SECOND ANNUAL REPORT

OF THE

BOARD OF TRUSTEES

OF THE

ILLINOIS INDUSTRIAL UNIVERSITY,

FOR THE ACADEMIC YEAR

COMMENCING SEPT. 14, 1868, AND ENDING JUNE 5, 1869.

WITH A REPORT OF THE

AGRICULTURAL LECTURES AND DISCUSSIONS

HELD AT THE UNIVERSITY

JANUARY 12TH TO 22D, 1869.

SPRINGFIELD:
STATE JOURNAL PRINTING OFFICE.
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Every man is a consumer, and ought to be a producer. He fails to make his place good in the world, unless he not only pays his debt, but also adds something to the public wealth. Nor can he do justice to his genius without making some larger demand on the world than a bare subsistence. He is by constitution expensive, and needs to be rich.

Wealth has its source in applications of the mind to nature, from the rudest strokes of spade and ax, up to the last secrets of art. Intimate ties subsist between thought and all production, because a better order is equivalent to vast amounts of brute labor. The forces and resistances are Nature's, but the mind acts in bringing things from where they abound to where they are wanted; in wise combining; in directing the practice of the useful arts, and in the creation of finer values, by fine art, by eloquence, by song, or the reproductions of memory.—*Ralph Waldo Emerson.*

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Mechanical Department—VAN OSDEL, BROWN of Chicago, DUNLAP, and GRIGGS.

Second Year.—*The Farm.*—Chemical elements and chemical treatment of soils. Fertalizers—their composition, manufacture, preservation and application. Climate, influence of light, heat, and eleetricity on soils and vegetable growth. Farm Implements—principles of structure and use. Road making. Fruit culture—modes of propagation, production of new varieties, diseases of fruit trees. Insects injurious to vegetation. Animal husbandry—breeds and varieties of neat cattle, horses, sheep, and swine. Principles of breeding, rearing, training, fattening, etc. Chemical composition of food, and preparation of the several varieties. Sheep husbandry. Poultry. Bees.

Related Studies.—Trigonometry, Chain Surveying and Mensuration. Geometrical Drawing. Topographical Drawing. Vegetable Economy. Chemistry. German.

Third Year.—*Agricultural Economy.*—Relation of agriculture to the other industries and to commerce. The several branches of agriculture. Agricultural book keeping, the farm book, herd book, etc.

Related Studies.—General principles of Geology. Local and agricultural Geology. Theoretical Agriculture. Compass Surveying and Leveling. Maps of farm surveys. French.

Fourth Year.—*Rural Law.*—Of tenures and conveyances of land, of highways, of cattle, of fences, of noxious weeds, etc. Veterinary surgery and medicine. Landscape gardening, and laying out of large farming estates. Rural architecture and engineering. Foreign agriculture. History and literature of agriculture.

Related Studies.—English Literature. Inductive Logic. Animal Physiology. Entomology. Meteorology. Physical Geography. Political Economy.

DEPARTMENT OF PURE MATHEMATICS.

The studies of this department extend through three years. Those of the first year belong properly to the preparatory course, and should, when practicable, be completed before entering, by those who wish to take either of the fuller courses in the University.

First Year.—(Preparatory.)—*First Term.*—Geometry, first four books of Legendre. *Second Term.*—Geomerty completed through eighth book. *Third Term.*—Algebra. Davies' Bourdon—Chapters VII-IX.

Second Year.—*First Term.*—Trigonometry. Special Geometry. *Second Term.*—Trigonometry one-third term. Analytical Geometry two-thirds term. *Third Term.*—Analytical Geometry completed.

Third Year.—*First Term.*—Higher Algebra. *Second Term.*—Differential Calculus. *Third Term.*—Integral Calculus.

DEPARTMENT OF NATURAL AND MECHANICAL PHILOSOPHY AND ASTRONOMY.

The course in this department will occupy four years, and will be pursued with the use of text books, combined with lectures, and practical investigations of the several subjects.

First Year.—*First Term.*—Natural Philosophy—Properties of Matter, Force, Gravity, Falling Bodies, Pendulum, Motion, Projectiles, Hydrostatics and Hydraulics, etc. Mechanical Drawing. *Second Term.*—Natural Philosophy—Pneumatics, Barometer, Pumps, Steam Engine, Acoustics, Optics, Electricity, etc. Mechanical Drawing. *Third Term.*—Mechanics. Drawing.

SECOND YEAR.—*First Term.*—Heat—Steam and its applications, Steam Engine, its theory, construction, history, etc. Air Engines, and drafts of Engines. *Second Term.*—Electricity, statical, dynamical, Terrestial Magnetism, Construction and use of Telegraph, Theory of Electroplating, etc., Acoustics, Laws of Sound. *Third Term.*—Optics, Theories of Light, Polarization, Telescopes, Microscopes, Mathematics of, etc.

THIRD YEAR.—*First Term.*—Practical Hydraulics—flow of liquids in pipes, pressure, etc. Hydrostatics, Motors, Practical Pneumatics, Friction, etc. *Second Term.*—Machinery—theory, construction, location, calculation of power, motors. *Third Term.*—Building materials, strength of materials, designs and estimates for mills, machinery, etc.

FOURTH YEAR.—*First Term.*—Astronomy—Solar System, Descriptive Astronomy. *Second Term.*—Stellar System, Meteorology, etc. *Third Term.*—Practical Astronomy, calculations of eclipses, use of instruments.

DEPARTMENT OF CIVIL ENGINEERING.

The studies in this department will occupy three years, and the instructions will be as follows:

FIRST YEAR.—*First Term.*—Chain Surveying, Mensuration, Geometrical Drawing. *Second Term.*—Descriptive Geometry, Geometrical Drawing. *Third Term.*—Compass and Transit Land Surveying, Leveling Plats, Maps of Farm Surveys.

SECOND YEAR.—*First Term.*—Topographical Surveying, Elements of Hydrographical Surveying, Leveling, Maps of Topographical Surveys. *Second Term.*—Mahan's Civil Engineering, Plans and Elevations of Engineering Constructions. *Third Term.*—Gillespie's Roads and Railroads. Railroad and Canal Surveying, Plans, Profiles and Sections of Surveys.

THIRD YEAR.—*First Term.*—Descriptive Geometry applied to Stone Cutting, Projections of the Earth, Warped Surfaces. Mathematical Theory, and results of Experiments upon the Strength of Materials, and of the Stability of Girder, Suspension, Tubular and Arch Bridges, and of Retaining Walls and Frames. Plans and Elevations of Engineering Constructions. *Second Term.*—Supply and Distribution of Water, Distribution of Gas, Drainage. Theory of Machines, Plans and Elevations of Engineering, Constructions. Machine Drawing. *Third Term.*—Method of determining the form of the Earth. Methods of the United States Coast Survey. Designs and Reviews of Special Machines, and Engineering Constructions. Discussion of Scientific Subjects. General Field Work.

The first year of the above course corresponds with the second year of the Mathematical course.

DEPARTMENT OF ENGLISH LANGUAGE AND LITERATURE.

The studies of this department will extend through three years. The instruction will be given by text books and lectures, with exercises in Composition, Essays, Forensics, Presentation and criticism of plans. Declamations throughout the course.

FIRST YEAR.—*First Term.*—Advanced Grammar, and the grammatical analysis of authors, etc. *Second Term.*—Principles of Punctuation, use of Capitals, etc., English composition. *Third Term.*—Grammatical and philological analysis of Milton and other authors, with history of their times and contemporaries.

SECOND YEAR.—*First Term.*—Grammatical and philological analysis of Shakespeare and earlier Dramatists, History of the times and contemporaries of Shakespeare. *Second Term.*—Grammatical and philological analysis of Chaucer and Spencer, and history of their times, etc. *Third Term.*—History of English Literature.

THIRD YEAR.—*First Term.*—History of English and American Literature of the 19th century. *Second Term.*—Rhetoric—Invention—Plans for Essays, etc. *Third Term.*—Elements of Criticism—Methods of Philological study, etc.

DEPARTMENT OF THE FRENCH LANGUAGE AND LITERATURE.

The course of instruction in French will extend through three years, but students who desire to pursue the language only far enough to enable them to read the scientific works which they may find it ncessary to consult, are expected to acquire sufficient for this in a single year. The reading room will be supplied with French agricultural and scientific journals, which will be used in instruction as soon as the advancement of the student allows.

FIRST YEAR.—Robertson's Grammar, Fasquelle's Colloquial French Reader, McGill's French Reader.

SECOND YEAR.—Telemaque, Charles XII, and modern French authors, Arnoult's French Grammar.

THIRD YEAR.—Classic and modern French authors, De Vere's Advanced French Grammar for reference, History of French Literature.

DEPARTMENT OF GERMAN LANGUAGE AND LITERATURE.

The course in German will extend through three years. The first year is expected to prepare students to read such German scientific books as they may need or desire to consult. The second year's instruction will be so conducted as to enable students to complete their mastery of the language and give German students an opportunity to acquire a perfect knowledge of their native tongue.

FIRST YEAR.—German Grammar and Reader, German Classic Reader. One exercise a week in reading German agricultural and scientific papers.

SECOND YEAR.—Classic Reader, Schiller's William Tell, Goethe's Iphigenia. Conversation and Composition.

THIRD YEAR.—History of German Language and Literature, by Vilmar. Kohlrauchs Geschichte des deutschen Volkes. Conversation and Composition. Reading of scientific journals in the several branches.

DEPARTMENT OF THE LATIN LANGUAGE AND LITERATURE.

The course of instruction in this department will extend through three years, and will, at every stage, include a careful attention to the subject matter of the authors read in connection with the study of the language. A preliminary year is also provided in order to meet the present wants of students. This year is not considered a part of the regular course, and is to be dropped as early as practicable. Students will not be admitted to this department who are not prepared to enter at once upon the reading of Cæsar. For this purpose, a satisfactory knowledge of the Latin Grammar and Reader is required.

[PRELIMINARY YEAR.—Four books of Cæsar's Gallic war; Sallust's Conspiracy of Catiline; Ancient Geography of Europe, and chapters 64, 65 and 66 of Liddell's Rome.]

FIRST YEAR.—*First Term.*—Three orations of Cicero against Catiline Latin Prose Composition begun and continued through the course. Chapter. 67 to 71 inclusive of Liddell's Rome. *Second Term.*—Fourth oration against Catiline.. Oration pro lege Manilia, and pro Archia Poeta. Political constitution of Rome. *Third Term.*—Selections from Virgil. Latin Prosody.

SECOND YEAR.—*First Term.*—Selections from Livy. Chapters 28–35 and 46 of Liddell's Rome. *Second Term.*—Livy continued. Horace begun. Chapters 38–45 Liddell's Rome. *Third Term.*—Selections from Horace and Juvenal, Geography of the Countries bordering on the Mediterranean.

THIRD YEAR.—*First Term.*—Cicero De Officiis. Lectures on the History of Roman Literature and Philosophy. *Second Term.*– Cicero De Oratore. Lectures on the origin and structure of the Latin language. *Third Term.*—Freize's Quintillian. Lectures continued. Other authors will occasionally be substituted in place of some of the above.

DEPARTMENT OF GREEK LANGUAGE AND LITERATURE.

This course will also occupy three years, and the instruction will resemble that in the Department of Latin.

FIRST YEAR.—Harkness' First Greek book. First three books of Xenophon's Anabasis Greek Prose begun.

SECOND YEAR.—Herodotus, Demosthenes, Thucydides, Homer's Iliad.

THIRD YEAR.—Xenophon's Memorabilia of Socrates. Selections from Plato and the Greek Poets.

Select portions of Smith's History of Greece will be read in course, and lectures given on the Grecian History, Literature and Philosophy.

DEPARTMENT OF HISTORY AND SOCIAL SCIENCE.

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

FIRST YEAR.—*First Term.*—Discovery, settlement and colonial history of United States, with notice of other American States. American geography Two lectures (or lessons) a week. *Second Term.*—History of the United States from the time of the Revolution. Two lectures (or lessons) a week. *Third Term.*—Political Economy. Five lessons a week.

SECOND YEAR—*First Term.*—Ancient history of Greece and Rome with notices of other ancient nations. Ancient Geography. Five lessons (or lectures) a week. *Second Term.*—Medeiæval history, with history of christianity and ancient schools of philosophy. Scholasticism. Five lessons (or lectures) a week. *Third Term.*—Modern history—general European history. European geography. Five lessons (or lectures) a week.

THIRD YEAR.- *First Term.*—Constitutional history of England, and of the United States. Two lectures a week. *Second Term.*—History of civilization Analysis of historical forces and phenomena. Notices of the history of the arts and inductive sciences. *Third Term.*—Political philosophy. Constitutional and international law.

COMMERCIAL DEPARTMENT.

The course in this department will occupy one or two years, according to the time the student may give to the special studies of the department.

First Term.—Book-keeping by single and double entry for sole trader—applied to farming, mechanic and mercantile accounts. Theory of the several principal and auxiliary books. Theory of journalizing. Penmanship. Commercial calculation.

Second Term.—Partnership business. Commission and shipping accounts. Railroad books. Manufacturing accounts. Farm books. Herd and stock books. Business forms and papers. Notes. Endorsements. Drafts. Bills of exchange, inland and foreign. Bills of lading. Accounts current. Accounts sales. Inventories, invoices, receipts, etc. Commercial correspondence.

Third Term.—Banking and insurance. Commercial customs. Commercial law. Currency and exchange. Political economy applied to trade, markets, etc. Commercial geography. History of commerce.

DEPARTMENT OF MILITARY TACTICS AND ENGINEERING.

FIRST YEAR.—*First Term.*—Infantry Tactics—Schools of the Soldier and Company; Squad and Company Drills. Reports and Returns required from Company Commandants. *Second Term.*—Infantry Tactics—School of the Battalion. Instruction for Skirmishers. Reports and Returns required from Battalion Commandants. Bayonet Fencing. *Third Term.*—Infantry Tactics—Evolutions of a Brigade. Reports and Returns required from Brigade

Commandants. Skirmish and Battalion Drills. Guard-mountings, Inspections, Escorts, Funeral Honors.

SECOND YEAR.—*First Term.*—Artillery Tactics in the different Schools. Artillery Drills. Reports and Returns required from Artillery Officers. *Second Term.*—Cavalry Tactics in the different Schools. Reports and Returns required from Cavalry Officers. Sword Fencing. *Third Term.*—Evolutions of a Division, and of a Corps, in the different Armies. Reports and Returns required from Division and Corps Commandants. Forms for Parade and Review of a Division and of a Corps. The Essential Principles of Strategy and Grand Tactics. Advanced Guard, Outpost and Detachment Service of Troops. History of the most remarkable Epochs in the Military Art. Infantry and Artillery Drills.

THIRD YEAR.—*First Term.*—Field Fortifications. Descriptive Geometry applied to Drawing Fortifications. Duties of Staff Officers. Plans, Profiles and Sections of proposed Works. *Second Term.*—Permanent Fortifications. Theory of Gunnery, and Results of Experiments. Plans, Profiles, Sections and Drawings of proposed Works. *Third Term.*—Jomine's Art of War. Duane's or Mahan's Manual for Engineer Troops, consisting of Pontoon Drill, Practical Operations of a Seige, School of the Sap, Military Mining, Construction of Batteries. Cullom on Military Bridges. Benet's Military Law. Army Regulations.

The three years, or any two, may be taken in one, if the student is properly prepared in other studies.

DEPARTMENT OF MENTAL AND MORAL SCIENCE.

The studies in this department will occupy one year. The instruction will be given by lectures, combined with reading selected portions from specified authors, and examinations on the topics discussed.

First Term.—Mental philosophy—definitions and classification of mental phenomina. Connections and relations of mind and matter. Theories of perception. Phenomena of consciousness. Doctrines of ideas. Theory of mental culture. Three lectures a week.

Science of education, or mental philosophy applied to education. Two lectures a week.

Second Term.—Moral philosophy—connection of moral and mental philosophy. Theories of moral obligation. The moral powers. Practical ethics. Three lectures a week. Logic. Two lectures a week.

Third Term.—History of philosophy. Modern schools of philosophy. Inductive logic. Three lectures a week.

LECTURE COURSES.

It is a part of the plan of the University to provide courses of lectures in special departments of knowledge and art. These lectures will be given by regular members of the Faculty, or by eminent scholars and authors whose services may be secured for this purpose. Dr. John A. Warder, the eminent

American pomologist, has already accepted an appointment, and will deliver, during the winter term, a course of lectures on fruit growing, etc. Rev. Edward Eggleston, an eminent writer and editor, is also under appointment as lecturer on English Literature, and negotiations are in progress to secure other lecturers.

A weekly lecture is delivered to all the students, on manners, formation of habits and character; on the conditions of health, happiness, and success in life; on the general duties and affairs of life; on methods of study, courses of reading, etc.

AGRICULTURAL LECTURE SESSION.

It is also designed to hold at the University, each winter, a lecture session of two weeks, for several courses of lectures on the several branches of Agricultural and Horticultural science, to be delivered by gentlemen of eminent acquirements and experience in these departments. Due notice of the time of this course will be given. It is hoped and expected that these lectures will bring together a large number of the practical farmers and fruit growers of this and adjoining States, and that discussions of great value will follow the several lectures. Arrangements will be made to provide board at reasonable rates, and comfortable quarters, for as many as may attend.

APPARATUS OF INSTRUCTION.

A costly set of philosophical and chemical apparatus has just been received from the celebrated manufactory of E. S. Richie & Son, Boston, and large additions will be made at an early day. Rooms are set apart for a good working laboratory for the students in analytical chemistry, which will be fitted up under the direction of the Professor in Chemistry.

Valuable collections have already been secured for cabinets, in Mineralogy, Botany, Conchology, Geology, Palæontology, and in several departments in Zoology; and Prof. Powell, of the Chair of Natural History, is now absent in charge of a scientific expedition to the region of the Colorado of the North, making additional collections.

The illustrative apparatus in the Departments of Agriculture is designed to be very full and complete. The University owns over one thousand acres of improved farming lands, equal to any in the State. Forty acres are set apart for gardens, nurseries, and specimen orchards. The remainder are to be used for experimental and stock farms, orchards, arboretum, etc, Through liberality of manufacturers, the University is rapidly accumulating a collection of agricultural implements; and cabinets and drawings of specimen fruits, vegetables, etc., will be added as fast as practicable. The ornamental grounds around the building already contain a large variety of evergreens and flowering plants.

A collection of maps, charts, models and engravings, is also begun, and is being steadily increased by donation or purchase.

THE UNIVERSITY UNIFORM.

Under the authority of the act of incorporation, the Trustees have prescribed that all the students shall wear the University uniform. This uniform consists of a suit of cadet-gray mixed cloth, of the same color and quality as that worn at West Point, and manufactured by the same establishment.

The coat is a single-breasted frock, buttoned to chin, with standing collar, and a trimming of black mohair cord on shoulders, in loops. The vest is also single-breasted, buttoned to chin, with standing collar. Buttons for coat and vest are manufactured purposely for the University. They are gilt, of medalion style, the design being a sheaf of wheat surrounded with the words, "Illinois Industrial University." The pants have a welt of dark blue in the outside seams. The suit is a very tasteful dress, and is substantial and enduring. An arrangement has been made with responsible parties to furnish the suits to students at twenty-seven dollars each. Students can procure them ready made on their arrival here.

The University cap is of dark blue cloth, and ornamented with the initials I. I. U., surrounded by a silver wreath in front.

The arms and equipments used in the drill are furnished by the State.

Students will wear their uniform always on parade, but in their rooms, and at recitation, may wear other clothing. An army blouse, or fatigue dress, will be furnished at low rate to those that want it.

CHOICE OF STUDIES.

Entire liberty of choice is allowed each student, in selecting the departments which he will enter and the studies he will pursue. It is expected that students will ordinarily pursue the studies of two or more departments at the same time. Each student is required to have fifteen lessons a week, unless specially excused for cause. Changes from one department to another can only be made at the opening of a term.

REQUIREMENTS FOR ADMISSION.

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

2. The law also prescribes that "no student shall be admitted to instruction in any of the departments of the University, who shall not previously undergo a satisfactory examination in each of the branches ordinarily taught in the common schools of the State." In addition to these, candidates for any particular department will be examined in such studies as may be necessary to fit them to pursue successfully the course in that department.

The chief aim of all examinations for admission to the University is to ascertain the student's preparation to pursue successfully the studies of the course. Hence, thoroughness, and a general knowledge of the subject, will be accounted as of more importance than the amount studied. A student of earnest purpose and well disciplined mind will often pursue a new study more successfully than one of much more extensive preparation, but of less discipline and diligence. Much more solicitude is felt about the progress of the student after he enters, than about the preparation made before he enters, the University. Frequent and searching examinations will be held to test the progress in study, and to determine each student's fitness to remain in the classes. The University cannot be held responsible for the lack of thoroughness in the common school studies of its students, but will insist upon thoroughness in its own proper studies.

THE LABOR SYSTEM.

Practice in some form, and to some extent, is indispensable to a practical education. It is the divorcement of the theoretical and practical which renders so much of education mere "book learning." To guard against this fatal defect, the trustees have directed that the manual labor system shall be thoroughly tried, and all students, who are not excused on account of physical inability, are required to labor from *one* to *two* hours each day, except Saturday and Sunday. During the autumn the labor occupied only one hour a day. The students go out in squads, under their military officers, and under the general supervision of members of the faculty, or superintendents of the departments.

The labor is designed to be educational, and to exhibit the practical applications of the theories taught by the text books and in the lecture room. Thus far it has been popular among the students, several attributing to it the preservation of their health through a long term of severe study. They have already accomplished a large amount of valuable work, and are proud to point to the grounds fenced, planted with trees, and ornamented by their own labor. It is found to facilitate, rather than hinder study, and affords a much more valuable means of physical culture than any system of gymnastics.

The labor is compensated in proportion to the ability and fidelity of each laborer, the maximum compensation being eight cents an hour. Many students voluntarily work over hours, and receive for such overwork twelve and a half cents an hour. The experience of the past confirms the belief that this union and alternation of mental and muscular effort will not only give the "sound mind in a sound body," but will help to produce educated men who will be strong, practical and self-reliant, full of resource, and practical in judgment, the physical equals of the strongest, and the mental peers of the wisest; thus redeeming higher education from the odium of puny forms and pallid faces, and restoring the long lost and much needed sympathy between educated men and the great industrial and business classes.

It is not expected that all prejudices against work will disappear at once, or that labor will at once assume for all, its position of native dignity and honor; but we may confidently hope, if the increasing numbers do not render it impracticable to furnish profitable employment, finally to overcome the strongest prejudices, and render the labor system one of the most popular features of the University, with the public as well as with the students themselves.

HONORARY SCHOLARSHIPS.

The Legislature prescribed that one honorary scholar shall be admitted from each county in the State. These scholarships, which are designed "for the benefit of the descendants of soldiers and seamen who served in the armies and navies of the United States during the late rebellion," entitle the incumbents to free tuition. The trustees have also authorized the faculty of the University to remit the tuition of worthy young men whose circumstances are such as to require this aid.

PRIZE SCHOLARSHIPS.

A movement has been started to secure in each county of the State the endowment of a prize scholarship, with a permanent fund of $1,000 for each. The plan contemplates that the income of this fund shall be annually awarded to the best scholar from the public schools of the county, who shall present himself as a candidate for the University. The scholarship shall be determined by a competitive examination, to be held in each county, under the Regent of the University, and the State Superintendent of Public Instruction. The examinations will be held the first Friday in September, or at such time and place as the county superintendent of schools may appoint. Honorary scholars will be examined at the same time. Only a few of the counties have as yet provided for the prize scholarship, but it is hoped that a prize of greater or less amount will be provided in each county in which a worthy candidate shall be selected.

STUDENTS' DORMITORIES AND BOARD.

There are in the University building about sixty private rooms for students, which are rented to the students who first apply. Each room is designed for the accommodation of two students. These rooms are fourteen feet long and ten feet wide. They are without furniture, it being deemed best that students shall furnish their own rooms. It is earnestly recommended for health's sake that each student have a separate bed. A narrow bedstead and mattress, with suitable clothing, shall be provided by each. A study table, chairs, and a small coal stove, may be provided in common by the occupants of the room.

Good private boarding houses are already springing up around the University, where either day board, or board and rooms can be obtained, with the advantages of the family circle. Several students have provided themselves with meals in their rooms, at an expense varying from $1 to $1 50 per week.

To avoid unnecessary litter about the grounds, coal is purchased by the University at wholesale, and furnished to students at cost.

HOW TO ENTER THE UNIVERSITY.

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

1st. If you are over fifteen years of age, of good habits, and have a fair

knowledge of the common school branches, Arithmetic, Grammar, Geography, and History of the United States, you may enter, and take any course of study you are prepared for. The further advanced in study, the better you will be prepared to secure the full advantages of a residence at the University.

Some of the Departments require more preparation than others.

2d. You should enter at the beginning of a term; but you may enter at any other time if prepared to go forward with any of the classes.

3d. If doubtful of your ability to enter the departments you have selected, write to the Regent, J. M. Gregory, Champaign, and state what branches you have studied, the progress you have made in each, and your wishes as to course and term of study.

4th. If prepared, come on at once, bringing with you, if practicable, a letter of recommendation from your last teacher, or county superintendent of schools, or any good citizen.

HOW CAN I PAY MY WAY?

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

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

2nd. During the Spring and Fall terms, and to some extent during the Winter term, you can find work on the University farm and gardens, or in the shops, for which you will be paid 12½ cents per hour, if diligent and faithful. You can easily, without hindering your studies, work three hours a day, and if needful the whole day, on Saturdays. This will amount to $3 12½ per week, and will, if you choose to board yourself, more than cover all your expenses. If you understand some common trade, you can do still better. You will easily be able to earn, during the vacation, enough to buy your clothes and books. Some students pay their way, and have money to spare.

If possible you should have, to start with, money enough to pay your entrance fee and bills, and to buy your half of the furniture of your room, which will cost, say $15. Your uniform will cost you $27; but this will save you from purchasing other clothing to start with. You will find numbers of fellow students, who are taking care of themselves, and who will, with true brotherly feeling, advise and assist you. Come on without fear. What man has done, man can do.

TERMS AND VACATIONS.

The college year is divided into three terms of twelve weeks each. The work of the term will in all cases commence on Monday morning, and students who fail to be present at the opening will be expected to make up, by private study, every lesson which may have been passed over by their classes. Examination of new students will be held the Saturday preceding the opening of the term.

The only vacations are, the holiday recess, including Christmas and New Years, a vacation of one week between the winter and spring term, and the long vacation at the close of the third term.

CALENDAN FOR 1869–'70.

Winter term closes			March 6th,	1869.
Spring	"	opens	March 15,	"
Spring	"	closes	June 5,	"
Fall	"	opens	Sept. 13,	"
Fall	"	closes	Dec, 4,	"
Winter	"	opens	Dec. 6,	"
Winter	"	closes	March 5,	1870.
Spring	"	opens	March 14,	"
Spring	"	closes	June 4.	"

EXPENSES.

Tuition to Illinois students	$15 00	per annum
Tuition to foreign students	20 00	"
Fee for incidentals	2 50	per term.
Room rent for each student	4 00	"

Room rent is only charged to students who room in the University build ing. Each student is required to pay a matriculation fee of $10 on first en tering the institution. This entitles him to membership till he completes his studies. Honorary and prize scholars pay no tuition fee, but pay all other fees. All bills due the University must be paid, and the treasurer's receipt be shown to the Regent, before the student can enter the classes. Students boarding in University Hall will be required to deposit with the steward $10 each, to apply on their board bills at the close of the term.

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

Tuition, room rent, and incidentals, from	$34 50	to	$39 50
Board in Hall	108 00	to	126 00
Fuel and lights	10 00	to	15 50
Washing, 75c. per dozen	10 00	to	15 00
Total	$163 00		$195 00

Many young men reduce the expense to within $100 a year, and pay this by their labor during the year. It ought to be known that *any young man can pay his way through college* who is willing, for the sake of an education, to practice steadily the virtues of industry and economy.

GOVERNMENT.

The University is designed for *men*, not *children*, and its government rests in an appeal to the manly feeling and sense of honor of its students. It has but one law, and that is, "DO RIGHT." If any student shall show himself so weak or corrupt that he can not, when thus treated, refrain from vicious conduct, he will receive permission to leave the institution, where his presence

:an only injure others, without being of any benefit to himself. But no pains vill be spared to counsel the inexperienced, to admonish the careless, and to ave the tempted. Especially will it be an object to establish and maintain hat high toned, refined, and honorable public sentiment, which is at once he best safeguard against meanness and vice, and a constant inspiration to obleness and virtue.

DONATIONS.

In addition to the donations heretofore acknowledged, the officers of the Jniversity take pleasure in acknowledging the following:

Hon Lyman Trumbull, Hon. John A. Logan, Hon. S. M. Cullom, congressional documents and speeches.

J. Davis Wilder, Chicago, 8 yards paper black board.

Edgar Sanders, Florist, Chicago, several flower bulbs.

A. Blumenschein, Florist, Chicago, collection of green-house plants.

T. A. E. Holcomb, South Pass, Ill., collection of Roses and green-house plants.

E. M. Potter, Kalamazoo, Mich., Potter's Three-horse Clevis.

Collins Co., Hartford, Conn., per H. H. Taylor, agent, Chicago, 1 cast steel plow with steel beam.

J. H. Pickrell, Harristown, Ill., 1 large and beautiful colored lithograph of group of Durham cattle.

Harper Brothers, Publisher's, New York, set of classical text books and histories.

D. Appleton & Co., Publishers, New York, several text books.

Sheldon & Co., Publishers, New York, several text books.

A. S. Barnes & Co., Publishers, New York, 1 set Mathematical and other text books.

John Burchard, Beloit, Wis., Gates and Castings for self-opening gates.

OFFICERS AND INSTRUCTORS.

JOHN M. GREGORY, LL. D.,

REGENT, AND PROFESSOR OF PHILOSOPHY AND HISTORY.

WILLIAM M. BAKER, M. A.,

PROFESSOR OF ENGLISH LANGUAGE AND LITERATURE.

*GEORGE W. ATHERTON, M. A.,

PROFESSOR OF HISTORY AND SOCIAL SCIENCE, AND INSTRUCTOR IN LATIN.

J. W. POWELL, M. A.

PROFESSOR OF NATURAL HISTORY AND GEOLOGY.

WILLARD F. BLISS, M. A.,

PROFESSOR OF AGRICULTURE.

A. P. S. STUART, M. A.,

PROFESSOR OF THEORETICAL AND APPLIED CHEMISTRY.

PROFESSOR OF HORTICULTURE.

PROFESSOR OF MECHANICAL SCIENCE.

PROFESSOR OF CIVIL AND RURAL ENGINEERING.

PROFESSOR OF MATHEMATICS.

THOMAS J. BURRILL,

ASSISTANT PROFESSOR OF NATURAL HISTORY.

COL S. W. SHATTUCK, M. A.,

ASSISTANT PROFESSOR OF MATHEMATICS, AND INSTRUCTOR IN MILITARY TACTICS.

CAPT. EDWARD SNYDER,

ASSISTANT PROFESSOR OF BOOK KEEPING AND GERMAN.

JONATHAN PERIAM,

HEAD FARMER AND SUPERINTENDENT OF PRACTICAL AGRICULTURE.

NON-RESIDENT PROFESSORS.

JOHN A. WARDER, M. D., CINCINNATI,

LECTURER ON VEGETABLE PHYSIOLOGY AND FRUIT GROWING.

EDWARD EGGLESTON, M. A., CHICAGO,

LECTURER ON ENGLISH LITERATURE.

LECTURER ON VETERINARY SCIENCE.

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*Resigned Jan. 1, 1869.

CATALOGUE OF STUDENTS.

SPRING TERM OF 1869.

Names.	Residence. City.	Residence. County.	Nativity.
Edwin Fletcher Abbott	Centralia	Marion	Wisconsin
*Charles Edward Allard	Roseclare	Hardin	Indiana
Benton Alfred	Urbana	Champaign	Illinois
*Wilbur Clinton Alvord	Bement	Piatt	Massachusetts
John F. Alexander	Alex Stat	Morgan	Illinois
*David Baily	Champaign	Champaign	Illinois
Herbert Ozias Barber	Rantoul	Champaign	Illinois
Delenson Elroy Barnard	Kankakee	Kankakee	Indiana
Joseph T Beasley	Champaign	Champaign	Illinois
Louis Henry Beidler	Champaign	Champaign	Illinois
George W. Brewer	Champaign	Champaign	Illinois
Frank Morgan Burroughs	Champaign	Champaign	New York
Hiram P. Blackburn	Rossville	Vermilion	Illinois
James Frederick Blake	Mount	Jo Davies	Illinois
Milo Benedict Burwash	Champaign	Champaign	Canada E.
Thomas Nathaniel Burwash	Champaign	Champaign	Canada E.
*John Wilbur Busey	Champaign	Champaign	Illinois
Oscar Fred. Cady	Champaign	Champaign	Illinois
James William Campbell	Springfield	Sangamon	Illinois
Willis Smith Chase	Chicago	Cook	N. Hampshire
Cassius C. Clendemin	Morrison	Whiteside	Illinois
Thomas Benton Columbia	Champaign	Champaign	Illinois
William Harrison Crayne	Urbana	Champaign	Indiana
*Joseph Buchanan Dare	Champaign	Champaign	Illinois
John Jefferson Davies	Freeport	Stephenson	Illinois
Joseph Martin Davidson	Tolono	Champaign	Illinois
*Frank Dexter Dole	Mattoon	Coles	Illinois
Ira Bardwell Donaldson	Morrison	Whiteside	Illinois
Henry N. Drewry	Mason	Effingham	Indiana
Henry Dunlap	Champaign	Champaign	Illinois
Ernest Sans Dunlap	Champaign	Champaign	Illinois
Herbert Eaton	Philo	Champaign	New Jersey
Ernest Eaton	Philo	Champaign	New Jersey
Elias Quincy Emerson	Champaign	Champaign	Massachusetts
Charles S. Emerson	Mahomet	Champaign	Illinois
John Leslie Evans	Decatur	Macon	Illinois
Charles Austin Falls	Urbana	Champaign	Kentucky
Alfred Murray Flagg	Moro	Madison	Illinois
Cyrus David Fry	Freeport	Stephenson	Pennsylvania
*Fayette Gere	Urbana	Champaign	Illinois
James E. Graham	Galena	Jo Daviess	Illinois
*Charles Payton Graham	Champaign	Champaign	Kentucky
James M. Goodspeed	Urbana	Champaign	Ohio
Charles Henry Hall	Danville	Vermillion	Indiana
William Townsend Hamar	Champaign	Champaign	Indiana
Miles Fayette Hatch	Blivens' Mills	McHenry	Illinois
Edmund Brooks Hazard	Lynden	Whiteside	Illinois
Robert Harrison Hazlett	Springfield	Sangamon	Illinois
Edgar Lewis Hill	Watson	Effingham	Illinois
William H. Henrichsen		Morgan	Illinois
Charles W. Hoxsey	Macon	Effingham	Wisconsin
William Hubbard	Elgin	Kane	Illinois

CATALOGUE OF STUDENTS—CONTINUED.

