but unless the plants are set very early in the spring, you will not have many blossoms to destroy. In the fall the plants must be well covered and this will end the first year's cultivation. Various materials are used by different growers for covering in the fall. I prefer marsh hay, as it is free from weeds and contains no noxious seeds. Straw that is free from foul seeds, is a good covering, but it is seldom that it can be obtained, and in using straw you are in great danger of seeding your ground with a crop of weeds. Begasse from the cane mills is used by some growers in sections where sorghum is raised, and is highly recommended. I should prefer to try it, however, on a small scale until I was well satisfied of its utility.

The mulching is not to be done until the ground is frozen and then great care is necessary in the operation. It should be spread thinly and evenly. Do not get it too thick. From an inch to an inch and a half is about right. If put on too thick it is liable to smother the plants; and do not be in too great a hurry to uncover the plants in the spring. One of the principal objects of the covering, is to prevent the alternate freezing and thawing of the

ground in the spring, which is almost sure to be fatal to the plants. After the covering is removed, treat the ground to a good dressing of manure and wood ashes, and if there is danger that the berries will touch the ground, mulch around the plants. The Wilson treated in this way will bear any way, and if the bed does not bear the plants are not Wilson's. Whatever the season may be, either spring or fall, if there be weeds or grass in the bed take them out, but do not cultivate the ground too deep. I go over my bed and clean out the weeds three times before picking. If I find that my Wilsons are going to give me an immense crop I generally manure the beds a second time just before the first picking and thus preserve the size of the fruit in the latter part of the season. Ashes are the best fertilizer for this purpose. Just before the picking season water is an absolute necessity for the plants and it must be supplied in abundance. One good watering is worth half a dozen poor ones. Rain water is preferable and in applying water artificially the temperature of rain water should be maintained as near as possible.

By a careful selection of varieties you can extend the time of ripening very considerably. The Crescent is perhaps a little earlier than the Wilson, while the Kentucky is later, and these two with the Wilson for the main crop will enable you to hold the market much longer than you can with any one variety alone. At the close of the bearing season should the plants droop and show signs of decay, turn them under and put in some other crop; but should they show signs of recuperating, try them another season. The Wilson seldom bears more than two years. For a long bearer there is none better than the Charles Downing, which will bear picking for five or six years, but it is not a good market berry.

Never, by the way, set out staminate plants, for they are sterile; pistilate and perfect or hermaphrodite plants only are valuable. The staminate varieties have the largest stems and narrowest leaves, and can be told thereby. The Wilson is an hermaphrodite variety.

In picking, each picker should be provided with two boxes, into one of which all the fine perfect berries should be put; while the imperfect ones should be put in the other. The boxes should be heaped up as full as they will hold without crushing, and at once placed in the crate without handling, and as soon as possible removed from the sun, and cooled off, either in a cellar, or by means of ice.

In carrying to the depot, the crates should be placed in a spring wagon, and the horses never driven off a walk.

We make our own crates, finding it cheaper than buying them. I believe in high cultivation, and would have no plants which would not bear high culture. The average yield per acre for the country is forty to fifty bushels, fifty-nine bushels being the highest average reported for the district. This is too small. By a system of high cultivation, the Wilson or any other berry will quadruple this average. In 1875, I raised on a quarter of an acre 3,571 boxes of merchantable berries, being at the rate of 446 bushels per acre. Though I have never exceeded this amount, I often exceed 300 bushels an acre. The same result is attainable, by any one who will practice high cultivation.

In estimating the amount of ground to plant for family use, count a square rod of ground for fifty boxes, and then cultivate your ground up to that estimate; and in picking for domestic use do not gather the instant it becomes red, as you would for marketing, but allow it to hang on until it becomes a deep dark red, and then it is the largest and sweetest.

In the afternoon, Mr. Cleveland, of Chicago, Ills., read the following paper:

The Culture and Management of our Native Forests, for Development as Timber or Ornamental Wood.

Man's progress from barbarism to civilization is indicated by the degree of skill he has attained in the cultivation of those products of the earth which minister to his necessities and comfort. As long as the natural resources are sufficient to supply his primary wants of food and clothing, he will make no effort to increase them, and it is only as he is driven by the necessities of increasing demand and diminishing supply, that he exerts himself to secure relief by artificial means.

The first efforts of the savage at cultivation are of the rudest description, and just in proportion as tribes and nations advance in numbers, power, and intelligence, do they also gain in improved methods of tillage, in greater knowledge of the science of culture, and in better implements and machinery for its performance.

These are simple truths, which everyone will recognise. Their application to the subject of forest culture, lies in the obvious fact that it is not until a nation has reached mature age, and an ad-

vanced stage of civilization, that the native growth of wild forest proves insufficient for the increasing demand for timber, and the necessity of providing, by artificial culture, for an additional supply, begins to be felt.

We could hardly have a more striking illustration than is here afforded of the adaptation of the provisions of nature, first to the immediate necessities of existence, and subsequently to the development of the latent powers of the human race. The cereals and vegetables which are essential to man's daily support are of annual growth. Their culture is comparatively simple, and he soon learns that his very existence is dependent upon their renewed production with each recurring summer. The forests are equally essential to his further development, by furnishing material for the construction of houses and ships, and the countless implements by whose aid he attains to almost superhuman power. But the forest requires the lifetime of two or three generations for the full attainment of maturity. In the infancy of the race, the necessity of providing for such distant wants could not be foreseen.

Nature, therefore, as if she had been conscious that forest culture was too arduous an undertaking for primitive man, has furnished so abundant a supply, that no deficiency or necessity of economy is felt till the nation has acquired such a degree of intelligence as to be competent to the solution of the problem. And this is the point at which we now stand, and which the older nations of Europe have long since passed, seeing plainly that our natural sources are well-nigh exhausted, yet shrinking from the unfamiliar task of seeking to supply the deficiency by artificial means.

Many once powerful nations have dwindled into insignificance in consequence of their neglect of this lesson which nature imperatively demands that we should learn. Their fate should be to us a warning, as the efforts of the most intelligent nations of to-day should be to us an example, to save us from a like fate. The necessity for action is imminent, and can not be averted. The subject of the increasing demand and rapidly diminishing supply of timber throughout the country has been so thoroughly discussed by legislative committees, both state and national, by agricultural societies and by able individual writers, that it would seem but a waste of time to bring forward the oft-repeated statistics in evidence of the danger that threatens us, and the urgent need of adopting measures of protection and relief.

Assuming, therefore, that my readers are familiar with the data which prove the necessity, I pass at once to the consideration of the means of averting the danger.

The only measure of relief thus far suggested with any definite prospect of success, is the planting of new forests. Much has been said. it is true, about the preservation of those that remain; but the words seem meaningless, in view of the fact that private property is beyond the control of the government, and congress declines even to grant means to prevent the destruction of that which still pertains to the public domain.

The planting of new forests is indeed an all-important work, which can not be too strongly urged, but we have not yet reached the period when it is likely to be successfully inaugurated, except perhaps, in occasional instances by railroad or manufacturing companies, with a view to their own future wants. Individuals will not engage to any great extent, in a work which demands the investment not only of a large amount of money, and the continuous expenditure of a great deal of labor, but also of a long period of time, which is the one form of capital of which we never have a surplus. It behooves us, therefore, to study rather more closely than we have heretofore done, the possibility of improving the condition of that which remains. The woods still standing contain a vast amount of available material, which is susceptible of development in far less time than would be required for the planting and growth of new forests, our utter neglect of which furnishes one of the most striking proofs of our ignorance of forest culture.

No one can travel through any portion of the states east of the prairie regions without being impressed by the fact that he is never out of sight of woodland. In fact the chief cause of the prevailing apathy on the subject of forest planting arises from the fact of the great abundance of groves and extended forests, which convey the impression, in spite of the assertions of staticians, that there is still enough wood growing to supply the place of that which is removed.

The Duke of Argyle, in the interesting sketch of his trip through the States, published after his return to England, says emphatically that nothing in the aspect of the country surprised and impressed him so much as the great amount of wood still remaining, and everywhere giving beauty and variety to the landscape; but he added that it was everywhere that beauty of the wild wood, which never bore any evidence of culture or effort to increase its value by artificial development.

"I saw nothing (he says) that could be called fine timber, and no woods which showed any care in thinning, with a view to the production of such timber in the future."

Such a criticism is not surprising from one who, like most country gentlemen of England, is familiar with the process of forest culture, but it certainly is surprising that, with all our boasted intelligence, we still remain practically insensible to the fact that, while almost every tract of woodland contains a large percentage of such trees as are most valuable for timber, already well advanced in growth, and susceptible, by judicious management, of being developed into proper form and size for use in far less time and at far less cost than would be required for the planting and growth of new forest; yet, if left to themselves, not one tree in a thousand will ever be fit for anything better than fencing stuff or fuel. Vast resources of wealth are lying latent and running to waste in our woodlands, and we stand stupidly unconscious of the fact that its development requires simply the application of the intelligent culture we bestow on all other crops. In many instances, it is true, the native woods have been so long neglected, that they are past redemption, but there are, nevertheless, large areas of continuous forest, and smaller groves and woodlots in every section of the country, now yielding no revenue, which might, by proper annual thinning, pruning and culture, be developed into timber forests of very great value, while yielding an annual crop of firewood in the process.

Where shall we find, or how shall we create, the men who are competent to the work? To judge from invariable practice, our people seem not only to be ignorant of the first principles of forest culture, but unconscious even of the possibility of its application to the development of our native woods. The fact of such prevailing ignorance rests not alone upon negative evidence. We have positive proof in abundance in the attempts which we often see at the "improvement" of a piece of woodland when it is appropriated as the site of a residence. It is hard to conceive of anything more dismal and forlorn than the average result of the effort to impart a homelike aspect to such a place; the dwelling, with its "span new" expression, standing in the midst of a multitude of tall poles, with tufts of leaves upon their tops, looking like fowls stripped of their feathers, and the bare ground fretted everywhere with freshly up-turned roots, the sole remnants of the wild shrubbery which has been ruthlessly exterminated.

In order to a comprehension of the principles of healthy forest growth, let us consider some of the processes of nature, and learn from them her requirements.

If we plant the seed of a maple, chestnut, linden, oak or ash tree by itself in the open ground in suitable soil, and suffer it to grow without molestation, simply guarding it from injury, we shall find that the first act of the young plant is to send out broad leaves, which serve among other purposes to shade completely the stem, and the ground immediately around it in which the roots are growing. As the tree grows, it preserves a symmetrical shape, the limbs spreading and the trunk increasing in size, in proportion to its height, but always preserving the condition of keeping the trunk and the ground for a considerable distance around it, in the shadow of the foliage till mature age, when the roots have penetrated to such a depth as to be safe from injury, and the trunk is protected by thick layers of cork like bark, which safely guards alike from heat and cold the inner layers and young wood in which the sap is performing its functions.

Such are the conditions to which nature adheres, if not interfered with by accident or design, and such, therefore, we may be sure, are those best adapted to healthy and vigorous growth. The fact that they are continually violated with apparant impunity, serves only to show the wonderful power of nature to supply deficiencies, and adapt herself to circumstances, but in artificial culture, we should aim as nearly as possible to imitate the course she would pursue if unimpeded.

The requirements of nature are of course the same when trees are growing together in a forest, as when they stand singly, but the conditions of growth are so changed that the end is attained by entirely defferent means.

If we enter a tract of woodland, covered with a hard wood growth of an average height of thirty or forty feet we find it composed almost exclusively of trees which have run up to a great height in proportion to the spread of their limbs. The largest and oldest of them may have had some lateral branches which are now dead, but the younger growth will consist only of tall, slender stems, without a branch or leaf except near the top. It will be difficult, perhaps impossible, to find a single tree possessing sufficient symmetry of form to be worth transplanting for ornamental use. A little reflection will serve to convince us that this form of growth, so differant from that of the single tree in the open ground,

is the natural result of the action of the same rules under changed conditions.

When a young wood first springs up on open ground, each tree begins to grow as if it were alone, sending out lateral branches and preserving its proportion. But whenever these laterals meet and mingle with each other, they shut out the sunlight from all below, and thence forward all lateral growth must cease, and each individual is struggling upward to keep even with its neighbors and secure its share of the sunbeams which are essential to its existence, and which can only be had at the top. It thus becomes forced out of all just proportions in the effort to keep even with its fellows. The conditions of keeping the trunk and roots in the shade, however, are even more rigidly adhered to than in the case of the single tree, growing by itself, for the whole area of the wood is shaded, and, moreover, the trees on the edges of the wood, if not interfered with by men or cattle, will be clothed on the outer side with limbs and foliage, clear to the ground, so as to check the free passage of the winds whose drying influence upon the soil is even more active than that of the sun.

If we examine more closely we shall find that nature adapts herself to these changed conditions, and avails herself of whatever advantages they afford.

The single tree when growing by itself sends its roots deep into the ground in search of the moisture which cannot be had near the surface, and thus, when it reaches mature age, it draws its supplies from sources beyond the reach of temporary changes, and, moreover, secures so firm a hold upon the ground that it suffers no injury from the storms that assail it, but fearlessly stretches forth its arms as if to challenge the gale.

In the woods, on the contrary, the surface soil never becomes parched or heated, but maintains an even degree of temperature and moisture in consequence not only of the exclusion of the sun and winds, but of the deep mulching of leaves which annually cover the ground and keep it moist, while by their decomposition, they form a rich mould comprising all the ingredients of vegetation.

If we dig only a few inches into this mould we find it everywhere permeated by fibrous rootlets emanating from larger roots, which under these circumstances have kept near the surface where they draw nourishment from the rich material there provided. If the single tree in the open ground had tried to live by such means, it would speedily have perished for want of nourishment, or would

have been uprooted by the winds as forest trees are liable to be when left alone in a clearing.

In the woods the necessity no longer exists of sending the roots to a great depth either in search of nourishment or for support against storms, and nature always adapts herself to circumstances and attains her ends by the simplest and most economical means.

If we now consider the facts I have stated, which anyone can easily verify for himself, we shall find that all the essential principles of tree culture are comprised within their limits, and by their rational observance we may secure healthy and vigorous trees, and develop at will either such forms as will fit them for timber or for ornamental use.

The five trees I have cited — maple, chestnut, linden, oak and ash — are among the most common and yet the most valuable of our forest trees, and may be taken as representatives and proper illustrations of the facts I am stating. Either of these trees, if growing by itself in proper soil and undisturbed by other than natural influences, will attain, at maturity, a height of seventy or eighty feet, with a spread of limb equal in diameter to its height, and a trunk of such massive proportions as leaves no room for apprehension of inability to uphold the wilderness of foliage it has to support. But these same trees, if grown in a wood, will send up a slender stem, straight as an arrow, fifty, sixty or seventy feet without a limb or a leaf, till it reaches the average height of its fellows, and sends out its tufts of foliage to secure the benefit of every sunbeam it can catch.

We see therefore, that if we wish to form a beautiful and symmetrical tree, or a grove of such, composed of individual specimens of majestic and graceful proportions, we must allow it free access to sun and air, with full power of expansion on every side. While young, however, the growth will be more vigorous and healthy, and we can develop the desired forms more easily and successfully by leaving a much greater number of trees than are eventually to remain, and removing from year to year all which are near enough to the final occupants to check or impede their full development.

If, on the other hand, we wish to develop the trunk or bole for use as timber we must plant, or suffer the trees to grow more thickly together, and thus extend its trunk longitudinally by forcing it to ascend in search of the sunlight on which its very existence is dependent. The indigenous growth, however, is always a

great deal too thick for successful development. The trees are so crowded that many of them perish in the struggle, and those which survive are drawn up into such spindling proportions that not one in a hundred ever attains the dignity of timber, whereas by proper and reasonable thinning, and judicious culture and pruning of the trees selected for final retention, every acre of woodland might be made to yield an annual crop of fire-wood, and all the while be growing timber which eventually in many instances might be worth more than the land itself; or by a different process of management may be converted into a grove of majestic and graceful, ornamental trees.

The proper performance of this work constitutes the most important part of forest culture and for want of the knowledge of how it should be done, or from ignorance of the possibility of its application to our native forest, a vast area (in the aggregate) of woodland is running to waste; yielding no revenue and promising nothing better in the future than fire-wood, of which a very large proportion is yet susceptible of redemption and conversion into timber of great value at far less cost of time and labor than would be required for the planting and rearing of new forests, while the very process of development would be yielding an annual income instead of demanding large outlays.

Travel where we may we are never out of sight of forests, and every woodlot is a mine of wealth waiting only the application of intelligent labor for its development. In almost every tract of woodland may be found more or less of the trees I have named and in many places also hickory, walnut, butternut, elm, cherry, beech and other valuable timber trees, mingled with a great variety of those which are worthless, or fit only for fuel. In some cases they are past redemption, having been so long neglected that they have run up into mere thickets of hoop poles. Young growth may everywhere be found, however, which are in condition to be taken in hand, and in almost all cases the work of thinning, and pruning may be entered upon with a certainty of profitable results if wisely and perseveringly conducted.

The work of thinning, as ordinarily conducted in the occasional instances in which on any account it has become desirable, is entrusted to mere laborers, who have no regard for the natural conditions which are essential to healthy growth, and which cannot be suddenly changed, without serious injury to the trees that are left.

All the small growth of shrubs, such as hazel, cornel, dogwood, elder, shad bush, etc., is first grubbed out and destroyed under the

general term of "underbrush," and this not only throughout the interior of the wood, but round its outer edges where such shrubbery is apt to spring up in thickets, which serve the very important purpose of preventing the free passage of the wind over the surface soil of the interior, besides adding incalculably to the beauty of the wood, as seen from without by connecting the line of foliage of the trees, with that of the sward below, and presenting a living mass of verdure. The trees which are considered the most desirable to preserve, are then selected, and all the rest at once removed. Finally the leaves are carefully raked from the surface and carried off or burnt.

Sun and wind now have free access to the soil, and it very soon becomes parched and dry. The fine rootlets near the surface, which have heretofore been preserved by the never-failing moisture of the rich mould under its mulching of leaves, are converted into a mass of wiry fibres, no longer capable of conveying nourishment, even if it were within their reach. And while the means of supply are thus reduced, the tall, slender trunk, through which the sap must ascend to the leaves, is now exposed to the free action of the sun and winds. Now I do not presume to say, that evaporation can take place through the bark, but the provisions which nature makes to guard the inner vital tissues, from the effect of the sun's rays indicate beyond all question, that they are in some way injurious. I have elsewhere shown that in the case of the single tree growing by itself, the trunk is always shaded by the spreading foliage, when suffered to retain its natural form. In the forest, the trees shade each other, and thus effect the object by mutual action. But now let me call your attention to another provision of nature which few people observe, but the meaning of which is too obvious to be mistaken. If we examine the bark of an oak, elm, chestnut or maple of mature age, which has always stood by itself, exposed to the full influence of atmospheric changes, we find it to be of great thickness of very rugged character, and of a cork-like consistency, all of which characteristics make it the best possible non-conductor of heat or cold that can be imagined, under the protection of which the living tissues are safely kept from injury through the burning heat of summer and the intense cold of winter.

Now go into the forest where the trees shade each other, and wind and sun are excluded, and you will find that the bark of the trees, is smooth and thin in comparison with that of those in the open ground.

Nature never wastes her energies needlessly, and the trees in the woods do not require the thick coat of those that are exposed. But the effect of suddenly admitting the sun and wind upon them is precisely the same as that of exposing any portion of the human skin which had heretofore been clothed. It is to guard against injury from this source that experienced tree-planters, when removing large trees from the woods, are accustomed to swathe the trunks with ropes of straw, which is a rational process, yet it is by no means uncommon to see the reverse of this action. I have seen during the past winter a great many very large fine trees planted on the best avenues in Chicago, at a cost of certainly not less than fifty dollars each, from the trunks and large limbs of which all the rough bark had been carefully scraped, leaving only a thin, smooth covering over the inner tissues. This is as if a man should prepare for unusual exposure to heat or cold by laying aside all his clothing.

Few persons, even among those whose business is tree culture, as fruit-growers and nursery men, have any just conception of the value of thorough mulching, as a means of promoting the health and vigor of growing trees. In fact, such a mulching of the whole ground as nature provides in the forest by the annual fall of the leaves, may be said to be unknown in artificial culture, so rarely is it practiced, yet its immediate effect in promoting new and vigorous growth is such as would seem almost incredible to one who had not witnessed it, and affords one of the most beautiful illustrations of nature's methods of securing the most important results by such simple and incidental means that they escape our notice, though going on right under our eyes from year to year.

Of course the richest food for plant consumption is in the soil near the surface, but if that soil is subjected to alternations of temperature and moisture, sometimes baked in clods, and at others reduced to the consistency of mire, no roots can survive the changes. In the forest, as I have elsewhere said, these changes are prevented by the shade of the foliage and the mulching of fallen leaves. The rich mould of the surface soil maintains an even temperature, is always moist, and is everywhere permeated with fibrous roots drawing nourishment from the rich sources which surround them, and this process may be artificially imitated and the same results attained, by mulching, if properly done. It does not suffice to pile a few inches of straw or manure around each tree for a short distance from the trunk. If the tree stands singly, at a distance from others, the mulching should extend on

every side beyond the spread of its branches; and in the case of an orchard, or young wood, the surface of the whole area it occupies should be covered with leaves, straw, shavings, chip-dirt, tan-bark or whatever material is most available, to a depth of several inches. I first learned the value of the process when a young man, on a coffee plantation in Cuba, where a portion of the hands were constantly employed in collecting refuse vegetable matter of all kinds, and spreading over the whole ground between the rows of the coffee bushes, to such depth as served to keep the surface cool and of even temperature, and also to prevent the growth of grass and weeds and thus supersede the necessity of ploughing between the rows.

Afterwards, when engaged in fruit culture in New Jersey, I practiced it in my vineyard and orchards with most satisfactory results, of which an account was published more than thirty years ago, in the *Horticulturist*, then edited by A. J. Downing.*

The trees and vines responded at once to my efforts in their behalf by such increased luxuriance of growth that it was easy to distinguish the portions that had been mulched as far as they could be seen, and, on digging into the surface soil under the mulch at any point, I found it filled with fibrous roots precisely as is the case in the leaf mould in the woods. No fruit-grower who has once tried this experiment will ever after forego the advantages it offers, and I have spoken of it thus at length from the obviously vital importance of its bearing on forest culture. A moment's reflection will show that in the opening and thinning of native wood which had grown thickly together, a heavy mulching of such portions of the ground as may unavoidably become exposed may be of most essential service in preserving the health and vigor of the trees that are to be retained.

It is difficult to lay down specific rules by which a novice could be guided in the work of opening and thinning out the wood of a native forest, except by fully impressing him with the importance of preserving, so far as is possible, the conditions which nature shows to be the most favorable to vigorous growth, and proceeding very cautiously when it becomes necessary to change the relative proportions of the influences which affect the vitality of the trees. The age and condition of the wood at the time the work is begun, are, of course, important elements for consideration. If the growth is not more than ten or fifteen years, and the trees have not sprung up so thickly as already to have become a mere thicket of hoop-

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poles, but have preserved a reasonable degree of symmetry, its management can be much more easily controlled than if it has attained a more mature age, and especially if the object is to create an ornamental grove composed of fine specimens of individual trees, a process by which the value of desirable residence sites in the vicinity of cities or large towns might often be very greatly increased.

Whether this be the object, or the development of timber, the first thing to be done is to select and place a distinguishing mark upon every tree which is ultimately to be retained. Then remove at first from its immediate vicinity only those which are actually crowding it, or impeding its growth by shading or interfering with its foliage. Those which simply shade the trunk or the ground around it are serving a useful purpose, and should not be disturbed. Indeed, if it is found that the necessary removals involve much increased exposure of the surface soil around the tree, it should at once be covered with the mulching of sufficient depth to prevent the possibility of its becoming heated and dry. All other sources of danger to the health of the trees are insignificant in comparison with that of the rude check they are liable to receive from sudden exposure of the trunks and surface roots to the influence of the sun and wind, from which they have heretofore been protected, and to which they can only become accustomed by a gradual change.

The next year it will be found that the tree has gladly availed itself of the opportunity for expansion, and has spread its limbs to fill the vacant space around it, so that more trees must now be removed, while the increased mass of foliage it has developed renders it less liable to suffer injury from their loss.

The removal of the undergrowth of shrubbery, should be very cautiously conducted, and in no case should it be removed from the outskirts of the wood, which should everywhere be left with as dense a growth as possible, to prevent the entrance of the winds.

The sirocco-like wind from the S. W., which often blows with great violence for days together, especially in the spring and early summer, when the trees are full of sap and the young shoots and leaves are tender and sensitive, is the one from which most danger is to be apprehended. The merely mechanical injury it inflicts upon the spray and foliage is often serious, and its worst effects are due to its absorption of moisture and vitality.

All experienced nurserymen and fruit-growers, have learned to dread its exhausting influences, especially upon grape vines and other broad leaved plants, and they too are aware of the fact, which

comparatively few ordinary observers seem to have noticed, that its effects in giving a general trend of the spray and branches of trees in exposed situations towards the N. E., is so marked that no one who has learned to observe it, need ever be long at a loss to know the points of the compass in any part of the country.

The fact, however, that we have it in our power to guard against the evil effects of this wind by artificial means, is not so generally known as it should be, and it was only after many years observation and experience that I came to a full realization of certain facts in connection with its action, which have a most important bearing upon the question of forest culture.

I became aware, many years since, that many shrubs, trees and plants would grow and thrive at Newport, R. I., and at Yarmouth, Nova Scotia, which in the interior were only found much farther south, and would certainly perish if removed to the latitude of those towns. The reason assigned in both cases was the warming influence of the neighboring gulf stream, which seemed a plausible explanation in which my faith remained unshaken for years, until I went to Chicago, where I found it was impossible to grow many of the finer fruits, and some of the forest trees which elsewhere are found in much higher latitudes. Neither peaches or grapes can be grown at Chicago, or at any other point on the western side of the lake without artificial protection, and the native growth of wood is very meagre, and many varieties which elsewhere are found much farther north, as the beech and the hemlock cannot be grown; yet the eastern shore of the lake, only sixty miles distant, has no superior in the whole country as a fruit growing region. Peaches, grapes, strawberries, etc., grow most luxuriantly anywhere on that shore up to the northern extremity of the lake, three hundred miles north of Chicago, and every variety of forest tree indigenous to the country is found in the best condition of vigorous health.

There is no gulf stream to account for this difference, but the relative position towards the lake of the whole extent of its fruitful shore is the same as that of Newport and Nova Scotia towards the ocean. In both cases the S. W. wind reaches the shore after passing for a long distance over water, and instead of burning and exhausting vegetation with a breath of fire, it comes laden with the moisture it has gathered up in its passage, and brings health and strength upon its wings, instead of disease and death. Further reflection served to convince me that the rule was susceptible of much wider application, and serves to explain the different vegeta-

tion of the eastern and western shores of great continents in the same parallels of latitude. Central Spain and southern Italy, the lands of the orange and grape are in the same latitude as Boston, and going west on the same parallel to California, we again find ourselves surrounded with fruits and plants which in Boston can only be grown under glass. Continuing our western flight across the Pacific, we find the flora of Eastern Asia to bear, in many respects, a striking resemblance to that of Eastern America.

These facts have certainly a very important bearing upon the question of forest culture. They prove that the S. W. wind of spring and early summer is perhaps the worst enemy we have to guard against, and also that its deleterious influences are neutralized when it passes over a large body of water. It is comparatively rare however, that a situation can be secured affording that advantage, and the question naturally arises, are there no other means of protection? I am happy to have it in my power again to summon nature as a witness that such means are within our reach.