Names.	Residence. City.	Residence. County.	Nativity.
Robert G. Hulett	Morrison	Whiteside	Ohio
Marion Franklin Kirkpatrick	Champaign	Champaign	Illinois
Theodore Julius Krafft	Bellville	St. Clair	Illinois
James C. Ladd	Ringwood	McHenry	Illinois
Peter Winfield Lawver	Freeport	Stephenson	Illinois
Joseph Kirk Love	Sidney	Champaign	Ohio
George H. Lyman	Richland	Sangamon	Illinois
Edward Lynch	Wapella	Dewitt	England
John L. Lyon	Rockford	Stephenson	Massachusetts
Taylor Martin	La Moille	Bureau	Illinois
James Newton Mathews	Mason	Effingham	Indiana
James H. McCarkle	Fairmount	Danville	Illinois
Howard M. Montilius	Freeport	Stephenson	Illinois
Edwin F Moore	Tolono	Champaign	New York
Ernest Nelson	Canton	Fulton	Illinois
Henry Norris	Tolono	Champaign	N. Jersey
George H Pancake	Mahomet	Champaign	Illinois
*John Joshua Parish	Raleigh	Saline	Illinois
Calvin E. Parker	Philo	Saline	Massachusetts
Wildey Lemon Parke	Urbana	Champaign	Ohio
John Charles Patton	Paxton	Ford	Illinois
Clark Lewis Payton	Danville	Vermillion	Illinois
John J. Parsons	Marshall	La Salle	Illinois
Russell D. Peacock	Chicago	Cook	Illinois
Edward F. Phillips	Chicago	Cook	Illinois
Millard F. Porterfield	Sidney	Champaign	Pennsylyania
Elijah Newton Porterfield	Sidney	Champaign	Pennsylvania
Hiram C. Powell	Champaign	Champaign	Indiana
George D. Pratt	Mahomet	Champaign	N. Hampshire
Adolphus Lafayette Rader	Charleston	Cole	Tennessee
Isaac Stuart Raymond	Champaign	Champaign	Ohio
Willis Albert Reiss	Bellville	St. Clair	Illinois
George Martin Randall	Yellowhead	Kankakee	Michigan
Stephen Avery Reynolds	Belvidere	Boone	Wisconsin
Thomas Edwin Richards	Springfield	Sangamon	Illinois
Ozias Riley	Urbana	Champaign	Illinois
Samuel Earhardt Rigg	Champaign	Champaign	Pennsylvania
Charles Wesley Rolfe	Oswego	Kendall	Illinois
James Simpson Romine	Urbana	Champaign	Illinois
*Reuben Roughton	Rantoul	Champaign	England
John Robinson Rowlen	Tolono	Champaign	Ohio
*Albert Russell	Urbana	Champaign	Illinois
Charles Elliott Sale	Newcomb	Champaign	Ohio
Edgar Sawyer	Tiskilwa	Fulton	Illinois
George Blanchard Scripps	Astoria	Fulton	Illinois
Luther Edgar Shinn	Urbana	Champaign	Illinois
Wilbur Thomas Shinn	Urbana	Champaign	Illinois
Howard Silver	Urbana	Champaign	Ohio
Charles Wallace Silver	Urbana	Champaign	Ohio
Edward G. Smith	Peru	La Salle	Illinois
Charles Carrol Smith	Freeport	Stephenson	Pennsylvania
Albert Alexander Snelling	Kinmundy	Marion	N Hampshire
*Henry Augustus Staples	Springfield	Sangamon	Maine
John Newton Swinford	Paxton	Ford	Illinois
*Thomas Stoddert	Charleston	Coles	Illinois
Riley Swisher	Butler	Butler	Illinois
James David Swearingen	Champaign	Champaign	Illinois
David Edwin Swyer	Bellville	St. Clair	Illinois
Jared Teeple	Woodstock	McHenry	Illinois
*Irving Terwilliger	Belvidere	Boone	Illinois
John R Trevett	Champaign	Champaign	Illinois
Samuel West Thompson	Homer	Champaign	Illinois
*Irwin Bedell Towle	Urbana	Champaign	New York
Lewis Cass Warner	Salem	Marion	Illinois
*Samuel Thompson Weber	Raleigh	Saline	Illinois
Samuel Judson Westlake	Springfield	Sangamon	Illinois
Jacob Norton Wharton	Bement	Piatt	Pennsylvania
Joseph C. Walker	Champaign	Champaign	Illinois
Oscar R. Wheeler	Versailles	Brown	Illinois
Cyrus W. Wheeler	Versailles	Brown	Illinois

CATALOGUE OF STUDENTS—CONTINUED.

Names.	Residence.		Nativity.
	City.	County.	
William J. Weagley	Jacksonville		Illinois
Samuel Weaver White	Paxton	Ford	Ohio
James Alexander Williams	Urbana	Champaign	Illinois
Reuben O. Wood	Woodburn	Macoupin	Illinois
Paul Way Woody	Champaign	Champaign	Indiana
Harley Wilburn Yeager	Monticello	Piatt	Illinois

*Absent this year.

The names of members who have been expelled, or who have left without permission, are omitted from this catalogue.

APPENDIX.

The following courses of combined studies are here presented to aid such students as may need some assistance in making out courses for themselves. It must be remembered that each study taught in the University must be confined to its regular terms, and any selection of studies must be made with constant reference to this fact. The terms in which each study will be taught, can be ascertained by a reference to the courses in the several Departments.

Other courses of study belonging to institutions of well-known fame, are added as affording valuable suggestions.

AGRICULTURAL COURSE.

Three Suggested Courses of Collateral Study in Agriculture, prepared by Prof. Bliss.

"Chemistry is the corner-stone of Scientific Agriculture."—Dr. Jno. A. Warder.

"Without a knowledge of Physics, of Chemistry, and of Agricultural Geology in the widest signification, is no understanding of Plant and Animal Life to be gained. The Natural Seiences can never be learned *thoroughly*, that is, so that practical application of them can be made in life, from books or lectures. The student will grasp, understand, and assimilate mentally what he has learned and read only when he *makes Chemical Experiments, Physical Experiment, dissects Plants, and investigates aad observes* for *himself*. *Practical* knowledge is *thorough* knowledge. All *superficial* knowledge is *unpractical*. The farmer who wishes rational education, and does not devote at least a year exclusively and earnestly to the study of Physic, Chemistry, and Physiology, had better not pursue the Natural Sciences at all."—M. J. Schleiden.

The work laid down in the following courses is designed at once to supplement and explain the Lectures delivered from time to time on the various branches of Agriculture, and to afford such general education as is absolutely necessary to progress in any direction, and which must, for the present, be provided for students here, since they do not bring it with them.

Students desiring to remain but a single year and pursue special branches during that time, will be allowed to do so.

Persons wishing to spend the Fall and Winter terms of each year here, and the Spring term at home, will still be able to go on with their classes at the beginning of the succeeding year, though at some disadvantage.

A TWO YEARS' COURSE.

First Year.—*First Term.*—Chemical Physics and Inorganic Chemistry. Structural and Physiological Botany. First four books of Davies' Legendre.

Second Term.—Organic Chemistry in text book, "How Crops Grow." Fifth book of Davies' Legendre. English Language.

Third Term.—Qualitative Analysis. Detection of the alkalies, alkaline-earths, earths, etc. Systematical Botany. Excursions and Collections. English Language.

Second Year.—*First Term.*—Qualitative Analysis continued. Detection and separation of the Elements. Chain Surveying and Mensuration. Geometrical Drawing. General Principles of Zoology (or German.)

Second Term.—General Principles of Geology. Vegetable Economy. How Plants Feed. Topographical Drawing. Animal Physiology, (or German.)

Third Term.—Geology of Illinois. Vegetable Economy. Entomology, (or German.)

THREE YEARS' COURSE.

First Year.—*First Term.*—Chemical Physics and Inorganic Chemistry in text books. Structural and Physiological Botany. First four books of Davies' Legendre.

Second Term.—Organic Chemistry in text books. Vegetable Physiology. Fifth book of Davies' Legandre. English Language.

Third Term.—Qualitative Analysis. Detection of the alkalies, alkaline-earths, earths, etc. Systematic Botany. Excursions and Collections. English Language.

Second Year.—*First Term.*—Qualitative Analysis continued. Detection and Separation of the Elements. Chain Surveying and Mensuration. Geometrical Drawing. German.

Second Term.—Quantitative analysis of salts, minerals, ores, alloys, furnace products, etc. Vegetable Economy. German.

Third Term.—Quantitative analysis of soils, manures, ashes of plants, etc. Vegetable Economy. German.

Third Year.—*First Term.*—General Principles of Zoology. Plane Trigonomety one-half term. Entomology. French.

Second Term.—Principles of Geology. Tillage and Manures. French.

Third Term.—Geology of Illinois. Compass Surveying and Leveling. French.

A FOUR YEARS' COURSE.

First Year.—*First Term.*—Chemical Physics and Inorganic Chemistry in text book. Structural and Physiological Botany. First four books of Davies' Legendre.

Second Term.—Organic Chemistry in text books. Fifth book of Davies' Legendre. How Crops Grow. English Language.

Third Term.—Qualitative Analysis. Detection of the alkalies, alkaline-earths, earths, etc. Systematic Botany. Excursions and Collections. English Language.

Second Year.—*First Term.*—Qualitative Analysis continued. Detection and Separation of the Elements. Chain Surveying and Mensuration. Geometrical Drawing. German.

Second Term.—Quantitative Analysis of salts, minerals, ores, alloys, furnace products, etc. Topographical Drawing. How Plants Feed. German.

Third Term.—Quantitative Analysis of soils, manures, ashes of plants, etc. How Plants Feed. German.

THIRD YEAR.—*First Term.*—Higher Physics. Plane Trigonometry one-half term. French.

Second Term.—Principles of Geology. Tillage and Manures. French.

Third Term.—Geology of Illinois. Excursions and Collections. Compass Surveying and Leveling. Maps and Plats of Farm Surveys. French.

FOURTH YEAR.—*First Term.*—General Principles of Zoology. Inductive Logic. English Literature.

Second Term.—Animal Physiology. Stock Feeding and Dairy produce. Meteorology. English Literature.

Third Term.—Entomology. Political Economy. English Literature.

GENERAL COURSE.

FIRST, OR FRESHMAN YEAR.

	REGULAR STUDIES.	OPTIONAL AND EXTRA.
1ST TERM—	Trigonometry and Surveying.	
	Structural Botany.	
	Cicero's Orations against Cataline.	
	French.	Greek.
2D TERM—	Trigonometry and Analytical Geometry.	
	Systematic Botany.	
	Cicero's Orations.	
	French	Greek.
3D TERM—	Systematic Botany.	
	Analytical Geometry completed.	Greek.
	Geometrical Drawing.	
	French Literature.	
	Selections from Virgil.	

SECOND, OR SOPHOMORE YEAR.

1ST TERM—	Mechanics.	
	Chemistry. Zoology.	Livy.
	German.	Greek.
2D TERM—	Chemistry.	
	Entomology, etc.	Livy; Horace.
	Physics—Mechanics.	Greek.
	German.	
3D TERM—	Mineralogy.	
	Physic—Rhetoric.	
	German Literature.	Horace and Juvenal.

THIRD, OR JUNIOR YEAR.

1ST TERM—	Astronomy.
	Geology.
	English Literature.
	Ancient History.
2D TERM—	Geology
	Mediæval History.
	Meteorology.
	English Literature.
3D TERM—	Logic
	Physical Geography.
	Modern History.
	English Literature.

FOURTH, OR SENIOR YEAR.

1st Term—Mental Philosophy and Science of Education.
Constitutional History of England and of the United States.
Elements of Criticism.
2d Term—Moral Philosophy.
History of Civilization.
Civil Polity; Constitution of the United States.
3d Term—History of Philosophy.
Modern Philology.
Constitutional Law.
History of Inductive Sciences.

COURSE OF INSTRUCTION

IN MICHIGAN AGRICULTURAL COLLEGE.

FRESHMAN CLASS.

First Half Year.—Algebra, Robinson; History, Weber; Geometry Robinson; Book-keeping, Bryant & Stratton.
Second Half Year.—Trigonometry, Robinson; Surveying, Davies; Practical Agriculture; Geology, Dana.

SOPHOMORE CLASS.

First Half Year.—English Literature, Chambers, Spaulding; Botany, Gray; Elementary Chemistry, Youmans.
Second Half Year.—Entomology, Harris; Analytical Chemistry, Fresenius; Botany, Gray, Darlington, and Lindley; Horticulture.

JUNIOR CLASS.

First Half Year.—Physics, Snell's Olmstead; Agricultural Chemistry, Johnstone; Inductive Logic, Herschel.
Second Half Year.—Physics, Miller; Rhetoric, Whately; Day's Praxis; Animal Physiology, Dalton.

SENIOR CLASS.

First Half Year.—Zoology, Carpenter; Practical Agriculture; Mental Philosophy, Wayland; Astronomy, Snell's Olmsted; Landscape Gardening, Downing, Kemp.
Second Half Year.—Civil engineering, Mahan; Moral Philosophy, Haven; Political Economy, Carey, Walker; French, Fasquelle.

COURSE OF STUDY AND INSTRUCTION

IN THE MASSACHUSETTS AGRICULTURAL COLLEGE.

FRESHMAN YEAR.

FIRST TERM.—Algebra; Human Anatomy and Physiology; Chemical Physics.

SECOND TERM.—Geometry; French; Chemistry.

THIRD TERM.—Geometry; French; Botany; Lectures upon Hygiene, Chemistry, Botany and Agriculture; and Exercises in Orthography, Elocution and English Composition, during the year.

SOPHOMORE YEAR.

FIRST TERM.—German; Agriculture; Commercial Arithmetic and Book-keeping.

SECOND TERM.—German; Trigonometry; Analytical Chemistry.

THIRD TERM.—Mensuration; Surveying; Anaylitical Chemistry; Zoology and Drawing; Lectures upon Comparative Anatomy, Diseases of Domestic Animals, Organic Chemistry and Market Gardening; Exercises in English Composition and Declamation, during the year.

JUNIOR YEAR.

FIRST TERM—Physics; French or German; Agricultural Chemistry, Drawing.

SECOND TERM.—Physics; Rhetoric; Horticulture.

THIRD TERM.—Astronomy; Systematic Botany; History of the United States; Lectures upon Physics, Mineralogy, the Cultivation of the Vine, and Fruit and Forest Trees, and Useful and Injurious Insects; and Exercises in English Composition and Debate, during the year.

SENIOR YEAR.

FIRST TERM.—Intellectual Philosophy; History; Physical Geography.

SECOND TERM.—Moral Philosophy; Political Geography; The Civil Polity of Massachussetts and the United States.

THIRD TERM.—Geology; Engineering; Political Economy; Lectures upon Stock Farming, Architecture, Landscape Gardening, Geology and English Literature; and Exercises in Original Declamation and Debate, during the year.

Exercises in Gymastics, Military Tactics, and the various operations of the Farm and Garden, through the course.

COURSE OF INSTRUCTION

IN THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FIRST YEAR.—Mathematics. Algebra. Solid Geometry. Trigonometry, Elementary Mechanics. Chemistry. English. German. Descriptive Geometry. Mechanical Drawing. Free-hand Drawing.

Second Year.—Mathematics. Spherical Trigonometry. Analytical Geometry of two and three dimensions. First Principles of the Differential and Integral Calculus. Descriptive Astronomy. Surveying. Physics. Chemistry. English. French. German. Descriptive Geometry. Mechanical Drawing. Free-hand Drawing.

Third Year.—1. *Course in Mechanical Engineering.*—Mechanism. Mathematics. Differential and Integral Calculus. Analytic Mechanics. Applied Mechanics. Descriptive Geometry. Drawing. Physic. Geology. English. Constitutional History. French. German.

2. *Course in Civil and Topographical Engineering.*—Engineering. Mathematics. Applied Mathematics. Spherical Astronomy. Descriptive Geometry. Drawing. Physics. Geology. English. Constitutional History. French. German.

4. *Course in Mining Engineering.*—Engineering. Descriptive and Determinative Mineralogy Assaying. Quantitative Chemical Analysis. Metallurgy. Mathematics Applied Mechanics. Drawing. Physic. Geology. English. Constitutional History French German.

5. *Course in Building and Architecture.*—Architectural Design. Construction. Drawing. Mathematics. Applied Mechanics. Descriptive Geometry. Physics. Geology. English. Constitutional History. French. German.

6. *Course in Science and Literature.*—Mathematics. Chemistry. Physics. Architectural Design. History. Drawing. Physcs. Geology. English Constitutional History. French. German.

Fourth Year.—1. *Course in Mechanical Engineering,*—Machines. Motors. Building Materials. Descriptive Geometry. Drawing. Political Economy. Natural History. French. German.

2. *Course in Civil and Topographical Engineering.*—Engineering. Machinery and Motors. Building Materials. Descriptive Geometry. Drawing Political Economy. Natural History. French. German.

4. *Course in Mining Engineering.*—Mining. Machinery and Motors. Engineering. Chemistry. Geology. Building Materials.. Drawing. Political Economy. Natural History. French. German.

5. *Course in Building and Architecture.*—Architectural Design. Professional Practice. Drawing. Engineering. Desscriptive Geometry. Warming, Lighting, Ventilating, Acoustics. Building Materials. Political Ecnomy. Natural History. French. German.

6. *Course in Science and Literature.*—The Higher Mathematics. Chemistry. Physics. Architectural Design. Mental Science. Building Material. Drawing. Political Economy. Natural History. French. German.

COURSE IN CIVIL ENGINEERING

IN RENSSELAER POLYTECHNIC INSTITUTE.

FOUR YEARS.

DIVISION D.

Winter Session.—Mathematics—Davies' Bourbon's Algebra—Chapters VI–IX, inclusive; Davies' Legendre's Geometry—Books IV-VI, inclusive. Plane Graphic Geometry—Warren's Elementary Plane Problems. English Language—Quackenbos' English Composition and Rhetoric, commenced. French Language—Fasquelle's French Grammar—Lessons I–L, inclusive. Geodsey,—Line Surveying, Elementary Practice. Geometrical Drawing—Plane Problems—Warren's Drafting Instruments and Operations.

Summer Session.—Mathematics—Davies' Legendre's Geometry—Books VII–IX, inclusive. Mensuration—Use of Mathematical Tables. Analytical Trigonometry, Plane and Spherical Trigonometry. Descriptive Geometry—Warren's Elementary Projections. Physics—Loomis' Natural Philosophy. English Language—Quackenbos' English Composition and Rhetoric, completed. French Language—Fasquelle's French Grammar, completed. Geodesy—Line Surveying, Chain Surveys. Geometrical Drawing—Elementary Projections. Construction Drawing—Elements of Structures.

DIVISION C.

Winter Session.—Mathematics—Higher Algebra. Descriptive Geometry Orthographic Projections. Physics—Physics of Heat. English Language—English Composition; Logical and Rhetorical Criticism. French Language—English Translations, Reading of French Scientific Authors. Geodesy—Line Surveying, Theory, Compass Surveys. Geometrical Drawing—Orthographic Projections. Topographical Drawing—Elementary Drawing, Topographical Plans.

Summer Session.—Mathematics—Analytical Geometry. Descriptive Geometry—Orthographic Projections. Chemistry—Inorganic Chemistry. Natural History—Botany. English Language—English Composition; Logical and Rhetorical Criticism. French Language—English Translations; French Composition. Geodesy—Adjustment and Use of Instruments, Line Surveying, Topographical Sketching, Farm Surveys. Geometrical Drawing—Orthographic Projections. Topographical Drawing—Map of Farm Surveys.

DIVISION B

Winter Session.—Mathematics—Differential Calculus, Integral Calculus, Calculus of Variations. Descriptive Geometry- Shades and Shadows. Physics—Electricity, Terrestrial Magnetism, Statical and Dynamical Electricity. Chemistry- Practical Chemistry, Qualitative Analysis, Blow-pipe Analysis, Determinative Minerology. Geodesy—Practical Trigonometry, Leveling, Topographical Surveying. Geometrical Drawing—Shades and Shadows, Machine Drawing, Elements of Machines. Topographical Drawing—Maps of Topographical Surveys.

Summer Session.—Rational Mechanics—Mechanics of Solids, Mechanics of Fluids. Descriptive Geometry—Linear Perspective. Physics—Acoustics, Optics. Astronomy—Descriptive Astronomy. Natural History—Descriptive Geology. Geodesy—Hydrographical Surveying, Theory and Practice. Geometrical Drawing—Perspective; Construction Drawing, Bridge Drawing. Topographical Drawing—Colored Topography.

DIVISION A.

Winter Session.—Mathematics—Method of Least Squares. Astronomy—Spherical Astronomy, Practical Astronomy. Physical Mechanics—Mechanics of Solids—Friction, Strength of Materials; Mechanics of Fluids—Practical Hydraulics, Practical Pneumatics. Machines—Theory of Machines. Descriptive Geometry—Stone Cutting. Natural History—Physical Geography. Philosophy—Intellectual Philosophy. Geometrical Drawing—Stone Cutting. Topographical Drawing—Maps of Hydrographical Surveys.

Summer Session.—Machines—Theory of Prime Movers, Designs for, and reviews of Special Machines. Constructions—Stability of Structures, Construction of Engineering and Architectural Works, Designs for, and reviews of Special Works. Road Engineering—Common Roads. Railroads. Chemistry—Technical Chemistry. Geology—Practical Geology, Technical Geology. Philosophy—Ethical Philosophy. Topographical Drawing—Plans, Profiles, and Sections of Railway Surveys.

COURSE IN MECHANICAL ENGINEERING

IN RENSSELAER POLYTECHNIC INSTITUTE.

FOUR YEARS.

DIVISION D.

THE COURSE IDENTICAL WITH THAT IN CIVIL ENGINEERING.

DIVISION C.

THE COURSE IDENTICAL WITH THAT IN CIVIL ENGINEERING.

DIVISION B.

WINTER SESSION.—Mathematics—Differential Calculus, Integral Calculus, Calculus of Variations. Descriptive Geometry—Shades and Shadows. Physics—Electricity; Terrestial Magnetism, Statical and Dynamical Electricity. Chemistry—Practical Chemistry, Qualitative Analysis, Blow-pipe Analysis, Determinative Minerology. Geodesy—Practical Trigonometry, Leveling, Topographical Surveying. Geometrical Drawing—Shades and Shadows, Machine Drawing, Elements of Machines. Topographical Drawing—Maps of Topographical Surveys.

SUMMER SESSION.—Rational Mechanics—Mechanics of Solids; Mechanics of Fluids. Machines—Cinematics. Descriptive Geometry—Linear Perspective. Physics—Acoustics, Optics. Astronomy—Descriptive Astronomy. Natural History—Descriptive Geology. Geometrical Drawing—Perspective; Machine Drawing, Elements of Machines.

DIVISION A.

WINTER SESSION.—Mathematics—Method of Least Squares. Astronomy—Spherical Astronomy. Physical Mechanics—Mechanics of Solids; Friction, Strength of Materials; Mechanics of Fluids; Practical Hydraulics, Practical Pneumatics. Machines—Construction of Machines, Location of Machines, Theory of Machines, Efficiency of Machines. Philosophy—Intellectual Philosophy. Geometrical Drawing—Machine Drawing, Complete Machines.

SUMMER SESSION.—Mechanics—Theory and Construction of Prime Movers, Designs and Estimates for, and reviews of Special Machines. Constructions Stability of Structures. Chemistry—Technical Chemistry, Chemistry of the Materials and Processes of Heating and Illumination. Philosophy—Ethical Philosophy. Geometrical Drawing—Machine Drawing, Complete Machines.

CLASSICAL COURSE OF INSTRUCTION

IN HARVARD UNIVERSITY.

FRESHMAN CLASS.

FIRST TERM.—Greek.—Xenophon's Memorabilla, Homer's Odyssey, Goodwin's Greek Moods and Tenses, Exercises in writing Greek. Latin.—Livy, (Lincoln's Selections], Cicero's Epistles, Ramsay's Elementary Manuel of Roman Antiquities, Zumpt's Grammar, Exercises in writing Latin. Mathematics.—Pierce's Geometry, Pierce's Algebra, begun. French.—Otto's Grammar, Moliere, Racine, Modern French Comedies. Elocution. Ethics.—Champlin's First Principles of Ethics, Bulfinch's Evidences of Christianity. Integral Education.—Lectures.

SECOND TERM.—Greek. Lysias, Homer's Odyssey, Arrian's Anabasis, Greek Antiquities, Goodwin's Greek Modes and Tenses, Exercises in writing Greek. Latin.—Horace, Odes and Epodes, Cicero's Tusculan Disputations, Zumpt's Grammar, Ramsay's Elementary Manual of Roman Antiquities, Exercises in writing Latin. Mathematics.—Pierce's Algebra, finished (including Logarithms, Pierce's Plane Trigonometry. History, in French.—Histoire Grecque par Duruy. Elocution.

SOPHOMORE CLASS.

FIRST TERM.—Rhetoric.—Campbell's Philosophy of Rhetoric (Second Book), Themes. History.—Roman History. Chemistry.—Cooke's Chemical Physics. Elocution. French.—Histoire de la Litterature Francaise.

Elective Studies.—Pure Mathematics.—Pierce's Plane and Spherical Trigonometry and Navigation and Surveying, with Bowditch's Tables, Puckle's Conic Sections, Salmon's Conic Sections. Applied Mathematics.—Pierce's Plane Trigonometry and Surveying, with Bowditch's Tables, Smith's Mechanics. Greek.—The Prometheus of Aeschylus, the Birds of Aristophanes, Felton's Greek Historians. Exercises in writing Greek. Latin.—Cicero de Officiis, Quintilian, Zumpt's Grammar, Exercises in writing Latin.

SECOND TERM.—Rhetoric.—Whatley's Rhetoric, Themes, Reading in English Literature. Philosophy.—Stewart's Philosophy of the Mind. Chemistry.—Eliot and Storer's Elements of Chemistry, Lectures. German.—Krauss' German Manual, Rolker's German Reader. Elocution.

Elective Studies.—Pure Mathematics.—Puckle's Conic Sections, Salmon's Conic Sections. Applied Mathematics.—Conic Sections, Smith's Mechanics, Goodwin's Elementary Dynamics. Greek. Demosthenes, Grote's History of Greece, Vol. XI. (chapters 86–90), Lysias, Greek Composition. Latin.—Terence, Cicero, Horace, Exercises in writing Latin.

JUNIOR CLASS.

FIRST TERM.—Herschel's Outlines of Astronomy, last edition, Lectures on Mechanics.* Rhetoric.—Themes. Chemistry.—Lectures,

Elective Studies.—Mathematics.—Pierce's Algebra, chapter VIII, Pierce's Curves and Functions, Vols. I. and II. Ancient History.—Polybius, Greek Composition. Greek.—Aeschines and Demosthenes on the Crown, Greek Composition. Latin.—Pliny's Letters, Martial, Latin Exercises and Extemporalia. Chemistry.—Galloway's Qualitative Analysis, with instructions in the Laboratory. Natural History. English Language.—Thorpe's Analecta Anglo-Saxonica, Morris' Specimens of Early English, The Bible, Spencer, Shakespeare. German.—Krauss' German Manual. Spanish.—Gil Blas, Josse's Grammar and Exercises, (Sales' ed). Italian.—Dall's Ongaro's La Rosa dell' Alpi, Cuorre's Grammar and Exercises.

SECOND TERM.—Philosophy.—Forensics. Physics.—Lardner's Course of Natural Philosophy, (Optics), Lectures on Hydrostatics, Pneumatics, etc.

Elective Studies.—Mathematics.—Pierce's Curves and Functions, Vols. I. and II. Ancient History.—Plutarch, Greek Composition. Greek.—The Electra of Sophocles, Plato, Greek Composition. Latin.—Plautus, Latin Exercises and Extemporalia. Chemistry.—Galloway's Qualitative Analysis, with instruction in the Laboratory. Natural History. English Language.—Studies of the First Term continued. German.—Simonson's Deutsches Baladenbuch. Spanish.—Don Quijote, Sale's edition.

* The full course of Lectures in this department appears only by consulting the Caltaguefor wo successive years, with reference to the same student.

SENIOR CLASS.

First Term.—Logic and Philosophy.—Bowen's Logic, Bowen's Political Economy, Forensics. Physics.—Lectures on Optics and Acoustics. History.—Constitutional History of the United States.

Elective and Extra Studies.—Mathematics.—Pierce's Curves and Functions. Greek.—The Agamemnon of Aeschylus, the Antigone of Sophocles, Greek Composition. Latin.—Quintilian, Cicero against Verres, Latin Exercises and Extemporalia. German.—Schiller's Wilhelm Tell, Geothe's Faust, Lectures on German Grammar. Spanish.—Gil Blas, Sale's Grammar. Italian.—Dall' Ongara's La Rosa dell' Alpi, Cuorre's Grammar and Exercises. Modern Literature.—Lectures. Patristic and Modern Greek. Geology.—Lectures. Anatomy.—Lectures.

Second Term.—Philosophy.—Hamilton's Metaphysics, Bowen's Ethics and Metaphysics. History.—Modern History. Religious Instruction. Rhetoric.—Themes.

Elective and Extra Studies.—Mathematics.—Pierce's Analytic Mechanics. Greek.—Thucydides, Greek Composiiion. Latin—Lucretius, Latin Exercises and Extemporalia. German.—Goethe's Faust, Otto's German Grammar, Lessing's Emilia Galotti and Laokoon. Spanish.—Calderon's El Principe Constante, Calderon's El Magico Prodigioso. Italian.—Dante. Zoology.—Lectures. Modern Literature.—Lectures. Patristic and Modern Greek.

The Hebrew Language is taught by Professor Noyes to those who desire to learn it.

COURSES IN CIVIL ENGINEERING AND MECHANICS,

IN SHEFFIELD SCIENTIFIC SCHOOL.

JUNIOR YEAR.

A. Civil Engineering. *First Term.*—French and German—(see Select Course.) Mathematics—Descriptive Geometry (Church's), Analytical Geometry of Three Dimensions. Surveying—Higher Surveying, Topographical Surveying. Drawing—Topographical.

Second Term.—French—(See Select Course). Mathematics—Davies' Shades, Shadows, and Linear Perspective, Differential Calculus. Astronomy. Norton's Astronomy with practical problems.

Third Term.—French—(See Select Courses). Mathematics—Linear Perspective (continued), Isometrical Projection, Differential and Integral Calculus. Drawing—Isometrical and Mechanical.

B. Mechanics.—The same as the course in Civil Engineering, with the omission of Higher Surveying, Topographical Surveying, Topographical Drawing and Astronomy, and the substitution of Mechanics (Peck's Elements), Mechanical Drawing, Metallurgy, and Principals of Mechanics.

SENIOR YEAR.

A. Civil Engineering.—*First Term.*—French—Selections. Field Engineering and Surveying—Hench's Field Book for Railroad Engineers. Location of Roads, Geodetic Surveying. Mechanics—Peck's Elements, Thermodynamics. Geology—Dana, Drawing—Architectural.

Second Term.—Mechanics—Peck's Elements (continued), Application of Calculus to Mechanics, Principles of Mechanism, Theory of Steam Engine.

Civil Engineering—Strength of Materials, Bridge Construction, Stability of Arches, Stone Cutting, with graphical problems. Geology—Dana (continued).

Third Term.—Mechanics—Mechanics applied to Engineering (Weisbach, Vol. II.), Prime Movers. Civil Engineering—Stone Cutting (continued), Building Materials (lectures), Designs of Structures, Mahan's Civil Engineering. Drawing—Structural.

B. MECHANICS.—*First Term.*—Analytical Mechanics, Machinery, Thermodynamics. Drawing—Architectural.

Second Term.—Analytical Mechanics (continued), Strength of Materials, Theory and Construction of Steam Engine, Examination and Reports of Machines, Mechanical Practice.

Third Term.—Prime Movers, Mill Work, Designs of Machines.

COURSE IN AGRICULTURE.

JUNIOR YEAR.