I have said that the beech would not grow near Chicago, a fact which I was very reluctant to admit on first going there, and was only fully convinced of its truth by witnessing repeated failures, and the evidence of reliable nurserymen who had tried in vain to preserve it. Yet after I had long been satisfied that it was idle to attempt its culture, I was one day amazed, while surveying in the woods a few miles from the city, at coming upon a little group of beech trees comprising some twenty or thirty in all, of mature size and in full health and vigor. On examining the situation, to discover, if possible, an explanation of the phenomenon, I observed first that they stood in the bottom of a ravine so deep that their tops were scarcely even with its banks, while the woods which surrounded them extended more than a mile to the S. W., so that they were completely sheltered from the effects of the wind from that quarter. I have never been able to find or to hear of another beech tree anywhere in that region, and can only account for their presence by supposing the seed to have been brought from a distance by birds, probably crows, jays or wild pigeons, and dropped accidentally on a spot, which proved to be a "coigne of vantage," where they were safe from the enemy. The evidence thus afforded of the value of a screen on the S. W. side, should not be lost upon those who are selecting sites for orchards, or vineyards, and shows the importance when thinning a wood, of leaving whatever shrubbery or foliage there may be on that side to arrest the progress of the wind.

The work of pruning the trees which are to be preserved for tim-

ber involves a careful consideration of the principles I have set forth, apart from the judgment required for the skillful performance of the mere manual labor. The object in view being the development of the bole, it is important to remove any limbs which threaten to become its rivals in size, if any such have become established before the work of improvement began. But after the trunk has attained the desired height, it is on all accounts desirable to develop the largest possible mass of foliage, because the making of wood can only be effected by the elaboration of the sap, which is the work of the leaves.

If one is rearing a new forest, in which the trees have been under his control from the time of planting, it must be the result of his own ignorance or negligence if he has failed to secure such forms as he desired, since it is easy to direct the growth of young trees, and prevent them from running into extravagances, which will unfit them for service as timber. And not unfrequently we may find a young wood of indigenous growth, which may be taken in hand and wrought into such shape that its future progress can be easily directed. But, for the most part, in woods that have been suffered to run wild till they have approached maturity, a good deal of skillful pruning will be required to bring the individual trees that are to be preserved into such form as will give them most value. Nothing but practice and careful observation can confer this power. The little treatise of DesCars on the pruning of forest and ornamental trees, translated by Mr. C. S. Sargent, of the *Arnold Arboretum*, and published by A. Williams & Co., of Boston (price 75 cents) contains full and explicit illustrated directions for all the manual work of pruning, and is invaluable as a guide to the novice, and a work of reference to experienced foresters. But mere manual skill in the performance of the work will be of little avail without the application of a thorough knowledge of the principles of tree growth, and a strict compliance with the requirements of their nature.

If our agriculturists will but apply to the management of their forests the same intelligence with which they direct the culture of other farm crops, they will find an equally ready response to their efforts. The farmer who should leave his field of corn or potatoes to shift for itself, or suffer his cattle and hogs to ramble through it at will, would be justly sneered at by his neighbors and punished by the loss of his crop—and trees have no more capacity for self-management than corn or other vegetables, and are quite as ready to profit by judicious culture, and to yield returns corres-

ponding to the care bestowed upon them. They are not liable to be utterly destroyed, as corn is, by the incursions of live stock, but they do suffer serious injury from the trampling and rooting up of the ground. I have seen beautiful groves of oaks in Iowa full of dead and dying trees, and, on asking the cause, have been told that the native woods "can't stand civilization," but always die out when cattle begin to run in them; and I am told that, in Kentucky and elsewhere in the South, the young growth is found to contain only the inferior varieties of oaks, as the swine running in the woods seek and greedily eat the acorns of the white oak, on account of their superior sweetness. Has anyone ever estimated the cost of raising hogs on such food?

I have endeavored in the preceding pages, to confine myself to the special features of forest growth which need to be regarded in the effort to develop and improve a native wood, wherever it may be. The planting and culture of an artificial forest is quite another affair, and I have made no allusion to it because my special object has been, if possible, to urge the fact, and arouse attention to it, that we still have vast resources of latent wealth on every side, susceptible of development by proper management, which we are everywhere suffering to run to waste. The work of planting and rearing artificial forests can not indeed be urged too strongly, and there is no danger of its being overdone. But the conviction of its necessity can be more readily and forcibly impressed upon the popular mind by an illustration of the possibilities of forest culture, when applied to our native woods, than by any other means. The need of further progress by artificial planting will speedily become obvious, and will follow in natural course.

It has been asserted, and with truth, that it is idle for us to establish schools of forestry, because there is no demand for foresters, and consequently no stimulus to the acquirement of a knowledge of the theory and practice of the art. It will be time enough to establish such schools, it is said, when we have evidence that there are people who desire to avail themselves of the advantages they offer, and that will not be till there is a demand for the services of those who have done so. This is true, so far as it goes, but the next consideration is, how to create the demand. There was no demand a few years ago for telegraph operators, and when I was a boy there was no demand for railroad employes, for there were no railroads. How was the demand created? By showing the importance of the results. Think of the time and labor expended by Morse and his associates before they could get permission

to demonstrate the value of the electric telegraph by a line from Washington to Baltimore. No general interest was felt in the scheme till its advantages were thus made manifest, because there was no *realizing conviction* of its truth. And to-day we are in a similar position in reference to the question of forestry. The impending danger of the diminishing supply of timber is acknowledged by all who are familiar with the subject, but there is no realizing sense of it in the popular mind, and there is a want of confidence in the practicability of any of the proposed measures of relief. The first and most important thing to do, therefore, is to stimulate popular interest by showing what *can* be done. To create a popular demand of any kind, it is essential first to demonstrate the value of its object. The men who are familiar with forest culture, know, as well as Morse knew the capability of the telegraph, that the wealth of the nation may be enormously increased by the proper development of the native woods already standing, but they can point to no evidence of the truth of their assertion, and the fact that it has not been done is regarded as proof of its impossibility. There is no such thing in the country as an illustrative example of what may be accomplished by timber culture, and very few of our citizens who visit Europe can appreciate the works which have there been achieved. They go abroad to study works of art, with the idea that we have nothing to learn in regard to natural productions, and the comparatively small number who grasp the conception of the grand possibilities of development which our forests offer to the exercise of such artificial culture as may there be seen, can do no more on their return than express their convictions and urge the importance of acting upon them. This they have done for many years past, but they have not succeeded in arousing such a popular conviction of the necessity as should enforce the action of their representatives to the point of making needful provision. The enormous and costly scale on which the work of planting new forests must be undertaken, in order to be effective, seems to throw a damper upon every effort to bring it to pass.

If every owner of a wood lot could be convinced that its value might be enormously increased by a process which, so far from demanding an outlay, would add to his annual income, it would not be long before farmers would consider it as derogatory to their reputation to leave the forests in the wild condition they now are, as they would to have a field of corn presenting a similar appearance of slovenliness. To produce such conviction the truth must be dem-

onstrated in actual practice, and the cost of such demonstration will be but a trifling price to pay for the returns it will bring. Let any state or city select a track of woodland at some easily accessible point, and put it under a proper course of management, as an experimental forest, and it would very soon excite an interest which could not fail to increase. A portion of it should be suffered to remain in its original, unimproved condition. Another part should be improved as "open park," for the best development of individual trees in their fullest natural capacity of dignity and grace, and a third portion should be devoted to the production of timber by the process of thinning, pruning and proper culture. The progress of development could then be seen and watched from year to year in all its stages, and the demonstration thus afforded would touch the interest of every owner of a wood lot. The process would soon begin to be imitated, a conviction of the value and importance of a knowledge of forestry would become established in the popular mind, and the demand for the services of those who had acquired it would lead to a demand for the means of acquirement, and thus the schools of forestry would be called into existence by the natural course of events.

The inauguration of such an experimental or illustrative forest as a means of exciting public interest is suerly an object that is well worthy the consideration of legislative and municipal bodies, or of corporations whose interests are connected with this form of national wealth. The cost would be insignificant in comparison with that of planting and maintaining new forests, and the spur of presonal interest would incite such general action as would add incalculably to the wealth of every State without further outlay than the cost of demonstration.

It is of course desirable that the experimental forest should be as conspicuous and easily accessible to the public as possible, for which reason the vicinity of a city would seem the most appropriate point. And municipal bodies would be justified in making a liberal appropriation for the promotion of such an object, since it would certainly constitute, for great numbers of people, one of the principal attractions of the city. The beneficial results which would follow, however, would add so largely to the substantial wealth and power of the State that its main support should be derived from legislative rather than municipal action.

It is not, however, my province to discuss the means of effecting the work, beyond this general suggestion.

I have aimed only to convey a conception of the rich resources

which nature has placed at our disposal, if we choose to avail ourselves of her offer.

I have made no statement in regard to forest growth which will not be recognized as true by all who are familiar with the subject, and all such persons will endorse my statement that, *practically*, the rules which govern the process are universally ignored.

I have pointed out what I conceive to be the readiest means of awakening public attention and creating such general interest as will insure reform and I leave to other hands the task of arranging the laws which must govern its execution.

The morning session of Thursday, March 9th, 1883, was devoted to Market Gardening, by J. S. Harris, of La Crescent, President of Minnesota State Horticultural Society, who spoke as follows :

LADIES AND GENTLEMEN :—When Professor Porter invited me to assist him in this course of lectures, I did not consent because I believed that I had any peculiar talent in that way, but because I have a great respect for farmers and farming, and because I desire to encourage everything that will add dignity to the calling and bring prosperity to those who follow it. Farming is the leading and essential business of about one half of the laboring population of this State, and is the basis of the wealth, power and prosperity of the American people. Whatever lessens its dignity or lowers its appreciation tends to demoralize the nation and just in the ratio in which this is done, do we retrograde and go back toward barbarism, just in proportion as we lend dignity to it so far do we advance national greatness. It was the original and divinely appointed calling of man. We read in Holy Writ that God planted a garden in Eden, and made it man's duty to keep and dress it. When driven from Eden, it was still his duty to till the soil, and "Earn his bread by the sweat of his brow." From that time down to the present, agriculture has been the basis of all progress, and on its prosperity hangs the hope of the race more than any other calling or industry, and without it no other calling or industry could exist for any length of time. If it does not provide means of salvation for the increasing population of the world, there could be no growth and progress, and now and ages since mankind would be a race of canibals or imbecile barbarians and few in number compared with the teeming millions who constitute the present population. Agriculture is the lever which moves the world, and forces the development of the arts and sciences. It is its strength that has tamed the elements and trained them to the use of man. She has made highways across the trackless seas and

linked ocean to ocean with chains of steel, and even the lightnings acknowledge her power and gracefully submit to do her bidding. Commerce and manufacturers are her children, and without her motherly care could not exist. The farmer is a man of knowledge and agriculture has been brought to its present honorable position by the intelligence and energy of those who pursue it as their chief occupation. We often hear it remarked that any man with sufficient muscle is good enough for a farmer, that such can dig and delve, and will enjoy it better than the refined and educated man, but it is the fact, that to enjoy it and prosper in it, a man must have brains and knowledge, and there is no calling so well fitted to give a man more profound knowledge or comprehensive education. Therefore the true farmer is a man of knowledge whether he knows it or not, and the time is at hand when he will be the most thoroughly educated of all men.

But my topic is "Market Gardening" or what is frequently termed Truck farming, and it ranks in importance not one whit behind those branches of farming which have been so ably presented and described in this course of lectures. It is a branch of agriculture that may be followed by the man of limited means, who could not successfully engage in stock breeding, dairying, wool growing or the raising of grain, while it also gives ample scope for the use of capital, and it is a system of husbandry that will cause the earth to afford more human food from a given quantity of soil than any other. I do not claim that it is more honorable, lucrative or important than other vocations, but that it is equally so and merits a little of our attention. It is a branch of business that is more particularly adapted to the vicinity of cities and large towns where the limited grounds attached to tenement houses, will not permit private gardening, and because many of its most valuable products are of so perishable a nature or so bulky in proportion to their commercial value that they would not pay the expense of distant transportation. Whoever contemplates engaging in the business should bear in mind that it is a laborious one and that it requires in the man who follows it skill and tact, and that education is no disadvantage although not an absolute necessity. Although laborious, the business is not so heavy as in some branches of farming but is constant, pleasant and healthful, and usually profitable.

As I have said before, a large capital is not an absolute necessity, here in the West where good arable land is comparatively cheap, but the man with a small money capital must start in a small way and enlarge and branch out as his means will permit, and a young

man starting in the business in this way will be fully as likely to make a fortune as the one who starts in other business with a capital, will be to save it, for the reason that he will at first be compelled to rely mainly upon his own labor, and practice rigid economy. The man who intends to engage in market gardening cannot use too much caution in selecting a locality. It should be within a convenient distance and of easy access to some thriving village or city that will afford a ready market for all that is produced. Peter Henderson says in his admirable work *Gardening for Profit*, "it is always better to pay a rent or interest of \$50 or even \$100 per acre on land one or two miles from market than to take the same quality of land 6 or 7 miles distant for nothing for the extra expense of teaming, procuring manure and of greater difficulty of attaining labor far more than counterbalances the difference in the rental of land." This, of course, has a more especial reference to the business in the vicinity of New York. In this State, except in the vicinity of St. Paul and Minneapolis, the purchase money of land suited to the purpose would not greatly exceed that sum, and ordinarily less manure is required, and teams are more cheaply fed, but the reasons will hold equally good here as there, aside from taking account of the extra time consumed in traveling to and from a greater distance. This, of course, applies only to those who raise bulky and perishable crops and do their own marketing. A market gardener who gives his attention chiefly to growing vegetables of a less bulky or perishable nature, and that will bear shipments to long distances may locate his garden anywhere, at a point convenient to a railroad station and depend upon making his sales to dealers, and do well, especially if he can grow a better quality or get them into market a little ahead of those who are located nearer by. Where land is as cheap as it is in this State, and so good an opportunity is afforded for making a selection, it will not be an object to use any that is not cheaply put into condition, or that is not the best adapted to the kind of crops it is designed to grow. Somewhat of a variety of soil is desirable, but if confined to one kind of soil in a garden for all purposes, I should choose a deep, rich, sandy loam—having a porous subsoil of sandy loam. A light, sandy soil with a sand or gravel subsoil, is almost useless for the growing of late crops, and especially onions, cabbage, cauliflower and celery, while a stiff clay loam, with clay or hardpan subsoil, could hardly be made to pay for growing salads, melons, cucumbers, radishes, tomatoes, etc., but this kind of soil, if deeply underdrained and well worked, will be the very best for late cab-