FIRST TERM.—Agriculture—Chemistry, Structure, and Physiology of the Plant, Water Atmosphere and Soil in their relation to Vegetable Production, Improvement of the Soil, Tillage, Draining, Amendments and Fertilizers, Lectures. Experimental and Analytical Chemistry—in their Agricultural Applications, Daily Laboratory Practice. Zoology—Lectures. French—commenced. German—Woodbury's Method. Meteorology—Academical Lectures.

SECOND TERM.—Agriculture—Chemistry and Physiology of Domestic Animals, Digestion, Respiration, Assimilation and Excretion; Composition, Preparation and Value of the kinds of Fodder; Milk, Butter, Cheese, Flesh and Wool, as Agricultural products, Lectures. Experimental Chemistry—Laboratory Practice. French and German—continued. Physical Geography—Lectures. Zoology—Lectures.

THIRD TERM.—Horticultural and Kitchen Gardening—Propagation, training and culture of Fruit Trees, the Vine, Small Fruits and Vegetables, Lectures. Mineralogy—Lectures and practical Exercises. Experimental Chemistry—Laboratory Practice. French or German—continued. Drawing—Free Hand Practice. Excursions.—Botanical, Zoological, &c.

SENIOR YEAR.

FIRST TERM.—Agriculture—The staple grain, forage, root and fiber crops of the Northern States, their varieties, soils adapted for them, preparation of soil, seeding, cultivation, harvesting, and preparation for market. Lectures. Agricultural Zoology—Origin and Natural History of Domestic Animals, Insects useful and injurious to Vegetation, Lectures. Geology—Dana's Manual. French or German—Selections. Excursions—Agricultural, Zoological, Geological, &c.

SECOND TERM.—Agriculture—Raising and Care of Domestic Animals, characteristics and adaptation of Breeds, Cattle for Beef and Draught, The Dairy, Sheep for Wool and Mutton, Horses, Swine, pasturing, soiling, stall feeding, Tobacco, Hops, &c., Lectures. Forestry—Preservation, culture and uses of Forests and Forest Trees, Lectures. Human Anatomy and Physiology—Lectures Agricultural Botany—Weeds and Noxious Plants, Lectures. French or German.

THIRD TERM—Rural Economy—History of Agriculture and Sketches of Husbandry in Foreign Countries, Adaptation of Farming to soil, climate, market, and other natural and economical conditions, Systems of Husbandry, Stock, Sheep, Grain, and mixed Farming, Lectures. Farm Accounts—Lectures and practical exercises. Excursions—Agricultural, Geological, Zoological and Botanical. Examinations in the studies of the Course.

MEETING OF THE BOARD OF TRUSTEES.

ILLINOIS INDUSTRIAL UNIVERSITY,
Urbana, Champaiyn Co., Ill., Nov. 18, 1868.

The Board of Trustees of the Illinois Industrial University met pursuant to the call of the Executive Committee, in the Library Hall, at 9 o'clock, A. M.

After the reading of the Scriptures and prayer, upon calling the roll, the following members answered to their names:

Allen	Goltra
Blackburn	Hayes
Brown, of Chicago	Johnson
Brown of Pulaski	Mahan
Burchard	McMurray
Cobb	Pickrell
Cunningham	Pullen
Dunlap	Quick
Edwards	Scroggs
Flagg	VanOsdell
Galusha	The Regent

The following named gentlemen were absent:

Bateman	Lawrence
Brayman	McConnell
Burroughs	Topping
Hammond	The Governor
Hungate	

Mr. Harding being deceased.

The Regent presented the following report relating to the progress and present wants of the University:

GENTLEMEN:—Though not positively required from me by any rule of the Board, it seems fitting that I shall report to you those facts concerning the University and its several departments which will enable you to judge of its present wants, and to act intelligently upon the several matters which require your attention.

DOINGS OF EXECUTIVE COMMITTEE.

Since your meeting in March, the Executive Committee has held three meetings; the first held the 12th of May, the second was held June 11th, and the third September 16th.

At the meeting in May, the committee audited the accounts then due. It was ordered by the committee that the students might be employed at overwork at 12½ cents an hour. The Regent was instructed to take measures to secure as favorable terms as possible for students' uniforms. The Regent and head farmer were authorized to employ a gardener, and $400 were appropriated for repairing farm buildings and fences. A portion of the trees having been received from Mr. Dunlap's nursery, a committee was appointed to confer with the supplier concerning the prices for the same.

At the meeting of June, the accounts were audited to that date. The issue of a circular and catalogue was ordered, and appropriations were made for drums and fifes. A committee was appointed to inquire into the quality and cost of tile wanted for draining farm and garden. It was ordered that application should be made to the Trustees to sell 50,000 acres of scrip at not less than $1 10 per acre.

These orders were subsequently carried out, but no sale of scrip has yet been made under the authority thus obtained. The committee also ordered that Assistant Professors shall be paid a salary of $1200 per annum.

At the meeting in September all accounts were audited to that date, and appropriations were voted as follows:

For Chemicals	$368 69
" Chemical apparatus	439 45
" a Microscope, not exceeding	250 00
" Forcing pit	250 00
" Drainage	1200 00
" Surveying instrument	400 00

Judge Cunningham and Mr. Periam were appointed a committee to rent the Griggs farm for the next year. A meeting of the Trustees was ordered to be called for the 18th of November. Alterations were authorized to be made to provide a dining room in the basement, and to fit up the old dining room for the library and reading room, with portable furnace to warm the class rooms and chapel above it. The purchase of additional chairs, and of seed wheat, was also ordered. The Professor of Chemistry was instructed to keep an account of chemicals used by each student, and that the question of price to be charged for these chemicals, be left to be decided by the full Board.

The orders have been carried out, except that relating to drainage. A correspondence was opened with the several manufacturers of drain tile, to ascertain the costs of the several kinds of tile, and Prof. Shattuck proceeded to make a topographical survey of the farm and garden, preparatory to the adoption of some suitable system of drainage. We shall be ready to begin the work whenever the weather will permit.

The bills for the several purchases made under the orders of the Executive Committee will be presented to the Board for approval.

Under the authority granted, Mr. Thomas Franks, a thoroughly instructed and competent English gardener was employed, and is now at work, at a salary of $50 a month.

It may be stated here, that considerable donations of bedding plants and shrubs have been received from several prominent Horticulturists in the State. Other donations of valuable tools and implements for the farm and garden have been received from gentlemen engaged in the manufacture of agricultural implements, and donations of text and library books have been made by several eminent publishing houses.

The following is a list of donations received to this date:

L. Vandesyde, Calumet, 1 set reed mats.

Emerson & Co., Rockford, 1 Jones' hand corn planter.

Fuller & Palmer, Chicago, 50 sash for garden use.

R. S. Wheatley, Du Quoin, 1 subsoil and garden plow.

Barlow, Wood & Co., Quincy, 1 Vandever's corn planter with drill attachment.

Furst & Bradley, Chicago, 1 walking cultivator.

Clark & Utter, Rockford, 1 Gorham seeder and cultivator, combined.

Wm. Lintner, Decatur, 1 farm pump.

J. J. Inglehart, Matteson, 1 Granger patent rotating harrow.

Hubbard & Finch, Champaign, 1 two horse cultivator, Frazier's patent, and 1 Kalamazoo three horse clevis.

Robert Douglas, Waukegan, collection evergreen seeds.

S. Wilbur, Momence, duplicate collection of flower seeds.

D. M. Ferry & Co., Detroit, Mich., collection of flower and garden seeds, and 1 package of Behera wheat, imported from Egypt.

T. W. Lachore, Blue Island, 2 wheel hoes.

B. Dornblazer, Joliet, 1 Hoosier riding or walking cultivator, and 1 double shovel plow.

J. C. Wilson, Crete, 1 patent rotary harrow.

Phœnix, Bloomington, 100 rose bushes, and collection of flowering shrubs and bedding plants.

Edgar Sanders, Chicago, 100 select bedding plants.

P. S. Meserole, Chicago, 1 Allen's Weeder, 1 Hexamer pronged hoe.

Joseph Mainhofer, Ottawa, 1 Messenger or Gopher cultivator, with extra shares.

John Deere, Moline, 1 improved P. P. plow.

O. M. Railsback, Champaign, 300 select green house and bedding plants.

Jacob Strayer & Co., South Bend, Ind., 1 Statesman force feeding grain drill, grass sower and surveyor.

Fairbanks, Greenleaf & Co., 1 set of grocer scales, 1 set counter scales, discount on hay scales, $75.

H. C. Rector, Champaign, 1 Blevin's patent plow and cultivator.

M. A. & J. M. Cravath, Bloomington, 1 revolving cultivator and hilling machine.

M. Dorsett, Chicago, 1 model straw rick, with ventilating tube for preserving hay or grain, and movable roof.

M. Cochrane, Architect, 1 fine colored lithograph of new State Capitol.

Valuable text and library books received from Sheldon & Co., New York, R. S. Barnes, New York, D. Appleton, New York, Harper Bros., New York, Ivison & Phinney, New York.

S. M. Hayward & Son, Pana, Ill., red Genesee winter wheat, for seed.

A. Blumenshein, Florist, Chicago, collection of green house plants.

Edgar Sanders, Chicago, collection of bulbs,

Edgar H. Potter, Kalamazoo, Mich., improved three horse clevis.

DOINGS OF OTHER COMMITTEES.

The committee on Building and Grounds met in conjunction with the Executive committee, both in April and June. They recommended several alterations and improvements in the University buildings, which, having been considered and ordered by the Executive committee, were afterwards carried into effect. They also recommended the erection of a building to be used partly as a carpenter's shop, and partly to shelter tools and one team. This building, under an order of the Executive committee, has been erected, and is now in use.

The committee on Faculty and Studies has also held several meetings. The time when Prof. Powell should enter upon service having been referred by the Board to this committee, an interview was held with Prof. Powell, and on his full acceptance of the appointment tendered him by the Board, he was put on service at once, but at his own request was detailed to conduct the scientific expedition he was already engaged in. The sum of six hundred (600) dollars was voted to him as a salary in full for the time he should be absent, it being agreed that this sum should also be in lieu of the appropriation he had asked from this Board in behalf of the University, to the several collections proffered by Prof. Powell as an inducement for such appropriations. Subsequently Congress passed a law granting some material aid to this expedition, and giving it much larger power to secure valuable collections. Prof. Powell's absence has delayed a reception of the collections made by him in his former expedition.

Prof. Sewall having declined the appointment tendered him to the chair of Chemistry, the committee, under the authority given by the Board, secured the services of Prof. A. P. S. Stuart, late of the Lawrence Scientific School, in Harvard University, and now recommend Prof Stuart to the Board for permanent appointment to the chair of Chemistry.

The committee also secured the services of Col. S. W. Shattuck, late of Norwich University, as Assistant Professor of Mathematics, and of Prof. Thos. J. Burrill, late Principal of the Urbana High School, as Assistant Professor of Natural History and Botany, and now ask the appointment of these gentlemen to these places for the current year. In accordance with a resolution of the Board, the committee has employed Capt. E. Snyder as Accountant and teacher of Book-keeping, and his appointment for the current year is cordially recommended. The salary of Profs. Shattuck and Burrill was fixed at $1,200 per annum, and that of Capt. Snyder at $1,000. I would respectfully suggest that, as Capt. Snyder has been called upon to give instruction in German, is doing full service as a teacher, that the title and salary of an assistant professor be accorded to him. The appointments tendered by you to Dr. Warden and Mr. Eggleston have been accepted by these gentlemen, and Dr. Warder will give his first course of lectures in January next. The time for the lectures of Mr. Eggleston has not yet been fixed.

Prof. Atherton having accepted a Professorship in an Eastern college has given notice of his resignation, to take effect the 1st of January next. As chairman of the Library committee, and under advice from the committee, I have recently expended $600 of the library fund, set apart by you from the matriculation fees, for such books as seemed most needful, including a large number of agricultural works. There is a small unexpended balance of this fund, which will enable us to provide the reading room with a necessary supply of periodicals. It is of vital importance to the

Chemistry. Thos. J. Burrill as Assistant Professor of Natural History and Botany, Col. S. W. Shattuck as Assistant Professor of Mathematics and Instructor in Military Tactics, and Capt. E. Snyder as Bookkeeper and Instructor in Bookkeeping, and now recommend these gentlemen for permanent appointment to these several places. The Regent further stated, that Capt. Snyder had been employed during the term in teaching German, and recommended that he be appointed to an Assistant Professorship, to be hereafter named.

The Board, on motion, proceeded to consider the nominations made by the committee on Faculty and Course of Study, and on motion of I. S. Mahan, it was voted—"That Professor A. P. S. Stuart be and is hereby elected to the chair of Chemistry, at a salary of two thousand (2000) dollars per annum, to take effect from and after September 1, 1858; that Thomas J. Burrill be elected Assistant Professor of Natural History, at a salary of twelve hundred (1200) dollars per annum, for the term of one year from the 1st day of September, A. D. 1868.

Resolved, That Col. S. W. Shattuck be elected Assistant Professor of Mathematics and Instructor in Military Tactics, at a salary of twelve hundred (1200) dollars per annum, for one year from September 1st, A. D. 1868.

The Regent asked that Captain Snyder be appointed Assistant Professor without assigning his place, at a salary of twelve hundred (1200) dollars per annum. Whereupon on motion of Mr. Cunningham, he was so appointed, his appointment to take place from and after this date.

Mr. Hayes, of Chicago, asked leave to read a communication from the Common Council of Chicago, in relation to the Polytechnic School in Chicago; which being granted, he proceeded to read as follows:

STATE OF ILLINOIS, }
COOK COUNTY, }
CITY OF CHICAGO. }

I, A. H. Bodman, Clerk of the City of Chicago, do hereby certify that the following proceedings were had in the Common Council of said city, at a regular meeting held August 3d, 1868, to-wit:

Ald. Holden, of Committee on Finance, to whom had been referred several petitions in relation to the location of the Mechanical department of the Illinois Industrial University, and asking that the Common Council appropriate a certain amount of money therefor, submitted a report recommending the adoption of a preamble and resolution attached thereto.

Chemistry. Thos. J. Burrill as Assistant Professor of Natural History and Botany, Col. S. W. Shattuck as Assistant Professor of Mathematics and Instructor in Military Tactics, and Capt. E. Snyder as Bookkeeper and Instructor in Bookkeeping, and now recommend these gentlemen for permanent appointment to these several places. The Regent further stated, that Capt. Snyder had been employed during the term in teaching German, and recommended that he be appointed to an Assistant Professorship, to be hereafter named.

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Ald Macalister moved that the report and resolution be laid over and published.

Carried.

The report and resolution are as follows:

To the Hon. the Mayor and Aldermen of the City of Chicago, in Common Council assembled:

Your Committee on Finance, to whom was referred a communication, with preamble and resolution, from Hon. S. S. Hayes, Trustee Mechanical Department State Industrial University, as also communication from S. S. Hayes, J. C. Burroughs, J. M. Van Osdell, E. L. Brown, and D. S. Hammond, Committee of the Trustees of the Mechanical Department of the Illinois Industrial University; also seventeen petitions from citizens of Chicago—all of which ask this Council to favorably consider their application to have the Polytechnic College or Mechanical department of the State Industrial University, located in the city of Chicago, with an appropriation of $250,000, by a contribution to the same, having carefully considered the subject, report that your Committee fully indorse the views as set forth in the preamble and resolution referred to them.

Your Committee believe that the interests of the mechanics of the Northwest, of which Chicago is the commercial center, demand an institution of this kind for the better development of the arts and sciences in our midst, and believing this, we think it the duty of this Council, as the legislative body of the City of Chicago, to lend its aid in the manner sought, and we would respectfully ask the concurrence of this Council in the following preamble, and the passage of the resolution herewith.

WHEREAS, The establishment and successful operation in the city of Chicago of a Mechanical or Polytechnic College, for the more thorough education of mechanics in those sciences which are necessary for the attainment of the highest skill in the mechanical arts, would be of great value to the industrial class in the city of Chicago, and to the State at large, and

WHEREAS, Under the acts of Congress, and the General Assembly of the State, the Board of Trustees of the State Industrial University have designated Chicago as the place for the location of the Mechanical or Polytechnic department of that University, subject to the condition that the same be located as near the center of the city as possible; and

WHEREAS, The county of Champaign has donated to the Agricultural department of said University, county bonds of said county to the amount of $100,000, and other property to the estimated value of $350,000 more, in consideration of the location of said Agricultural Department in said county; and

WHEREAS, There seems to be a defect of power under the city charter for the city to issue bonds for such a purpose at this time, therefore, be it

Resolved, by the Mayor and Aldermen of the City of Chicago, in Common Council assembled, That the following proposition be and the same is hereby made to the Board of Trustees of the Mechanical or Polytechnic department of the State Industrial University, to-wit: If and upon condition that the Trustees of said Mechanical department shall permanently locate said de-

Ald Macalister moved that the report and resolution be laid over and published.

Carried.

The report and resolution are as follows:

To the Hon. the Mayor and Aldermen of the City of Chicago, in Common Council assembled:

Your Committee on Finance, to whom was referred a communication, with preamble and resolution, from Hon. S. S. Hayes, Trustee Mechanical Department State Industrial University, as also communication from S. S. Hayes, J. C. Burroughs, J. M. Van Osdell, E. L. Brown, and D. S. Hammond, Committee of the Trustees of the Mechanical Department of the Illinois Industrial University; also seventeen petitions from citizens of Chicago—all of which ask this Council to favorably consider their application to have the Polytechnic College or Mechanical department of the State Industrial University, located in the city of Chicago, with an appropriation of $250,000, by a contribution to the same, having carefully considered the subject, report that your Committee fully indorse the views as set forth in the preamble and resolution referred to them.

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WHEREAS, Under the acts of Congress, and the General Assembly of the State, the Board of Trustees of the State Industrial University have designated Chicago as the place for the location of the Mechanical or Polytechnic department of that University, subject to the condition that the same be located as near the center of the city as possible; and

WHEREAS, The county of Champaign has donated to the Agricultural department of said University, county bonds of said county to the amount of $100,000, and other property to the estimated value of $350,000 more, in consideration of the location of said Agricultural Department in said county; and

WHEREAS, There seems to be a defect of power under the city charter for the city to issue bonds for such a purpose at this time, therefore, be it

Resolved, by the Mayor and Aldermen of the City of Chicago, in Common Council assembled, That the following proposition be and the same is hereby made to the Board of Trustees of the Mechanical or Polytechnic department of the State Industrial University, to-wit: If and upon condition that the Trustees of said Mechanical department shall permanently locate said department and its buildings at a site within one-half mile of the geographical centre of the city of Chicago, the Common Council will, and hereby pledges itself, to make application to the General Assembly of the State, at its next regular session, for power to issue seven per cent. bonds of the said city to the amount of $250,000, as an endowment for said Mechanical department, and, upon obtaining such power, will, within ninety days thereafter, issue and deliver to the Trustees of said Mechanical or Polytechnic department for the purpose aforesaid, the said amount of $250,000 of seven per cent. bonds of the city of Chicago.

All of which is respectfully submitted.

Charles C. P. Holden,
Charles G. Wicker,
Theodore Schintz,
Committee on Finance.

I do further certify that at the regular meeting of said Common Council, held in Chicago August 10th, A. D. 1868, the following proceedings were had, to-wit:

Report of Committee on Finance on petitions and resolutions in relation to Illinois Industrial University, laid over and published Aug. 3, 1868.

Ald. Holden moved to concur in the report and pass the resolution.

Ald. S. I. Russell moved to postpone action until next regular meeting, and demanded the ayes and noes thereon.

The motion was lost by the following vote:

Ayes—Knickerbocker, Calkins, Macalister, S. I. Russell, B. F. Russell, Casselman, Buehler, Beebe, Schmidt, Berger, Herting—11.

Noes—Cox, Donnellan, Wicker, Hahn, McRoy, Raber, Sheridan, Walsh, Keeley, Hildreth, Comiskey, Rafferty, Carpenter, Salisbury, Holden—15.

The question then being on the motion of Ald. Holden, the ayes and noes were called, and the report was concurred in, and the resolution adopted by the following vote:

Ayes—Knickerbocker, Cox, Dixon, Donnellan, Wicker, Hahn, McRoy, Calkins, Raber, Sheridan, Walsh, Keeley, Macalister, Hildreth, Comiskey, Rafferty, Carpenter, Salisbury, Holden, Buehler, Beebe, Schmidt, Berger, Herting—24.

Noes—S. I. Russell, B. F. Russell, Casselman—3.

The following is the resolution as passed:

Whereas. The establishment and successful operation in the city of Chicago, of a Mechanical or Polytechnic College for the more thorough education of mechanics in those sciences which are necessary for the attainment of the highest skill in the mechanical arts, would be of great value to the industrial classes, to the city of Chicago, and to the State at large, and

Whereas, Under the acts of Congress, and the General Assembly of this State, the Board of Trustees of the State Industrial University have designated Chicago as the place for the location of the Mechanical or Polytechnic department of that University, subject to the condition that the same be located as near the center of the city as possible; and

Whereas, The county of Champaign has donated to the Agricultura

partment and its buildings at a site within one-half mile of the geographical centre of the city of Chicago, the Common Council will, and hereby pledges itself, to make application to the General Assembly of the State, at its next regular session, for power to issue seven per cent. bonds of the said city to the amount of $250,000, as an endowment for said Mechanical department, and, upon obtaining such power, will, within ninety days thereafter, issue and deliver to the Trustees of said Mechanical or Polytechnic department for the purpose aforesaid, the said amount of $250,000 of seven per cent. bonds of the city of Chicago.

All of which is respectfully submitted.

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The following is the resolution as passed:

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WHEREAS, Under the acts of Congress, and the General Assembly of this State, the Board of Trustees of the State Industrial University have designated Chicago as the place for the location of the Mechanical or Polytechnic department of that University, subject to the condition that the same be located as near the center of the city as possible; and

WHEREAS, The county of Champaign has donated to the Agricultura

department of said University, county bonds of said county to the amount of $100,000, and other property to the estimated value of $350,000 more, in consideration of the location of said Agricultural department in said county, and

WHEREAS, There seems to be a defect of power under the city charter for the city to issue bonds for such a purpose at this time, therefore, be it

Resolved, By the Mayor and Aldermen of the city of Chicago in Common Council assembled, that the following proposition be, and the same is hereby made to the Board of Trustees of the Mechanical or Polytechnic department of the State Industrial University, to-wit: If, and upon condition that the Trustees of said Mechanical department shall permanently locate said department and its buildings at a site within one-half mile of the geographical centre of the city of Chicago, the Common Council will, and hereby pledges itself, to make application to the General Assembly of this State, at its next regular session, for power to issue seven per cent. bonds of the said city, to the amount of $250,000, as an endowment for said Mechanical department, and, upon obtaining such power, will, within ninety days thereafter, issue and deliver to the Trustees of said Mechanical or Polytechnic department for the purpose aforesaid, the said amount of $250,000 of seven per cent. bonds of the city of Chicago.

And that said resolution was duly approved by the Mayor of said city, and remains in full force.

[SEAL.] In testimony whereof, I have hereunto set my hand and the seal of said city, this 17th day of November, A. D. 1868.

A. H. BODMAN, *Clerk*.

Mr. Flagg asked and obtained leave to read a resolution relating to experiments to be carried out upon the University farm, and simultaneously in different parts of the State, and that the Regent be authorized to draw a warrant to meet the expenses of the same, unless the Legislature shall make up appropriations for the same; and also a resolution, that the Executive committee provide for a course of lectures and discussions, to commence about the 12th of January next, to continue two weeks; that the co-operation of the practical farmers of the State be earnestly solicited to make the discussion successful, and disseminating the views in practical and scientific agriculture and in facts relating thereto.

Laid on the table.

On motion, a recess was taken until 12 o'clock, to enable the committee on Polytechnic branch to report. Upon re-assembling at 12 o'clock, the committee on Polytechnic School reported as follows:

department of said University, county bonds of said county to the amount of $100,000, and other property to the estimated value of $350,000 more, in consideration of the location of said Agricultural department in said county, and

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REPORT OF COMMITTEE.

Your special committee to whom was referred the resolution of the city of Chicago, proposing the donation of $250,000 to the Mechanical department of this institution, located at Chicago, and the resolution of Mr. Hayes in relation thereto, would report that we recommend the adoption of the resolution in the following form:

Resolved, That this Board appreciate highly the liberal proposition of the city of Chicago, by its resolution of August 11th, 1868, to appropriate $250,000 of seven per cent. bonds of said city, as soon as the requisite power can be obtained, as an endowment for the Mechanical Department of this University, upon condition that the said department and its buildings should be permanently located at a site within one-half mile of the geographical center of said city.

Resolved, That in accordance with the resolution of this Board of March 13th, 1867, establishing a Mechanical Department of the Industrial University at Chicago, as near as possible to the center of the city, the members of this Board residing in the Third Grand Division and First Congressional District be, and they are hereby, instructed to accept said proposition, and notify the said city thereof; and they are authorized and instructed to execute and deliver such contracts as may be necessary or proper in the premises.

(Signed) I. S. MAHAN,
Chairman of Committee.

Mr. Hayes moved its adoption, which being seconded, the ayes and noes were called, resulting as follows:

Ayes—Allen, Blackburn, Brown of Chicago, Brown of Pulaski, Cobb, Burchard, Edwards, Flagg, Goltra, Hayes, Johnson, Mahan, McMurray, Pickrell, Pullen, Quick, Scroggs, Van Osdell, the Regent—19.

Noes—None.

The subject of Legislative appropriation was then called up. Mr. Johnson moved that this subject be made the special order for 7 o'clock, and that it be discussed in secret session. After some discussion, on motion of Mr. Flagg, it was referred to the Finance Committee. Carried.

On motion the Board adjourned to 2 o'clock, P. M.

AFTERNOON SESSION.

The Board was called to order at 2:30 P. M.

The following resolutions of Mr. Flagg were taken up and passed:

Resolved, That the Superintendent of the Farm be instructed to report a scheme of Agricultural experiments for the year 1869, to be carried out on the University farm, and also simultaneously at other points in the State, em-

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Resolved, That said scheme of Agricultural experiments, when revised, corrected and approved by this Board, or the Executive committee, shall be carried out by the Superintendent of the farm and the Corresponding Secretary under the direction of the Regent, and that the Regent be authorized to draw a warrant, or warrants, not to exceed the sum of $500, to meet such expenses as may be incurred in procuring material for, and carrying out these experiments, unless the Legislature shall, at the next session, make an appropriation for that purpose.

Also the following:

Resolved, That the Executive committee be instructed to provide for a course of Agricultural lectures and discussions, to commence about the 12th of January next and continue two weeks, these discussions to be held at the University and free to all persons—and that the attendance and co-operation of the practical farmers of this State is hereby earnestly solicited to aid in making these discussions successful, both in disseminating their views on the best methods of practical farming and in furnishing facts for a science of agriculture.

Carried.

The Committee on Horticulture reported plans and specifications for improvements of horticultural grounds and experimental planting, which, on motion, were referred to the Finance committee.

To the Board of Trustees of the Illinois Industrial University:

The committee on Horticulture respectfully beg leave to report.

Section seven of the Act of Incorporation, among other things, authorizes the Board of Trustees to "establish and provide for the management of said model farms as may be required to teach, in the most thorough manner, such branches of learning as are related to agriculture and the mechanic arts."

As a part of such model farm, and for the more perfect demonstration of that department of agriculture known as horticulture or garden culture, we beg leave to make the following recommendations:

The plat hereunto attached as a part of this report, marked A, exhibits the ground plan of the grounds proposed to be occupied, and the schedule shows how they may be planted, and also contains the list of forest trees recommended for trial.

No extended argument is required at this time to prove the need of teaching the cultivators of the soil the importance of forest tree planting, of orcharding, and of other departments of gardening.

In regard to the orchard proper, the most important feature that we now recommend, is the procuring and planting of samples of all the improved varieties of fruits for identification and for comparison—a sort of fruit tree museum of varieties, that will be at all times accessible for reference.

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In regard to the orchard proper, the most important feature that we now recommend, is the procuring and planting of samples of all the improved varieties of fruits for identification and for comparison—a sort of fruit tree museum of varieties, that will be at all times accessible for reference.

The management of the orchard, vineyard and garden will more properly come under the care of the Professor of Horticulture, or head gardener. But we would urge that the grounds reserved for the orchard, be occupied for that purpose at as early a day as possible. The estimate for the cost of trees will be found in the schedule, but that for labor and other material are combined in the ground plan, and its proportion, to some extent, must be left to the discretion of the person in charge of the improvements.

The great feature of these grounds, and what is of paramount importance at this time, to the whole people of the State, is the planting of forest trees for useful purposes. It is a new demand upon their industry and upon their lands, from which they cannot fail to reap the most valuable results.

The new condition of things, created by railroads and improved agricultural implements, present new industries, both to the cultivators of the soil and to the mechanic, in which they have a mutual interest. The forests are rapidly disappearing, or at least those useful trees that have a commercial value, and yet many of the new demands have not been met, nor is the old supply likely to hold out. But, if the forests of Michigan, Wisconsin, Minnesota and Indiana were adequate to the demand, as a matter of economy in freights, if not in the superior quality of our second growth timber, especially of the decideous varieties, it is an object to grow them at home, rather than to buy them.

Timber for railroad ties, culverts, cars, roadways and buildings, fencing, vineyard stakes, hop poles, stanchions for coal banks, soft wood, like white willow and the poplars, for berry boxes, crates and staves; hoop poles, wagon and carriage material, agricultural implements, and the multiform wants of the age, make up a demand of most surprising magnitude, that will add to our rural industry an importance that the most sanguine have not hitherto dreamed of.

If we look at this as simply the demand of agriculture, it must be conceded that it is legitimate and ought to be granted without an objection; but we have added to this the claim of the mechanic, who is also largely interested, for it will enable him to compete with those of other States in the supply that commerce demands.

The State that sells the raw products of its soil is never rich, while the States that manufacture for others do well; those that grow the raw material and manufacture it at home, are the most prosperous. No doubt the State of Illinois had these facts in view when it established this great school of the industries for the especial benefit of those two classes who create the wealth of the State.

There are in this State about eighty species of forest trees, besides the larger shrubs. With the exception of the oaks, yellow poplar and hickory, we have not drawn largely from our native forests; and to-day we purchase nearly all of our timber. Nearly all of the ash timber used for agricultural implements, a part of our fence posts, and a portion of our railroad ties come from other States. Added to these is the greater part of the material for our wagons and carriages, when not wholly manufactured in other States; timber

The management of the orchard, vineyard and garden will more properly come under the care of the Professor of Horticulture, or head gardener. But we would urge that the grounds reserved for the orchard, be occupied for that purpose at as early a day as possible. The estimate for the cost of trees will be found in the schedule, but that for labor and other material are combined in the ground plan, and its proportion, to some extent, must be left to the discretion of the person in charge of the improvements.

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To bring these useful trees within the bounds of culture and to utilize them, is one of the objects of this industrial institution. To teach the people of the State how to add these products of the forest to their other crops, and thus add millions of dollars annually to the wealth of the State, to give labor a wider range and a more comprehensive field for its employment, are objects worthy of such an institution.

Thousands of acres of timber can be planted in shelter belts, to check the winds that comes down from the north, with its polar cold, destroying the plants that the genial summer, fanned with the breath of the tropics, has made to flourish on our open plains. Wall in these prairies of central and northern Illinois with belts of conifers and decideous trees and we shall have one of the best of climates; genial and equable, and with the best soil in the Union, with a geographical position midway between the two oceans, over which must pass a large part of the commerce of the world, and if we are not laggards in the world's progress we may reap from such surroundings a rich reward.

The Committee have divided these thirty species of useful forest trees into three classes, according to their supposed value for the demands of commerce and for domestic use. In the first class they include the European Larch, Austrian Pine and Norway Spruce, native trees of Europe, and the Osage Orange, native of the Southwestern States. In the second and third class, White Willow, a native of Europe; Black Spruce and Norway Pine, natives of the more Northern States. Thus making up the list with four European, three of other States and twenty-three species from the forests of Illinois.

Our other native trees of minor importance will find a place in the arboretum, where those of other sections of this Continent and of Europe may be tested side by side. It is probable that among them may be found many of value.

The ten acres reserved for a commercial garden and grounds—for the testing of new varieties of plants—for comparing and further testing of old ones—for the proving of new modes of culture and the testing of new implements, cannot fail of proving useful, especially to those students who remain at the University during the spring and summer occupied in some "industrial avocation." As the larger part of this plot of ground will be devoted to a market garden it is hoped that it will prove to be a paying investment.

We recommend the planting of an osage hedge around the two hundred acres embraced in the plat.

We recommend that so much of lot Y as is suitable for the purpose be planted to an experimental orchard of the apple; two trees of each variety; the rows to run North and South, twenty-four feet wide, and the trees twenty-five in the rows; the trees in each tenth row to consist of Norway spruce. In this connection we also recommend that the offer of A. M. Lawver for railroad cars, and hard-wood lumber for many other useful purposes, that ought to be grown near the place of manufacture.

To bring these useful trees within the bounds of culture and to utilize them, is one of the objects of this industrial institution. To teach the people of the State how to add these products of the forest to their other crops, and thus add millions of dollars annually to the wealth of the State, to give labor a wider range and a more comprehensive field for its employment, are objects worthy of such an institution.

Thousands of acres of timber can be planted in shelter belts, to check the winds that comes down from the north, with its polar cold, destroying the plants that the genial summer, fanned with the breath of the tropics, has made to flourish on our open plains. Wall in these prairies of central and northern Illinois with belts of conifers and decideous trees and we shall have one of the best of climates; genial and equable, and with the best soil in the Union, with a geographical position midway between the two oceans, over which must pass a large part of the commerce of the world, and if we are not laggards in the world's progress we may reap from such surroundings a rich reward.