bage, cauliflower and celery. It is very bad policy to select land that has been worn out or run down by injudicious cropping and bad cultivation, or that is naturally of very poor quality, because the labor and expense of putting such land into good heart will be more than is required to take off two or three crops from the good soil. In selecting a garden site it is well to select one that is nearly level with just slope enough toward south or east to give good surface drainage. The reasons are that upon nearly level ground the plowing and fitting can be done more cheaply, and a large part of the cultivation may be done with a horse; and it will not gully in heavy rains, which would destroy and carry away much of the best soil. Southern slopes have advantages for growing early crops, but if any ways steep will require horizontal ditches to conduct water away and prevent washing, the expense of which will be very little less than erecting walls or tight board fences upon the north side. Under-draining is but little practiced in this state, but it would pay well wherever the subsoil is retentive of water. In this country the preparation of the soil is always done with a team and plow. In Europe garden soil is fitted by trenching. The operation consists in opening a ditch upon one side of the plat, about three feet wide and one foot deep, throwing the soil removed to one side. Manure and litter is spread in the ditch made and dug in as deeply as well can be. Then, on the next course of three feet deep, the soil is removed and placed in the first ditch, and the bottom of the ditch served the same as the last. This is continued until the whole plat is dug over, when the soil thrown out of the first ditch is carted over to fill the last. Unsightly rubbish, small brush and bones are frequently buried in the bottom, and land prepared in this manner is in good condition for all kinds of crops, and will be loose and friable for many years, but the process is a slow and laborious one, and in this country where labor is scarce and dear is not practical. In that country the spade is used much more than this in the place of the plow, but it is too slow a method for the American people, and unless very perfectly done is not in my judgment as good as plowing. My method of preparing soil for a garden in this State is with a strong team and plow. If the ground is in natural sod, it must first be broken, an operation that is familiar to you all. This is best done in June when all vegetation is in its most luxuriant growth, and the vegetation should all be turned under to facilitate the rotting and retain its fertility. The ground may lay without a crop the first summer, being harrowed once or twice to destroy weeds, or

a crop of beans or sod corn may be taken off, that will pay a part of the expense incurred, but the best plan would be to yard a flock of sheep upon it. If the breaking was well done and the season has been reasonably favorable the soil will be pretty well rotted by fall, and it should be dragged and plowed before winter sets in and somewhat deeper than it was broken. If manure is at hand it will be beneficial if turned under at this plowing; and if the land is not fertile it is highly important that it should be done. The next spring it will be ready for use, but there are some crops that might not pay the first year; probably the safest crop would be corn, potatoes, tomatoes, late cabbage, melons and cucumbers, giving another year's time before sowing fine seeds. For most garden crops ground will require liberal and frequent applications of fertilizers and you can hardly apply too much for asparagus, cabbage, cauliflower and celery. Stable or barnyard manure is considered the best and most natural fertilizer for all crops as containing the constituents that go to make up the cellular structure of plants and the gardener who has a liberal pile always at hand has deposits in a bank that never breaks or suspends payments. Where a sufficient quantity of barnyard manure cannot be procured, Peruvian guano is considered the best for general crops. In applying, it is sown over the surface after plowing at the rate 800 or 1000 pounds per acre and then thoroughly harrowed in, and the crop is to be put in at once. For cabbage and cauliflower it is said to be an excellent fertilizer either used in the hill or sown broadcast and harrowed in. Lime, ashes, salt and almost every waste material of the house has great value when applied to the land as the earliest vegetables of their kind always meet with the most ready sale and often at two or three times better prices. The thrifty gardener will resort to every means within his power to hasten forward his plants, that he may be the first in the market. The best devices for this purpose are manure, hot-beds, cold frames, forcing pits and green houses or other glass structures that enable the gardener to have under his control the heat and atmospheric conditions necessary to growth no matter what the state of the weather outside may be. The first cost of hot beds and cold frames being the least they are much more generally used than the others. The best material for hot beds is fresh manure and litter from the horse stables. It is all the better if it contains considerable of a proportion of grain straw or leaves from the forest, as these material will generate heat much longer than the fine manure or mixtures with hay, which is very commonly used for

bedding in this county. About three weeks or so before the time for making hot beds the manure designed for the purpose should be hauled out and placed in piles or ricks near where the beds are to be made. It will not do to leave it scattered about to become frozen or it will be too late in generating heat. After a few days when the heat begins to come up which may be known by the escape of steam from the pile, the whole mass should be forked over and mixed well together. As soon as fermentation again begins it is ready to lay up into beds. The beds may be built upon the surface of the ground, but in this climate it is economy to excavate pits a foot or more deep and one foot longer and wider than the frame, which is to cover it after completed. In building the bed the manure laid in level courses beating each course evenly down with the back of the fork until the whole is one and a half or two feet deep finishing off the top with the finest manure or earthy rakings from the bottom of the pile. When the manure bed is completed we place upon it a frame made of inch boards one foot deep in front and one and one-half at the back this should be put on with the lowest side facing the south to admit the more direct rays of the sun and the sash are put on immediately. As soon as the heat is up which is usually in two or three days, remove the sash and place within the frame about six inches deep, of good, but rather light garden mould and replace the sash again, after leveling off the surface with a rake, and removing sticks, stones, and other rubbish. Now, when this soil gets warmed through, it is ready to receive the seeds. These we sow in rows across the bed, about three inches apart. Cabbage, cauliflower and lettuce should not be mixed in promiscuously with tomatoes, egg plants, peppers, &c., as the latter require a greater degree of heat to bring them up, and will endure a degree that would be disastrous to the first. After hot beds are sowed they will require constant attention to give air when too warm, and whenever the sun shines out brightly, and water when needed. I have often seen the entire contents of the bed burned up in a short time, where the sun suddenly came out brightly on a stormy day, with no one at hand to give ventilation. Hot bed sash can be made by any ordinary carpenter, or they can easily be purchased in our larger towns, ready-painted and glazed. The most convenient size is $2\frac{1}{2}$ to 3 feet wide by 6 long. Cold frames are much the same as hot beds, except the manure is left out, and we depend upon the rays of the sun to impart heat and extra coverings and protection at night to retain it. Cold frames are very useful for growing cabbage plants, and for transplanting into from the hot beds for

hardening off. Both cold frames and hot beds are much better for being sheltered on the north side by buildings, walls or close board fence.

IMPLEMENTS.

The gardener should use the best implements that can be procured. The first cost may be a little more, but they will prove more durable, and will enable *him to do* his work better and more expeditiously. Within the last forty years inventors have brought out many improvents in these, and added to the list some that save considerable labor, so that the labor of planting a garden is more pleasant and the cultivating more expeditious than formerly. The implements that are nearly indispensable are a two-horse steel plow, an Ames' bright spade and shovel, flat tined spade fork, cast-steel rake, harrow, shuffle or push hoe, pronged hoe, or potato hook, cultivator and horse hoe, and drill-wheel hoe, or the two combined in one, of which *Allen's Planet Gem* are fully as good as any in use, wheel-barrow, manure fork, line and reel, watering pot, &c.; one each of plow, harrow, seed drills, cultivator, and more in numbers of the others according to the size of the garden and number of men employed. The total cost of the above, I think, will not exceed \$100.00. A good substantial market wagon is another of the requisites.

Seeds.—If there is any one thing that is of more importance than any other toward success, it seems to me that it is good, pure seeds. For this reason, were it practical, it would be better for every one to grow and save his own seed, or have it grown expressly for him; but no gardener, who grows a general variety of vegetables, can raise his own seed, and keep it pure, on account of the liability of varieties to mix. Another difficulty in the way is that only the earliest and best specimens should be saved, for producing seeds, and these are just what his customers want, and they will frequently bring him much more than the seed would be worth. Seeds had better, as a rule, be raised on larger farms more distant from the city, and where there is room to keep the varieties and species widely separate. Again some varieties quickly deteriorate on our soil and climate, and are much better and cheaply grown in Europe. Of many varieties Minnesota grown seeds will be found superior to any others. It is well known that grains and vegetables go through an acclimating process, after being introduced here for several years

increase in earliness and often in beauty of appearance and fine flavor. Especially is this the case with corn, lima beans and tomatoes. I would recommend any gardener to grow even a large proportion of his seeds, and in no case more than one variety of a family or species. This advice makes it necessary to purchase considerable of our seed, and the question that meets us is where is the best place to purchase. There are a number of reliable seed firms in the United States that grow everything that is best grown here and import the balance from the growers of Europe. If you have been dealing with any such firm for a number of years and find them always reliable, remember that it is not generally good policy to swap off an old friend for a new one. If you have no such place to secure your seeds, I would advise you to purchase the bulk of them at home. We have two seed houses in this State, and perhaps more that have already established a reputation for fair dealing and the superior quality of seeds and a considerable proportion of their seeds are not only produced in this State, but in the most careful and skillful manner, and unless you have good reasons to the contrary, I shall recommend you to give them your support. True they do not grow all the seeds they sell, and neither do the more Eastern firms. I think that as a rule it will be better not to divide your patronage, as the one you deal with will have better facilities than you, for securing the best. Never purchase any article for the reason that it can be had cheaper than in any other place. As a rule the price of good seed is nearly the same everywhere. Also, it is well to shun the commission seeds that are kept on sale at the grocery stores. Whoever attempts to raise his own seed should invariably select for the purpose the best grown specimens and purest type of the variety to prevent deterioration. The mixing of varieties takes place while the plant is in flower, the pollen from one being carried to another by the winds and insects. The comingling of the flower, and crossing process seldom affects the fruit or vegetable the same season, except where it is the true seed that is valuable as in the case of corn. It is well known sweet corn, fertilized by the field varieties, becomes tough and loses much of its sweetness. In all cases the effect is seen in the next crop, grown from the seed, and in no family of vegetables more than the cucurbitaceæ, which includes our cucumbers, melons, squashes, etc. There is scarcely a farmer present who has not planted melon seeds and grown mongrel pumpkins and squashes; still this crossing process is not without its advantages when skillfully managed, for by it some valuable hybrids have been and may be

originated, that by judicious selection and cultivation retain their types. The following is a list of the vegetables the market gardener is expected to be able to furnish to his customers, of which I will only mention such varieties of each as my experience has demonstrated to be the best for this climate. Asparagus—Conover's colossal. Beans—bush or dwarf; for shell beans, early China, red eye, white marrowfat, York snaps, early valentine, German black seeded wax, golden wax beans, pole or running, Seria or small Lima, large white Lima, Horticultural or speckled cranberry. Beets—Egyptian turnip, Dewing's improved blood turnip. Cabbage—early Jersey, Wakefield, early dwarf, flat Dutch, premium flat Dutch, green curled savoy, red Dutch for pickling. Carrots—early scarlet horn, half long red, improved Lanser's. Cauliflower—Henderson's early snowball, early dwarf Erfurt and Algiers. Celery—Sandringham, dwarf white celaric or turnip-rooted. Corn—Marblehead, early Minnesota, Harris Esveyson, Stowell's evergreen. Cucumbers—early Russian, improved white spine and green prolific pickling. Egg plant—improved New York purple, early green curled. *Kohl Rabi*—early white Vienna. Lettuce—early curled, Simpson, black seeded butter and Hanson. Musk melon—large netted nutmeg. Green citron—Hackensack and Bay View. Watermelon—Phinney's early, mountain sweet. Onion—extra early, red globe, white globe, yellow globe. Parsnips—sugar or hollow crown. Peas—Landreth's extra early, little gem, Laxton's alpine, champion of England. Pepper—sweet mountain or mammoth, long cayenne. Pumpkin—large cheese. Radish—early scarlet turnip, French breakfast, white olive shaped, scarlet China winter. Rhubarb—Linncœus or wine plant, salsify or vegetable oyster. One variety of spinach. Savoy leafed, new thick leafed. Squash—early bush scalloped for summer, Hubbard, Butman, Boston marrow for winter use. Tomato—Canada Victor, trophy, acme, paragon, and for trial Livingston's, perfection. Turnips—early flat Dutch, early red top, strap leaf, yellow globe or golden ball. Rutabaga, improved purple top, Laing's improved and a few herbs such as sage, summer savory, majorum and Thyme. Time will not permit me to give a description of each of these varieties, or a detailed description of the methods of cultivation and fitting for market. But they are all such as the gardener, who is located so convenient to market that he can go in every day, will find it profitable to grow, and that of the best quality and to get them into the market as early in the season as they can possibly be matured. The gardener distant from market may find

it more profitable to omit lettuce, sweet corn, summer squash, and a few others. I have purposely omitted potatoes, as I grow only the early, and am not able to discuss the merits of the many fine varieties recently introduced. For early I have found the Beauty of Hebron to be about the best. To grow vegetables to perfection requires constant attention in keeping the weeds out and the surface of the soil mellow and loose, and the appearance and condition in which they are placed on the market adds very much to their value and readiness of sale. All early vegetables that are usually bunched should be washed clean, surplus leaves removed, and be tied into uniform sized bundles and so much of the tops neatly cut off as will not mar the appearance of the bunch, as this prevents wilting. I will now give a more detailed account of my method of growing two or three of the more important varieties, by which time you will be weary enough to let me off with good grace.

I will first describe the making of an asparagus bed, as my friend Smith is present and can help me out or correct any errors I may make, and afterward follow with my method of growing tomatoes, if time will permit.

ASPARAGUS.

This is one of the most important crops that the market gardener has to do with. It is the earliest culinary vegetable that comes into the market; is wholesome and rapidly growing in favor; is very profitable, and ought to be produced in such quantities as will bring it within the reach of the laboring classes. It takes two years of cultivation to bring new or wild land into that state of cultivation that best fits it for this vegetable. As it is a plant that endures for many years, and will grow better with age, it will well pay for the best of treatment. The cheapest method that I know of for forming an asparagus bed is as early in the spring as the ground is dry enough to work to select a piece of dry, sandy loam, and with a one-horse plow, or cornmarker, draw furrows across it, four feet apart, and follow with a common plow, returning in the same furrow, repeatedly until a ditch a foot deep is opened, and the soil opened at least sixteen inches in the bottom of this ditch; spread three or four inches of well-soaked manure (that from stall fed cattle is the best); then place on this a little soil, and drop the roots, which should be two years old, about 18 inches apart. This seems a waste of ground

at the first; but the beds will endure longer, and produce a better quality of asparagus for it. The plants are to be covered by drawing 3 or 4 inches of soil over them with a hoe. This leaves the trench a little more than half filled, and the sprouts will soon come through; while if filled, some of the weakest plants will be smothered. Frequent hoeing must be given the first summer to encourage the strongest possible growth, and to keep down all weeds.