The Committee have divided these thirty species of useful forest trees into three classes, according to their supposed value for the demands of commerce and for domestic use. In the first class they include the European Larch, Austrian Pine and Norway Spruce, native trees of Europe, and the Osage Orange, native of the Southwestern States. In the second and third class, White Willow, a native of Europe; Black Spruce and Norway Pine, natives of the more Northern States. Thus making up the list with four European, three of other States and twenty-three species from the forests of Illinois.

Our other native trees of minor importance will find a place in the arboretum, where those of other sections of this Continent and of Europe may be tested side by side. It is probable that among them may be found many of value.

The ten acres reserved for a commercial garden and grounds—for the testing of new varieties of plants—for comparing and further testing of old ones—for the proving of new modes of culture and the testing of new implements, cannot fail of proving useful, especially to those students who remain at the University during the spring and summer occupied in some "industrial avocation." As the larger part of this plot of ground will be devoted to a market garden it is hoped that it will prove to be a paying investment.

We recommend the planting of an osage hedge around the two hundred acres embraced in the plat.

We recommend that so much of lot Y as is suitable for the purpose be planted to an experimental orchard of the apple; two trees of each variety; the rows to run North and South, twenty-four feet wide, and the trees twenty-five in the rows; the trees in each tenth row to consist of Norway spruce. In this connection we also recommend that the offer of A. M. Lawver for duplicates of his collection of varieties, be accepted, and the proper order drawn for the amount.

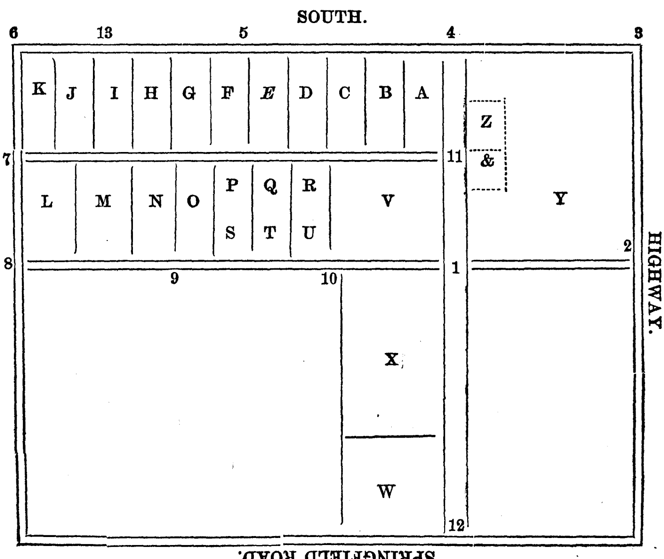
We also recommend that there be an additional experimental orchard of twenty acres, to be located on the stock farm, (Busy farm), for the testing of varieties of the peach, pear, plum, cherry, quince, apricot, nectarine—two trees of each variety, to be planted in rows sixteen by sixteen feet, with every tenth row running North and South to be planted with Norway spruce. Pears to be both standard and dwarf; one half of the dwarf pears to be planted eight feet in the row, thus: 8 by 16 feet. The relative value of standard quince stock to be tested with same varieties, both as regards market value and quality. Cherries to be tried on Morello, Mazzard and Mahaleb stocks. The whole to be surrounded with a double row of Norway spruce, set eight feet apart. The site selected to be the highest point, or points, best adapted to the purpose.

Also, one acre of vineyard, two plants of a variety, and so planted as to test the relative value of different modes of training and pruning.

Also, that lot B of the plat, containing one acre, be devoted to the testing of new varieties of the small fruits. It is probable that at some future time it may be found advisable to extend the plantation of small fruits for market, for the purpose of giving employment to those students who may, in accordance with the law, desire to remain in the University.

We also recommend the formation of an arboretum, to be located North of the new street that is located East and West on the forty acre tract, to contain about ten acres, and marked on the plat "W." So far as practicable to make the same ornamental, on the ground plan of a park, for the use of the University, and the citizens of Urbana and Champaign.

PLAT A.—SCHEDULE.



Shelter belt of two rows of trees, the one sixteen feet inside of the hedge and the other eight feet therefrom, and trees eight feet in the rows, as follows:

From	1 to	2,	80 rods		European Larch.
"	2 "	3,	108	"	Norway Spruce.
"	3 "	4,	80	"	White Ash.
"	4 "	5,	80	"	Austrian Pine.
"	5 "	13,	40	"	Silver Maple.
"	13 "	6,	40	"	White Pine.
"	6 "	7,	60	"	Arborvitæ.
"	7 "	8,	48	"	Green Ash.
"	8 "	9,	60	"	Red Cedar.
"	9 "	10,	60	"	Blue Ash.

Avenue 1 " 4, 80 feet wide.
" 7 " 10, 66 feet wide, and may be slightly curved.
Alley west of "A" 33 feet wide.
Alley west of belt 33 feet wide.
Alley A to J 24 feet.
Alley between ——— 24 feet.
Half of street 6 to 8, 33 feet.
Lots A to J each 188 feet wide ——
" A to J each 908 feet long.
" L, M, N, O, each 260 feet wide.
" L, M, N, O, each 669 feet long.
" P, S, Q, T, each 260 feet wide.
" P, S, Q, T, each 335 feet long.
" U, R, each 128 feet wide.
" U, R, each 335 feet long.
Lot V, 10 17-100 acres, 669x662 feet.
" X, about 26 acres, excluding streets.
" W, arboretum, about ten acres.
" Y, enclosure for apples, about 43 acres.
" Z, one acre for gardener's residence.
" &, two acres for Superintendent's house and outbuildings.
Avenue 1 to 12, 80 feet.

USEFUL TREES—FIRST CLASS.

				Estimated Cost.
Lot A,	4	acres	European Larch,	$108.80
" B,	4	"	Osage Orange	21.76
" C,	4	"	White Pine	133.20
" D,	4	"	White Ash	65.20
" E,	4	"	Austrian Pine	133.20
" F,	4	"	Green Ash	65.20
" G,	4	"	Arborvitæ	326.40
" H,	4	"	Blue Ash	65.20
" I,	4	"	Red Cedar,	54.40
" J,	4	"	Norway Spruce	133.20
	40 acres.			$1,106.56

SECOND CLASS.

Lot K,	2 acres	White Sugar Maple		$27.20
" "	2 "	Black Sugar Maple		27.20
" L,	2 "	American Chestnut (10 bushels nuts)		100.00
" "	2 "	Shellbark Hickory—nuts		15.00
" N,	2 "	Cucumber		54.40
" "	2 "	Norway Pine		326.40
" O,	2 "	Silver Leaf Maple		27.20
" "	2 "	Tulip		43.52
" M,	2 "	White Willow		10.88
" "	2 "	Black Walnut		10.00
	20 acres.			$1,748.36

THIRD CLASS.

Lot P,	1 acre	Red Maple		$13.60
" "	1 "	White Elm		21.76
" Q,	1 "	Red Elm		21.76
" "	1 "	Butternut (nuts)		10.00
" R,	1 "	Catalpa		5.00
" S,	1 "	Hemlock		40.80
" "	1 "	Basswood		27.20
" T,	1 "	White Oak		10.00
" "	1 "	Black Spruce		40.80
" K,	1 "	(South end) Burr Oak		10.00
	10 acres.			$1,949.28

The White Pine, Austrian Pine, Norway Spruce and Hemlock to be planted 8 by 8 feet; all others 4 by 4 feet. The former requiring 680 trees to the acre, and the latter 2,720. The above distances to be varied to some extent by way of experiment, to ascertain, by actual trial, the most proper distances for the planting of the several species.

ESTIMATE OF FUNDS REQUIRED.

Trees, Nuts and Seeds for Forest Grounds	$2,000
" for Orchard (4,000)	1,200
" " Belts	500
" " Orchard on the Stock Farm	2,000
Hedge Plants	18
House for Superintendent	3,000
" " Gardener	500
Barn and Out-buildings	2,000
Farm and Repairs	500
Two Span of Horses	600
Two Wagons and Harness	282
Team hire, Subsoiling or Trench plowing	300
Tile Draining	2,000
Labor, 2 years	7,100
Total	$22,000

We would recommend that the Legislature of the State be asked to make an appropriation of eleven thousand dollars a year, for two years, for the above purpose.

B. PULLEN,
S. EDWARDS,
O. B. GALUSHA,
M. D. DUNLAP,
W. C. FLAGG.

Dr. W. Kile, of Paris, Edgar county, having been appointed by the Governor to the place made vacant by the death of Mr. Geo. Harding, appeared in his seat, and the usual oath was administered to him by Judge Cunningham.

The treasurer, J. W. Bunn, read statement of sale of scrip, and the manner in which the funds have been invested. Referred to committee on Finance.

On motion of Mr. Burchard, the account of balance left in the hands of the Regent was referred to the auditing committee, and he further moved that all of the accounts be referred to the same committee.

The following resolution was then offered:

Resolved, That the committee on Library be instructed to obtain a policy or policies of insurance on the library, instruments, apparatus in the University building, and on all farming implements, and on the buildings in which said implements are housed or stored—to be insured at the full value, or as near thereto as practicable; and the amount sufficient to pay such premiums as may be required is hereby appropriated, and the Regent is instructed to draw a warrant for the same.

Carried.

Mr. Edwards presented the following resolution:

Resolved, That we recognize it as a duty of the Board of Trustee to make this University pre-eminently a practical school of Agriculture and the Mechanic arts.

After discussion, Mr. Cunningham moved to amend, by adding after "arts" the following words, "not excluding other scientifical and classical studies." Pending the discussion which followed, the Regent announced that the students were assembled in the Chapel, and a recess was taken to enable the Trustees to inspect them.

Upon re-assembling, after further discussion, the yeas and nays being called, it was passed as amended by the following vote:

Yeas—Allen, Blackburn, Brown of Chicago, Brown of Pulaski, Burchard, Cobb, Cunningham, Dunlap, Edwards, Flagg, Galusha, Goltra, Hayes, Johnson, Kile, Lawrence, Mahan, Pickrell, Pullen, Quick, Scroggs, Van Osdell, and the Regent—23.

Nays—McMurray.

Upon motion of J. M. Pickrell it was voted: That the foregoing resolution be furnished to the agricultural and other presses of the State, with request for its publication. A motion to adjourn until 7 o'clock, P. M. prevailed.

EVENING SESSION.

Board called to order at 7 o'clock.

On motion of Mr. Blackburn, it was voted to dispense with the ruling of the morning to debate with closed doors. The report of the Committee of Agriculture was then read, and upon motion, it was referred to the committee on finances.

To the Board of Trustees Illinois Industrial University:

The committee on Agriculture make the following report for your consideration.

1st. That the Stock farm is in such condition as to require for the cultivation of the lands, protection of the crops, repair of building and fences thereon, the sum of three thousand ($3,000) dollars, to be expended as follows:

For the purchase of two teams	$ 800 00
" " of harness	75 00
" " of one wagon	125 00
To be expended in repairing fence	1,000 00
For hedging Stock farm	100 00
Repairing house, barn, and for well and cisterns	1,000 00
	$3,000 00
And in addition, as a contingent fund to meet such necessary expenditures not herein enumerated, but as may be called for,	$2,000 00
	$5,000 00

Your committee likewise recommend, as soon as the finances of the Institution will admit, or can be augmented, that the following amounts be set apart to be expended on said farm:

1. $5,000 for barn and tool house on experimental farm.
2. $5,000 for stock and sheep barn, pens, hennery, pigery, apiary, &c.
3. $5,500, houses for farm laborers and gardners.
4. $5,000 for fencing.

5. $2,500 for tools for farm and garden.
6. $5,000 for stock, neat cattle, sheep, swine, etc.
7. $8,000 for underdraining experimental farm and gardens, 200 acres, at $40 per acre.
8. $2,000 for roads, gates, bridges, etc.

Making in the aggregate, $38,000.

All of which is respectfully submitted.

THOMAS QUICK,
Chairman Agricultural Committee.

The report of the Committee on Mechanical Department was then read, and, on motion, so much of it as relates to estimates was referred to the Finance committee.

REPORT.

The committee on Mechanical Department would respectfully report:

That in their opinion it has become necessary that there should be erected a building for the reception of machinery, for the repair of machinery, and other mechanical work; also, for Art Gallery, etc., etc. Your committee herewith present, a sketch plan, embodying somewhat their ideas; also they herewith present an approximate estimate from Mr. Searfoss, the present carpenter of the University, giving the probable cost of the building without any engine, shafting, etc., at the sum of $26,000. But your committee would state that, in their opinion, this estimate is too low by $10,000 at least, and would, therefore, give their estimate for said building at $40,000.

J. W. SCROGGS,
Chairman of Mechanical Committee.

On motion, Dr. W. Kile, of Edgar county, was appointed to the place in the standing committee formerly occupied by Col. George Harding, deceased.

The following resolution was offered by Mr. Johnson:

Resolved, By this Board, that the future good of this University requires that we look forward to the removal of the present University buildings to the Busey farm, and that all improvements now made be in conformity thereto.

Motion to lay on the table prevailed.

Mr. Johnson offered the following resolution:

Resolved, That female students be admitted to the benefits of this University upon the same terms and requirements as male students, except the requisitions for military study and drill.

After discussion, Mr. Flagg offered the following substitute:

Resolved, That from and after the commencement of the Fall term of 1869, female students shall be admitted to the lecture and recitation rooms of the University.

On motion, the substitute was laid on the table. Mr. Quick moved a reconsideration. Carried. Question: Shall the substitute lie on the table? Voted nay.

On motion, the whole matter was referred to full Board at their annual meeting. The ayes and nays being called for, resulted as follows: Ayes—Allen, Blackburn, Brown of Pulaski, Brown of Chicago, Burchard, Cobb, Goltra, Kile, Lawrence, Mahan, Pullen, the Regent—12. Nays—Dunlap, Edwards, Flagg, Cunningham, Galusha, Lawrence, McMurray, Pickrell, Quick, Scroggs, VanOsdel—11.

A. M. Brown offered the following resolution:

Resolved, That a committee of three, of which the Regent shall be Chairman, be appointed, whose duty it shall be to prepare an address to the Legislature setting forth fully and in detail the plans of the Board for the improvement of the lands of the University, and the increase of its facilities for teaching, the importance of carrying out these plans and the necessity for aid from the State in carrying them out, with estimates of the amounts required.

Adopted.

The Auditing Committee, to whom was referred the Treasurer's Report, have examined the same and compared his vouchers with his accounts, and find the same entirely correct; that he has exhibited warrants drawn by the Regent, numbered 16, 34, 58, 105, 145, 151, 153, of old numbers, and of No. 1 to 278, inclusive, except No. 113, of 2nd series, and we recommend that the Treasurer be ordered to cancel said warrants so paid by him, and hold the same.

L. W. LAWRENCE,
A. M. BROWN,
H. C. BURCHARD,
SAMUEL EDWARDS,
O. B. GALUSHA,
Auditing Committee.

The following resolution, offered by H. C. Burchard, was then adopted:

Resolved, That the Treasurer, under the direction of the Chairman of the Finance Committee, be authorized to invest in the bonds of Counties of this State drawing ten per cent. interest, whenever the same can be safely done, portion of the land scrip funds now temporarily invested in Illinois six per cent. bonds.

Also the following:

Resolved, That the Treasurer be authorized to pay the taxes on the lands located by the University, and that the Regent issue warrants in his favor for such sum as may be necessary.

Carried.

On motion of Mr. Edwards, the Chairman of the Auditing Committee was requested to look over the accounts and report to the Executive Committee.

On motion of Judge Brown it was—

Resolved, That the Regent be authorized to secure from Mr. Lawver the apple trees referred to in the report of the Horticultural Committee, upon the best terms, as to price and time of payment, that he can obtain.

Amendment by Mr. Galusha, that Judge Brown be substituted for the Regent.

Amendment agreed to.

The following preamble and resolution by Mr. Blackburn, relating to the decease of Colonel George Harding, was then presented:

WHEREAS, This Board, with deep felt sorrow, has learned since its last meeting of the death of Colonel George Harding, one of its most faithful and efficient members, and an earnest and devoted friend of industrial education.

Resolved, That we express our heartfelt sympathy with the bereaved family and friends in this irreparable loss.

Resolved, That a copy of the above resolution be forwarded by the Recording Secretary to the widow and family of the late Colonel Harding, and that it be entered upon the minutes of this Board.

It was voted that it be so done.

The Finance Committee then reported back the report of Treasurer on sales of scrip, which was accepted.

Report of sale of the Agricultural College scrip, sold for account of the Illinois Industrial University:

96,160	acres sold at 56 5–16 per acre	$54,150.10
48,000	" " " 56 1–2 " "	27,120.00
32,000	" " " 56 7–8 " "	18,200,00
1,280	" " " 58 cents " "	742.40
1,280	" " " 60 " " "	768.00
960	" " " 61 " " "	585.60
320	" " " 62 " " "	198.40
180,000	acres sold for	$101,764.50

35,520	acres sold at $93.18¾ per 160 acres	$20,687.61
32,000	" " " 93.37½ " " "	18,675 00
16,000	" " " 93.50 " " "	9,350.00
1,120	" " " 93.60 " " "	655.20
8,000	" " " 94.10 " " "	4,705.00
2,560	" " " 94.00 " " "	1,504.00
640	" " " 94.40 " " "	377.60
4,000	" " " 95.10 " " "	2,377.50
160	" " " 96.00 " " "	96.00
100,000	acres sold for	$58,427.9[illegible]
100,000	acres sold for	90,000.00

RECAPITULATION.

180,000 acres sold for	$101,764.50
100,000 " " "	58,427.91
100,000 " " "	90,000.00
Total	$250,192.41
Invested as follows:	
40,000 Champaign Co. bonds, 10 per cent., int. payable annually May 1st	$40,000.00
50,000 Sangamon Co. 9 per cent., int. payable semi-annually, 1st of April and 1st of October	50,000.00
25,000 Morgan Co. bonds, 10 per cent., int. payable annually, June 15th	25,000.00
25,000 Chicago city 7 per cent. water bonds, int. payable semi-annually, July and January	24,961.80
109,000 Illinois 6 per cent. bonds—cost par and interest	110,153.34
Invested	$250,115.14
Balance for scrip on hand	77.27
Total	$250,192.41

SPRINGFIELD, November 17th, 1868.

JOHN W. BUNN, *Treasurer.*

REPORT OF FINANCE COMMITTEE.

To the Board of Trustees Illinois Industrial University:

The Finance Committee would submit the following suggestions:

Our March estimates for the receipts of the current year, together with money then in the hands of the Treasurer, amount to $33,373 10. Our estimates of expenses for same time amounted to $28,295 10. Upon looking over the Treasurer's report, we find that $26,000 has already been used, leaving only 2,0 for the next four months, appropriated. As the various committees have not reported what they will probably need for their departments for the balance of the year, we cannot ask, at this meeting, for any further appropriations. The current salaries, however, amount to about $1500 per month. The Treasurer reports amount on hand at this time at about $6000, which would cover this expense, leaving the January interest and other receipts, which he estimates at 5,000, to pay any other expense that may be ordered by this Board or the Executive committee between now and the March meeting.

The Executive committee ordered the sale of 50,000 acres of land scrip, at $1 10. We have not been able to sell at these figures. This committee would ask further instructions from the full Board in regard to this matter.

The 25,000 acres of scrip authorized to be located, has, as yet, not been effected. This committee would recommend that the Treasurer and Mr. Goltra be authorized to make such locations.

Also that said Treasurer be authorized to get up a set of scrip and land books, with appropriate headings; scrip book to contain statement of scrip sold, to whom, price, number, etc., scrip located, and by whom, State, subdivision, etc. Land book to contain full description of all land located, State, township, range, etc., with such remarks as the persons locating it can furnish.

All of which is respectfully submitted,

EMERY COBB,
J. O. CUNNINGHAM,
J. H. PICKRELL,
H. C. BURCHARD.

The report of Finance committee on Agricultural, Horticultural, and other appropriations, was then accepted.

REPORT.

The Finance Committee, to whom was referred the subject of asking appropriations from the Legislature the coming winter, would recommend that this Board appoint a committee to bring the matter before said body—being particular to specify each and every item. Said amounts so referred are as follows:

For Horticultural Department,	$22,000
Polytechnic and Mechanical Department	40,000
Agricultural Department	38,000
	$100,000

The committee on Agriculture ask for an appropriation of $3,000 for fences, hedges, teams, etc. The committee report that said amount be appropriated out of our income account, unless we get the above appropriations from the Legislature.

(Signed)

EMERY COBB,
J. H. PICKRELL,
WM. KILE,
H. C. BURCHARD,
J. O. CUNNINGHAM.

Judge Brown then offered a resolution that the committee be authorized to sell fifty thousand acres of scrip at a price not less than 95 cents an acre.

An amendment, that the minimum be 100 cents per acre, was lost, and the question upon the resolution to sell at not less than 95 cents per acre prevailed.

On motion of Mr. Burchard, it was

Resolved, That in addition to the appropriations requested by the committees on Horticulture, Agriculture and Mechanical departments, to be made by the Legislature, an appropriation also be asked for the Library, Chemical and Philosophical apparatus, Cabinets, etc., at least of 25,000.

Mr. Cobb and Mr. Lawrence were appointed a committee to prepare a memorial to the Legislature. On motion of Mr. Cunningham, Mr. Goltra was added to the committee.

It was moved and seconded that the Board stand adjourned until the annual meeting.

Carried.

JONATHAN PERIAM,
Recording Secretary.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE ILLINOIS INDUSTRIAL UNIVERSITY.

RECEIPTS.

1868.			
March	11	Balance on hand	$10,536 30
"	30	Rent from A. Chase	15 36
"	30	Interest on Illinois Bonds	325 00
April	11	J. M. Gregory for freight for self	298 19
"	11	Tuition 43 students at $5.00	215 00
"	11	Incidentals, 75 students, at $2.50	187 50
"	11	Matriculation, 75 students, at $10.00	750 00
"	11	Room rent	221 50
May	4	Amount refunded by M. C. Goltra	1,185 10
"	18	J. M. Gregory for freight on lumber	350 99
"	18	Interest on Champaign County Bonds	10,000 00
July	6	" on $109,000 Illinois 6 per cent	3,270 00
"	6	" on $25,000 Chicago Water Bonds	875 00
"	11	R. M. Eppstein & Bro. for University Buttons	65 55
Aug.	10	J. M. Gregory for hay and corn	429 84
"	21	J. M. Gregory for freight refunded	40 05
Oct.	1	Interest on $50,000 Sangamon County Bonds	2,250 00
Nov.	1	Jonathan Periam for hay, corn and feed	127 60
"	16	J. M. Gregory for tuition, etc	1,000 06
			$32,143 00

EXPENDITURES.

Amount paid for expenses of Trustees	$724 90
" " " salaries, wages, etc	10,372 06
" " " library, chemical apparatus, mathematical instruments etc.	2,314 55
" " " printing, advertising and stationery	696 66
" " " labor, materials, and University grounds	3,501 43
" " on account of farm	4,739 89
" " " students labor	550 03
" " " one lot	220 00
" " " locating lands	200 00
" " " furnace, furniture, etc	947 75
" " " lumber	1,498 55
" " " freight and express charges	122 00
" " " examining and recording title and deeds	114 25
Balance on hand	$6,140 99
Total	$32,143 06

SPRINGFIELD, November 17th, 1868.

JOHN W. BUNN, *Treasurer.*

THIRD ANNUAL MEETING.

URBANA, ILL., *March* 12, 1869.

The Board of Trustees of the Illinois Industrial University met in the library at the University building, at ten o'clock A. M., and was called to order by J. M. Gregory, the Regent. The meeting was opened by reading the scriptures and prayer by the Rev. Isaac S. Mahan.

The following members answered to their names: Allen, Blackburn, Brown of Pulaski, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Lawrence, Mahan, Pickrell, Wright, Van Osdel, the Regent—15;

Which being two less than a quorum, on motion of Mr. GOLTRA, the Board adjourned until two o'clock.

TWO O'CLOCK, P. M.

Board met pursuant to adjournment, at two o'clock, P. M., and the following gentlemen answered to their names: Messrs. Allen, Blackburn, Brown of Pulaski, Burroughs, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Lawrence, Mahan, Pickrell, Wright, Van Osdel and the Regent—16, lacking one of a quorum.

On motion of Mr. COBB, the Board adjourned to 4:30 P. M.

HALF-PAST FOUR, P. M.

The Board met pursuant to adjournment, at 4:30 P. M., the Regent in the chair. Upon calling the roll the following members answered to their names:

Allen, Blackburn, Brown of Pulaski, Burroughs, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Lawrence, Pickrell, Pullen, Wright, Van Osdel, the Regent—16, still lacking one of a quorum.

On motion, the by-laws adopted by the Board were read as far as Article VII, when, on motion, the further reading was dispensed with.

On motion of Judge BROWN, the Board adjourned to the next day, March 10, at nine o'clock, A. M.

SECOND DAY—MORNING—MARCH 10, 1869.

The Board met at ten A. M., pursuant to adjournment. Reading of scriptures and prayer by Mr. LUTHER LAWRENCE. Present, Messrs. Allen, Blackburn, Brown of Pulaski, Burchard, Burroughs, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Lawrence, Kile, Pickrell, Pullen, Wright, Van Osdel, the Regent—18.

Minutes of the previous meeting were read and approved. The minutes of the last meeting of the Executive Committee were read and approved.

Resignation of Jonathan Periam, as head farmer, on motion of Mr. BURCHARD, referred to the Committee on Agriculture.

Mr. LAWRENCE was called to the chair and the report of the Regent was read, except the concluding portion, for which time was asked.

ANNUAL REPORT OF THE REGENT.

Gentlemen of the Board of Trustees :

The By-Laws require the Regent to make "An Annual Report to the Board exhibiting the progress and condition of the several departments of the University, with such suggestions as he may deem needful for their improvement." The present report marks the close of the first year of actual work of the University. This fact lends to this annual review both interest and importance.

The University was opened for the reception of students the second day of March, 1868. During the brief year allowed for maturing our plans and preparing for the opening, strenuous efforts were made to advertise the University thoroughly throughout the State. The Regent visited many counties and addressed agricultural fairs, and other gatherings of the people. A competitive examination was held in most of the counties, for students, and both the State Superintendent of Public Instruction and the County Superintendents of Schools gave hearty and efficient aid to make the new institution favorably known among the people. The applications for admission were numerous and but for the false charges which were made against the University before it had put in operation a single plan or done a single day's work, it seemed certain to open with at least 200 or 300 students. There is evidence that many were diverted from their purpose of coming by these mischievous assaults. But notwithstanding all opposition, the first term showed an attendance of seventy-seven students. The second or autumn term opened with a considerable increase of numbers. The entire number who have entered up to the present time is 136.

The distribution of the students in the several courses cannot be precisely stated, since many have been engaged in preparatory studies, and many have not decided upon their course. It is believed that nearly one-third of the whole number are looking to the agricultural course. Several are entering the mechanical course, while others are pursuing engineering or commercial courses.

The instruction was given in the spring term by four instructors, the Regent, Professors Baker and Atherton, and Assistant Professor Burrill. There are now actually employed beside the Regent, three Professors and three Assistant Professors, representing the departments of History, English Language, Chemistry, Agriculture, Botany, Mathematics, Book-keeping and Modern Languages. Besides these, there are two lecturers, one on Pomology, Dr. John A. Warder, of Cincinnati, and one on English Literature, Rev. Edward Eggleston, of Evanston. Professor Powell, appointed by the Board to the chair of Natural History, has tendered his resignation on account of his continued detention with his expedition. I communicate herewith his letter of resignation and also that of Professor Atherton.

It is important that several additions be made to the Faculty before the opening of the next year, in September. The chairs of Horticulture, Mathematics and Mechanics, and either a professor of Natural History or one or two lecturers in this department should be chosen. A lecturer on Geology and another on Zoology, each spending a month with us in the winter term, would sufficiently reinforce those departments of study for the present.

A lecturer on Veterinary Science should also be appointed at an early day. I recommend that the Committee on Faculty and Courses of Study be instructed to recommend suitable persons to fill these places, and employ temporarily such teachers as may be needed before the next meeting of the Board.

STUDIES.

According to the plan of the University the students have been left entirely free to select their own studies. These students are not mere boys, but mostly grown men, many of them having been engaged in teaching or other independent business for their own support. They are competent judges of their own tastes and needs. To attempt to impose any study upon them without their consent would be simple oppression, and to refuse them any study the law requires us to teach would be equal oppression.

Most of the students have studied during the year some branch of Natural Science, as Natural Philosophy, Chemistry or Botany. Many have studied Book-keeping, English Composition, History, and all have either studied or attended lectures on Agriculture. A considerable number, and always at their own option, have studied either the ancient or modern languages. Considering the somewhat violent prejudices which many persons have conceived against the languages, it is perhaps a pity that these young men should have chosen to embrace language among their studies. But as none of the so-called, more practical studies have been neglected on account of the languages, we may leave these students without offence to gain the advantages or suffer the loss resulting from their choice.

I cannot forbear to remark here, that to my mind it is a most pitiful business that any one should have narrowed this magnificent question of industrial education down to a petty debate on the study of languages—a matter which seems to me as irrelevant as the question whether students shall eat butter with their toast, or take sugar in their coffee—and a matter over which we as trustees have little or no control, since the laws of Congress and of the State forbid the exclusion of classical studies.

The Faculty, without exception, came from the laboring classes. They were all trained in boyhood to hard labor, and, by their own industry, won and paid for the education which now enables them to teach others. Becoming educated men, they have not ceased to be practical men—farmers and mechanics. Holding each a different creed, they work with one heart for interests broader than sects, and dear as humanity itself.

CHEMICAL LABORATORY.

The chemical laboratory has been opened for students, and I submit herewith Prof. Stuart's plan of compensation for chemicals used by students. In January Dr. Warder gave a course of twelve lectures on vegetable physiology and fruit growing, which were attended by the entire body of students. Most of the students also attended the lectures and discussions of the Farmers' Institute held at the University in January. The influence of these lectures was happy, in helping to create a fresh interest in agricultural affairs.

STUDENT LABOR.

During the spring term the students labored two hours each day. In the autumn the time was reduced to one hour per day, as we were unable to provide employment for so large a number of students for a longer time. The labor system has cost much solicitude and care on the part of those managing it, and it will always be attended with many difficulties; but so manifold are its advantages that we may well question whether it ought not to be persevered in against even greater obstacles. It is difficult to see how we are to give the practical character and bearing we all desire to our courses of instruction, without these practical exercises on the farm, or in the gardens. All book study tends to grow unpractical and abstract. It must be closely linked with the daily exercise of the senses and muscles in the same field of study, if you will insure it against dwindling to mere theorizing.

It is often urged upon us by those who never stop to inquire into the facts, that our students will be farmers' sons, who get their practice at home. Now it happens that a large proportion of our agricultural students come from the cities or villages, and are the children of merchants, lawyers, etc., who often desire to make farmers of their sons. Such was also the case at the Michigan Agricultural College, while I was acquainted with it, and such will be largely the case with all the agricultural colleges. This is a fact we should hold in mind, or as trustees we may be imposed upon by unfounded assumptions.

But while these students of agriculture, who come not from the farms, certainly need the practical training furnished by the labor plan, those who come from the farms will be more helped than hindered by the fresh practice, tice, under different guidance, which they find here. I do not stop to urge again the considerations of health, of physical culture, of honor done to labor, and of the aid furnished to indigent stndents, by the labor system. It is useful for all these reasons, but it seems indispensable as a part of a practical education. It is certainly a very significant fact that most of the agricultural colleges are adopting it. The Massachusetts Agricultural College requires one hour a day. Maine also requires it. Michigan has maintained it for years. Iowa and Kansas require labor; and President White, of Cornell, said lately that a labor system to enable students to pay their way is *desirable*, but educational labor is *essential.*

The main difficulty of the labor system is to apply the labor effectively and profitably. To accomplish these ends, the labor should be performed in small parties, and under close supervision. I am inclined to believe that the maximum rate of compensation should be raised to twelve and one-half cents an hour, which is the price paid for volunteer labor. Inferior wages tempt to inferior performance of work. But lower rates may be paid for young or inferior workmen, and forfeiture of some part of the wages may be imposed for unexcused absence, or gross neglect of duty in the labor. Mechanical students ought, as far as practicable, to be furnished with mechanical labor.

I would also suggest that lots of half an acre or one acre be allowed, under proper conditions, to such students as may desire it, for experiments in agriculture or horticulture.

THE FARMS.

The work upon the farm and garden during the past year has already been reported to you in the report of Mr. Periam, the Head Farmer, made in November last. Much could not be done with the very limited means at our command, but Mr. Periam accomplished a good season's work in preparing the grounds for future cultivation. His services have been quite valuable and important.

The Griggs farm was rented for $1175.

A considerable part of the stock and experimental farms were rented, under such stipulations as to crops and culture as would best prepare them for their future uses. The rents received in kind for the portions so rented are estimated at $———. The remainder of these farms have been cultivated by the University force.

We are now prepared to begin the development of the several farms with reference to their final use. The Board will remember that, according to the plan of organization early adopted, the Professor of Agriculture is the Superintendent of the Farms—these being his laboratory and apparatus of illustration. It was also provided that his plans for the management of the farms should be annually submitted to the Regent and Faculty, and, after discussion and adoption by them and the Trustees or Executive Committee, shall be put on record. I have the pleasure to submit herewith Prof. Bliss' plans of management for the farms for the current year, which have been discussed and concurred in, though not formally adopted by the Faculty. To make clear the aim and scope of his plans for the year, he has presented a series of diagrams, exhibiting the proposed rotation of crops on the stock farm for the next ten years.