In the fall when first frost occurs the tops are to be cut away, and the ditches filled up level with the surface, and the whole ground covered with a liberal dressing of manure. The next spring the beds may receive a shallow plowing, being careful not to go deep enough to disturb the roots, and a few days level over with a harrow; and during this season the principal part of the cultivation can be done with a horse and cultivator. No cuttings ought to be made yet this year. In the fall remove the tops, and cover again with manure. The next spring rake out the coarsest of the litter and plow between the rows, throwing the furrows over the row, and rake it over to remove all lumps, sticks and stones. This leaves a shallow ditch between the rows. This season the bed will yield considerable of a crop of asparagus, and to keep it in good condition, it should be cut every day, and after every rain the surface should be gone over carefully to keep it loose and fine. The cutting should not be continued too late this season, lest the roots become weakened. When the cutting is stopped there should be a liberal dressing of manure applied between the rows and the ridges over the rows plowed down, and the whole bed be harrowed over fine and level, and all asparagus that comes up afterward is left to grow the balance of the season. It is beneficial to apply liberal dressing of salt after the cutting is finished and the bed laid away for the summer, and it is imperative that no weeds are allowed to impede the growth of the asparagus or impoverish the land. In the fall remove the tops as last year, cover with manure, and each year give the same treatment as we have described for the last, and the bed will continue to grow better for many years and be a paying investment for at least twenty years. About when to cut asparagus to have it the best there is a diversity of opinion. It should always be cut two or three inches or more beneath the surface of the ground, using a long knife for the purpose. If a crisp green article is demanded by your customers let it get about six inches above the surface before cutting, as at that stage of growth all below the surface of the ground will be tough and

stringy. If a pure white article is wanted it must be cut as soon as it breaks the ground, and be sure to cut at least six inches below to give a suitable length for bunching; and great care must be exercised not to break or injure the buds that are not yet through. After it is cut it is to be washed clean and put into bundles, tops even and all one way, neatly tied with two strings, the butts cut off square so that the bunches will be of uniform length, when it is ready for market. If it is not sold immediately it must be kept in a cool place, and never be watered to freshen it up, or it will quickly decay. If the market could be educated to it, it would be better without washing as it would thus keep much longer, and in fair weather cut at evening will not have much soil adhering.

GROWING TOMATOES.

This is an important and valuable crop if they can be well grown and got into the market early. For the earliest sow seeds in hotbed about the 15th of March. They will come up in from four to six days, and will need watching and watering and air on all pleasant days to prevent burning or damping. At the end of two weeks they will be in their second or rough leaf. My practice at this time is to have another hotbed ready, and to take up the young plants carefully and prick them out into it in rows three or four inches apart and an inch or so distant in the rows. This operation is best done at evening or on a cloudy day. Water immediately after setting and shade for a day or two when the sun shines. They will quickly get accustomed to their new quarters and will require plenty of air on all mild days. When they get about six inches high I take up and transplant again into cold frames, keeping them covered with sash nights and stormy days, where they are to remain until time for transferring to the open ground. In this frame they stand four to six inches distant each way and will be strong and stocky and can be taken up with spade or trowel, leaving most of the roots and a large ball of earth attached, and if carefully planted will receive no check in their growth.

For early tomatoes, I prefer a rather sandy loam not made too rich with manure. This is best plowed two weeks before the plants are to be planted out.

I never like to transplant them when the ground is wet or upon a rainy day, but do not object to a smart shower soon after the work is done. I have usually got the best results where the rows are $4\frac{1}{2}$ feet apart and the plants 3 feet in the row. If the ground

is dry make the hills with a spade or spade fork shoving it down full length lifting out the soil and inserting it back into the hole made; this leaves the surface moist and loose. The plants are now carefully dropped one at each hill and a man or boy follows taking the plant in his left-hand opens a hole in the fine soil with the right, setting the plant in considerable deeper than it stood in the bed and with a quick motion of the hands draws the earth about it and in the same motion presses it firmly with the knuckles. If the soil is not rather moist the planter goes back on the row pressing it about the plants with his feet, afterward drawing a little loose earth over the surface to serve as a mulch and prevent baking after showers. I prefer the evening for transplanting tomatoes (and all other plants) and whenever possible use rather large stocky transplanted plants, carefully taken from the beds with a trowel and with such plants never water no matter how dry the weather may be; but the plants should be thoroughly watered in the bed a few hours before taken out. I am aware that this method is not as expeditious as using smaller plants and sitting with a dibble but I have always found it much the cheapest in the end unless the weather should prove very favorable, as this vegetable is one of the gardener's most important crops and pays much better if ripened early.

The afternoon session of Thursday, March 9th, 1882, was also devoted to gardening when Mr. W. S. Hollister, Secretary of the State Horticultural Society, presented the following paper on Farmer's Gardens.

The farmer of the present as compared to him who tilled the soil a half century ago, surely occupies an enviable position.

Education has done the work; prejudice has been swept aside by her all powerful influence, and to-day, the American farmer, stands forth well toward the center of the arena of active life, a representative citizen.

The students of science and mechanical art, recognizing the fact that agriculture held the foremost place of all the industries of the world, have bent their best energies to further your interests.

Science does not trim her lamp in vain, and as a result of her labors, we find theory and practice reconciled; we find book "farmers" the most successful ones; we find refinement seeking a congenial home in rural places; we find farmers' sons and daughters no longer ashamed of their vocation; we find the farmer himself demanding the constitutional political privileges of citizenship, and asserting his commercial and social position. He has ceased

to believe that because his avocation gives him health, renders his arm strong, and his nerve steady, that his brain is therefore the less active, and is prone to do much of his own thinking, and much of the agricultural talking, that used to be delegated to lawyers and doctors and politicians; and as advancement must be the rule in the future, as in the past, we need not be much surprised, to hear that a farmer had delivered an agricultural address at an agricultural fair.

If I had been led to believe that the subject assigned me was one of the most important of this course, I would be very properly charged with an attempt to make an acre look as large as quarter section, because I treat of the circumscribed area of the former as compared with the broad domain you call a western farm.

The seeming unimportance of my subject gains strength when we stop to consider that of all the important interests, that go to make a system of mixed farming successful, not one of them can stand alone, but each one must have the help of others, and I must claim for the farm garden that it has a very important place among the helpful factors.

I shall not in demanding rights for the garden combat any farm product, any more than to wrest from the grasp of the Minnesota monarch, No. 1 hard, a single acre and help to properly cultivate it.

Men work that they may live. It is a principle of human nature as strong as the love of life to rebel against unrequited toil; and farmers as a general rule, hate the garden, because they think it does not pay.

Dollars and cents enter largely into all plans for farm operations as well as commercial, and the farmer is as apt as any one to drop a venture in which there is apparently no profit.

In planning for the year's work, he lays out his fields in tracts to be devoted to spring crops.

In estimating the cost of production of these crops the average farmer is very apt to count strictly every item of hired help, machinery, etc., but to entirely ignore the cost of living.

If he kept this last account as carefully as he did the first, he would find that it bore a very discouraging relation to his profit account, and very nearly equaled all the others.

This is fast becoming a world of luxury in food as in all things else, and the habit is fast getting foothold among the tillers of the soil.

If you do not grow and preserve for use the finer vegetables and fruits, you are compelled to purchase them. Maine, Massachusetts, California, and other equally distant or foreign sources of supply, annually send hundreds and thousands of tons of canned fruit and vegetables to our state, and it is reasonable to suppose that farmers purchase at least one-half the importation. Such being the fact, and with the guarantee that if you faithfully persist in a system of intelligent farm gardening, you can save all this expenditure, and consume a better class of goods, you need not be surprised at the temerity of your horticultural friends who come here to do battle for the garden.

To begin with the vegetable department, your garden must be rich in the elements of plant growth. If not naturally so, you must spread on fertilizers with a liberal hand. Do not be afraid of getting it too rich. All the garden crops do better, in proportion, as the soil is made rich, even beans, reputed to grow on land too thin for any other crop, will do better on land capable of producing one hundred bushels of corn per acre.

Barnyard manure is not only the cheapest, but the best for all purposes. Having once established the fertility of your garden it must be maintained by liberal annual dressing.

Select the location convenient to the house, with southern or eastern exposure if possible. The best form is a parallelogram 10x13 rods or longer as you may desire. So arrange, that nearly all the cultivation can be done by horse power, by which I mean, put everything in rows which should run north and south, for proper distribution between the open rows of light and heat.

Cabbages will grow just as well in a row a hundred feet long, as in a space ten feet square and the same is true of everything else.

Get out of the old rut that impels you to plant beets, onions and like growing sorts in little raised beds. Put them in rows the whole length or width of your garden, and give them the same liberal flat culture that you find best for corn and cabbages.

ASPARAGUS.

Procure an ounce of seed and sow it in a carefully prepared space a little out of the way, so it will not be plowed up the next spring. Hoe and keep clean from weeds for two years. Then prepare the ground for the permanent plantation by thoroughly enriching and deep plowing or spading. Set the two year old plants 18 to 24 inches apart each way. Plant the crown of the plant four inches

below the surface, cultivate and each fall fork in an inch or two of well rotted manure, and the mystery of asparagus growing becomes a simple success.

Once established, as it will be in fair grass from the seed, it will annually throw up its abundance of rich healthful food product through all your time and your children's children can go and eat from the original plantation.

BEANS.

There is not much mystery about growing this plebean. Plant as soon as all danger from frost is past, in rows thirty inches apart and a foot apart in the row. Cultivate thoroughly if you want a good crop. It is a popular notion, that they must not be cultivated or disturbed when the vines are wet. This is based on the fact that disturbance at that time produces a rust on the leaves which materially shortens the yield.

For garden use it is a matter of taste whether you choose the green or wax pod sorts. Of the former the early Mohawk is the best for use as snaps, as it is the most productive of them all, and remains longest in a green state. For green shelled the early China red eye is one of the best, being nearly white at this stage of its growth, large and plump. Of the wax beans you will not be disappointed if you plant either the Black or Golden Wax. The latter perhaps the least objectionable on account of color. Both are stringless and of fine mild flavor when used as pods.

The above are of the popular dwarf or bush varieties, best suited for farm gardening.

Of the pole sorts the Horticultural pole and large Lima are very popular on account of their excellent quality green shelled.

In this latitude they should be planted in rich, quick soil, in a warm sunny place, and when the vines reach the top of a six foot pole, should be pinched back to hasten the development of the pods that are just setting low down on the vines. By this means you can produce an abundant supply of this semi-tropical luxury in Minnesota.

The green pods of the first named sorts are successfully canned and dried for winter use.

BEETS.

In this vegetable we have one that may be had as required for use twelve months in a year in a perfectly fresh state, which makes it a very important adjunct to our gardens.

Seed may be sown just as early in the spring as the ground will work well. If sown a little too thickly, the young plants may be pulled or thinned out as required for greens, or as a substitute for spinach, though many would put it the other way, and grow spinach as a substitute for young beets. They are usually boiled tops and all, and are fit to use in this state until the beets get to be an inch in diameter, when the final thinning must be done, leaving the plants from eight to twelve inches apart in the rows, which should be 24 inches apart. For best results in both quantity and quality of crops cultivate well. When gathered in the fall those designed for winter use may be stored in the cellar, packed in dry sand or sawdust, where they will keep in a perfectly fresh and crisp state until spring.

If you wish a few for spring or early summer use bury them in the fall in a trench below the frost line, and when the pit is opened the first of May, they will be found as good if not better than when buried the fall before.

For first use of the young growing crop, plant the Egyptian; it is the earliest of them all, and of very fine delicate flavor when young, but grows woody as it matures, and is inferior for winter use.

For general crop plant equal quantities of Long Dark Blood and Dewing's Turnip.

Both are good table sorts, and excellent keepers. The advantage of this vegetable over many others is that if you have a surplus at any time of the year it can be profitably fed to cows, and as a general rule there is never too many bushels of beets on any farm as they are very valuable stock food.

CABBAGE.

Probably the most extensively and universally grown of anything on our list.

It requires the best of land and the most persistent cultivation. It will make a fair crop with the ordinary weekly hoeing of the garden, but, if you are after big specimens for exhibition at the

fair, see that the earth is stirred about it every day during its growing season.

As it is so universally grown, so is its culture generally understood.

For first early sorts some plan should be adopted to have the plants ready to set out in the ground as soon as it is fairly in working condition, either by growing them in boxes in the house, or in a hotbed. If grown in either place, too great importance cannot be attached to gradually hardening them by out door exposure, to enable them to stand the freezing they are sure to get if planted early, without injury. A plant directly from the hotbed or house, always having been kept warm, will be ruined by fifteen degrees of freezing, when if hardened by gradual exposure it would endure nearly twice that without injury.

The finest crop of early cabbage I ever grew was planted out in Southern Wisconsin the second week in March. After planting, a snow storm covered the plants, and the thermometer marked zero next morning. It gradually became warmer; the snow melted away from the plants, and all but about ten per cent. came out all right.

In hotbed planting it is a safe rule to plant the seed six weeks before you expect the ground will be ready to receive the plants; and this applies to hardy and tender plants alike, tomatoes being, perhaps, an exception, and may remain in hot bed 10 or 12 weeks.

For plants of winter, or late cabbage, plant the seed in the open ground in time to produce strong plants for planting out by the middle of June in this latitude.

To prevent the bursting open of the heads in the fall, pull as soon as grown, and invert in a dry place; or if the weather is moderately dry, they may be pulled and placed roots up where they grew until time to store for the winter.

As a general rule you can easily keep all you want for winter use, by hanging up by the roots in the cellar, or setting them on a shelf.

To keep through the winter for spring use is quite another thing.

The safest plan is to place them where they will freeze and remain frozen until the final thawing out in the spring. It matters little how you do this, if you bear in mind that the head must be kept inverted, to guard against the possibility of any water being retained in the leaves, and that it must freeze and thaw but once, and that when the frost is drawn, it must be while protected from exposure to the air.