Accompanying this report, I submit a paper from Prof. Bliss, prepared by my request, and a plot illustrating his suggestions regarding the ultimate subdivision of the Experimental Farm. I concur heartily in his suggestion of the need of an intelligent foreman to aid in carrying out the practical work on the farms, and recommend that he be authorized to employ such foreman at a reasonable rate, and also such other farm laborers as may be necessary.

The 200 acres lying nearest the University will doubtless be found sufficient both for the horticultural grounds and the experimental farm. The plan accompanying this report exhibits the proposed distribution of this 200 acres, which is as follows, beginning on the north, next the street railroad:

For arboretum, ten acres.

Allowing sixty trees to the acre, which it is believed would leave abundant space for the paths and drives, this would afford room for 600 trees. Only eighty species are reported as indigenous to Illinois. But a much larger number can be acclimated here from other parts of this continent, and from the old world. The arboretum should be divided so as to exhibit, as far as practicable, the trees of each quarter of the globe by themselves. A distinct department should be made of the Illinois trees.

Next the arboretum, if the ground is suitable, may be placed the nurseries, occupying five acres.

Next this is the market garden, ten acres.

These two departments, which will furnish considerable labor for students, will thus be found near at hand.

Next may follow the small fruit plantations, viz;

For strawberries, two acres.

For raspberries, blackberries, etc., two acres.

For currants, gooseberries, whortleberries, two acres.

For grapes, two acres.

These plots will be large enough to exhibit the several varieties of these fruits.

This will bring us near a swale or slough susceptible of perfect drainage, but probably unsuitable, on account of its greater liability to early frosts, to most of horticultural purposes. It may be used for the cranberry or other shrubs or trees loving a wet soil.

Passing this swale we again reach high ground, where we may plant our specimen and experimental gardens requiring five acres. In this garden we should exhibit as large a variety as possible of culinary vegetables; carefully measured plots should also be provided here for experimenting with the different fertilizers and modes of culture.

Through the 160 acre lot, two farm avenues should be extended, one from north to south and the other from the east to the west. These may be lined on either side by deciduous or evergreen trees, serving at once to give beauty and to serve as shelter belts. Near the outer gateways, opening into these avenues, small and tasteful cottages should be placed both to accommodate the farm laborers, and to provide protection for our grounds. The grounds embracing about fifty-three acres west of the north and south avenue is judged to be fit for orcharding, and may be occupied as follows:

1. By specimen apple orchard, sixty trees to the acre, planted in quincunx order. .... 25 A
2. Market apple orchard of approved varieties.......... 10 A
3. Cherry orchard.......... 5 A
4. Pear orchard, dwarf and standard.......... 5 A
5. Peaches, plums and other fruits.......... 5 A
6. Roads and shelter belts.......... 3 A

These orchards should be well protected by both hedges and a paling fence, and may be surrounded by a shelter belt of evergreens.

East of the north and south avenue there will be found abundant space and favorable grounds for the farm experiments. Room will be found here also for the plots spoken of for students.

East and south of the crossing of the farm avenues will be found a favorable site for a superintendent's house and a large barn, unless it is deemed best to place these at north entrance to the experimental farm. A plan and estimates for a barn are herewith presented, as also plans for laborers' houses.

HORTICULTURAL GROUNDS.

There is herewith presented a colored plan for the ornamental grounds about the University building, and some plans are expected to be contributed by Mr. Letz, of Chicago, for the glass structures needed. It is hoped that some part of these structures may be erected the current year. Mr. Franks, the gardener, has made good use of the small propagating house erected last fall, and has a large number of bedding plants to adorn our grounds this summer. A small appropriation is asked for seeds, ornamental trees and shrubs and tools for this department, as stated in the accompanying schedule.

An appropriation of $600 is needed for seeds, stocks, and young trees for the nurseries. We have a bill of imported evergreens offered us at rates which seem quite favorable, with a guarantee of excellent condition.

The 3,000 specimen apple trees already received, will cost $750. Other trees, for orchard and arboretum, needed this spring, will cost about $700.

The entire orchard grounds, and as much as practicable of the gardens, should be underdrained at once. One main drain has already been put down through the ornamental and parade grounds. Another should be made at once on the west side. Hedges also may be set at once along the east and west lines of garden plots and experimental farms.

It is asked that a strip fourteen feet wide be relinquished to the public from the west side of the forty acre lot. This will make the line correspond with the west line of the University grounds and make the street of equal width throughout.

I recommend also that a proffer be made of one-half of a four rod street along the north line of experimental farm, between Wright street and Mt. Hope avenue.

In order to save to the Trustees the opportunity to buy the two lots which separated our lots south of the Springfield road, and which I judged would be needed in time for buildings, I purchased these lots at very reasonable rates, and now hold them subject to the decision of the Board. The purchase price was $400.

MECHANICAL.

The shop erected last summer will not be sufficient for our work if much building is to be done this summer. I recommend that the stable now occupying one part of it be vacated and the whole be fitted up as a shop. We have several students in the mechanical course who have sought for practice in the shop, and are already exhibiting some skill in the use of tools. If a supply of tools can be furnished they will render effective service in our building operations.

We shall need at once some draughting tables or stands for the students in mechanical drawing. It should not be forgotten that instruction in Mechanics is as obligatory upon us as instruction in Agriculture, and a Professor in this department should be put on service at the opening of the fall term at latest.

THE UNIVERSITY BUILDING.

The intense heat of the last summer so nearly ruined the slate composition roofing, that only by repeated patching have we been able to keep out the rains. It is evident that the roofing must at once be replaced by something more substantial. I recommend that a good tin roof be put on and well painted.

A slight inspection will also convince you that something must be done immediately to preserve the brick of the basement story from further decay. A good coating of stucco or mastic might perhaps suffice. The steeple and cornice need repainting, and I recommend also that the side walls in the several halls be painted to some height at least, that they may be more easily washed and kept clean.

An ornamental gateway, the gift chiefly of Mr. John Burchard, of Beloit, is ready to be erected at the main entrance.

The sidewalk on the west front should be extended to the Springfield road, if not across the brook.

FINANCES.

I report herewith a statement of the warrants issued during the year. The total expenditure for all purposes, not including the railroad donation, nor the trees, etc., donated by Champaign county, from Dunlap's nursery, is

$36,698 03. The purposes for which these expenditures have been made, are submitted elsewhere.

These expenditures have slightly exceeded the estimates for the year, but a portion of them has been made in anticipation of the appropriation, and are properly chargeable to it as permanent improvements. Some considerable income may yet be expected from the sale of farm produce now on hand and from rents.

The Treasurer's report will give you a statement of the receipts of the year.

The amount received on account of the Illinois Central Railroad freight donation, up to March 1st, is $3.

The accompanying statement will show the number of trees and shrubs received from Mr. Dunlap, together with the sizes of the same. These have been taken by actual count and measurement on the ground made by the gardener. A few trees, which were mostly overgrown when received, have died, an account of which is added. Mr. Dunlap has not yet presented any written statement of the account. The officers who received these trees had nothing to do with fixing prices, those being determined by the deed of gift as at "catalogue rates." It will be necessary, therefore, for the trustees to settle the account thus far, and decide how much more is due on the donation.

An application was made in due form to the Legislature for an appropriation for the several departments, and copies of the memorial prepared have already been seen by you. A bill making an appropriation of $60,000 has passed the House of Representatives and is now pending before the State Senate.

Patents have already beed issued for most of our lands, and taxes have begun to accrue. Ought not some plans and terms of sale of these lands to be adopted at once?

LIBRARY, CABINETS AND APPARATUS.

Some additions have been made to the library since the last meeting of the Board, but it is still wholly inadequate to our needs. If the appropriation now pending is passed, I recommend that the Library Committee be authorized during the coming summer to make such purchases as are needed.

A paper relating to botanical excursions, proposed by Assistant Professor Burrill, is herewith submitted. I heartily recommend that he be furnished with the necessary materials and outfit, and that as far as practicable he and his class be encouraged to make excursions, if not in term time, at least, in the vacations.

The cabinets we have in possession are here only on exhibition, and are offered for sale. Measures should be taken this present year to begin the collection of cabinets.

A set of meteorological instruments ought to be provided at once, that a series of regular observations may be opened here at an early date. I am informed that a full set will cost $100.

HONORARY SCHOLARSHIPS, ETC.

The language of the statute, strictly construed, restricts the honorary or free scholarship provided for each county to the descendant of a soldier or sailor. It is, however, permitted to the Board to provide other honorary scholarships. In order to give some regularity to this business, I recommend that it be provided by resolution that when the regular honorary scholarship in any county is not claimed, one free or honorary scholarship be offered to such student as shall pass the best examination and shall be of good character and promise.

There is already one application from a graduate of a college to come here and study as a resident graduate. Other applications of this sort may be received. I would recommend that a rule be adopted that resident graduates be admitted on the payment of the ordinary fees, excepting the matriculation fee.

On motion of Mr. BURROUGHS the report of the Regent, with the accompanying documents, was referred to the proper standing committees.

Mr. BURROUGHS' resolution was as follows:

Resolved, That the different subjects contained in the Regent's report be referred to the several committees on the subjects, for the coming year, and that a committee on nominations be now appointed to bring in, as soon as possible, names of such committees.

Carried.

On motion, Messrs. Lawrence, Edwards and Goltra were appointed a Committee on Nominations.

On motion of Mr. GOLTRA, Mr. J. S. Slade was invited to take a seat with the Board.

Moved and seconded that the new members be sworn in.

Carried.

Messrs. Pearson, Griggs, Kile and Wright were then sworn in, Judge Ayres administering the oath.

On motion, the report of the Treasurer was read.

TREASURER'S REPORT.

November 13, 1868.	By balance	$6140 99
December 9, 1868	By J. M. Gregory, tuition, etc., balance for fall term	169 50
January 4, 1869.	By interest on $109,000 Illinois bonds	3270 00
January 4, 1869.	By interest on $25,000 Chicago water bonds	875 00
January 27, 1869.	By J. Periam, sales of farm produce.	328 34
January 27, 1869.	By J. Periam, notes for rent of land.	468 75
March 5, 1869.	By J. M. Gregory, collection of fees for winter term	785 50
		$12,038 08

To amount paid for salaries	$4468 24
To amount paid expense of trustees	433 20
To amount paid salaries, expenses, for lecturers	883 45
To amount paid for insurance	251 50
To amount paid Superintendent's salary and labor for farm	1289 74
To amount paid students' labor	404 40
To amount paid for printing and advertising	137 50
To amount paid for coal and wood	283 55
To amount paid for wages of carpenter, gardener and janitor	631 33
To amount paid for library apparatus and cabinet	549 50
To amount paid for freight and express charges	55 20
To amount paid for stationery	11 60
To amount paid for draining tile	270 00
To amount paid for labor, material for University and grounds	1053 68
Balance on hand	1324 59
	$12,038 08

CHAMPAIGN, ILL., *March* 9, 1869.

JOHN W. BUNN,
Treasurer.

[The above report, as will be seen, embraces only the latter part of the year, from November 12, 1868. The report for the first part of the year was made to the Board at the meeting in November, 1868.]

On motion of Mr. BURCHARD, the report of the Treasurer was referred to the Auditing Committee.

Then the report of Committee on Military Department was received.

On motion of Mr. BURCHARD, it was received and laid on table for future action.

Judge BROWN offered the following resolution:

Resolved, That the Treasurer be authorized to sell 50,000 acres of the remaining land scrip, at such prices as he may be able to obtain: *Provided*, he shall not sell at a lower price than may be approved by the Finance Committee.

On motion of Mr. PEARSON, it was laid on the table until Thursday morning, March 11.

Judge BROWN moved then, that the Finance Committee be instructed to devise and report to the Board a plan for putting on the market and selling the lands entered by virtue of the Congressional scrip issued to this University.

On motion, the bills and accounts now in the hands of the Regent were referred to the Auditing Committee.

Mr. J. H. PICKRELL offered the following resolution:

Resolved, That the boarding arrangements made with Mr. Aaron Potter, as set forth on page 93 of Annual Report, be annulled, and that the Executive Committee are directed to sell or otherwise dispose of the fixtures, and give Mr. Potter notice to vacate the premises.

Carried.

Mr. M. L. Dunlap moved that the Committee on Library and Cabinets be directed to settle with Prof. Powell in regard to specimens of natural history, and that any expense incurred in relation to same be paid out of the library fund.

Laid on the table.

Mr. Edwards made the motion that Messrs. Edwards, Pearson and Pullen be a committee of three to make a final settlement with Mr. Dunlap in regard to the donation of $2,000 worth of trees and shrubbery, and report the same to this Board before its adjournment.

Carried.

Motion to adjourn until two o'clock P.M. prevailed.

TWO O'CLOCK P. M.

Board met pursuant to adjournment—Regent in the chair.

On motion of Mr. Pickrell, Mr. Slade was asked to take his seat, and be qualified as soon as the proper officer should arrive—a telegram having previously been read from Senator Flagg, stating that the new Trustees had been confirmed by the Senate, except Mr. Scott.

The committee to which was referred the nomination of the standing committees made their report.

A motion to recommit their report was carried.

The committee then reported back the following nominations, as amended:

Executive Committee—Regent, Cobb, Brown of Pulaski, Pickrell, Cunningham, Griggs, Goltra, Pullen and Wright.

Agricultural Department—Pickrell, Johnson, Allen, Kile and Blackburn.

Horticultural Committee—A. M. Brown, Pullen, Galusha, Pearson and Edwards.

Finance Committee—Cobb, Burchard, A. M. Brown, Pickrell and Griggs.

Building and Grounds—Goltra, Van Osdel, Griggs, Cunningham, Johnson and the Regent.

Auditing Committee—Lawrence, Dunlap, Cunningham, Pearson and Galusha.

By-Laws—Burchard, Lawrence, Slade and the Regent.

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

[Mr. Griggs substituted for Mr. Pickard. See page —.]

Military Affairs—Brayman, Dunlap, Scroggs, Kitchell and Kile.

Library and Cabinet—Regent, Bateman, Mahan, Allen, McMurray and Slade.

Mechanical Department—Van Osdel, Brown of Chicago, Dunlap, Goltra and Griggs.

On motion, the nominations were adopted.

The question arising whether, in the election of officers, a majority of the full Board should be required to elect, or only a majority of the members present,

Mr. PICKRELL offered the following resolution:

Resolved. That in the election of officers, a majority of the members present (being in all cases a quorum) shall only be required; and that all resolutions and rules of the Board in conflict with this resolution are hereby repealed.

Carried.

Judge BROWN moved that the Board proceed to the election of officers.

Carried.

On motion of Mr. LAWRENCE, the subject was deferred, and made the special order for Thursday, March 11, at ten o'clock A.M.

The Finance Committee then reported as follows:

REPORT OF FINANCE COMMITTEE.

The Finance Committee submit the following:

The gross expenses for the year ending March 1, 1869, are as follows:

Board expense	$2,381 26
Library	809 12
Land scrip	219 25
Salaries	13,000 00
Chemical apparatus	978 00
Engineering instruments	345 45
Philosophical apparatus	504 50
Fuel, lights, repairs and incidental expenses	3,175 04
Improvements and alterations in buildings and grounds	8,222 12
Farm and garden, including purchases of teams, wagons, implements. fencing, building of barn, and running expense	7,863 28
Total	$36,698 02

Receipts for the year ending March 9, 1869, were as follows:

Interest on Champaign county bonds	$10,000 00
Interest on Illinois bonds	6,865 00
Interest on Sangamon county bonds	2,250 00
Interest on Chicago water bonds	1,750 00
J. M. Gregory, for freight	649 18
Rent of farm lands	468 75
Tuition and other fees	3,329 50
Sales of produce of farm	941 27
M. C. Goltra, refunded on land scrip	1,185 10
R. M. Eppstein, for University buttons	65 55
	$27,503 85
Amount on hand, March 9, 1868	10,173 10
Total	$37,676 95
Less disbursements	36,698 02
Leaving balance in hands of Treasurer, after paying warrants now outstanding	$978 93

At our November meeting, the Treasurer and Finance Committee were authorized to sell 50,000 acres of land scrip at ninety-five cents. As yet we have not been able to effect a sale, and would suggest that the limit be removed, and authority to sell without limit be granted.

The location of the 25,000 acres of scrip will probably be attended to at as early a date as possible the coming spring and summer, by the Treasurer and Mr. Goltra, in whose hands it was put at our November meeting.

The sale of lands already located should receive attention as soon as practicable; and with a view of furthering the same, the Treasurer was authorized, at our November meeting, to procure books, classifying said lands, with such other information as could be obtained in relation to them.

The interest-bearing securities in the hands of the Treasurer remain the same as at our November meeting. The Treasurer and the Chairman of the Finance Committee are doing their utmost to obtain county bonds (issued for other than railroad purposes) bearing a rate of interest at least eight per cent., into which we may convert most or all our Illinois bonds, bearing six per cent.

The estimates of expenditures for the coming year will have to be made after the Board, through the various committees, have signified their wishes in regard to improvements, etc.

In regard to our expected appropriation from the State, we would recommend that the Board, before its adjournment, should signify its wishes as to the expenditure of the same, as much in detail as possible, and would recommend that it should be put in substantial improvements, economically as may be, and strictly for the purposes appropriated.

Respectfully submitted.

EMORY COBB,
H. C. BURCHARD.

On motion, the report was accepted and approved.

It was moved that the report of the Regent be taken up in detail, and allotted to the appropriate committees.

On motion, the first or introductory portion was referred to the Committee on Faculty and Course of Study; so much as relates to the farm, to the Committee on Agriculture; so much as relates to buildings and grounds, to the Committee on Buildings and Grounds; so much as relates to Horticulture, to the respective committee; so much as relates to Library and Cabinets, to the committee on same; so much as refers to the Mechanical Department, to the committee on this department; so much as relates to Finances, referred to the Committee on Finances; so much as relates to warrants drawn, to the Auditing Committee; so much as relates to honorary scholarship, to the Committee on Faculty and Course of Study; so much as relates to newspapers and scurrilous reports, be referred to a Special Committee, consisting of Messrs. Pearson, Lawrence and Blackburn.

On motion, the Board took a recess until 7 o'clock P. M.

SECOND DAY—EVENING—7 O'CLOCK.

Board was called to order at 7:30 P. M. Regent in the chair.

The roll being called, the following gentlemen answered to their names:

Allen, Blackburn, Brown of Pulaski, Burchard, Burroughs, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Griggs, Lawrence, Mahan, Kile, Pickrell, Pullen, Wright, Van Osdel, the Regent—20.

Report of Finance Committee in relation to accounts, was then received and adopted.

REPORT OF COMMITTEE.

Your committee to whom was referred the resolution in regard to the appointment of a book-keeper, with instructions to examine the books of account of the University, would respectfully report that they have considered the resolution in regard to the appointment of a book-keeper, and while they find the latter correctly kept, yet they deem it advisable that fuller accounts and entrees should be made so that the books will show, at all times, the monetary transactions, and exact financial condition of the University, and that accounts should be opened so as to exhibit the receipts and expenditures in each department as well as the general expenditures and the amount of debit or credit of every fund or appropriation.

Your committee would, therefore, recommend the passage of the following resolution:

Resovled, That the Finance Committee be instructed to employ a competent accountant, and to see that a set of books be opened in double entry, in which shall be represented the entire business of the University, including distinct accounts of the leading sources of income and expenditures; and the said accountant to present a proper balance sheet at each annual meeting of the Board, and oftener, if required; and said books to be open at all times to the inspection of the Trustees and Officers of the University; and said accountant shall be subject to the call of the Regent or Recording Secretary for any clerical services they may require.

Carried.

On motion of Mr. VAN OSDEL, a committee of three, Messrs. DUNLAP, PURCHARD and COBB were appointed to examine the books for errors, if any there be.

The Auditing Committee made a report as follows:

REPORT OF AUDITING COMMITTEE.

The Auditing Committee to whom was referred the Treasurer's Report, beg leave to report that they have examined the same, with the vouchers accompanying, and find that the accounts have been kept correctly, and show that warrants numbered from 1 to 412, inclusive, have been paid except No. 113 for $179, and No. 403 for $166 66, amounting to $345 66, leaving a balance now in the Treasurer's hands of $1324 59.

The committee recommend that the report be accepted, and that they have canceled the warrants from No. 279 to No. 412, inclusive, except No. 403, by cutting a notch in lower side of the same.

They have examined the following bills and recommend that warrants be ordered for the payment of the same, viz:

Doty & Mitchel	$50 00.
Walker Brothers	9 37.
O. L. Barber	25 00.
J. A. Hutchinson	16 00.
Mowlding & Harland	66 00.
W. S. Maxwell	2 00.
William Price	27 30.
Dodson & Hodges	81 58.

Respectfully submitted.

L. W. LAWRENCE,
JOHN M. PEARSON,
O. B. GALUSHA,
M. L. DUNLAP,
Auditing Committee.

On motion, the report was adopted.

The following resolution was offered by Mr. EDWARDS:

Resolved, That female students be admitted to recitations and class lectures on the same terms as to qualification and charges for tuition as male students. But in no case are they to have rooms in the institution; and shall be under such rules and regulations as the Faculty shall from time to time prescribe, until otherwise ordered by the Board.

On motion, it was postponed until Thursday, 11 o'clock A. M.

The Special Committee to whom was referred that portion of the Regent's report relating to newspaper criticisms, reported that the sume should be expunged from the records, together with the report relating thereto.

The report of the Committee on Buildings and Grounds was read. (See report, page—.)

After discussion, on motion of Mr. BURROUGHS, it was voted that this report and all other reports which may be made calling for appropriations, be referred to the Committee on Finances, with instruction to report to the Board a schedule of all the appropriations asked for.

The report of the Horticultural Committee was read, and on motion recommitted to be reported Thursday.

Report of the Committee on Mechanical Department was referred to Finance Committee.

Report of the Committee on Agriculture was read and adopted.

REPORT.

The Committec on Agriculture beg leave to report that they have had the resignation of Mr. PERIAM under consideration, and would recommend that it be accepted. We have also partially examined his accounts and vouchers, and have no hesitation in saying that we believe them correct. We also find that there is an item charged against the farm of team labor performed at the grounds of the University building amounting to $831 75; also an average of three months time of the Superintendent was spent on the grounds of the building, which would make an amount of $375. These two items we would respectfully ask may be placed to the credit of the farm and charged to their proper accounts.

We have had under consideration that portion of the Regent's report accompanied with plans for the future rotation of crops, etc. We would say that we fully concur in said reports and recommendations, except so much of it that requires the Professor of Agriculture to submit the management of the farm to the Regent and Faculty for their approval. We would respectfully ask that instead of the Faculty, the Committee of Agriculture be substituted, and that only so much of the plans of the Professor of Agriculture as may relate to the classes shall be submitted to the Faculty.

We would also recommend that the Professor of Agriculture be empowered to employ such help as he may deem necessary, and keep separate and correct accounts of the farm and his acts and doings, to manage the farm known as the Experimental and the Busey Farm.

The Griggs Farm, we understand, has been satisfactorily rented for the next year. We would respectfully ask that the Professor of Agriculture be authorized to have an accurate survey of the Busey Farm made, in order that the hedges may be set in the proper place. We would further recommend that the present crop of produce that will not be needed for the farm should be sold and placed to the credit of the Farm account.

All of which is respectfully submitted.

J. H. PICKRELL,
WILLIAM KILE,
A. BLACKBURN,
LEMUEL ALLEN.

Mr. PEARSON moved that the recommendations of Prof. Stuart in relation to needed apparatus and chemicals, and the method of using and disbursing the same, be referred to Committee on Mechanical Department.

Carried.

Report of Military Department was then read, and, on motion, recommitted, to be reported Thursday, March 11, 10 A. M.

Mr. EDWARDS introduced the following resolution:

WHEREAS the Board of Trustees contains too many members, incurring too much expense, therefore

Resolved, That the Board suggest to the General Assembly the propriety of so amending the law in regard to the number of Trustees, that the Board shall hereafter consist of one member from each Congressional District and the present members *ex-officio*, a majority of whom shall form a quorum.

Resolved, That the Recording Secretary transmit a copy of these resolutions to the Governor.

On motion it was laid on the table.

Mr. BROWN offered the following resolution:

Resolved, That fourteen feet in width along the west side of the forty-acre tract be conceded to the public, for the purpose of widening the avenue along the line.

It was moved that the resolution lie on the table. Lost—yeas 9, nays 12.

On motion, the whole matter was recommitted to the Committee on Buildings and Grounds.

The following motion was offered by Mr. PICKRELL:

I move that tuition be free for the Departments of Agriculture and Mechanic Science and Engineering, and that five dollars per term be charged for the other scientific and classical studies; that twelve dollars be charged for the use of chemicals and apparatus in the Department of Analytical Chemistry, and that two and a half dollars per term be charged to all students for incidental expenses, provided that students holding honorary scholarships shall be exempt from incidental expense.

After discussion, Mr. PICKRELL offered the following:

Moved, that the question of tuition be reconsidered, so far as may apply to the next calendar year.

On motion, they were referred to the Finance Committee.

Mr. BLACKBURN offered the following resolution:

Resolved, That the two lots referred to in the Regent's report, purchased by him and offered the University at cost, be accepted, and he be directed to draw upon the Treasurer for the amount required for this purchase and the proper conveyance of said lots to the University.

On motion, it was referred to the Finance Committee.

The Special Committee, to whom was referred the bill of Mr. Dunlap, made the following report:

Your Committee, to whom was referred the bill of Mr. Dunlap for trees and shrubbery furnished the University, would report, that whilst in many localities the prices of many of the articles would be considered too high, yet, owing to the scarcity or impossibility of obtaining the larger sizes of trees and plants, either here or at any point near by, at lower figures, also from the fact that such plants are much more valuable if obtained near home, under the circumstances we recommend the allowance of the bill as before us. The amount of the bill is $1,547, and now due $453.

SAMUEL EDWARDS,
JOHN M. PEARSON,
B. PULLEN.

The report was recommitted to the Committee for further consideration.

On motion of Mr. Cobb, it was resolved that the balance of trees be received by the Horticultural Committee.

On motion of Mr. Brown, the name of Mr. Griggs was added to the Committee on Course of Study, in place of Mr. Pickard.

The Board thereupon adjourned to Thursday, March 11th, at 9 o'clock, A. M.

THURSDAY, MARCH 11, 1869—10, A. M.

Board called to order at 10 o'clock, A. M. Reading of the Scriptures and prayer by Mr. Blackburn. Upon calling the roll, the following gentlemen answered to their names: Allen, Blackburn, Brown of Pulaski, Burchard, Burroughs, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Griggs, Kile, Lawrence, Mahan, Pickrell, Pullen, Slade, Wright, Van Osdel, the Regent—21.

The previous minutes of the present meeting were read, and adopted as amended.

The special order for the election of officers was brought up. The Regent called Mr. Allen to the chair.

Mr. Lawrence moved that Mr. Burchard administer the oath to such members as had not already been qualified.

The oath of office was duly administered to Mr. Slade.

Mr. Edwards moved that all persons, except reporters for the press, be requested to retire during the election of officers.

After discussion, the motion was withdrawn.

Mr. MAHAN moved that all persons not members of this Board be requested to withdraw.

It was moved that this motion lie on the table.

Carried.

Mr. COBB moved that tellers be appointed.

Carried.

The CHAIR so appointed Messrs. Cobb and Goltra.

Mr. EDWARDS nominated Jonathan B. Turner for Regent of the Illinois Industrial University.

Judge BROWN nominated Dr. J. M. Gregory for re-election as Regent.

On motion, the Board proceeded to ballot for Regent. It was moved that the roll be called, and that members come forward and deposit their ballots.

Upon the roll-call, twenty came forward—Messrs. Allen, Blackburn, Brown of Pulaski, Burchard, Burroughs, Cobb, Dunlap, Edwards, Pearson, Galusha, Goltra, Griggs, Kile, Lawrence, Mahan, Pickrell, Pullen, Slade, Wright, Van Osdel.

The CHAIR announced the vote as follows: J. M. Gregory, 17; J. B. Turner, 2; blank, 1.

The CHAIR thereupon declared Dr. J. M. Gregory elected.

On motion of Mr. BROWN, a committee was appointed to notify Dr. Gregory of his re-election. Messrs. Brown and Pickrell were appointed said committee.

Dr. GREGORY was introduced, and returned thanks in a few eloquent words.

On motion of Mr. BURCHARD, it was voted that the election of officers be proceeded with in their regular order. John W. Bunn was nominated as Treasurer, and, on motion, Emery Cobb was authorized to cast for him the unanimous ballot.

Twenty votes were cast, and Mr. Bunn unanimously elected.

On motion, Mr. FLAGG was elected Corresponding Secretary unanimously, as by the preceding vote.

Prof. W. F. BLISS was unanimously elected Recording Secretary, as by the preceding vote.

The committee to whom was recommitted the consideration of Mr. Dunlap's bill of trees, made their report.

ADDITIONAL REPORT OF SPECIAL COMMITTEE.

Your Committee, to whom was referred the bill of trees and contract of M. L Dunlap, would respectfully represent that they have given the subject some farthe attention, upon consultation with Mr. Dunlap have agreed with him and he with them to change the price of Norway Spruce from $2 00 each to $1 75, as follows:

500 Norway Spruce, @ $2 00	$1,000 00
should be, 500 Norway Spruce, @ $1 75	875 00
Making Cr. on said bill of	$125 00

showing balance due University, in stock, of $578.

The Committee also feel that it is due to Mr. Dunlap to say, that in delivery of the balance of the contract he desires the Committee of Selection to take notice of the prices charged at the time, and assures this Committee that if said prices are objectionable he will pay the balance of the contract in cash; we therefore append the following:

Resolved, That said account be amended to correspond with the above statement, and the balance of stock taken from Mr. Dunlap's nurseries as soon as convenient.

SAMUEL EDWARDS,
B. PULLEN,
JOHN M. PEARSON,
M. L. DUNLAP.

Mr. Burchard moved to amend as follows:

Strike out $1 75 and insert $1 50, which appears by the catalogue furnished by Mr. Dunlap to the Committee to be the lowest catalogue price.

Question on the amendment voted nay. Question on the original motion voted aye. Question on the adoption of the additional report, voted aye.

The report was adopted.

Mr. Cobb offered the following:

Moved that the chairman of Committee on Agriculture be added to the Horticultural Committee as agents of this Board to receive the balance of Mr. Dunlap's donation of trees and shrubbery.

Carried.

The report and resolutions of Committee on Horticulture was then received and referred to the Finance Committee.

The Committee on Horticulture, to whom that portion of the Regent's report relating to the Horticultural Department was referred, ask leave to submit the following report:

The impossibility of making a personal inspection of the grounds, prevents the Committee from forming any very intelligent opinion of the merits of the plan recommended for the division of the grounds to be devoted to orchards, gardens, etc. It seems to them that there is no material difference between the plan of the Regent and that recommended in the report of the Committee on Horticulture made to this Board at its last November meeting. They recommend adherance to the plan of that Committee, to be worked out as the means at the disposal of the Board in the future may enable us to do it.

If the Legislature should pass the appropriation expected, we shall have $10,000 available for expenditure the present year and the same amount for the year 1870.

Your Committee recommend the construction of the barn and gardener's house estimated for in the report to which they have referred above, and that there shall be no permanent tree planting except the 3,000 trees purchased from Lawver—an osage hedge around the grounds and the timber belts provided for in the November report.

These belts will require the following trees, to-wit:

330 European Larch.
450 Norway Spruce.
330 White Ash.
165 Silver Maple.
330 Austrian Pine.
165 White Pine.
250 Arbor Vitæ.
210 Green Ash.
165 Red Cedar.
250 Blue Ash.

Of these, the evergreens should be 2½ feet high and the deciduous trees 3 to 6 feet high. The estimated cost of these is $534 60.

The Committee think that for all plantings except those indicated above, small trees should be purchased, as far as the means will allow, and cultivated in nursery for one or more years.

Your Committee recommend the following appropriations, viz:

Trees for timber belts	$600 00
Other trees, nuts, seeds and plants	1,000 00
Orchard, including the two purchased from Lawver	1,000 00
Hedge plants	18 00
Gardener's house	600 00
Barn and out buildings	2,000 00
1 Span horses	300 00
1 Wagon and harness	150 00
Tile draining orchard	2,000 00
Labor one year	1,332 00
	$10,000 00

Your Committee ask the adoption of the following resolutions:

1. *Resolved*, That the plan for dividing and planting the grounds to be devoted to horticulture, devised and recommended by the last November report of this Committee, be adopted, subject to such modifications and amendments in the details as may hereafter, upon the further survey of the grounds, be deemed necessary.

2. *Resolved*, That until a Professor of Horticulture shall be appointed, the execution of the plan indicated above shall be under the general supervision and control of the Professor of Agriculture, who shall have power to make the necessary contract for under-draining the land—to employ competent laborers for planting the orchards, nursery, hedge and timber belts, and to receive and recommend to the Executive Committee plans for the barn, out-buildings and gardener's house, and upon the approval of such plans the said Professor of Agriculture shall proceed to have said buildings erected.

3. *Resolved*, That Samuel Edwards and O. B. Galusha are hereby authorized to purchase the trees, seeds and nursery stock estimated for in the foregoing report, of

such kinds and in such proportions as they may agree upon, and the Regent is directed to draw warrants upon the Treasurer for the price of such trees, etc., upon their order.

4. *Resolved*, That the sum of $10,000, to be paid out of the appropriation made by the Legislature, be appropriated for the purpose of carrying the foregoing resolutions into effect, to be expended for the various objects set forth in this report, as far as may be necessary.

5. *Resolved*, That the Professor of Agriculture select and receive, this spring, from the nursery of M. L. Dunlap, stock to the amount of the balance due from him, provided he shall find there such trees and plants as will answer our purposes.

A. M. BROWN, *Chairman.*

After discussion the Committee on Horticulture offered the following substitute to third resolution, contained in their report:

Resolved, That the Professor of Agriculture, advising with the chairman of Committee on Horticulture, be authorized, etc. [See report resolution 3.]

And further recommend to amend the resolution appropriating $10,000 for Horticultural Department by increasing item for gardener's house to $850, and decreasing item for draining to $1,750, and recommended the passage of resolutions, as amended.

Which substitute and amendment were made a part of the report.

On motion the Board adjourned to 2 o'clock P. M.

THIRD DAY—THURSDAY, MARCH 11, 1869.

Board called to order at 2:30 P. M., Dr. KILE in the chair.

Mr. LAWRENCE made report in relation to a bill presented by Dr. WARDER.

Mr. DUNLAP made report for Military Committee on Uniforms, etc.

Mr. GOLTRA moved to strike out blue and insert gray. Motion on adoption of resolution lost.

Moved, that the following addition to rule 4, of the by-laws of this Board [page 86], be adopted.

ADDITION TO RULE 4, PAGE 86 OF FIRST ANNUAL REPORT.

That hereafter no student shall be required to provide himself with a military dress for the first term of his attendance. That there be set apart for the purpose of procuring buttons, and the letters I. I. U., to be enclosed in a suitable metalic wreath for the caps, the sum of fifty dollars, which shall be placed in the hands of the book-keeper, who shall procure a supply of these buttons and letters under the direction of the Faculty, and the said book-keeper shall sell the same at cost to the students or other persons for the purpose herein contemplated, in such lots as they may need. He shall be charged with the fifty dollars, and have credit for the sums received and buttons on hand. It shall be his duty, out of this fund, to keep a supply of buttons, letters and wreaths on hand to meet the demand.

Resolved, That fifty dollars be appropriated out of the library fund for the purchase of buttons and letters required for the military uniform, to be expended as provided in the resolution adopted by the Board and referred to the Committee.

This addition to rule 4, of the by-laws, was adopted.

The special order of the hour being the resolution of Mr. Edward in relation to admission of female students,

On motion of Mr. Griggs, it was voted to lay it on the table.

Ayes and nays being called for, the vote counted as follows:

Ayes—Messrs. Allen, Brown of Pulaski, Burchard, Burroughs, Cobb, Pearson, Goltra, Griggs, Lawrence, Mahan, Kile, Pullen, Slade, Van Osdel and the Regent—15.

Nays—Messrs. Blackburn, Dunlap, Edwards, Gulusha, Pickrell, Wright—6.

The report of Committee on the Mechanical Department, to whom Prof. Stuart's communication in regard to regulations for the laboratory was referred, was read.

REPORT OF COMMITTEE.

The Committee on Mechanical Department to whom was referred a communication of Prof. Stuart, beg leave to report.

1st. That each student of analytical chemistry shall, before commencing work in the laboratory, deposit with the Treasurer or his representative, a sum of money equal to the average expense, for use of chemicals and wear and depreciation of apparatus in the hand of such student.

2d. That for a course of two hours daily (except Saturdays) during a term of 12 weeks the sum deposited shall be $12—for a course of four hours daily, the sum deposited shall be $24, and for a course of six hours daily, the deposit shall be $36.

3d. That an account shall be kept by the Professor of Chemistry with each student, in which all the items furnished such student shall be recorded, with charges of cost of same; and the account shall be closed the day before the first day of the examinations at the end of the term, when a settlement shall be made.

4th. That a student who shall use the apparatus belonging to the laboratory and who shall wish to return the same at the end of the term, shall be permitted to do so, provided the apparatus be returned in good condition, and provided also a sum equal to 20 per cent. or its value when received be allowed for the use of the same, such per centage not to exceed $3 00 for the term.

5th. Students shall pay the value of the apparatus broken or destroyed by them individually.

6th. A scale of prices shall be established for the chemicals, or reagents used by students, and the prices to be the cost of the same as paid by the University.

7th. All moneys received from students for chemicals and apparatus shall constitute a distinct fund, from which the Professor of Chemistry may draw to purchase supplies from time to time, as occasion may require.

8th. That proper regulations may be established for the government of the students, while working in the laboratory. And a penalty may be fixed for the violation of any such rules proportioned to the magnitude of the offence, the penalties not less than five or more than twenty cents for the violation of any one rule so established, and posted in a conspicuous place in the laboratory.

9th. As it will be desirable for the Professor to have chemicals for the analysis of soils, plants, grains, etc., made outside of the regular work of the students, and as there will be much wear and tear, and depreciation of apparatus in general use, not chargeable to the students, and as extensions and additions to the laboratory is contemplated and necessary, therefore

Resolved, That the sum of five hundred dollars be appropriated for the purpose as set forth in the ninth section of this report.

Resolved, That the charges, rules and regulations for students in Analytical Chemistry, as set forth in the above report, be adopted.

JOHN M. VAN OSDEL,
Chairman of Committee on Mechanical Department.

On motion, the ninth resolution was stricken out and the report was then adopted as amended.

Mr. PICKRELL offered the following:

Resolved, That the Committee on By-Laws be instructed to prepare a set of laws and rules for the guidance of the Faculty.

Adopted.

Mr. ALLEN offered the following preamble and resolution:

Mr. Jonathan Periam, our late Head Farmer, having resigned his position in connection with the Board,

Resolved, That we regret the loss of his valuable services and ripe experience at this juncture of our history,

And resolved, That we are gratified to learn of his appointment to a position where he may be eminently useful in developing one of the new Agricultural enterprises of the State.

Carried.

Mr. BLACKBURN offered the following resolution:

Resolved, That the Board embrace the occasion of the re-election of Dr. J. M. Gregory, as Regent of this University, to renew to him their oft-expressed assurances of continued confidence and respect, and to congratulate him on his almost unanimous re-election to the place he has filled for the closing term of two years with so much credit to himself, advantage to our rising institution and the great interests of the laboring and industrial classes, and that we hereby vindicate this institution, its officers and faculty, against the charge of wresting it from its primary and normal design, and from all bitter and unfounded charges made and put in circulation against it.

Mr. DUNLAP moved that it lie on the table.

Lost.

Vote upon the original resolution carried.

Mr. EDWARDS moved to take the resolution from the table in reference to the number of Trustees.

Ayes and nays being called for, his motion was withdrawn.

The report of the Committee on Faculty and Course of Study was then read:

REPORT.

The Committee on Faculty and Course of Study recommend that—

1st. The labor system to be continued as an important and valuable feature of practical education, and that the maximum rate of wages be fixed at twelve and one-half cents an hour, and that the hours of labor shall not be less than one and not more than three per day for five days each week, the amount to be determined by the Faculty, who may also excuse any student from the labor for cause. [Amended: *Provided*, that all labor shall be voluntary.]

2d. That the hours of labor and the wages of the several students shall be determined monthly, by the Faculty, and paid by the Regent from the funds of the department for which the labor has been performed, provided that the Faculty may impose a forfeiture of wages for willful absence from labor, or for negligence or unfaithfulness at work.

3d. That the labor shall be conducted with a steady aim to the practical education of the students and shall, as far as possible, coincide with and illustrate their several courses and studies.

The committee also recommend:

4th. That whereas the honorary scholarship provided for by the law is restricted to descendants of soldiers or seamen who served in the army or navy of the United States, there shall be offered by the Trustees one free or honorary scholarship to each county in this State, to be awarded to the student who shall pass the best examination for admission, and who shall agree to pursue one of the industrial courses of study.

5th. That graduates of other colleges desiring to pursue any special branch of study here, be received as resident graduates, on the payment of the usual fees except the matriculation.

6th. Whereas, in the early commencement and organization of the work of committees of this Board, it seemed necessary that the Regent of the University should be placed upon said committees and assume responsibilities which properly belong to the heads of other departments, therefore,

Resolved, That the Regent, at his request, be excused from active service on committees, except the Executive Committee and Committee on Faculty and Course of Study, and that each department be held responsible to this Board for the manner in which it shall discharge its duties; the Regent, as the executive officer of this Board, holding the head of each department to a rigid accountability for the same.

Signed, J. M. GREGORY,

Chairman.

Mr. DUNLAP moved to amend by inserting at the end of section one:

"*Provided*, That all labor shall be voluntary."

The report was then adopted with the amendment.

Mr. PICKRELL moved that the State appropriation made for farms of the University, be appropriated, to be expended under the direction of the Professor of Agriculture and the Farm Committee.

Accepted and referred to the Executive Committee.

The report of the Committee on Buildings and Grounds was received and adopted.

REPORT.

Your Committee on Buildings and Grounds, to whom was referred that part of the Regent's report, which relates to repairs and improvement of the University buildings, beg leave to report that a new roof of tin work should be put on the main building the estimated cost of which would be $850.

They also recommend a cast iron water table around the entire main and wing building on the offset in the brick work at the top of the basement stones, cost about $250. Also, the cornices and cupola of main building should be painted; cost, about $75.

Also, that painting of the entire brick wall of the University building would prevent the absorption of moisture and much improve the appearance of the building; the cost of painting the entire walls, $1,000.

They recommend the sidewalk to the Springfield road, about 900 feet on west side of University grounds; cost of sidewalk, $250.

They also recommend the walls of corridors or passages in the University building to be painted five feet high, two coats; cost about $150.

SYNOPSIS.

1.	Roof on main building	$850
2.	Cast iron water table	250
3.	Painting cornices and cupola	75
4.	Painting brick walls	1000
5.	Sidewalk	250
6.	Painting corridors	150
	Total	$2575

M. C. GOLTRA,
Chairman.

Report of Committee on Mechanical Department, was read and adopted:

REPORT.

Your committee, to whom was referred that part of the Regent's report relating to the Mechanical Department, beg leave to report, that suitable drawing tables, drawing boards, T squares, and instruments, should be provided, and instruction given in geometrical drawing applicable to the science of architecture and the mechanic arts, also the application of the theories of mechanical forces and the strength of material, illustrated by models and experiments.

We also recommend the employment of a suitable Professor, to teach the science of Architectural and Mechanical Drawing, before the commencement of the fall term.

We also recommend the enlargement of the workshops by removal of the stalls, so that a larger number of the students may be employed in carpentry and the practical construction of implements and machinery. For the use of the students engaged in this department, we recommend that suitable tools be obtained, provided the cost of such tables, boards, instruments and tools shall not exceed in the aggregate $500.

Respectfully submitted,

JOHN M. VAN OSDEL,
Chairman.

The Committee on Library and Cabinets, reported back as follows:

REPORT.

The Committee on Library and Cabinets, to whom was referred so much of the Regent's report as relates to library and cabinets, and to communications referred to in that connection, report the following resolutions:

1. *Resolved*, That the offer of Professor Burrill, to give six weeks of the summer vacation to making collections in Natural History in this State, be accepted, and that he be authorized to take with him such members of his class as may volunteer to accompany him, not exceeding five.

2. *Resolved*, That he be permitted to organize and conduct such short excursions for this purpose during term time as he and the Faculty may agree upon, provided that the same shall not interfere with the regular work and study of the term.

3. *Resolved*, That there be appropriated for such excursions and summer service the sum of $300, to be expended for two (2) wall tents, eight (8) rubber blankets, ten (10) woolen blankets, one (1) oil burning stove and furniture, taxidermal instruments, nets, boxes, cans, bags, ammunition, paper and other materials needed and to be used in collecting and preserving specimens, and for provisions for the party.

4. *Resolved*, That Professor Burrill be requested also to give such attention to the agricultural, fruit-growing and mechanical interests and enterprises of the sections he may visit, as he shall find practicable, and secure such specimens of seeds, soils, grasses, etc., as may serve to illustrate the Agriculture of the State, and that for this end we heartily recommend him to the favor of the Agriculturist and Manufacturers of the State.

5. *Resolved*, That the sum of $100 is hereby appropriated for the purchase of a set of meteorological instruments, and that the Faculty be instructed to provide at once for taking and recording regular meteorological observations.

6. *Resolved*, That the chairman of the committee on Library and Cabinets, in connection with Prof. Burrill, be a special committee to secure and remove the cabinets due us from Prof. Powell.

7. *Resolved*, That there be appropriated, during this year, out of the State appropriations and other funds,

For Library	$2500 00
For Chemical Laboratory and chemicals	2500 00
For Philosophical and other apparatus	1250 00
For Cabinets and Cases	1250 00
	$7500 00

All of which is respectfully submitted,

J. M. GREGORY,
I. S. MAHAN,
LEMUEL ALLEN,
JAMES P. SLADE.

Dr. KILE moved to strike out the $300 appropriated for botanical excursions.

Ayes and nays being called for, resulted in 3 ayes, 17 nays.

Ayes—Messrs. Blackburn, Pearson and Kile—3.

Nays—Messrs. Allen, Brown of Pulaski, Burchard, Burroughs, Cobb, Dunlap, Edwards, Galusha, Goltra, Griggs, Lawrence, Pickrell, Pullen, Slade, Wright, Van Osdel, the Regent—17.

The report and resolutions were then adopted.

A report was offered proposing certain changes in regard to rules of tuition, which report did not come to the hands of the secretary, but the following substitute was offered:

Resolved, That tuition be free to students who pursue studies exclusively in the Agricultural, Polytechnic and Military Departments, and that the tuition to students in other departments, or who pursue other scientific or classical studies, remain as already fixed by the Board. This provision to take effect at the commencement of the next collegiate year.

The question on the substitute was carried.

The Committee to whom was referred the matter of re-imbursement of Dr. Gregory for moneys expended by him in purchase of two lots for the University, reported back in favor of buying said lots.

The report of Special Committee, in relation to errors on account, was accepted and adopted.

REPORT.

Your Committee, to whom was referred the resolution of Mr. Dunlap, in regard to instructing the Finance Committee in relation to errors in books, beg leave to report that they have had the same under consideration and make the following statement:

We find, on page 117, First Annual Report, an order dated July 10th, 1867, to J. O. Cunningham, for the sum of $7,278 50 for the purchase of lands, and on page 140, Report of Executive Committee.

"Mr. COBB moved that the Regent and Dr. Scroggs be a Committee to negotiate with McKinley and Burnham for forty acres of land lying between the horse railroad and the 160 acres tract, at a price not exceeding $180 per acre, also to negotiate for the two lots lying between the Springfield road and horse railroad, also to obtain offers for the Griggs' farm or some part thereof, and report at the next meeting of the Executive Committee.

Motion carried."

We are unable to find any further record on the subject.

We are satisfied that said warrant was paid for the land and lots, as stated in the motion of Mr. Cobb, and we have no doubt that the error is in the printed record of the Executive Committee; therefore

Resolved, That said report be so amended as to show that the purchase of said land was made on the authority of the Committee by said J. O. Cunningham, and that the said warrant was duly drawn for that purpose.

M. C. DUNLAP,
H. C. BURCHARD,
E. COBB.

Mr. DUNLAP moved that Professors T. J. Burrill and S. W. Shattuck be paid $1,500 per annum, from March 1st, 1869.

Carried.

An additional report of the Committee on Faculty and Course of Study was then submitted:

REPORT.

The Committee on Faculty and Course of Study further recommend that the suggestions of the Regent in respect to an increase of the Faculty be concurred in.

Also, that Prof. W. F. Bliss be re-appointed to the chair of Agriculture.

Carried.

On motion of Mr. BURCHARD, it was

Resolved, That the Corresponding Secretary be allowed the sum of two hundred ($200) dollars for services during the past year, and a warrant drawn in his favor for that sum.

On motion, it was voted that the Committee on By-laws be instructed to report to the next meeting of the Board an amendment to the by-law relating to the number requisite to change the by-laws; also, to that relating to the payment of Professors' salaries, substituting monthly instead of quarterly, and that, in the meantime, the Regent be authorized to draw warrants for the payments of Professors' salaries monthly.

On motion of Mr. Burchard, it was

Resolved, That the Treasurer be allowed for salary, during the past year, the sum of five hundred dollars ($500), and a warrant drawn in his favor for that amount.

Mr. Galusha introduced the following resolution:

Resolved, That the Committee on Faculty and Course of Study be and they are hereby instructed so to re-arrange the course of study to be pursued in this institution that they shall consist of,

1. A ccurse in Agriculture, having branch courses in Animal Husbandry, in Horticulture and Gardening.

2. A course in Mechanics, which shall be so varied as to embrace instruction in those branches of study which are relating to the leading mechanic arts.

3. They shall provide for the instruction of students in Military Tactics.

4. They shall provide for teaching of such other scientific and classical studies as are legitimate and desirable in an industrial institution, provided any five or more students in the University shall wish to pursue them.

On motion of Mr. Griggs, it was referred to Committee on Faculty and Course of Study.

The Auditing Committee then made the following additional report:

Bill of Wall's Colliery Coal Mining Company, Feb. 18th, March 10th, for two cars coal, $40; to be paid by a warrant in the usual form.

Which was adopted.

On motion of Dr. Gregory, a special committee of three on the Chemical Department was appointed.

The committee consisted of Messrs. Griggs, Cunningham, Dunlap.

The Committee on regulations for the Uuiversity reported as follows:

REGULATIONS OF THE UNIVERSITY.

§ 1. The government of the Illinois Industrial University shall be and is hereby committed to the Regent and Faculty, who shall, as soon as possible, prepare a system of rules for the proper government of the students, and maintenance of order in the University, and, from time to time, such additional rules as may be found necessary, and shall submit the same for approval to this Board or the Executive Committee; but such rules shall be in force on the authority of the Faculty until they can be approved by the Trustees.

§ 2. The Faculty shall meet statedly at such times as they shall appoint for the transaction of business pertaining to the management of the internal affairs of the University; and all questions coming before such meetings shall be determined by the votes of a majority of the members, with the concurrence of the Regent.

§ 3. It shall be the duty of the Regent, as the executive officer of the University, to enforce the regulations of Trustees and Faculty for the maintenance of discipline and order, and to this end, the students of the University shall be subject to his authority, and when the Faculty is not in session, shall be liable to be called to account by him for any violation of rules or orders, to be suspended or otherwise punished at his discretions; but all such acts of the Regent shall be in force only until the next meeting of the Faculty, to which they shall be submitted for final action.

§ 4. Each Professor shall have authority to control students in his own class-room, and at his discretion to suspend or otherwise punish students for any violations of the order of his class, until the next meeting of the Faculty. It shall also be the duty of each Professor to exercise his personal authority at all times to maintain order among the students of the University, and promptly to report to the Regent cases requiring special discipline.

§ 5. Each Professor in charge of a department of instruction in this University shall be held responsible to the Board of Trustees for the faithful and efficient carrying out of the requirements of his department, the adoption of the best methods of instruction and government, and the best text-books and apparatus. He is also charged with the duty of procuring, on consultation with the Regent, and within the limits of the appropriations made for the purpose, the necessary instruments and materials of illustration for his department, and the proper care and preservation of the same. All purchases thus made shall, before put in use, be reported to the book-keeper, and be entered in the inventory of stock, with their cost, and also in the account with the department to which they belong.

§ 6. The Regent shall have general supervision over all the departments of instruction, and shall carefully examine the manner in which each is conducted, consult freely with the Professors in charge, and report to this Board the condition and wants of each.

§ 7. In case of the absence of the Regent of the University, a member of the Faculty, to be, from time to time, designated by the Trustees on the nomination of the Regent, shall act in his place as presiding officer for the administration of the affairs of the University.

The regulations were adopted.

The following resolution, offered by Mr. Pickrell, was voted:

Resolved, That this Board tender their thanks to the publishers of the Champaign County Gazette, for papers furnished at this meeting.

Dr. Gregory offered the following resolution, which was adopted:

Resolved, That the thanks of this Board be tendered to the several parties that have made valuable donations to the University.

On motion of Judge Brown, it was voted that Mr. Thomas Franks be and is hereby appointed Gardener to the University, and that his salary be fixed at $75 per month.

On motion of Mr. ALLEN, it was

Resolved, That the thanks of this Board be tendered to the Agricultural and Daily Press for the reports of the proceedings of the meeting of this Board.

The report of the Finance Committee was then read and received:

REPORT.

Your Committee on Finances would ask the Board to make the following appropriations for the current expenses of the year, and that warrants may be drawn to meet the same.

APPROPRIATIONS FOR THE CURRENT YEAR.

1.	University Building	$2,575
2.	Mechanical Department	500
3.	Military Department (purchase of buttons)	50
4.	Agricultural Department	3,000
5.	Purchase of two lots	425
6.	Treasurer and Corresponding Secretary's salary	700
7.	Taxes on lands	1,200
8.	Board Meetings	1,000
9.	Salaries	21,544
10.	Students' Labor	1,500
11.	Fuel and lights	500
12.	Cabinets (Geological and Botanical Excursion)	300
13.	Meteorological Instruments	100
14.	Stationery and Printing	150
15.	University grounds	1,000
16.	Incidental Expenses	1,500
	Total	$36,044

The receipts for the next year are estimated as follows:

Balance on hand	$9000
Interest on Champaign county bonds	10,000
" Morgan " "	2,500
" Sangamon " "	4,500
" Illinois 6 per cent. "	6,540
" Chicago Water "	1,750
Farm produce on hand to be sold	1,500
Probable receipts from matriculation and other fees	1,800
Proceeds of Farm for one year	3,000
Rent of lands	1,500
Total receipts	$33,990

This we respectfully submit as the estimate of receipts and expenditures for the next year, and recommend the adoption of the following:

Resolved, That the Regent be authorized to draw warrants, from time to time, to meet the expenditures for the above objects, not to exceed the amount hereby appropriated for each.

J. H. PICKRELL,
C. R. GRIGGS,
E. COBB,
H. C. BURCHARD.

On motion, the report was adopted.

The Auditing Committee then submitted the following report:

REPORT.

The Auditing Committee beg leave to further report, that they have examined the following bills, find them correct, and recommend that the Regent be ordered to draw warrants for their payment:

Trevett & Green, hardware	$15 67
J. V. Peterson, stationery	20 90
A. P. S. Stuart, chemicals	23 81
J. M. Gregory, petty expenses	73 72
C. G. Larned & Co., stoves and repairs	71 90

The bill of Dr. Warder your committee report back, with the recommendation that it be referred to the Executive Committee.

We also recommend the adoption of the following resolution:

Resolved, That all parties dealing with the University be instructed to make no bill against the same; but upon a written order from the proper person, which order shall be presented with the bills as vouchers therefore.

L. W. LAWRENCE,
JNO. M. PEARSON,
M. L. DUNLAP,
O. B. GALUSHA.

The report and resolution were, on motion, adopted.

On motion of JUDGE BROWN, the Treasurer and Chairman of Finance Committee, were authorized to convert Champaign county bonds to meet any deficiency reported by the Finance Committee, or such deficiencies as may occur.

Carried.

Moved and seconded, that the Board stand adjourned.

Carried.

J. M. GREGORY,
Chairman.

JONATHAN PERIAM,
Recording Secretary.

The following " Statement of Warrants drawn by the Regent" should have appeared after the Regent's Report, on page 70, but did not reach the printer in time.

Statement of Warrants drawn by the Regent.

No.	To whom.	Date.	Object.	Amount.
		1868.		
1	O. B. Galusha	March 12	Services as Recording Secretary	$325 00
2	Thos. Quick	" 12	Expense to Board meeting	24 55
3	B. Pullen	" 12	" "	18 40
4	I. S. Mahan	" 12	" "	20 15
5	O. B. Galusha	" 12	" "	26 10
6	L. R. McMurry	" 12	" "	12 50
7	W. C. Flagg	" 12	Salary as Corresponding Secretary	100 00
8	W. C. Flagg	" 12	Expenses as Corresponding Secretary	39 80
9	Thos. Quick	" 12	1 span of horses	384 00
10	G. W. Atherton	" 14	Salary, February	166 67
11	H. C. Stewart	" 16	1 span horses	300 00
12	Lemuel Allen	" 16	Expenses to Board meeting	22 40
13	J. H. Pickrell	" 16	" "	12 10
14	A. Blackburn	" 16	" "	27 20
15	J. S. Johnson	" 16	" "	44 60
16	J. C. Burroughs	" 16	" "	34 60
17	A. B. McConnell	" 16	" "	13 25
18	Emory Cobb	" 16	" "	49 30
19	E. Cobb	" 16		107 50
20	J. W. Bunn	" 18	Services as Treasurer	600 00
21	W. S. Hall & Co	" 18	Blank books and Stationery	56 62
22	J. M. Gregory	" 18	Balance of Library expenses	18 67
23	Jos. McCorkle	" 19	Hardware	29 21
24	Flynn & Scroggs	" 19	Printing and advertising	48 50
25	Jonathan Periam	" 19	Harness and farm expenses	127 10
26	G. K. Hosford	" 19	Spittoons and lamps	6 85
27	Dodson & Hodges	" 19	Hardware	79 29
28	F. Porter Thayer & Co	" 19	15 d z. chairs	136 00
29	C. G. Larned & Co	" 19	Stoves and pipes	63 60
30	W. C. Flagg	" 19	Expense to Board meeting	21 45
31	Fuller, Warrant & Co	" 19	1 cook stove, etc	110 50
32	L. C. Garwood	" 21	1 eight day clock	36 00
33	S. F. Percival	" 24	5 tons hay	35 00
33½	Walker Bros	" 24	Lumber and tables	218 32
34	Palmer, Fuller & Co	" 24	20 hot-bed sash	74 50
35	Hubbard & Herrick	" 24	Hardware	12 40
36	Prairie Farmer Company	" 24	Circulars and advertising	107 25
37	J. W. Scroggs	" 24	Service as Secretary Executive Committee	15 00
38	Hibbard & Finch	" 26	1 wagon, 5 bush. wheat, 3 bags, 2 collars	126 05
39	C. H. Dolton	" 28	Seed potatoes	25 10
40	Hovey & Nichols	" 28	Grass seed and peas	59 91
41	Hamar & Green	" 30	Hardware	120 92
42	C. Scribner & Co	" 30	Maps and globe	135 65
43	Jackson Burt	" 30	5 bush. seed wheat	12 50
44	M. L. Dunlap	" 31	Expense at Board meetings	7 50
45	G. L. Hessell	" 31	Harness	67 10
46	F. D. Reaford	" 31	24 bush. potatoes	32 40
47	W. A. Baker	April 3	Salary for March	166 67
48	Jonathan Periam	" 4	Salary for 1st quarter	375 00
49	Jonathan Periam	" 4	Board of men and seeds	60 00
50	Robert Rolston	" 4	3 months' work on farm	60 00
51	Fred. Finder	" 4	" "	60 00
52	N. J. Swayze	" 4	Plan for portico	20 00
53	G. W. Atherton	" 8	Salary for March	166 67
54	J. M. Gregory	" 14	" "	333 33
55	Elisha Eldred	" 14	10,000 feet fencing	180 00
56	M. C. Goltra	" 28	Locating land scrip	200 00
57	M. C. Goltra	" 28	Expense at Board meeting	17 05
58	A. M. Griswold	" 29	1 post augur	4 00
59	Cormish & Cook	" 29	3 horse whiffletrees, etc	19 00
60	J. Riehl	" 29	10 bush. seed oats	7 50
61	James Braddock	" 29	1 month's work on farm	20 00
62	Geo. Limberger	" 29	3 horses, 1 wagon, 1 harness	400 00
63	H. N. F. Lewis	" 29	Advertising in Western Rural	39 60
64	Aaron Potter	" 29	Services as clerk and librarian	100 00

Statement—Continued.

No.	To whom.	Date.	Object.	Amount
		1868.		
65	G. H. Anderson	May 1	Interest on warrant 34, of 1867	$20 ..
66	W. A. Baker	" 1	Salary for April	166 66
67	J. S. Searfoss	" 2	Wages for April	83 07
68	H. Dunlap	" 4	5000 strawberry plants	25 ..
69	J. W. Bartman	" 5	1 load of wood	2 75
70	Fuller, Finch & Fuller	" 5	1 barrel linseed oil	49 58
71	J. M. Gregory	" 5	Pay-roll of students' labor	125 ...
72	Beidler & Kratz	" 12	Lumber	182 73
73	Thomas Quick	" 12	Expense of Executive Committee meeting	16 30
74	I. S. Mahan	" 12	Expense of Executive Committee meeting	16 10
75	J. S. Johnson	" 12	Expense of Executive Committee meeting	25 ..
76	M. C. Goltra	" 12	Expense of Executive Committee meeting	17 ..
77	J. M. Gregory	" 13	University buttons for uniforms	63 75
78	Hall & Peterson	" 13	Books and stationery	18 88
79	Dodson & Hodges	" 13	Hardware	147 85
80	Sam. Houston	" 13	Two days' teaming	8 ..
81	J. Periam	" 13	Farm expenses	140 15
82	J. M. Davies	" 13	Stones and labor	21 70
83	Flynn & Scroggs	" 13	Printing blanks	37 ..
84	J. M. Scroggs	" 13	Salary as Superintendent	101 66
85	A. H. Andrews & Co	" 13	Anatomical plates	30 ..
86	C. G. Larned & Co	" 14	Stoves and pipe	66 ..
87	Adams, Blackmer & Lyon	" 14	1 history chart	6 .
88	Aaron Potter	" 14	Meals furnished Trustees	10 70
89	Wm. Price	" 14	Paints and painting	413 28
90	Park & Royer	" 14	312 feet posts	7 80
91	Beidler & Kratz	" 14	Lumber account	28 17
92	Hulburd, Herrick & Co	" 14	50 brass keys	3 12
93	J. M. Gregory	" 14	Pay-roll of students' labor	101 13
94	Patrick Lamb	" 14	Wages of Janitor—1 month	37 ..
95	G. W. Atherton	" 16	Salary for April	166 66
96	J. M. Gregory	" 18	" "	333 34
97	J. A. Hutchinson	" 18	Services of jack	10 ..
98	D. J. Ayres	" 18	9 1-4 days work, carpentering	25 44
99	Elisha Eldred	" 23	Lumber for barn, shop and fence	545 37
100	Chas. Sherman	" 30	6 days' work, carpentering	16 50
101	D. G. Ayres	" 30	11 days' work, carpentering	30 25
102	J. W. Powell	" 30	Salary	600 ..
103	Hanson Henry	June 1	2 months, 13 days' work	48 66
104	John S. Davis	" 1	1 month's work	36 ..
105	J. M. Gregory	" 1	Salary for May	333 33
106	A. M. Cheny	" 1	1 day's work, carpentering	2 75
107	W. A. Baker	" 1	Salary for May	166 66
108	S. P. Percival	" 2	Hay and osage orange plants	17 10
109	Fuller, Finch & Fuller	" 2	Glass and white lead	44 18
110	J. S. Searfoss	" 2	Wages for May	83 07
111	Robert Rolston	" 3	2 months' farm work	40 ..
112	Walker, Lapham & Co	" 3	Lumber and work	23 24
113	J. O. Cunningham	" 3	Expense for labor and insurance	179 ..
114	Robert Peacock	" 3	Bill of lumber	86 54
115	S. M. Dunsett	" 4	1½ days plastering	6 ..
116	N. Bateman	" 5	Postage on circulars	14 82
117	G. W. Atherton	" 10	Salary for May	166 66
118	J. M. Gregory	" 11	Pay-roll of students' labor	180 ..
119	Thos. Quick	" 12	Expenses at Board meeting	13 30
120	I. S. Mahan	" 12	" "	15 05
121	B. Pullen	" 12	" "	15 05
122	E. W. Holmes	" 13	Board for farm hands	128 ..
123	Aaron Potter	" 15	Services as librarian and clerk	40 42
124	T. J. Burrill	" 15	Teaching 1-6 of academic year	200 ..
125	F. A. Avey	" 15	Blacksmithing	14 15
126	Elisha Eldred	" 15	Lumber	154 18
127	Angle, Sabin & Co	" 15	Plows	33 50
128	Patrick Lamb	" 15	Wages as Janitor, 1 month	37 ..
129	D. G. Ayres	" 20	12¾ days' work, carpentering	35 06
130	J. Periam	" 23	Boarding farm hands	56 ..
131	Chas. E. Allard	" 23	1 week's wages, farm work	4 70
132	Aaron Potter	" 23	1 week's boarding, farm hand	3 50
133	C. D. Gregory	" 27	Services as accountant	15 ..
134	J. M. Gregory	" 27	Salary for June	333 33
135	J. L. Davis	" 29	1 month's wages, farm work	36 00

Statement—Continued.