I have kept them in perfect condition by setting them in a row, heads down, and covering with earth to the depth of eight inches.

For first early, plant Jersey Wakefield, or early York; for late, flat Dutch and Fottler's Brunswick. The latter is a second early, or medium late, and may be planted as late as the second week in July and make a good late crop.

CAULIFLOWER.

When well grown, is one of the finest vegetables that can grace a farmer's table, and is used very extensively, both cooked and pickled.

Same soil and treatment as you give the cabbage will answer for cauliflower. The only difficulty being in procuring seed of a strain that will produce good heading plants.

It is impatient of heat and dryness, and for this reason it is better for the farmer to grow the autumn heading or late sorts, planting them out at the time of planting winter cabbage.

To be successful, the plants must be got out so early as to mature before the summer drouth, or so late as to begin heading in the cool of September and October.

Of the early sorts, the snowball and extra early Erfurt are the best, and Lenormand's short stem the safest late to plant.

CARROT.

Questionable whether this vegetable has a place here; but as it is often cooked, or used in soups, it must have a little attention, especially as your horses will thank you for any surplus you may have on hand.

Plant very early in spring; thin to 8 inches, in rows 24 inches apart, and keep from insects.

Easily keep fresh through the winter by packing, or burying same as described for beets.

For table use the early Scarlet Horn is the best; while for stock purposes the honors are pretty evenly divided between Denver's half long and long orange.

CELERY.

Here we have a plant—a royal good one, too; healthful, easily grown; but farmers are so mystified by the pretended great skill re-

quired to grow it, that it is seldom attempted, and almost unknown on the farm table.

Sow the seed, out doors, in a carefully prepared seed bed, cover very lightly or not at all; a packing down of the bed, with the back of the spade after the seed is sown, being sufficient. Water liberally, and keep free from weeds. As soon as the plants are an inch or two high, I take them out of the seed bed, pinch off all the tops, and transplant right back, into the same bed, as thickly as can be done. This transplanting, causes a mass of fibrous roots to grow, so that when finally planted out, where they are to grow, they are better able to stand the dry weather, that usually occurs in Minnesota at the proper time for doing this work, which is from the middle to the last of July.

Select the richest part of your garden, lay out rows four feet apart, and set the plants as you would any other, about six inches apart in the row, cultivate thoroughly, but do not disturb while the plants are wet with dew or rain. When the plants are six or eight inches high, say the latter part of August, begin earthing up, by first holding the stems together with the hand, while earth is drawn around them, sufficient to keep them in an upright position. About once a week after this, throw more earth about the plants, gradually approaching the top, which you must reach by the time freezing weather sets in. This earthing is done to blanch, or whiten the stalks, and renders them tender and fit for table use. If you prefer, you need only earth up a few stalks for early fall and winter use, the majority of the crop may grow on without any earthing but the first handling, and be blanched in boxes in the cellar during winter as wanted.

Any box a foot wide, and of a depth equal to the height of the plants, answers for the cellar work. Take up the plants with the earth still adhering to the roots, and pack upright in the box, as closely as you can. Keep them at a temperature a little above freezing, and you can have celery fit for the table, until spring.

The dwarf growing sort, Sandringham, or American white solid, are always good and reliable.

CUCUMBERS.

So easily grown that no directions need be given. The striped bug seems about the only difficulty any one ever encountered in growing them. By watching the young plants, and daily dusting them with anything that will frighten the bugs away until

the plants have made their rough leaves, and the danger is over. For years I was in the habit of dusting the plants with gypsum, ashes, soot, or anything I could find recommended. I finally began gathering up handfuls of dry earth from about the plants, and throwing it quickly over them. The bugs would begin to run about, take wing, and were gone for the day.

For the last six years I have used no other application to rid cucumber and squash vines of the striped bug, but dry earth. As with all other remedies it must be persistently used, and no matter how expensive, or hugely advertised any remedy may be, you will always find that "eternal vigilance is the price of" cucumbers.

SWEET CORN.

King corn presents, in the table varieties, a very desirable garden crop. I shall only tell you the sort to plant. It is highly important that a succession be kept up from the time of the first roasting ears until frost

By planting the following varieties, on the same day, you will not be without food table corn a single day from first until frost. They are named in order of earliness:

Early Minnesota, Crosby's Early, Moore's Concord, and Stowell's or Burr's Evergreen.

The Black Mexican excels them all for quality, but its tendency to mix with all other sorts on the farm will keep it from becoming popular.

LETTUCE.

Always esteemed as an early spring salad, and easily grown, but there is a great difference in the quality of that properly and improperly grown. Give it the best of soil, sow the seeds thinly so that you will not have the plants closer than six inches, hoe carefully to stimulate rapid growth, and you will be surprised at the results, as compared with the self-same crowded, uncultivated product.

Of all the sorts, I consider the Crisle Simpson white-seeded the best for ordinary culture.

ONIONS.

The only secret about growing them successfully from seed is to have a very rich and rather light soil, and plant just as early as you can possibly work it.

Weeds must be kept down, and the culture must be done shallow, that is the soil must not be stirred deeper than half an inch, if possible. All the fining, pulverising, or mellowing the soil must be done before planting.

For first early, it is best to preserve a few quarts of top or bottom sets, planting them out as easily as possible. It is a difficult crop to preserve in any great quantity in the cellar.

A bushel or two, laid thinly on a shelf, and scattered over a pile of potatoes, will keep fairly well; but as soon as you attempt to bin or level them in a warm cellar, they soon assert their strength, permeate the whole house, and rot before spring.

A number of years ago, having a large lot on hand, selected for seed stock, and having no proper storage room for them, I took the advice of the books, and let them freeze up solid and remain so until spring. They came out all right; and I have pursued this plan ever since. A year ago last fall the manager of the State Reform School farm had above 300 bushels of onions on hand that he wished to keep for seed stock. I advised him to pile them in long, winrows, and cover with about four inches of earth; and he finally, with much misgiving, placed two hundred bushels in this manner; and remarking that he would save a hundred bushels anyway, he put them in his well-constructed root cellar.

You all know what the winter of '80 and '81 was; long, steady cold, with the thermometer down among the thirties for days. The result was that the two hundred bushels frozen came out all sound in the spring, while of the hundred bushels kept in the root house not twenty bushels were fit to plant out in the spring.

Some of the best authorities in our country in their published writings tell us that the onion will not stand thirty degrees of freezing, without positive injury. The case just quoted as positively proves the contrary. The only care to be taken in subjecting onions to very severe freezing is, that they be *not* allowed to thaw but once, and that without removal, and still covered with earth, and at the final thawing out in the spring. Onion setts, so difficult to keep in good condition in any quantity during the winter, may be safely treated in the same manner.

PARSNIPS.

Better plant a few rows of Hollow crowned parsnips. They are fit for use as soon as grown in the fall.

A few may be dug, repacked in sand in the cellar for winter use, and the remainder left out of doors where they grew to be eagerly sought for and dug as soon as the frost is out in the spring.

Salsify is of similar habit and power of enduring cold, and may be used, stored and dug in the spring, for spring use, same as the parsnip.

It is a delicious, very wholesome diet, and very popular with many.

In preparing it for the table, cut in short pieces, and treat same as green peas.

When once you begin using it, you will probably continue.

The only danger in leaving those sorts out during winter arises from their being planted where water will stand, or being so located as to freeze and thaw several times during the winter.

In either condition, the roots rot in the ground.

PEAS.

Not one half are usually grown on the farm as they should be, of the simplest culture and the easiest growth.

Of these you want a succession also, and if you do not wish to be bothered with planting the same sorts, at different times, you may keep up the desired succession, by proper selection of early and late sorts.

For this I would recommend, four sorts, as follows: Philadelphia Extra Early, Little Gem, Yorkshire Hero, and Champion of England.

With this selection, planted at the same time, there will hardly be a break in the supply, from the time the first Philadelphias are ready, until the last of the Champions, which will take you through about all the length of season you can expect green peas in this latitude.

RADISHES.

Always popular in their season, if well grown, but oftener unfit for the table, because of the soil in which planted. It is a common mistake to lay all failure to produce crisp, tender roots to the seed

planted. But little radish seed that will grow at all, is sold, but will produce the finest results under proper culture.

You have only to be sure the seed is sown in very rich, light, warm or quick soil, to be as equally sure of the very best product.

SPINACH.

As easily grown as beets, and a very fine green, healthful, and relished by nearly every one. A half pound of seed—costing twenty cents—sown at intervals from early spring, until you tire of it, will supply a large family.

SQUASH.

Productive, in a large degree, of excellent, nutritious food for man and beast, you need not fear an overstock of this vegetable. As it is tropical in its nature, nothing is gained by very early planting, as they will absolutely refuse to make any headway, until the ground is warmed by the sun of summer.

I have grown as good crops of Hubbards, planted the first week in June, as I ever did by early planting. They are strong feeders, requiring the best of soil, and liberal culture, until the vines begin to run, when they should be let alone until harvesting time.

In gathering—for winter storage—handle carefully, so as not to bruise them, let them lie in piles in an open shed, to cure, until danger of freezing, when they should be placed on shelves, in a cool corner of the cellar.

The Hubbard still holds the first place—as a winter keeper—and its quality is unexcelled.

For earlier fall use, or early winter, you may prefer the Boston marrow, a soft shelled variety, of good quality, very productive, and excellent for stock.

TOMATO.

With this, perhaps the most valuable of all our list, I will close this dry detail. The plants should be started early, so as to be big and strong by planting-out time, about the middle of May.

The amateur, may, by pruning, and training, accomplish wonderful results, with this vegetable. A friend of mine in St. Paul, from half a dozen plants, trained against the south side of a six

foot board fence, managed to cover the entire fence with fruit bearing vines, that supplied an abundance through the season.

One of the most interesting experiments I ever made in tomato-culture, was to train a hundred plants to four foot stakes. The plants were pruned to a single stem, which was tied to the stake as it advanced in growth, and pinched back as often as it got beyond the top of the stake.

The fruit grew in great clusters, every one perfect in form and color. It was a beautiful sight, and I think the crop fully equalled in quality that where a dozen vines were allowed to spread over the ground from one plant, and the fruit was certainly finer.

In all management of this plant, it pays to devise some means to keep the vines up a little from the ground.

Preservation of the different vegetables for use beyond their season, is an important item. Beets, in the manner described may be kept in a fresh state as long as wanted.

Cabbages may be had — fresh — for eight months of the year, and we will try and get along with Sauer Kraut the balance of the time.

Celery must be kept in a natural state, as it is not possible to preserve it in any other way.

Carrots are used only in the natural state.

Cauliflower cannot be kept fresh — for any length of time — and is usually pickled for preservation.

Sweet corn, may be both dried and canned; and in either condition preserves its natural flavor excellently.

Cucumbers are only used green or pickled.

Onions may be had fresh the year around.

Peas — fresh and canned — as the secret of canning these things successfully is fast finding way into farmers' kitchens.

Squashes, may be dried, either after cooking, or sliced, in the good old New England way of treating pumpkins, and an excellent material for pies.

Tomatoes, both canned and dried, already enter largely into the winter store of farm housewives.

Currants, raspberries, and strawberries, all — canned and dried — may readily take the place of all other dried fruits on a farm table.

Having discussed soil, and varieties, it will not be out of place to talk about the seeds you plant. It is a lamentable fact, though much to the profit of the seedmen, that farmers are too careless of

selecting and saving seeds. Once engaged in this work, it not only becomes profitable but of the deepest interest.

The mysteries of fertilization and hybridization of plants, by which different sorts of the same species are mixed, and new, and better or worse varieties the result, forms one of the most interesting studies of vegetable life.

From this fact, we derive discouragement to the farmer, who attempts to grow seed from his own planting, because of the small area of the garden, and the difficulty in maintaining the requisite isolation of different sorts, to insure purity of seed.

He must plant more than one sort of sweet corn, in order to keep up a succession of product, fit for table use.

The early Minnesota, growing upon one side of his garden, the Black Mexican upon the other.

During the season, he selects a few of the best hills of Early Minnesota, to reserve for seed, and selects carefully — as he ought — the most perfect ears for next season's planting.

The following summer our gardner is disgusted to find that he is growing a mongrel corn, the white ears of the early Minnesota being spotted with the Black Mexican.

He did not think, that the almost impalpable dust that the wind took from the top or tassel of the black corn, and wafted across the garden and fell upon the silk of his pet early Minnesota, would work this change, but he learns it by experience.

Every grain upon an ear of maize, is supposed to be in communication with one of the thread like silks, that force their way — in a bundle — through the husk at the end of the ear.

Destroy that silk, or cover it with oiled paper, before it has any possible chance to be fertilized by the pollen from the top of the stalk, and the cob will be barren of grains.

The same principle then, that fertilizes the ear, and enables nature to produce the grain, will be found at work "mixing the children up."

We may be particularly impressed with the value of the Hubbard squash, and allow none other on our grounds. A neighbor half a mile away will grow nothing but the Boston marrow.

You do not let this little whim of his worry you, but proceed to select your perfect type of Hubbard squash, to furnish seed for the next season.

When the product is grown, you cannot account for the yellow streaks on green Hubbards, or for their inferior quality.

It happened in this way. Some enterprising bumblebee was out foraging one day when your squash vines were in bloom.

He stopped at your neighbor's, dipped down into the Boston Marrow blossoms, and covered himself with their pollen. On his way home he passes over your grounds, thinks he has hardly load enough, and tumbles down into the very bloom, that produces your pet seed Hubbard squash.

The mischief is done, the bee not only takes from this bloom, but leaves a little of the yellow powder on the pistils of the flower, fertilization is complete, and a hybrid the result.

Such results as these, while provoking in such cases, are often of great value, in producing new and superior sorts. All our new varieties of corn, peas, melons, squashes, tomatoes, &c., are produced in this way, and many of them are better than the original varieties.

I do not wish to discourage the careful selection and sowing of seeds.

You may begin with the meanest specimen of field corn you ever grew, and by fixing your mind on a type you wish to produce, and selecting seed persistently that approaches that type, you can in a very few years produce a pedigree corn, so firmly established as a variety, that like will produce like, and you have a new sort, entirely unlike the parent.