No.	To whom.	Date.	Object.	Amount.
		1868.		
136	James Braddock..........	June 29....	2 months' farm work................	$40 ..
137	Gammon & Prindle........	" 29....	1 horse rake........................	27 ..
138	S. H. Busey.........	" 30....	1 stack hay, for teams..............	25 ..
139	Hubbard, Herrick & Co....	" 30....	Locks for University..	10 75
140	J. N. Wharton	July 4....	9¾ days' work carpentering..........	14 62
141	A. L. Rader...............	" 4....	14 days' work on farm...............	21 ..
142	Albert Russell?...........	" 4....	1½ days' work on farm	2 25
143	Pat. Sullivan	" 5....	1 month's work on farm	20 ..
144	Pat. Lynch	" 5....	" "	20 ..
145	Fritz Finder	" 5....	3 months' work on farm	60 ..
146	Geo. Lauberger............	" 5....	2 months' work on farm..............	40 ..
147	Jonathan Periam	" 5....	Salary for 2d quarter...............	375 ..
148	W. A. Baker...............	" 5....	Salary for June	166 67
149	G. W. Atherton............	" 5....	"	166 67
150	W. H. Crayne..............	" 5....	14¾ days' work on shop	22 13
151	J. S. Searfoss	" 5....	Wages for June......................	80 33
152	J. E. Graham	" 5....	10¾ days' work on barn	16 12
153	D. G. Ayres...............	" 5....	5 days' work carpentering	13 75
154	I. C. R. R. Co............	" 6....	Advanced freight	7 55
155	Fairbanks & Greenleaf.....	" 10....	1 hay scale.........................	100 ..
156	Thomas Franks.............	" 15....	1 month's work, gardener.....	40 ..
157	Pat. Lamb	" 17....	21 days' work on farm	30 ..
158	J. S. Davis...............	" 18....	18 days' work on farm...............	20 90
159	J. M. Gregory.............	" 18....	Bill of Ritchie & Son for philosophical apparatus......................	504 50
160	Fuller, Finch & Fuller.....	" 18....	1 barrel linseed oil................	49 86
161	J. E. Graham..............	" 24....	15 days' work carpentering	22 50
162	W. H. Crayne..............	" 24....	9 days' work carpentering	13 50
163	J. M. Gregory	" 25....	Salary for July.....................	333 33
164	D. G. Ayres...............	" 27....	14¼ days' work carpentering.........	39 19
165	G. W. Holmes	" 30....	Boarding farm hands	28 82
166	G. W. Atherton............	Aug. 1....	Salary for July.....................	166 66
167	Wm. A. Baker.......... ..	" 1....	"	166 66
168	Trevett & Rupert	" 1....	Hardware............................	51 71
169	S. J. Searfoss............	" 6....	Wages for July	83 33
170	Champaign Union Gazette.	" 6....	Printing and advertising............	12 50
171	D. G. Ayres...............	" 7....	6 days' work carpentering...........	16 50
172	Jonathan Periam..	" 10....	Farm expenses	272 50
172½]	James Lynch........ ..	" 10....	1 month's wages on farm.............	35 ..
173	John Kinney...............	" 10 ...	" "	35 ..
174	Hamar & Green.............	" 11....	Hardware............................	13 83
175	J. M. Gregory.........	" 11....	Salary for August....	333 33
176	Journal Company...........	" 14....	Advertising and printing	163 75
177	Dodson & Hodges...........	" 14....	Tinning roof........................	669 91
178	Patrick Lamb	" 25....	1 month's wages, Janitor	37 ..
179	Thos. Franks..............	" 25....	1 month's work, less 1½ days	36 15
180	F. M. & A. Avey	" 25....	Blacksmithing.......................	24 ..
181	American Express Company	" 25....	Expense on books from Washington.	9 80
182	Geo. W. Holmes............	" 26....	Boarding farm hands	68 ..
183	James Braddock............	" 26....	2 months' farm work.................	40 ..
184	Pat. Lynch	" 31....	1 month's farm work.................	20 ..
185	James Lynch	" 31....	Labor on farm	29 35
186	Geo. W. Atherton..........	" 31....	Salary for August...................	166 67
187	Wm. A. Baker.	" 31....	"	166 67
188	Wm. P. Sweet	Sept. 4....	Lightning rods......................	41 15
189	J. S. Searfoss	" 4....	Wages for August....................	83 34
190	Bord & Chandler...........	" 5....	Engraving of college................	35 30
191	Hovey & Nichols	" 5....	Garden shears and border cutter.....	9 ..
192	Geo. Landberger...........	" 7....	2 months' farm work.................	40 ..
193	Elisha Eldrid.............	" 8....	195 feet moulding...................	6 34
194	Fritz Finder	" 9....	2 months' farm work.........	40 ..
195	John Kinney.......	" 12....	1⅓ months' farm work................	46 66
195½]	A. L. Rader	" 14....	3¾ days' work on grounds	5 63
196	Mrs. Mary Coffey	" 15....	4 7-10 days' cleaning...............	7 05
197	Thomas Franks.............	" 15....	1 month's wages	40 ..
198	B. Pullen	" 16....	Expenses at Board meeting	19 70
199	I. S. Mahan...............	" 16....	" "	20 45
200	Thomas Quick	" 16....	" "	27 65
201	J. M. Van Osdel...........	" 16....	Expenses at 4 meetings..............	70 ..
202	G. N. Richards.	" 18....	Printing circulars..................	35 50
203	J. M. Gregory	" 18....	Sundry expenses for labor, etc......	23 80
204	Elisha Eldred.............	" 18....	Lumber for fence and tank	80 ..
205	Hibbard & Finch	" 18....	Tools for farm	238 60
206	Church, Goodman & Donelly	" 18....	Printing circulars..................	154 74
207	Pat. Sullivan	" 18....	2 months' work on farm..............	40 ..

Statement—Continued.

No.	To whom.	Date.	Object.	Amount.
		1868.		
208	Pat. Lamb	Sept. 18	1 month's wages as Janitor	$37 ..
209	James Braddock	" 18	1 month's, 2 days' farm work	21 33
210	Jonathian Periam	" 19	Boarding farm hands	48 ..
211	J. M. Gregory	" 22	Salary for September	333 33
212	O. O. Alexander	" 22	Recording deeds	6 75
213	I. C. R. R. Co	" 22	Back charges on freight	14 82
214	Porter & Thayer	" 25	6 dozen chairs	51 50
215	Root & Cady	" 25	2 drums, 2 fifes	35
216	W. F. Bliss	" 25	Salary for September	166 66
217	J. M. Gregory	" 28	Books for library	600 ..
218	I. C. R. R. Co	" 28	Back charges of freight	5 10
219	W. A. Baker	" 30	Salary for September	166 67
220	George W. Atherton	" 30	" "	166 67
221	A. P. S. Stuart	" 30	" "	166 67
222	Thomas J. Burrill	" 30	" "	100 ..
223	S. W. Shattuck	" 30	" "	100 ..
224	Jonathan Periam	" 30	Salary for 3d quarter	375 ..
225	Edward Snyder	" 30	Salary for September	83 84
226	J. S Searfoss	" 30	Wages for September	83 33
227	American Express Co	Oct. 13	Expressage on chemicals	9 75
228	B. C. Beach & Co	" 15	3 tons of coal	17 ..
229	Thomas Franks	" 15	Wages for September	50 ..
230	Hovey & Nichols	" 15	Flower pots	23 71
231	M. & L. Gurley	" 16	Engineering instruments	234 89
232	J. M. Gregory	" 16	Pay-roll of students' work	130 ..
233	E. S. Ritchie & Son	" 16	Philosophical and chemical apparatus	136 26
234	S. R. Walker	" 17	3000 brick for hot-house	30 ..
235	Patrick Lamb	" 17	1 month's services as Janitor	37 ..
236	J. M. Gregory	" 17	Balance of students' pay-roll of labor	13 90
237	Hulburd & Herrick	" 17	1 bell	9 ..
238	Wm. Price	" 19	Painting and paints	119 59
239	McKinzie & Bowman	" 19	3 cubic yards' sand	3 ..
240	Dodson & Hodges	" 19	Hardware	59 12
241	James Vick	" 20	2 barrels onions	30 ..
242	Skinner, Briggs & Co	" 20	1 gang plow	48 ..
243	Palmer, Fuller & Co	" 20	10 boxes of glass—8x10—for hot-house	42 50
244	J. M. Gregory	" 20	Purchase of microscope	60 ..
245	Patrick Lynch	" 20	2 months' work on farm	40 ..
246	Patrick Sullivan	" 21	1 " "	20 ..
247	J. M. Gregory	" 21	Salary for October	333 33
248	George Stipe	" 22	1 month's work on farm	20 ..
249	McKinzie & Bowman	" 26	Gravel for walks	35 ..
249½]	Walls, Coll Coal Co	" 27	1 car of coal	20 ..
250	J. F. Luhme	" 27	Chemicals and apparatus	433 22
251	George W. Holmes	" 27	Boarding farm hands	43 03
252	F. M. Avey	" 28	Blacksmithing	12 53
252½]	Prairie Farmer Co	" 28	Printing 350 circulars	7 50
253	Page & Sprague	" 29	112 pounds putty	6 65
254	Jonathan Periam	" 29	Boarding farm hands	48 ..
255	Holbrook & Parker	" 30	10 tons hard coal	140 ..
256	W. F. Bliss	" 30	Salary for October	166 67
257	I. C. R. R. Co	" 30	Charges of freight	39 43
258	S. R. Walker	" 31	1200 brick for cistern	12 ..
259	A. P. S. Stuart	" 31	Salary for October	166 67
260	Wm. A. Baker	" 31	" "	166 67
261	S. W. Shattuck	" 31	" "	100 ..
262	J. S. Searfoss	" 31	Wages for October	83 33
263	George W. Atherton	" 31	Salary for October	166 66
264	Thos J. Burrill	" 31	" "	100 ..
265	Edward Snyder	" 31	" "	83 33
266	George Stipe	Nov. 2	Farm work, 2 months' board	50
267	August Shavelan	" 2	1 month's farm work	35 00
268	Fred. Finder	" 2	Farm work to November 1st	62 50
269	E. S. Gurley	" 4	Surveying and draughting instrum'nts	110 65
270	James M. Thorburn	" 5	Bulbs	40 49
271	J. Periam	" 6	Farm expenses	112 21
272	J. McKinzie	" 7	4¼ cubic yards sand	4 25
273	W. F. Foot	" 7	3700 bricks	37 ..
274	W. F. Bliss	" 7	Salary for November and December	333 34
275	John Osfield	" 8	Repairs of farming tools	25 ..
276	J. M. Gregory	" 9	Balance of account to date	89 12
277	J. Seavey & Co	" 9	Furnaces for library	447 40
278	Ahomas Devore	" 9	Farm work—husking	15 90
279	T. M. Gregory	" 16	Pay-roll of students' labor	248 ..
280	Pat. Lamb	" 16	Wages for November	37 00

Statement—Continued.

No.	To whom.	Date.	Object.	Amount.
		1868.		
281	Thos. Franks	Nov. 16	Wages for November	$50 ..
282	Pat. Lynch	" 17	1 month's farm work	20 ..
283	Thos. Quick	" 18	Expense at Board meeting	23 80
284	J. S. Johnson	" 18	" "	27 ..
285	O. B. Galusha	" 18	" "	36 35
286	B. Pullen	" 18	" "	23 45
287	Sam. Edwards	" 19	" "	28 60
288	I. S. Mahan	" 19	" "	19 95
289	W. Kile	" 20	" "	5 50
290	M. C. Goltra	" 20	" "	11 ..
291	L. M. McMurry	" 20	" "	11 75
292	W. C. Flagg	" 20	" "	41 65
293	A. M. Brown	" 20	" "	26 65
294	H. C. Burchard	" 20	" "	46 ..
295	J. M. Gregory	" 20	Salary for November	333 33
297	Skinner, Briggs & Enoch	" 20	Repair of farm tools	8 50
298	Aaron Potter	" 20	Services as clerk of Treasurer	60 ..
299	H. E. Lapham & Co	" 20	Lumber and lime	59 71
300	Beidler & Kratz	" 20	Lumber for hot-house	204 90
301	G. N. Richards	" 20	Printing chemical labels	9 ..
302	E. V. Peterson	" 20	Stationery, etc	11 60
303	A. Campbell	" 20	Roof repair	10 ..
304	Walker Bros	" 20	Lumber and dressing	58 54
305	Trevitt & Greene	" 20	Hardware	52 82
306	Henry Swanell	" 20	Paints and glass	50 14
307	Joseph McCorkle	" 20	Hardware	17 55
308	W. C. Flagg	" 24	Expenses at Board meeting	14 25
309	Thos. Devore	" 25	Farm work, husking	15 ..
310	Lemuel Allen	" 25	Expenses at Board meeting	22 40
311	Ermentrout & Alexander	" 26	262 posts at 12½ cents	32 77
312	James M. Rolfe	" 27	Mason work, hot-house and cistern	108 81
313	L. N. Lawrence	" 27	Expense at Board meeting	24 30
314	A. Avey	" 28	Blacksmithing	23 50
315	Prairie Farmer Company	" 28	Advertising	20 ..
316	A. Blackburn	" 28	Expense at Board meeting	23 70
317	A. P. S. Stuart	" 30	Salary for November	166 66
318	Geo. W Atherton	" 30	"	166 66
319	W. A. Baker	" 30	"	166 66
320	S. W. Shattuck	" 30	"	100 ..
321	Thos. J. Burrill	" 30	"	100 ..
322	E. Snyder	Dec. 1	"	100 ..
323	J. S. Searfoss	" 1	Wages for November	83 34
324	J. H. Blakesly	" 2	Farm work one month	35 ..
325	Jonathan Periam	" 2	Boarding farm hands	40 ..
326	J. H. Pickrell	" 3	Expense to Board meeting	10 45
327	Flynn & Scroggs	" 4	Printing and advertising	25 50
328	Bullock & Crenshaw	" 6	Chemicals and apparatus	384 87
329	George Stipe	" 6	1 month's work on farm	35 ..
330	Sam. McKinzie	" 6	Gravel for walks	30 ..
331	Western Rural	" 6	Advertising	24 ..
332	J. S. Busey	" 7	5 cords wood	21 25
333	J. M. Gregory	" 7	Pay-roll of students' labor	30 ..
334	A. F. Childs	" 8	Drain tile for farm	150 ..
335	J. M. Gregory	" 11	Salary for December	333 34
336	Pat. Sullivan	" 11	2 months' farm work	40 ..
337	Elisha Eldred	" 11	Lumber bill	270 25
338	Walls Coll. Co	" 11	2 cars of coal	40 ..
339	Beach & Co	" 15	Balance of coal bill	8 70
340	Thos. Franks	" 16	Wages for December	50 ..
341	Hulburd & Herrick	" 22	Hardware	9 ..
342	Pat. Lamb	" 22	Wages for December	37 ..
343	G. W. Atherton	" 23	Salary for December	166 66
344	J. S. Searfoss	" 23	Wages for December	83 33
345	W. J. Ermentrout	" 23	Insurance	50 ..
346	Pat. Sullivan	" 25	Wages farm-hand, 1 month	20 ..
347	Pat. Lynch	" 25	Farm work, 2 months'	40 ..
348	George Stipe	" 25	Farm work 1 month to December 31st	35 ..
349	Fritz Finder	" 25	Farm work 2 months to December 31st	70 ..
350	Aug. Shavelan	" 25	Farm work 2½ months to Dec. 31st	87 50
351	J. H. Blakesly	" 25	Farm work 1 month and 3 days	37 35
352	S. R. Walker	" 26	1500 brick for still	18 ..
353	Prof. W. A. Baker	" 28	Salary for December	166 66
354	A. P. S. Stuart	" 28	"	166 66
355	S. W. Shattuck	" 28	"	100 ..
356	T. J. Burrill	" 28	"	100 ..

Statement—Continued.

No.	To whom.	Date.	Object.	Amount.
		1868.		
357	Jonathan Periam	Dec. 28....	Salary for last quarter..............	$375 ..
358	Ed. Snyder	" 28 ...	Salary for December..............	100 ..
359	J. C. Sheldon	" 28....	Insurance on building	50 ..
360	Sherfy & Sweet...........	" 28....	" "	151 50
361	Sam. Richner............	Jan. 6, 1869	Desk for chemical laboratory	28 95
362	H. C. Burchard...........	" 13....	Expressage board meeting..	23 70
363	American Express Co......	" 18....	Expenses on books...............	15 70
364	Thos. Franks.............	" 18....	Wages University gardener	50 ..
365	Pat. Lamb	" 18....	Wages of Janitor..................	37 ..
366	J. M. Van Osdel	" 21....	Expense of board meeting..........	18 50
367	M. C. Goltra	" 21....	" "	13 10
368	A. F. Childs	" 21....	2000 drain tile....................	120 ..
369	Journal Co	" 21....	Printing catalogues..............	34 ..
370	Wall's Coal Co............	" 21....	1 car of coal..................	20 ..
371	N. J. Colman	" 21....	Advertising in Rural World..........	25 ..
372	George K. Hosford	" 21....	Lamps and burners.......	28 15
373	T. M. Avey...............	" 21....	Blacksmithing.....................	11 78
374	J. E. Hessel.............	" 21....	Harness and repair	119 25
375	J. M. Gregory.............	" 21....	Account of petty expense............	47 19
376	Hovey & Heffron	" 21....	Flower pots for hot house	17 57
377	J. A. Henderson...........	" 21....	1 copper still (chemical laboratory)..	14 ..
378	Dr. J. A. Warder..........	" 26....	Salary for lecturing...............	600 ..
379	J. M. Gregory	" 26....	Students' labor—pay-roll	74 ..
380	Jonathan Periam..........	" 26 ...	Farm expense at University..........	90 09
381	W. C. Flagg	" 26....	Expense course of lectures	283 45
382	M. L. Dunlap	" 26....	Expenses at Board meeting..........	22 75
383	Thos. J. Burrill	" 26....	Salary for January...............	100 ..
384	Holbrook & Parker.........	" 26....	10 tons hard coal for furnace	140 ..
385	Prof. W. A. Bakér	" 31....	Salary for January	166 66
386	W. F. Bliss..............	" 31....	" "	166 66
387	A. P. S. Stuart	" 31....	" "	166 66
388	S. W. Shattuck...........	" 31....	" "	100 ..
389	Ed. Snyder	" 31....	" "	100 ..
390	J. S. Searfoss.............	" 31....	Wages for January..............	83 33
391	American Express Co.	" 31....	Express on books...............	39 50
392	J. M. Gregory	Feb. 5....	Salary for January...............	333 33
393	Gardner & Co	" 5....	4200 pounds hard coal..............	33 60
394	Walls Coll Co.............	" 5....	1 car of coal.....................	20 ..
395	Fritz Finder	" 7....	Wages for January	25 ..
396	J. H. Blakesley...........	" 7....	Wages for January and board........	35 ..
397	A. Campbell..............	" 15....	Repairing roof..................	10 ..
398	Pat, Lamb...............	" 16 ...	Wages as Janitor..................	37 ..
399	Mark. Dare	" 23....	12 days' work....................	18 ..
400	J. M. Gregory...	" 23....	Periodicals for library..............	164 63
401	W. A. Baker...............	" 28....	Salary for February............. ..	166 66
402	W. F. Bliss	" 28....	" "	166 66
403	A. P. S. Stuart............	" 28....	" "	166 66
404	S. W. Shattuck	" 28....	" "	100 ..
405	Thos. J. Burrill............	" 28....	" "	100 ..
406	Ed. Snyder	" 28....	" "	100 ..
407	J. S. Searfoss.............	" 28....	Wages "	83 33
408	J. M. Gregory	" 28....	Salary "	333 33
409	Ed. Snyder...............	" 28...	Pay-roll of students' labor	52 ..
410	Fritz Finder..............	" 28....	Wages for February (farm)	25 ..
411	J. H. Blakesley...........	" 28....	" "	35 ..
412	Aug. Shavelan............	" 28....	" "	25 ..
	Whole amount of warrants	drawn	....	$36,698 02

Classified Statement of Expenditures.

Board expense	$2381 26
Library	869 13
Landscrip	219 25
Salaries	13,000 00
Chemical apparatus	978 00
Engineering instruments	345 45
Philosophical apparatus	504 50
Fuel, lights, repairs, and all incidental expenses	3175 04
Improvements and alterations in buildings and grounds	8222 12
Farm and garden, purchase of teams, wagons, implements, fencing and building of barn, etc., and running expense	7063 28
Total	$36,698 03

MINUTES OF MEETINGS OF EXECUTIVE COMMITTEE DURING 1868.

University Building, *April* 28, 1868.

At a called meeting of the Executive Committee and the Committee on Buildings and Grounds, held at the Industrial University, there were present only the Regent, Messrs. J. O. Cunningham and M. C. Goltra.

No quorum being present, the meeting was adjourned to meet in two weeks from date.

Jonathan Periam, *Secretary.*

University Building, *May* 12, 1868.

The adjourned meeting of April 28th, was called to order at the office of the Regent, at 9 a. m.

Present—The Regent, Messrs. Cunningham, Goltra, VanOsdel, Mahan, Quick and Cobb. Absent—Messrs. Pullen and Harding. The gentlemen comprising the Committee on Buildings and Grounds were invited to sit with the Executive Committee.

The Regent was requested to correspond with manufacturers for the purpose of purchasing cloth for uniforms.

The following bills were then audited and allowed, and it was ordered that a warrant be drawn, in favor of the Regent, for their payment:

Waterbury Button Company	$43 75
Waterbury Button Company	20 00
Dodson & Hodges	57 95
Hall & Peterson	18 18

Jonathan Periam	$140 15
Beidler & Kratz	28 17
C. J. Larned & Co	64 15
Samuel Houston	8 00
J. M. Davis	21 70
Flynn & Scroggs	37 00
On motion, Dr. Scroggs was allowed $186 68	
Off credit 65 00	
Leaving balance due him	101 68
Parke & Rogers	7 80
Wm. Rice	413 25
Hulburd, Herrick & Co	3 12
Labor of students, April, 1868	95 17
N. J. Swarey	20 00
M. L. Dunlap	25 00
S. Riehl	7 50
A. M. Griswold	4 00
J. S. Searfoss	83 34
A. N. J. Lewis	39 60
George Landberger	400 00
James Braddock	20 00
Aaron Potter	20 00
Aaron Potter—freight on his household goods was made free to him.	
M. C. Goltra	842 55
Elisha Eldred	180 00
Charles Dalton	25 00
Union Coal Mining Company	14 00
J. M. Boatman	2 75
Frederick Finder	60 00
Robert Rolston	60 00
Jonathan Periam	127 00
F. D. Rexford	32 40
Hamar & Green	120 92
Hovey & Nichols	59 91
L. Vandersyde	8 25
Jackson Burke	12 50
S. J. Percival	35 00
Williard & Finch	120 00
Palmer, Fuller & Co	74 00
Thomas Quick	384 00
H. C. Stewart	300 00
A. W. Andrews	30 00
Adams, Blackmer & Co	6 00
Aaron Potter	10 70

It was voted that when the Committee adjourned, they should adjourn to meet at the University Building, June 11th, 1868.

It was voted that the Regent and Farm Superintendent be authorized to employ a gardener, and it was also voted that a sum not exceeding $400 be appropriated for repairing farm buildings and fences.

JONATHAN PERIAM, *Secretary*.

UNIVERSITY BUILDING, *June* 11*th*, 1868

The Executive Committee met at 7 P. M.

Present—Messrs. Quick, Cunningham, Goltra, VanOsdel, Pullen, Cobb, Mahan, and the Regent.

Mr. Periam being absent, I. S. Mahan was chosen Secretary, *pro tempore.*

Voted that the amount of freight charged by I. C. R. R. Co., for the transportation of the Regent's household goods, is hereby donated to the Regent, amounting to $38.

J. O. CUNNINGHAM was appointed a committee to examine the freight accounts of the past year, and report to this Committee.

The REGENT made a verbal report in reference to warrants drawn for labor on grounds, in relation to the expenditure of $1500, and vouchers showing the expenditure of all but $426 55; also vouchers showing payment of the last named $426 55—all of which was referred to the Board of Trustees. The following bills were allowed:

J. M. & A. Avey	$14 15
F. C. Gill & Dodson & Hodges	20 10
J. O. Alexander	6 75
Elisha Eldred	545 37
Fairbanks, Greenleaf & Co	15 20
Hulburd, Herrick & Co	10 75
C. D. Gregory	15 00

On motion of Judge J. O. CUNNINGHAM, the Regent was requested to issue a suitable circular and catalogue for the ensuing year.

The Committee then adjourned to meet again, Friday, June 12th, 1868.

JONATHAN PERIAM, *Secretary.*

FRIDAY, *June* 12*th*, 1868.

The Committee met at the University, at 9 A. M., and the following bills were allowed:

Robert Rolston	$40 00
S. S. Percival	17 10
Hanson Henry	48 66
S. M. Dunsche	6 00

John L. Davis	$33 00
S. J. Searfoss	83 07
Fuller, Finch & Fuller	49 58
Fuller, Finch & Fuller	44 18
David G. Ayres	25 44
Patrick Lamb	37 00
A. M. Cherry	2 75
Chas. Sherman	16 50
E. W. Holmes	128 00
Elisha Eldred	154 18
Angle & Sabin	33 50

On motion of Judge Cunningham, the sum of $9 was appropriated for the purchase of a suitable bell.

On motion of Emery Cobb, the Regent and Judge Cunningham were appointed a committee to purchase a suitable bell.

The bill of Aaron Potter was allowed for $61 80.

A motion for an appropriation for the purchase of musical instruments, being made, after discussion, on motion of M. C. Goltra, the Regent and Judge Cunningham were appointed a committee to purchase a bass drum, a snare drum and a fife, and to report to the Board of Trustees in relation to the purchase of other instruments.

Professor G. W. Atherton reported a bill for the labor of students, amounting to $180, which, upon motion of Emery Cobb, was allowed.

It was moved by M. C. Goltra, and seconded, that the recording Secretary be requested to write to ex-Secretary O. B. Galusha, inquiring after the books and records. Carried.

On motion of I. S. Mahan, after some discussion, it was

Resoved, That a committee of three be appointed, to inquire into the cost of procuring tile, the propriety of underdraining, and to procure and examine specimens of tile.

Messrs. Quick, Mahan and Periam were so appointed.

The Regent called attention to the fact that scrip is now selling at over $1 per acre; and asked if some action should not be taken in relation to 75,000 acres now on hand. It was moved by M. C. Goltra, and seconded, that 50,000 acres of scrip be sold, with the concurrence of a majority of the Board of Trustees, provided that it be sold at not less than $1 10 per acre. The Finance Committee and Treasurer being authorized to sell upon the written consent of a majority of the Board of Trustees, as above; and consent was accordingly given, in writing, as follows:

The undersigned, Trustees of the Illinois Industrial University, hereby consent and advise the sale of fifty thousand (50,000) acres of scrip, by the financial committee, at not less than one dollar and ten (1 10) cents per acre.

I. S. Mahan,
B. Pullen,
J. O. Cunningham,
M. C. Goltra,
Emery Cobb,
J. W. Scroggs,
Thomas Quick.

The following preamble and resolution were then offered by Rev. I. S. Mahan:

Whereas, the Board of Trustees, at the annual meeting in March, 1868, offered a resolution, proposing a revision of the charges for room rent, tuition and incidental expenses, which was, by vote of said board, referred to this committee for its consideration and action; therefore,

Resolved, That hereafter charges for room rent and incidental expenses and tuition be as follows:

Room rent per term, for each student...	$3 00
Incidental expenses	2 50

A matriculation fee of $10 shall be paid by each student upon entering the University, and before being entitled to enter the classes, besides which no charges whatever for tuition shall be made against students: *Provided*, that nothing herein contained shall be so construed as to prevent the Faculty from admitting such indigent students free, to the privileges of the University, as shall, in their judgment, be worthy.

Laid on the table.

On motion, Emery Cobb was added to the committee for examining freight account.

It was moved by Judge Cunningham, and seconded, that assistant professors be paid not to exceed ($1,200) twelve hundred dollars per annum. Carried.

By Mr. Cobb, that the Regent be authorized to draw a warrant for ($200) two hundred dollars, to pay Prof. T. J. Burrill.

A motion to adjourn was carried.

Jonathan Periam,
Secretary.

University Building, *Sept. 16th*, 1868.

Pursuant to call, the Executive Committee met at the Regent's office at 9 o'clock, a. m.

Present—Messrs. Quick, Van Osdel, Cunningham, Pullen, Mahan and the Regent.

The following bills were allowed:

E. S. Ritchie & Son	$506 50
Hibbard & Finch	238 40
Elisha Eldred	6 34
A. S. Rader	5 63
J. J. Osfield	25 10
George Sandberger	40 00
Hovey & Nichols	9 00
Dodson & Hodges	669 91
Bord & Chandler	35 30
Mrs. Mary Coffee	7 05
William P. Sweet	41 15
F. M. & A. Avey	24 00
Thomas Franks	40 00
Thomas Franks	40 00
Thomas Franks	36 15
Journal Company	163 75
Hamar & Green	13 83
Rupert & Trevett	51 71
John Kinney	35 00
John Kinney	46 66
D. G. Ayres	16 50
D. G. Ayres	39 19
D. G. Ayres	13 75
J. S. Searfoss	83 33
J. S. Searfoss	83 34
J. S. Searfoss	83 33
James Lynch	35 00
James Lynch	29 35
Patrick Lynch	20 00
Patrick Lynch	20 00
Patrick Lamb	30 00
Patrick Lamb	37 00
Patrick Sullivan	20 00
G. W. Holmes	28 82
G. W. Holmes	68 00
Fritz Finder	60 00
George Sandberger	40 00
J. E. Mayhew	16 12
J. E. Mayhew	22 00
W. H. Crayne	22 13
W. H. Crayne	13 50
J. N. Wharton	14 62
Albert Russell	2 25
James Braddock	40 00
James Braddock	40 00
David G. Ayres	35 06

Chas. E. Allard	4 70
A. L. Rader	21 00
A. Potter.	3 50
J. L. Davis	20 90
J. L. Davis	36 00
S. M. Busey	25 00
Fairbanks, Greenleaf & Co	100 00
Gammon & Brindle	27 00
Fuller, Finch & Fuller	49 86
Champaign Union	12 50
N. Bateman	14 82
Jonathan Periam	272 50
Jonathan Periam	56 00
B. C. Beach, referred, with power, to the Regent	6 00
Church, Goodman & Donnelly	154 74
Pat. Lamb	37 00
T. J. Burrill	200 00
G. N. Richards	35 50
Root & Cady	35 00
Thos. Quick	27 65
B. Pullen	19 70
I. S. Mahan	20 45

It was moved and seconded that ($368 69) three hundred and sixty-eight dollars and sixty-nine cents be appropriated for chemicals; and it was moved that ($439 45) four hundred and thirty-nine dollars and forty-five cents be appropriated for chemical apparatus. Carried.

It was moved and seconded that a forcing pit or propagating house be built, at a cost of about ($250) two hundred and fifty dollars. Carried.

On motion of Mr. Van Osdel, the Regent was authorized to buy a good mounted microscope, not to exceed ($250) two hundred and fifty dollars. Carried.

The report of Committee on Drainage was then received:

REPORT OF COMMITTEE ON DRAINAGE.

To Executive Committee of Illinois Industrial University:

Your special committee, to whom was referred the matter of underdraining, would respectfully report:

We recommend that the 40 acre plot that is to be devoted to horticultural purposes, be underdrained with tile, this fall. A portion of this land is wholly unfit for the purpose for which it is designed without underdraining; but with underdraining it at once becomes very valuable For both experimental and practical gardening we believe it indispensable.

The cost of the tile will be nearly $800. They can be procured of A. F. & G. Childs, on the line of the I. C. R. R., at Anna, and will be warranted against breakage and the effects of the elements.

The work of surveying and superintendence could be done by persons already permanently employed in the institution. The further cost of labor would probably be about $1,200—total cost $2,000.

Respectfully submitted,
I. S. MAHAN,
THOS. QUICK,
JONATHAN PERIAM.

Ordered to be laid on the table for discussion at the evening session.

The bill of Elisha Eldred, for lumber and fencing, for $80, was allowed.

On motion, Judge Cunningham and J. Periam were associated as a committee to rent the Griggs' farm for the ensuing year. Carried.

Motion to adjourn to 7 o'clock, P. M. Carried.

JONATHAN PERIAM,
Secretary.

EVENING SESSION.

The Committee were called to order at 7:15 P. M.

It was moved and seconded, that the Board of Trustees be requested to meet on Wednesday, the 18th of November, 1868. Carried.

After discussion, it was moved and seconded, that the drainage of the garden plat and the experimental farm be prosecuted, at an expense not to exceed $1,200. Carried.

It was moved and seconded, that such alterations in the university building be authorized as will secure a dining room in the basement, and leave the present dining room free for a library and reading room. Carried.

Also, that the laboratory be fitted up with the necessary tables and fixtures. Carried.

It was moved that the library room be furnished with portable furnaces and pipes, for heating the recitation rooms and chapel. Carried.

The Regent's bill for unexpended balance of warrant 98, for the past year (1867), for $426 55, with vouchers, was examined, and the balance of $23 80, as due him, was allowed.

MINUTES OF MEETINGS OF EXECUTIVE COMMITTEE,

FROM JANUARY TO JUNE, 1869, INCLUSIVE.

UNIVERSITY BUILDING,
URBANA, ILLINOIS, *January* 21*st*, 1869.

Pursuant to call, the Executive Committee met, at the Regent's office, at 9 o'clock A. M.

Present—Messrs. Cobb, Cunningham, Goltra, Van Osdel, and the Regent.

On motion of Mr. EMERY COBB, the Regent's bill for balance of $4 28, for books for library, was allowed—the whole amount of said bill being $604 25.

Also, the following bills were allowed :

Samuel Richener's bill, for making desks, balance $28 75—whole amount of same being	$35 00
Hovey & Heffron	17 57
F. M. & A. Avey	11 78
G. E. Hessell	119 25
J. S. Henderson	14 00
James M. Thorburn & Co	40 49
Rural World	25 00
Iowa Homestead	2 00
American Naturalist	5 50
North-Western Farmer	1 00
Ohio Farmer	2 00
Horticulturist	1 75
Journal of Agriculture	1 50
American Entomologist	75
Rural World	2 00

On motion of Mr. VAN OSDEL, the amount of $16 50 was ordered to be taken from the library account.

It was directed that the Professor of Chemistry keep an account of the chemicals used by each student, and the compensation for their use be left to the full Board.