The same is true of all the vegetables from which you can save seed. Take the tomato as an example. By selecting the first ripening fruit, and that of the most perfect form, you can have seed for your own planting, better than you can purchase of any seedsman.

Get your boys interested in this work of improving old sorts, and producing new ones, and you have done much towards making them satisfied that farm life is the best condition of man in the world.

As soon as a man or boy becomes interested in the mysteries of Nature, begins to study her wonderful plans and resources, he becomes morally better.

Learn your boys all you can of these things.

Call their attention to facts, that set them to thinking. Illustrate by familiar surroundings.

An oak tree, spreading its top over a circumference of thirty or fifty feet, bears all the rain or dewfall far away from its trunk, and and at first you think that tree would suffer greatly for water. When you stop to think, you are reminded that the great gnarled

roots near the trunk have no capacity to drink in the water, but away around the line, just where the foliage sheds the water, are thousands of little rootlets, ready and capable of drawing life from the water, and sending it coursing up the trunk, through millions of cells, reaching the topmost leaf.

The tropical sunflower, thriving best with a limited supply of water, has its roots all in a close bunch, and the leaves are so arranged that the water from rain and dew is carried far from the reach of the rootlets.

The cabbage — with much the same habit of root but requiring much moisture — has its leaves so arranged that every drop of water that falls upon the leaves is carried toward the center of the plant and deposited right at the roots.

To return to the farm garden proper it is not complete with vegetables alone.

You must have grapes, raspberries, currants, and strawberries in abundance. There is no place in the Northwest, where wheat will grow that you cannot grow the small fruits easily and cheaply.

In the absence of apples, pears and peaches there is the greater incentive to grow the small fruits. These have all been or will be discussed at this meeting, under their proper heads. In our garden talk, if we succeed in interesting the farmers in the work, enough has been accomplished; their intelligence seconded by numberless papers and books will take care of all the details.

We of the farm do not appreciate our condition.

To grow grains, vegetables, fruits and flowers, is to occupy the only perfectly independent position in the world. Your time is your own, and you call no man master.

You are envied for this by the dweller in the city; and your table is eagerly sought, because the things there smack of mother earth, and your surroundings are those of Nature.

No one but the grower, or his guests, knows of the dewy freshness of fruits and vegetables right from his garden.

That is a part of the reward for labor, and there is not only satisfaction in it, but health and life.

If any man should secure the fullest extent of reward for labor, it is the tiller of the soil, and if any man does secure such reward it is the cultivator who makes the best use of soil, and climatic conditions that go to make up his surroundings.

Nature, in the indulgent kindness of her good heart, showering her choicest gifts upon the man who appreciates her enough to

intelligently and industriously second her magnificent efforts to make this a world of plenty.

The Farmers' lecture course Friday, the closing day of the season, was occupied mainly with matters relating to fruit and fruit culture, though a digression was made to include the birds of Minnesota. The attendance was fully up to the average. The first paper of the day was by George P. Peffer, vice-president of the Wisconsin State Horticultural Society on

FRUIT CULTURE OF THE NORTHWEST.

The speaker pleasantly reviewed the history of fruit growing in Wisconsin in the early days, and then said: Where the summer temperature is ninety or ninety-six degrees, and that of winter forty to sixty degrees below zero, fruit culture has to be learned or made a study of if it succeeds. Fruit cannot be raised on a southern exposure, as it will be too hot, the foliage will burn, and rust, mildew and blight will ensue. It cannot be raised in low places or ravines as the cold settles there, and the soil is too rich for trees. All fruits grow best on high clay or limestone soils, naturally underdrained sloping to the east or northeast. The cultivation should not stimulate overgrowth. Fruits that can be protected in winter such as berries, currants, grapes, &c., are safe to plant, as are also trees which have proved hardy in similar localities. Such are trees of the Siberian crab, and of the Astrachanica families, or hybrids from either; the last named are the ones that Minnesota and adjoining states will yet have to look to for their supply of apples. These hybrids are acclimated by reproducing from seed, and every generation can be grown a degree further north, and get used to its climate. The seeds should be raised as far north as possible, wherever, there is a good and loose subsoil. The main root is a very long one, and the fibrous roots near the surface but few, hence where ground freezes from two to four feet deep,

A LOOSE, GOOD SUBSOIL

is necessary to promote the deep growth of the tap root below frost where it can gather moisture through the winter. To raise a tree from the seed, prepare the ground thoroughly early in the spring, and cover the seed half or three-quarters of an inch deep. The root or sprout starts first, and is supported by the starch in

the dormant leaves that shield the bud until it sends out firm, fibrous rootlets, and a supply of earth food is obtained to feed the plantlet until its leafage is sufficiently expanded to enable it to draw on the atmosphere for support. The plant is at this time but a single bud, and all its energy is given to the formation of its first leaves. As soon as their leaves are opened a new bud appears in their axil and another extension is provided for; and so on to the end of the season. Some of these buds may be removed, and if placed under favorable circumstances will grow and make a new tree the same as the seedling tree itself. The individual life principle resides in each bud. Here then in a tree we have a community made up of as many individuals as there are buds, and supplied with an immense apparatus for absorption in common by which earth food is taken up; the whole to be digested in the innumerable cells of the inner bark.

THE STRUCTURE IS IN OUR HANDS

to be treated intelligently. In order that it may withstand the hot sun in a southern exposure, it must be protected by the growth of the limbs, which should be near the ground. To accomplish this, pinch back the leader thus throwing more sap into the side branches. Keep the head well balanced by pinching back the side limbs if necessary. If one branch gets much the start of another it is very apt to absorb so much of the sap as to practically starve the shorter one. This must be guarded against. Trees from a nursery can hardly be as hardy as trees raised from seed, for they receive a check in the removal, and the body will suffer more or less, sometimes to the extent of entirely losing vitality and dying. Let the young tree have as many branches and leaves as it will, for the tendency to fire blight will be thus partly avoided. Fire blight is caused by an over supply of sap when the weather is very hot, and unless there are plenty of leaves to aid in its digestion, fermentation sets in and then decay follows.

The hybrids from the Siberian and Russian crabs have an unusually thick leaf and are not so liable to blight as some other varieties, and they will probably prove to be the

DESIRED HARDY APPLE OF THE NORTHWEST.

One great trouble encountered in raising seed, especially in mixed orchards, is the extreme liability of any variety to be fertilized

by another, making it well nigh impossible to tell what kind of fruit the seed saved will raise. It may even happen that no two seeds from the same fruit will bear fruit alike; apples and hybrid crabs have often come from the seeds of the same apple. To raise trees of a hardy and constant variety, foreign pollen must be guarded against. This is done by enclosing the flower in a paper bag or glass jar or anything else which will not interfere with its fertilizing itself with its own pollen. In this way the same variety may be propagated generation after generation. To cross breed or hybridize remove the pollen by hand before the flowers open, and then enclose the flower, in a sack or jar until the foreign pollen that is to be used for fertilizing is ripe; then cut off a spur of the perfect flowers and place it in the jar with the flowers first operated upon, and shake the tree enough to cause the pollen to fall; leave the jar on the flowers until they wilt. Then there is nothing more to do except to label the new variety.

THE FRUIT FROM CROSS-BRED SEEDS

will resemble the male parent most closely, but the growth and hardiness of the tree will be more like the female parent. The male gives quality, texture, and somewhat of size to the new seedling fruit, the female gives the form and very often the color. By bearing these facts in mind, almost any one can raise fruit according to his taste, and with perfect success. If a peculiar quality of fruit is desired, use crabs for the female parent and pollen from almost any of the hardiest apple blossoms, such as the Wealthy or Walbridge. By following these directions, Minnesota farmers can soon have the finest varieties of hardy apples in quantities sufficient for home use and for shipment to foreign markets.

Following Mr. Peffer's paper, E. E. Harris, of Sheldon, read a paper on

"The Birds of Minnesota."

This beautiful land of "laughing waters and golden sheaves" would be monotonous indeed were it not for the companionship of its sweet feathered songsters, which, though lacking somewhat in the dazzling brilliancy of plumage possessed by those of a more sunny clime, are nowhere excelled in sweetness of voice and sprightliness of manners. Our forests, fields and groves are at no

season of the year entirely destitute of the presence of these winged citizens of the air. But few species seem fitted by nature to adapt themselves to all the climatic variations of our northern home. Therefore most of the summer residents do not remain to share with us the inhospitalities of our rigorous winters. As soon as the chilling frosts have robbed the foliage of its verdure, numerous visitors come to enliven the dreary woods, and in a measure, cheer the weary days of the reign of desolation.

That birds are a blessing and benefit to the agriculturist, no one will dispute. The *Creator*, who has made nothing in vain, seems to have given them, in their relations to the human race, a double duty to perform: to cheer our hearts when we are sad, to stimulate us to renewed exertions when discouraged, and to destroy and keep within bounds the many hundreds of different varieties of destructive insects, which infest the land. Insects are, as a general rule, very prolific, a single individual being known to lay several thousand eggs during its brief life of but a few days. What then would be the result if each of these eggs was allowed to go through its various transformations and become a perfect representative of its species and in turn reproduce at this astonishing rate? Is it not safe to affirm that if allowed unrestrained liberty in procreation these seemingly worthless creatures would soon increase to such prodigious numbers as to defy the husbandman in his efforts to cultivate the soil and gain a livelihood by the noblest and most independent of all vocations, agriculture?

To whom are we indebted for the prevention of the unlimited increase of those noxious vermin? No doubt there are several causes which tend to keep them within reasonable limits, chief among which is the birds. In my opinion if all the birds were taken from the earth and the insects allowed full sway, in a short time all vegetation would be destroyed, and consequently animal life would become extinct, and this beautiful world would be transformed from a paradise of surpassing loveliness into a gloomy and uninhabited desert.

Who can tell then, to what extent we are indebted to the birds for their indispensable services? But leaving out the vast amount of good they do the agriculturist, in ridding the earth of injurious insects, do they not more than repay him for the small percentage of his productions which they appropriate, by their sweet companionship? Whose heart has not been touched, whose life has not been made better by listening to the tender and elevating strains of the sweet songster as he sits upon his lofty perch pouring out

the gratitude of his sinless heart in a profusion of song, and causing the hills and valleys to reverberate with the sound of his joyful melody.

THE RAPTORES, OR BIRDS OF PREY.

The most prominent characteristics of this order are a stout compact form, long powerful wings, and strong sharp claws. They feed upon birds, small animals, snakes, etc., and some of the smaller varieties destroy great quantities of beetles.

THE RED-TAILED OR HEN HAWK.

is one of the most common of our rapacious birds. Who has not seen his familiar form circling through the air, eagerly scanning the earth for some helpless victim, and uttering at frequent intervals his disagreeable cry which might be translated, "Woe unto the helpless bird that falls into my merciless clutches."

The Red-tailed Hawk is very destructive to poultry and game, and fully merits the dislike with which he is looked upon by all. At the sound of his discordant voice the hens scatter and run for cover, the nimble hare seeks his hole, and all nature seems to look upon his coming with disapprobation. The nest of this bird is generally placed in the top of a lofty tree, and is composed of large sticks and brush. The eggs which are usually three in number are of a dull white color, with numerous spots of light brown, and as large as a good sized hen's egg. The young may be easily reared from the nest if taken when nearly ready to fly, but do not make desirable pets.

THE SPARROW HAWK

the handsomest representative of his family is frequently met with.

The following description of the habits of this interesting little fellow, is taken from Wilson, "The habits and manners of this bird are well known. It flies rather irregularly, occasionally suspending itself in the air, hovering over a particular spot for a minute or two, and then shooting off in another direction. It perches on the top of a dead tree or pole, in the middle of a field or meadow, and as it alights shuts its long wings so suddenly that they seem instantly to disappear, it sits here in an almost perpendicular position, sometimes for an hour at a time, frequently jerk-

ing its tail, and reconnoitering the ground below, in every direction for mice, lizzards, etc.

It approaches the farmhouse, particularly in the morning, skulking about the barnyard for mice or young chickens. It frequently plunges into a thicket after small birds, as if by random, but always with a particular and generally fatal aim."

The nest of the Sparrow-Hawk is usually in a hollow tree, and sometimes a deserted Wood-pecker's hole is made use of. Several other varieties of Hawks are found in the State, the Cooper Sharpshinned and Pigeon-Hawks are common.

THE FAMILY STRIGIDÆ, OR OWLS,

is well represented in our State. Body short and heavy, head very large and in some species furnished with erectile tufts of feathers. These tufts or egrettes are by some erroneously supposed to be their ears, which are simply holes in the head concealed by the feathers. Eyes very large and placed far in front, best fitted for seeing in the dark or twilight. Feathers very dense and extending to the toes.

THE GREAT HORNED OWL

is one of the largest and best known of this interesting family. He is a great lover of poultry, and his strong noiseless flight enables him to pounce upon the unsuspecting fowl and bear it to his lofty nest with perfect ease. I once took a pair of young ones from a nest and kept them two or three years. They make interesting pets. When food is placed in their cage they instantly pounce upon it, and standing on it with both feet tear off large pieces with the bill which they force down their throats, at the same time making the most hideous faces imaginable. I have seen one swallow a good sized rat without tearing it in pieces. They have a peculiar habit of rolling their eyes and snapping their bills when approached by a stranger.

The nest from which I obtained these two was built the preceding season by a pair of Red-tailed Hawks, which proves that this bird sometimes makes use of an abandoned nest, but it does not always do so. The eggs are usually three or four in number, of a yellowish white color, nearly round and about two by two and one-fourth inches in size.

THE SNOWY OWL

frequently visits us in the fall and winter but does breed in the State, its home being in the desolate North. Hence the habits of this handsome bird are not so familiar to us as the other varieties mentioned.

THE BARRED OWL

is quite plenty. He is probably the most uncouth representative of the family. His form is awkward, plumage dull, and eyes dark and expressionless, but better fitted for seeing in daylight than those of the other varieties. Hence he is often met flying about in the woods in the daytime.

THE BEAUTIFUL LITTLE MOTTLED OWL

is quite frequently met with. He is quite familiar and is generally found near the farm house or orchard. They feed upon birds and mice, rejecting feathers and bones, they also consume great numbers of beetles and nocturnal moths. The notes of this owl resemble the whine of a dog, uttered in a tremulous, doleful voice. The nest is a hollow tree, in which the young remain until able to shift for themselves. The diminutive Saw-whet Owl is less common in our locality than any of the above mentioned varieties. He is strictly nocturnal in habits, and though extremely active, is so stupid in daylight as to be often caught with the hand; although considerable caution is necessary to do this, as he is a little like the Irishman's flea, "when you put your finger on him he an't there."

The Picidæ or Wood-peckers are particularly beneficial to the horticulturist on account of the vast number of hurtful insects which they destroy.

The different varieties closely resemble each other in form and habits.

The Pileated Wood-pecker is the largest variety found in the State, and is quite scarce in most localities. His great strength and enormous bill enable this bird to chisel into the decaying trees, in search of food with astonishing ease and rapidity. Every tree near his habitation bears the marks of his untiring zeal in hunting out the hurtful borers found beneath the surface, which form the principal part of his diet.

The Golden-winged Wood-pecker is widely and plentifully distributed throughout the State. The following sketch is from Audubon.

"Their note is merriment itself, as it imitates a prolonged and jovial laugh, heard at a considerable distance. Several males pursue a female, reach her, and, to prove the force and truth of their love, bow their heads spread their tails, and move sidewise, backwards and forwards, performing such antics as might induce anyone witnessing them, if not of a most morose temper, to join his laugh to theirs. The female flies to another tree, where she is closely followed by one, two, or even half a dozen of these gay suitors, and where again the same ceremonies are gone through. No fightings occur, no jealousies seem to exist among these beaux, until a marked preference is shown to some individual, when the rejected proceed in search of another female.

In this manner, all the Golden-winged Wood-peckers are soon happily mated. Each pair immediately proceed to excavate the trunk of a tree, and finish a hole in it sufficient to contain themselves and their young. They both work with great energy and apparent pleasure. Should the male, for instance, be employed, the female is close to him, and congratulates him on the removal of every chip which his bill sends through the air. While he rests he appears to be speaking to her on the most tender subjects. In this manner, by alternate exertions of each, the hole is dug and finished.

The Red-headed Wood-pecker is quite common, but is not so well liked as the other varieties on account of his fondness for fruit. But let us not judge too severely of him, if he occasionally helps himself to a few of our choicest apples without saying "if you please," for has he not labored persistently to rid our trees of noxious vermin? Is it not right then that he should come in for a small share of the dainties which he has helped to produce? Let us rather thank him for his assistance in overcoming the many difficulties which nature seems to have put in the way of successful fruit culture in this latitude.

THE GAME BIRDS OF MINNESOTA,

though formerly very numerous, are yearly getting scarce. The Hawks, Owls, Wild Cats and Foxes, wage their unceasing warfare, and are amply assisted by the hunters, who are getting more numerous than the game.

THE PARTRIDGE,

too well known to need any description, is one of the finest flavored of our game birds. The peculiar drumming sound, produced by beating with the wings upon his body or a log is familiar. The nest of this bird is of a rather loose construction, consisting of a few leaves and twigs, placed upon the ground in some secluded spot, where the female lays from six to one dozen eggs, of a yellowish white color. The young, like those of the domestic fowls, are able to run about almost as soon as they leave the egg. They also have the happy faculty of concealing themselves in the leaves or grass on the near approach of an intruder. The food of the partridge, like all the gallinaceous birds, consists of seeds, small fruit and insects.

In severe weather this bird is known to pass the night under the snow, which affords a warm protection from chilling winds and biting frost.

The quail is still found in some localities, but its numerous enemies and severe winters have so greatly reduced their numbers, that in places where a few years ago the familiar "Bob White" was often heard, it is now unknown.

PRAIRIE CHICKENS

still abound in vast numbers in the interior and western parts of the State, but so persistently does the hunter pursue his so-called sport, that this interesting bird will soon like the poor Indian "read its doom in the setting sun."

When the sultry heat of summer gives place to the cool and invigorating autumn, the ducks, geese and brants congregate in the ponds and lakes in immense numbers, and but a few days in the rear comes the indefatigable "Nimrod," who has recovered from the effects of his "chicken shoot" and begins to feel the need of more sport. He comes loaded down with ammunition, whips and whistles, and accompanied by his faithful dog. He slowly wends his way to the shore of some secluded lake, poising upon his shoulder the characteristic "pistol-gripped, rebounding-locked, choke-bored, center-fire, laminated-barreled, breech-loader, and choosing the most favorable position, this model of patience and cruelty awaits the coming sport. Should he have chosen a good locality he will not have long to wait. The favorite Mallard is there, his beautiful green neck surrounded with its snow-white collar, and is easily identified as the original of our domestic Mallard. An-

other very handsome bird, with a black and white top-knot, we recognize as the Hooded Merganser.

The Shovelers or Spoon-bills are particularly noticeable on account of their enormous mandibles. The beautiful Golden-eye or Whistle-wing is often seen, but his rapid flight and shyness makes this interesting bird difficult to shoot. Blue and Green-winged Teal are plenty. The Canvas-back, Butter-ball, Scamp-Widgeon, etc., are frequently met with. But by far the handsomest and most interesting of our ducks is the Wood or Summer Duck. This variety is easily domesticated and breeds in confinement.

The Robin is very common and plentifully distributed throughout the United States. His habits are pretty well known, on account of his familiarity with man. The nest is generally built near a house, often in the garden or orchard. The Robin though very unpopular with some horticulturists, is really one of the most beneficial birds we have, as its food consists mainly of insects, and its appetite seems very voracious. The cut-worm well known as a very destructive grub, is devoured in immense numbers by this early riser.

The following experiment by Prof. Treadwell, illustrates the feeding habits of this bird much better than anything I could produce.

"Two Robins were caught when quite young, their tail feathers being less than an inch long and the weight of each about twenty-five pennyweights, less than half the weight of the full grown birds; both were plump and vigorous, and had evidently been very recently turned out of the nest. He began feeding them with earth-worms, giving three to each bird that night. The second day he gave them ten worms each, which they ate ravenously. Thinking this beyond what their parents could naturally supply them with, he limited them to this allowance. On the third day, he gave them eight worms each in the forenoon, but in the afternoon he found one becoming feeble, and it soon lost its strength, refused food, and died. On opening it he found the proventriculous gizzard and intestines entirely empty, and concluded therefore that it died from want of sufficient food; the effect of the hunger being increased perhaps by the cold, as the thermometer was about sixty degrees.

The other bird, still vigorous, he put in a warmer place, and increased its food, giving it the third day fifteen worms, on the fourth day twenty-four, on the fifth twenty-five, on the sixth thirty, and on the seventh thirty-one worms. They seemed

insufficient and the bird seemed to be losing plumpness and weight. He began to weigh both the bird and its food, and the results were given in tabular form.

On the fifteenth day he tried a small quantity of raw meat, and finding it readily eaten, increased it gradually, to the exclusion of worms. With it the bird ate a large quantity of gravel and drank freely after eating. By the table, it appears that though the food was increased to forty worms weighing twenty pennyweights, on the eleventh day the weight of the bird rather fell off, and it was not until the fourteenth day when he ate sixty-eight worms or, thirty-four pennyweights, that he began to increase. On this day the weight of the bird was twenty-four pennyweights, he therefore ate forty-one per cent. more than his own weight in twelve hours, weighing after it, twenty-nine penny weights, or fifteen per cent. less than the food he had eaten in that time. The length of these worms if laid end to end, would be about fourteen feet, or ten times the length of the intestines.

This presents a wonderful contrast with the amount of food required by the cold blooded vertebrates, fishes and reptiles, many of which can live for months without food; and also with that required by mammalia. Man at this rate, would eat about seventy pounds of flesh a day, and drink about five or six gallons of water.

The question immediately presents itself, how can this immense amount of food, required by the young birds be supplied by the parents? Suppose a pair of robins with the usual number of four young ones. These would require, according to the consumption of this bird, two hundred and fifty worms, or their equivalent in insect or other food, daily. Suppose the parents to work ten hours or six hundred minutes to procure this supply, this would be a worm to every two and two-fifths minutes, or each parent must procure a worm or its equivalent in less than five minutes during ten hours in addition to the food required for its own support.

THE BROWN THRUSH.

This distinguished songster is a great favorite with all. During the breeding season his loud, clear notes are heard at all hours, but particularly at the dawn of morning and the still evening twilight. This bird is supposed by many to imitate the songs of other birds; hence, he is often called mocking bird. This, however, is not the case as his various notes are all original. The nest is usually placed upon the ground, though often it is found in a small bush or small tree. Two broods are raised in a season. Like the birds

that build on or near the ground, he shows great anxiety for the safety of the young, and fiercely attacks every intruder on his precious domains. His food consists of berries, worms, caterpillars and beetles, and he is very beneficial to the agriculturist on account of the great number of cutworms and other destructive species which he destroys, and for every bit of fruit which he takes repays a hundred fold. Wilson thus appropriately speaks of him. "The Thrasher is a welcome visitant in spring, to every lover of rural scenery and rural song. In the months of April and May, when our woods, hedge rows, orchards and cherry trees are one profusion of blossoms; when every object around conveys the sweet sensations of joy and Heaven's abundance, is, as it were, showering round us, the grateful heart beats in unison with the varying and elevated strains of this excellent bird, we listen to its notes with a kind of devotional ecstasy, as a morning hymn to the great and most adorable Creator of all. The human being, who, amidst such scenes, and in such seasons of rural serenity and delight, can pass them with cold indifference, and even contempt, I sincerely pity; for abject must that heart be, and callous those feelings, and depraved that taste, which neither the charms of nature, nor the melody of innocence, nor the voice of gratitude or devotion can reach. By the latter part of September or the first of October, the Brown Thrush departs for the south and passes the winter in the West Indies and Mexico."

THE BLUEBIRD IS A GENERAL

favorite, on account of its social disposition, and well-known insectivorous habits. This bird is one of the earliest in its arrival from the south, often making its appearance before the snow has wholly gone.

The Bluebird seems to enjoy the society of man, hence its nest is often found near his dwelling, and quite frequently a knot-hole in a building is made use of. A hollow stump or fence post also makes a comfortable nesting place. Two broods are usually raised in a season, and the quantity of food which a family will consume is enormous. When we consider that this food consists almost entirely of insects which are injurious to vegetation, we must rank this bird among the most beneficial. Its song is a soft pleasing warble very agreeable to the ear, particularly in the early spring, before the superior songsters have arrived. Late in October these interesting little fellows congregate in small flocks and depart on their southern migrations.

Passing by a potato patch we often notice a very handsome bird perched upon the fence or some other convenient place; if we watch him closely we will soon see him dive down among the potato vines, capture a fat bug, and return to his perch to eat it. The Rose-breasted Grossbeak, though looked upon as a nuisance by those who have not investigated much, is really a valuable bird. The single habit of eating the potato beetle, if he possesses no other good qualities amply repays for all the damage he does by taking a little fruit.

Should he favor us with a song, we will observe that in respect to musical qualities he is excelled by but few of our other species. Its tender and affecting notes are occasionally uttered in the night as well as in daylight. So far as I know but one brood is raised each season. The Grossbeaks are not among the earliest arrivals in spring, and they usually depart early for the south. The farmer who studies carefully the habits of this bird will be well rewarded.

In conclusion I would say, that the study of the character and habits of these feathered bipeds is far from being a waste of time. The Minnesota farmer is coming to devote more time year by year to the education of himself and his children, nor would I have it otherwise. The brain as well as the hand of the useful citizen must be well trained and properly instructed, and to this end increased facilities are being placed within our reach each year, and the time has now arrived when we can truly say of our "fellow farmers" that though his hand be calloused and his gait agricultural, his mind should be stored with useful knowledge.

REPORT OF PETER M. GIDEON, SUPERINTENDENT OF THE STATE FRUIT FARM.

EXCELSIOR, MINN., Oct. 30, 1881.

To Edward D. Porter, Professor of Agriculture, University of Minnesota:

DEAR SIR:—Below I give a brief report of the doings and success of the State Fruit Farm, during the present year:

Last winter, though severe, was less ruinous than anticipated; only lost ten or twelve out of fifty varieties of long-keepers, not one of which on their own tender root, such as is generally used in nursery stock, could have survived the winter. But grafted on our hardy seedling stocks, they mature early and thus stop the sap flow and prepare for winter in time.

It gives assurance of ultimate success in growing long-keeping varieties by fertilization and by commingling the pollen of our most hardy, though early varieties, with that of the long-keepers. Thus hardness is given to the forth-coming seedlings, grown from the seed of the long-keeper. This is a very desirable result as there are no long-keepers yet tested that will make a long lived tree. Though grafted on the most hardy of stocks, they give a few crops, and that is the end of them. But in those few crops we hope to secured the desired prize.

As yet no long-keepers have fruited, but I hope by another year to produce a few specimens, as the trees are doing quite well.

As anticipated, each year we lose trees, but each spring their places are filled up again. When full the orchard holds 768 trees.

As to pear culture, the prospects are not flattering. Last winter blighted all except those on the American Mountain Ash. It hurt some of these even. A few more years of trial will tell definitely, whether they will be a success or failure.

We have about 600 grapevines on the State farm, consisting of nearly every variety of note in the United States. Most of these will probably fruit next year. No variety of blackberry will flourish here under cultivation, not even the native.

We find the raspberry and strawberry culture a paying success. Will be better able to judge of the varieties, another year.

That part of the State farm, cleared and ploughed by order of the University, and by the same paid for, contains five acres, two of which are covered by our best seedling apple-trees. This work was done without charge on our part; and we will utilize the balance if not otherwise ordered.

Important experiments on our own grounds, have not been neglected.

During the last two years grafting has been almost a failure, owing to the damaged condition of the trees. The effects of the two last hard winters have been pernicious. Some fine samples of new seedlings bore the first crop this season, but further trial will tell their real value in quality, and whether hardy trees spring from them.

We have a fair prospect of making peach culture a success. We had some fine fruit of this species this year. But it requires care and skill, for the trees have to be laid down and covered the same as the grape-vine; but it will take another year or more to tell whether it will pay for home luxury or for market. If a success, the whole procedure will be given.

Respectfully,

PETER M. GIDEON,

Supt. State Expt'l Fruit Farm.