J. M. Van Osdel's bill for $70, for attendance at four meetings, was allowed.

It was moved and seconded, that the Regent be authorized to procure six dozen additional chairs for recitation room and chapel. Carried.

The farmer was authorized to procure seed of five varieties of winter wheat, sufficient to seed ten acres of land, for experiment.

On motion, the meeting was adjourned, subject to the call of the Regent.

JONATHAN PERIAM,
Recording Secretary.

McKinzie & Bowman	$65 00
J. M. Gregory	47 19
Wall's Coal Mining Co	40 00
Thomas Franks	50 00
George Stipe	35 00
Patrick Sullivan	40 00
Patrick Sullivan	20 00
Holbrook & Parker	140 00
Fritz Finder	70 00
A. Scharelon	87 00
J. A. Busey	21 25
Western Rural	24 00
A. F. & G. Childs	150 00
Elisha Eldred	270 00
B. C. Beach & Co	8 70
Bullock & Crenshaw	384 87
R. S. Walker	18 00
American Express Co	15 70
J. H. Blakesley	37 35
Patrick Lamb	37 00
Patrick Lamb	37 00
George Stipe	35 00
J. S. Searfoss	83 33
Geo. K. Hosford (amount left blank at request of Regent)	
Wall's Coal Company	20 00

On motion of J. O. Cunningham, 1500 copies of catalogues were ordered.

On motion of J. M. Van Osdel, there was appropriated from library fund ——— dollars, for periodicals, foreign and American.

On motion of Mr. Goltra, the Regent was authorized to procure a wood-cut of the farm, for insertion in the catalogue.

On motion of Mr. Cunningham, the Regent was authorized to draw a warrant to pay lecturers.

On motion of Mr. Van Osdel, it was

Resolved, That the present course of lectures delivered by Dr. Warder be limited to twelve.

Bill of Journal Company, Springfield, was allowed, for $34.

The following preamble and resolution were offered by Mr. Cobb, and carried:

Section 6, of the state laws, entitled "An act to provide for the organization and maintenance of the Illinois Industrial University," says: "No money shall be drawn from the treasury, except by order of the board of trustees, on warrant of the regent, drawn upon the treasurer, and countersigned by the recording secretary."

This section pre-supposes that the regent, treasurer and recording secretary will all reside where the institution is located. This not being the case, be it therefore,

Resolved, That all appropriations of money by this board be made for specific purposes and classified accordingly, stating amount appropriated for each; and that it shall be the duty of the recording secretary to furnish the regent and treasurer with a copy of such appropriation; and that all warrants drawn by the regent shall mention for what purpose drawn and the fund chargeable therewith.

On motion of Mr. GOLTRA, the following gentlemen—Messrs. Cunningham, Dunlap and Cobb—were appointed a committee to make arrangements for and receive the members of the legislature, with power to audit the necessary bills made.

On motion, one hundred additional loads of gravel were ordered to be bought.

The fees of Mr. Cushing, whose health did not permit him to remain at the University, were remitted.

On motion, the committee adjourned.

JONATHAN PERIAM, *Secretary.*

APRIL MEETING—1869.

UNIVERSITY BUILDING,
URBANA, ILLINOIS, *April 8th*, 1869.

The Executive Committee met at the Regent's office—and the meeting was called to order by the Regent, at 10:15, A. M.

Present—the Regent, Messrs. Cobb, Pickrell, Cunningham, Goltra and Wright.

Absent—Messrs. Brown of Pulaski, Griggs and Pullen.

On motion of Mr. Goltra, it was voted that Messrs. Johnson and Allen, who were engaged in an adjoining room with the business of the Agricultural committee, be invited to sit at their convenience with the Executive Board.

After considerable discussion of the limits of the jurisdiction of the Committee on Agriculture and Horticulture and the committee on Buildings and Grounds, the following resolution was adopted, on motion of Mr. Cobb:

WHEREAS, the territory and duties of several of the committees have never been precisely settled by the board; and whereas, it has become a matter of present practical importance that these duties and territories be more definitely settled; therefore, 1st. *Resolved*, That until the meeting of the board the Horticultural Committee shall have charge of the 40 acre tract, the orchard on the western part of the experimental farm and ornamental grounds.

2d. *Resolved*, That the Agricultural Committee shall have charge of the stock farm and the experimental farm, except so much of the latter as shall be occupied by the orchards, to which is hereby assigned the 53 acres lying west of the line Wright street.

On motion of Mr. COBB, it was voted that the bills of "Prairie Farmer" and "Western Rural," and such other papers as may have bills against the Illinois Industrial University, for advertising winter lectures, be referred to the Corresponding Secretary, to report to this Committee, as soon as practicable, as to their correctness.

The bill of Dodson and Hodges, $32 48, was then audited and allowed.

On motion of Judge CUNNINGHAM, the Committee adjourned to 1:30 P. M.

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AFTERNOON—1:45 P. M.

The Committee met, pursuant to adjournment, and the following bills were audited and allowed:

Prairie Farmer, March 19th, 1869, advertising seed corn	$19 20
L. F. Childs, March 27th, draining tile	126 00
Hulburd, Herrick & Co., March 30th, hardware	28 40
Elijah Eldred, March 29th, lumber	90 79
" " 31st, "	201 45
" " " "	90 31
. Snyder, April 8th, postage and petty expenses	30 87
Vall's Colliery Coal Mining Company, March 30th	20 00
. D. Childs, jr. & Co., seal and press, March 30th	20 00
Chas. W. Rolfe, March 30th, pump	12 55
Hovey & Heffron, March 26th, kitchen garden and flower seeds	24 07
eed for market garden	34 80
arden syringe, etc	18 50
uller, Finch & Fuller, March 29th, oil and lead	83 90
iller & Toll, muslin	2 00
revett & Green, hardware	9 05
revett & Green, twine	40
M. Campbell, seed oats	37 87
7. F. Bliss, two sugar hogsheads	2 00

On motion of Judge CUNNINGHAM, it was ordered that Dr. Warder's bill for $150, for three lectures delivered in January, 1869, be referred to the Corresponding Secretary, with instruction to report, for the information of the Executive Committee, the particulars of the arrangement made with Dr. Warder.

A recommendation from the Faculty "that the rooms south of the library should, at as early a day as possible, be prepared for the reception of the geological and mineralogical cabinets," was, on motion of Judge CUNNINGHAM, adopted; and it was ordered that it be carried out immediately.

The Regent presented the following proposition, from Prof. Burrill, for the sale of a cabinet of minerals now on exhibition in the library room of the University:

INDUSTRIAL UNIVERSITY, *April 8th*, 1869.

GENTLEMEN: The cabinet of fossils and minerals, now in cases in the University and belonging to Mr. M. S. Hall, has been left in my hands for sale. Mr. Hall's price is $1000; but, owing to pressing demands for money, he is desirous of disposing of it, even though a much less sum be obtained.

The following statement, based upon my own count and estimate—the latter drawn from every source of information at hand—may aid in determining the value of the collection:

750 fossil plants, of about 35 distinct species, being about one-fourth of those known to exist in Illinois—40 cents, each	$300 00
25 extra fine geodes, at $3	75 00
70 medium " 1	70 00
70 smaller " 30 cents	21 00
40 specimens of minerals, granites, etc., 40 cents	16 00
60 fine specimens of pol. marble, agate crystal spars, at $3	180 00
200 animal fossils, at 30 cents	60 00
Total	$722 00

Duplicate specimens, if valuable separately, are equally so for exchange; but as there are many of these, and exchanges will be attended with some expense, and also making due allowance for the sale of a whole collection rather than by single specimens, I offer it to you for the sum of six hundred dollars.

T. J. BURRILL.

On motion of Judge CUNNINGHAM, it was voted that the proposition be referred to Prof. Stuart for an opinion in regard to the propriety of making the purchase, with instructions to report to the next meeting of the committee.

On motion of Judge CUNNINGHAM, it was voted that the proposed change of the walk running parallel with the main drive on the west side of the grounds be entrusted to Mr. Franks.

On motion of Mr. COBB, it was voted that the appropriation made for buildings and grounds, allowing $2,575, be disbursed by the Regent, with the advice and consent of the chairman of the Committee on Buildings and Grounds.

On motion of Judge CUNNINGHAM, it was ordered that regular monthly meetings of this committee be held on the first Wednesday of each month, for the transaction of business.

On motion of Judge CUNNINGHAM, it was ordered that the carpenter be instructed to complete, as soon as possible, the sidewalk on the street in front of the University building as heretofore ordered.

On motion of Judge CUNNINGHAM, the following preamble and resolution were adopted:

WHEREAS, the Regent has offered to visit some of the chief Industrial schools of Europe, during the summer vacation, at his own expense, to observe carefully their methods and facilities of instruction, to aid in the further development of the University; and whereas, such observations, at the present stage in the progress of the University, seem important and may prove of great benefit; therefore,

Resolved, That leave of absence be granted to the Regent from the middle of May to the opening of the autumn term; and he be requested to make thorough examination and copious notes of such things, in the several agricultural and polytechnic schools he may visit, as may serve to aid us in the more perfect organization of this Industrial University.

On motion of Judge CUNNINGHAM, it was voted that the authorities of the town of Urbana be requested to vacate the public road on the east and south side of the northwest quarter of the northwest quarter of section 19, township 19, range 9, and to locate a road on the north side of said tract, to connect the road, as now laid on the north side of said section 19, with the road laid on the range line between ranges 8 and 9.

The Agricultural Committee brought in their report; which was recommitted, with instructions to report to the Executive Board.

An application of Prof. Wm. M. Baker, for permission to have his lumber purchased and shipped with the lumber of the University, was not granted.

On motion of Mr. PICKRELL, it was

Resolved, That the state appropriation made for the Agricultural department be appropriated for the purposes named in the act; that the state appropriation made for the Horticultural department be appropriated for the purposes named in the act; that the state appropriation for the Chemical department be appropriated for the purposes named in the act; and that the state appropriation made to be used for other apparatus and books be appropriated for purposes named in the act.

On motion, the Committee adjourned, to meet Wednesday, May 5th, 9 A. M.

J. M. GREGORY, *Regent.*

W. F. BLISS, *Secretary.*

MAY MEETING, 1869.

UNIVERSITY BUILDING,
URBANA, ILLINOIS, *May 5th*, 1869.

The Executive Committee met, pursuant to order, at the Regent's office, at 9½ o'clock A. M.

Present—Messrs. Cunningham, Goltra, Pickrell, Pullen and the Regent.

Absent—Messrs. Cobb, A. M. Brown, Wright and Griggs.

The Regent read the following statement of the book-keeper, of accounts, from March 12th to present date:

EXPENDITURES.

Board expense	$520 25
Salaries	3,046 94
Farm account	603 82
Building account	29 15
University grounds	291 49
Chemical laboratory	61 05
Library account	21 50
Student's labor	117 60
Fuel and lights	60 00
Material and lumber in hands of carpenter	563 35
Purchase of 2 lots	425 00
Salaries of treasurer and corresponding secretary	700 00
Stationery, etc	20 90
University seal	20 00
Visit of legislature	66 00
University buttons	25 00
Incidental expenses	272 42
Total expenses	$6,927 80

There have been collected by me, and remitted to the treasurer, the following amounts:

March, 1869, various fees	$612 00
Farm produce	125 45

April, 1869, fees	$72 50
Collected for coal	39 48
Total	$849 43

Respectfully,

E. Snyder, *Book-keeper.*

The following accounts were then examined and allowed:

May 3d, C. G. Larned, hardware, etc., for laboratory	$30 15
April 10th, Johnson, Myers & Co., repairing agricultural implements	6 45
April 17th, F. K. Phœnix, flowers and seeds	22 60
April 10th, Adams, Blackmer & Lyon, pamphlet cases	21 60
April 26th, D. W. Weir, trees	58 00
April 23d, R. B. Nelson, whitewashing and plastering	25 15
April 16th, Moulding & Harland, flower pots	15 75
April 23d, Union Coal Co., 1 car coal	15 00
April 23d, Fuller, Finch & Fuller, 2 boxes glass	8 88
May 3d, Chas. G. Larned, hardware	3 25
April 13th, C. W. Beyer, insurance on library	21 50
May 4th, Prof. Stuart, expenses for chemicals	4 57
May 3d, F. M. Avey, blacksmithing	12 50
May 4th, Hibbard & Finch, seeds and plow	33 0
May 4th, Trevett & Green, Hardware	15 70
May 4th, E. T. Whitcomb, recording deeds	3 75
May 4th, G. Hessell, harness repairs	7 95
May 4th, G. K. Hosford, oil, chimneys, etc	7 72

The Committee on Buildings and Grounds offered the following:

The Committee on Buildings and Grounds, on examination, finding that the cast iron water-table proposed, by the Committee, will be of inferior value and efficiency to a water-table made of tin or galvanized iron, with a timber so placed as to make a proper projection, do hereby recommend such change in the plan, and ask the Executive Committee to authorize the same.

Respectfully, submitted,

M. C. Goltra, *Chairman,*
J. O. Cunningham,
J. M. Gregory.

On motion of Mr. Pullen, the recommendation was accepted and the change authorized.

On motion of Judge Cunningham, it was voted that the Regent be authorized to make such purchases of books and apparatus, in Europe, as he may find can be made with advantage there; and that, for this purpose, the necessary warrants be drawn on the appropriation made for library and apparatus.

On motion of Mr. Pickrell, it was voted that a warrant of $1,000 be drawn for the Committee on Locating Lands, and accounted for by said committee, as fees and expense in locating said land scrip.

On motion of Judge CUNNINGHAM, it was

Resolved, That the faculty be authorized to publish such catalogue and circular as, in their judgment, may be deemed necessary.

Adjourned to meet at the call of the Regent.

AFTERNOON.

The Committee was called to order in Dr. Gregory's library, at 12:30 P. M.

On motion, it was voted that Prof. Stuart be authorized to have the room intended for a laboratory enlarged.

Permission was given to the Professor of Agriculture to have put up in his room a case for agricultural specimens, books and documents.

The following communication was received from Prof. Stuart:

The undersigned, to whom was referred the valuation of the cabinet offered for sale by Prof. Burrill, respectfully begs leave to report that, in his judgment, the said cabinet is worth $500.

A. P. S. STUART.

URBANA, *May 5th*, 1869.

On motion of Mr. PULLEN, the report of Prof. Stuart was accepted, and the Regent was authorized to purchase the cabine for $500, subject to the State appropriation.

On motion of Mr. GOLTRA, it was voted that the Regent be requested to purchase a pump for the well of the University.

On motion of Judge CUNNINGHAM, it was voted that the salary of the Regent to the first of September, 1869, be paid in advance.

On motion of Judge CUNNINGHAM, it was voted that the gardener's house be located at such point on Green street as the Regent and the Professor of Agriculture may determine.

On motion of Mr. PULLEN, it was voted that the experimental orchard be planted in quincunx order, with trees 24 feet apart, and that the East and West avenue be extended to the western line of the orchard.

On motion of Mr. PICKRELL, the Recording Secretary was authorized to purchase a desk for his office and procure a copying press.

On motion of Judge Cunningham, it was

Resolved, That the Regent be authorized to purchase such amount of hard coal as, in his judgment, may be required for the use of the University during the winter months.

On motion of Mr. GOLTRA, it was ordered that in planting hedges on the outside of the experimental farm, they be set two rods from the lines on each side of the same, except on the west side, along Wright street, where the hedge shall be set 14 feet from the line, and along Mount Hope avenue, where it shal. be set 40 feet from the line.

Proposals for a new roof on the University building were then opened, in presence of the committee, and, on motion of Mr. PICKRELL, referred to the Regent and Judge Cunningham, with power to act.

J. M. GREGORY, *Regent.*

W. F. BLISS, *Secretary.*

JUNE MEETING.

UNIVERSITY BUILDING,
URBANA, *June* 2, 1869.

The Executive Committee was called to order in the Regent's office, at 10 o'clock, A. M., and, in the absence of the Regent, Mr. Goltra elected chairman.

On calling the roll, it was found that only Messrs Cobb, Pickrell, Cunningham and Goltra were present; and, on motion of Mr. Pickrell, the Committee, for want of a quorum, adjourned to Wednesday, July 7, the time of their next regular meeting, without transacting any business.

M. C. GOLTRA, *Chairman*

W. F. BLISS, *Secretary.*

AGRICULTURAL LECTURES AND DISCUSSIONS.

Following the precedent of the Yale agricultural lectures of 1860, the following course of agricultural lectures and discussions were held at the Industrial University, in January of 1869.

A number of gentlemen from Illinois, Missouri and Michigan, all eminent in their respective specialties, kindly consented to aid gratuitously in the inception of the first of what it is to be hoped will be a long series of farmer gatherings for mental instruction in the art and science of agriculture.

Prof. BLISS and SANFORD HOWARD were unable to fill their appointments. With these exceptions (resulting from circumstances beyond the control of the gentlemen mentioned) the lecturers were all able to be present, and performed the parts assigned them.

A large portion of these lectures have been solicited for and published in the Missouri Agricultural Report, for 1868, with the following note by the Secretary, Dr. L. D. Morse:

"Thus was inaugurated a new and probably important movement in Western agricultural education and improvement. Regarding it as an experiment, it may safely be recorded as resulting successfully. The lectures and discussions were attended by the students of the University, seventy or more in number, quite largely attended by the citizens of Champaign and vicinity, and there was a goodly number from various parts of the State. The lectures were, most of them, of an eminently practical character, and the discussions lively and interesting."

[CIRCULAR.]

ILLINOIS INDUSTRIAL UNIVERSITY,
CHAMPAIGN, *December* 19, 1868.

The first annual course of agricultural lectures and discussions, instituted by the Illinois Industrial University, in Champaign, commencing Tuesday, January 12th, 1869, and continuing during four days of that and the subsequent week, with three sessions in each day.

This is intended to be an annual gathering of the farmers of the State, and of their sons and daughters, for the purpose of discussing the best methods of agriculture; and it is earnestly hoped that all who desire to improve our tillage, our crops and our live stock, will be present and lend a helping hand.

No charge is made for admission. The University provides a hall properly warmed and lighted, and pays the expenses of the gentlemen who have kindly consented to open the discussions.

Each lecture, essay or "talk," will be followed by a discussion on the same subject, in which all are invited to participate.

Dr. John A. Warder, author of "American Pomology," will lecture daily from 4 to 5 P. M., on the subject of Fruit Culture.

Good boarding places can be had convenient, and at reasonable rates.

Railroads will be solicited to return persons in attendance at reduced rates.

J. M. GREGORY, *Regent.*

W. C. FLAGG, *Corresponding Secretary*

PROGRAMME.

TUESDAY, January 12th.

Morning, 9 o'clock. Introductory Address, Agricultural Facts and Theories.—Dr. J. M. Gregory.
Afternoon, 2 o'clock. The Natural Sciences and Agriculture.—Prof. W. F. Bliss.
Evening, 7 o'clock. Relation of Chemistry to Agriculture.—Prof. A. P. S. Stuart.

WEDNESDAY, January 13th.

Morning, 9 o'clock. Meteorology.—Prof. W. M. Baker.
Afternoon, 2 o'clock. The Soils of Illinois.—H. C. Freeman, of the State Geological Survey.
Evening, 7 o'clock. Management of Soils —Dr. John A. Warder.

THURSDAY, January 14th,

Morning, 9 o'clock. Grass.—Dr. L. D. Morse, Editor Journal of Agriculture.
Afternoon, 2 o'clock. Corn.—M. L. Dunlap, Agricultural Correspondent Chicago Tribune.
Evening, 7 o'clock. Wheat.—W. C. Flagg.

FRIDAY, January 15th.

Morning, 9 o'clock. Potatoes.—Jonathan Periam, Superintendent Practical Agriculture.
Afternoon, 2 o'clock. Root Crops.—Jonathan Periam.
Evening, 7 o'clock.—Agricultural Book-keeping.—Capt. Ed. Snyder, Instructor in Book-keeping.

TUESDAY, January 19th.

Morning, 9 o'clock. Orchard Fruits.—Dr. E. S. Hull, of Alton.
Afternoon, 2 o'clock. Grapes.—Hon. Geo. Husmann, of Hermann, Mo.
Evening, 7 o'clock. Small Fruits.—Samuel Edwards, of Lamoille.

WEDNESDAY, January 20th.

Morning, 9 o'clock. Breeds of Cattle.—Sanford Howard, Secretary Michigan State Board of Agriculture.
Afternoon 2 o'clock. Horses.—Col. N. J. Colman, Editor Rural World.
Evening, 7 o'clock. Swine.—Hon. Elmer Baldwin.

THURSDAY, January 21st.

Morning, 9 o'clock. Sheep.—A. M. Garland, President Illinois Sheep Growers' Association.
Afternoon, 2 o'clock. Agricultural Botany.—Assistant Professor Thos. J. Burrill.
Evening, 7 o'clock. Vegetable Physiology and Economy.—John H. Tice, Secretary Missouri Board of Agriculture.

FRIDAY, January 22d.

Morning, 9 o'clock. Rural Economy and Rural Life.—Dr. J. M. Gregory.
Afternoon, 2 o'clock. Fences and Hedges.—Dr. John A. Warder.
Evening, 7 o'clock. Timber Growing.—O. B. Galusha.

FIRST DAY.

ADDRESS OF WELCOME: BY DR. J. M. GREGORY.

GENTLEMEN AND LADIES: It is my high privilege to-day to welcome you to the Industrial University to its first annual course of lectures. We inaugurate to-day a part of the plan of operations, contemplated from the outset, to extend the benefit of this university beyond the ordinary students who shall gather here, out into the fields of adult life and of actual labor. The university, in this movement, leaving for the moment its place near the gateways of practical life, where it sits to train those about to enter, and to fit them for life's great duties, seeks to go out into the very midst of the busy throng of labor, and mingle its counsels and lend its light to the struggling, toil and thought of the practical world. Not content to teach its science to the young, it also seeks to enlighten, with its learning, the labors and the lives of the grown men and women who are doing the world's great work and bearing the burden of its endless battles. Teaching to beginners the elements of science, it also desires to take part in the solution of the fresh problems which are always arising in the progress of practical affairs. If science has gathered any clear light from the study of the past, when can it be better displayed than in aiding to solve the questions which perplex the present, and in thus opening the clogged highways which lead to the future? Through these annual courses of lectures addressed to the actual cultivators of the soil, the university will mingle its voices with yours in the very midst of the farmers and fruit-growers of the State.

But thus while welcoming you to these lectures as learners, we do not forget that you come also as teachers, and we extend to you a double welcome as bringing to us, fresh from the great fields of practical life, the latest questions which have arisen there, and the latest and best experience which have been gained. Your assembling here will help us to give a still more practical character to our institutions, and your discussions will lend a new and real air and value to the sciences our pupils are studying. We have to thank you, therefore, as well as welcome you, for the aid thus lent by your presence here in giving to the university the "pre-eminently practical character" the Trustees desire it shall bear. It will be our study and pleasure to make your stay here as pleasant and profitable as possible, and we solicit your co-operation to give to this initial lecture session such interest and value that the Trustees may feel encouraged to repeat it in the successive years.

It has already been seriously proposed to hold other lecture sessions in different parts of the State; and, if sufficient encouragement is given that the farmers and other citizens will attend, two such sessions, of three or four days each, will probably be held during this year—one in the northern and one in the southern part of the State. It is by this free and frequent interchange of views with the practical agriculturists of the State that the university hopes to work out one part of its great mission—the diffusion of agricultural science among mankind. Establishing some community of ideas between itself and the great classes in whose interest it works, it will be better able to organize its wide-reaching places of scientific observation and experiment, and will bring under its eyes the immense fields of research which it has undertaken to explore.

And, finally, we welcome you here that you may see for yourselves the work we are doing and are preparing to do for the cause of agriculture and the industrial education. We are confident you will say our plans are not one whit too broad to teach thoroughly those great and splendid branches of learning which relate to "agriculture and the mechanic arts;" and you will agree with us that no learning is too high to fit men to solve the great mysteries of seed and soil, and to master the mighty agencies of growth through which the brown earth is changed to golden grain, and pulpy fruit and fragrant flowers.

Again and heartily welcoming you, in the name of the university and of its faculty, I proceed to discuss the topic which has seemed to me a fitting one to open this course of lectures.

AGRICULTURAL FACTS AND THEORIES.

I regret that, for want of time, I shall be compelled to make this discussion in an extemporary form.

And in the first place, looking at the crude and disjointed facts which agricultural writers give us, we come to the conclusion that we have no *science of agriculture.* Botany is a science, because the facts which underlie it are established by fixed laws. Chemistry is a science for the same reason. But agriculture is not a science in any sense. It is simply a mass of *Empiricism.* If any one doubts this, let him attend the agricultural clubs and horticultural conventions, and he will be convinced. The ever recurring questions are still unsettled. One man has this experience, and another that, which is just the opposite.

One finds it most beneficial to plow his manure *under.* Another *top-dresses.* One plows in the *fall,* another in the spring. One *shortens back,* another leaves his trees to grow at pleasure.

But let it not be supposed that, in this statement of the present condition of agriculture, I, by any means, slander or underrate the value of the work already done. When I notice the change that has been wrought during this nineteenth century, and how far it is in advance of previous centuries in agricultural knowledge and practice in Northern Europe and England, and other parts of the world, we cannot too highly estimate the advancement made.

But after all, this advancement has been made in the way of *experience.* And we have nothing but experience. Hence we say, agricultural science is *empiricism*, and not an established science. It may be best to define what we mean by *science*.

Knowledge is not necessarily science. A great mass of knowledge is not necessarily scientific.

A great many facts, gathered and classified so that they may be made available for use, do not make science.

Just as in medicine, a large amount of facts are known in regard to specific medicinal substances, yet this does not constitute science.

Science can only be founded when the actual scientific fact belonging to that department which this scientific truth proposes to investigate, shall have been referred to fundamental laws, by which this fact may be explained and out of whose operations they grow.

For ages there were no certain facts known about plants—respecting their forms, shapes, or their qualities. What were supposed to be facts had not been traced to elementary truths which conform to laws. There is no science about it.

For ages there was much known about chemistry, but there was no science of chemistry.

Beautiful *theories* were based upon the facts gathered, but no science. I repeat, therefore, a mere knowledge of facts, however extended, does not constitute science.

True science is built upon asserted facts which have been reduced to scientific shape. Everything accidental thrown off—facts referring to the established laws of nature—growing from them and explaining them.

Agriculture has not yet reached these facts.

Ten million busy hands are occupied in looking up these facts, which must be referred to invariable laws, that we may be able to direct the result.

Goldwin Smith gives this definition of science: "It enables us, from a knowledge of invariable laws, to predict from certain facts what other facts will follow." Now agriculture has not yet reached that state of advancement.

The question whether agriculture can rise to the claim of being a science is an important one. We think it can; but let us look at the means by which this must be done, if at all. Now there are two stages of growth in this direction.

The first stage is that of simple facts—the stage of close observation and close deductions from these observations.

Every science has passed through this stage. If we go back in history, we will find that all sciences once occupied just that position which is held by agriculture to-day.

Take Chemistry. There was a time when it was held that this world was made up of four elements—earth, air, fire and water; and upon these supposed facts theories were built up.

So Chemistry, as well as other sciences, has had its stage of close observation and close speculation upon these facts.

The second stage comes when all theories fail—when the foundations upon which we have built are swept away by larger experience—when we throw away all theories and come back to a careful and calm statement of facts—fearful to take any conclusions beyond the demonstrated fact, still patiently following up these facts with persevering inductive processes.

To explain further the nature of these operations, I ask your attention to the classification of the methods in which the mind operates in building up a science. All science is the growth of human intellect. Science does not lie written upon nature, but is the result of the operation of the human mind working upon these facts.

Now, how does the mind work? There are two processes.

One is called *Induction*—that process by which we are led into truth step by step, and no further.

The other process is called *Deduction*—that process by which we begin with assumed facts, or facts proven, and spread out from that and form growth.

Now these two processes lie the one over against the other. I am very solicitous to be understood upon this point, for it seems to me important that we come to understand these two processes.

The first method is by careful induction, like a man walking upon stones and feeling his way one step at a time, and going only so far as he can see where to place his foot and no farther, and thus ultimately reaching the law.

But there is another process which takes the law when established, or that takes some fact believed to be true, and makes to grow a whole upper growth of theories, or system of theories. Now neither of these is to be eulogized at the expense of the other; yet the period of induction is the period of progress—the period that throws away all theories and comes to measure fact with fact—lays one brick upon the other let the result be what it may; let the plan of the architects appear when the work is done. Now, taking these two stages of science, we determine the question: "Can there be any science of agriculture?"

Agriculture is both an art and a science. So far as it simply applies to practice in special rules directing to particular results, it is an art. I imagine that most men class it as an art.

But authority or usage permits us to class as sciences some branches of knowledge which are combinations of the facts of several sciences. Take, for instance, Geography. It takes from Botany the distribution of plants; it uses Geology, Meteorology, Zoology and other sciences to explain facts which belong appropriately to each, and not to Geography alone; yet we call Geography a science, because these several sciences combine together in the explanation of one single object—the world. While Geography has not single fact of its own, it gathers all these facts around one central object, and usage permits us to speak of Geography as a science. In this sense, agriculture, the great mother of arts—the all-sustaining, fundamental art—the art of all arts—may claim to be a science. It combines many sciences on one common field—the field of animal and plant life.

Now let us see how science must grow. There is a distinction in facts which, it seems to me, the sooner we recognize and understand, the sooner will we advance to real science. There are common facts and scientific facts. A common fact is not necessarily a scientific fact.

What is a common fact? It is a fact which presents itself in our common observation or lies in our common observation of things. It is a common fact that many bodies, unsupported, fall to the ground. The real and essential character of the common fact may not be all comprehended. Thus the fact just mentioned was once so misunderstood and explained as would now seem absurd to us. For example, a philosopher of the middle ages undertook to explain the reason why a half dozen blocks would press harder downward than one block.

The blocks not occupying any wider space on the surface, being placed one upon the other, he could not see how it was that they pressed harder than one block. He did not suspect that any force was at work while the blocks lay at rest. His explanation of the fact was, that there was in the supporting body a certain sort of feeling or anticipation of the coming block, which aroused its resistance, and hence weight resulted.

But when statics became a science—when men came to understand that bodies press directly as the amount of matter, and inversely as the square of the distance—then the common fact became a scientific fact precisely stated. Many of the statements of Aristotle are to-day a laughing-stock for school boys. They simply take common facts and undertake to base upon them scientific deductions.

What is a scientific fact? It is simply a fact with all the husks stripped off—a fact from which has been eliminated the accidental, variable and non-essential, and there remains the essential and invariable.

The fact that all bodies have weight in proportion to the amount of matter and in the inverse ratio of the square of their distance from the earth, is a scientific fact; and upon this fact we safely base our deductions in physical science. In agriculture, facts seem to be settled; and we often proceed with our deductions based upon common facts, which are always fallible, having in them the same uncertainty and indefiniteness which belonged to the fact.

The trouble with agriculture is, as it has been with all the early sciences, that deductions begin too soon. It does not require much labor or ability to make loose deductions. Any mind with a little knowledge and some imagination can do this. None but well trained and thoroughly honest and clear minds will patiently confine themselves to induction.

Even Bacon, the founder of inductive philosophy—of which he has at least the credit—even Bacon, while he insisted on the necessity of not going beyond the facts of science, afterward presented one of the very worst instances of bad deductive reasoning. He did not follow out his own prescription at all. Aristotle proclaimed truth as clearly as Bacon did. But they both advanced too rapidly in their deductions, and propounded some of those absurd theories of which they stand convicted. Hence we say that it requires a patient and honest mind to be a good inductive philosopher.

It is said that Newton noticed the fall of an apple—but he did not draw all his deductions from the fall of the apple; he proceeded from this as a first step. The apple falls to the ground—then he proceeded to notice that other things fall, and that *all things* fall, that even the *smoke* falls whenever it enters a light medium.

Then he proceeded to inquire whether the planets are not falling, and whether it is not a scientific fact that all things fall or weigh directly in proportion to the matter they contain, and inversely as the square of the distance.

It was questioned whether the moon was not so far away that it will not fall. With the supposed facts respecting the weight and distance of the moon and planets he carefully proceeded to the solution of the problem. But it did not prove.

Now, a deductive philosopher, having the common fact, would have jumped at the conclusion and constructed the universe before Newton had his first scientific fact fairly proved.

But Newton did not take a single thing for granted. When he found that it did not prove—that the earth was not heavy enough to hold the world in its orbit—he laid aside his problem.

Others would have said, "It is true it does not quite work, but it is near enough;" and they would have held on to the conclusions half proven.

Afterward, when it was found that the geometers gave to the earth much larger dimensions, by seven hundred miles, than it was before supposed to have, Newton takes the new facts and proceeds carefully and surely to demonstrate his theory, which to this day is the received doctrine of science.

None but the best educated, none but the most honest minds will pursue the inductive process.

The great temptation is when men get two or three facts, they begin at once to build upon them.

I repeat: in deduction, theories which are built on common facts cannot be certainly well founded, and may not be worth the paper on which they are written. We can only build safely on scientific facts.

We have here, then, the *kind of facts* by which agricultural science may be built up—scientific facts. As yet, we have little else than theories built upon available experience. We are in the position of those who began, in the age of Newton, the study of astronomy, or of those who, in the age of Linnæus, began the study of botany; when the laws of the operation of the force pertaining to these sciences were imperfectly understood.

We to-day start with great vantage ground. We have facts and experiences which must lead to science. Agriculture is yet *Empiricism*, but it is doing the thing that will lead to success. We have learned, for example, that fertilizers do influence crops. We need not go back very far to find the time when the manure was utterly destroyed and cast out, as not only worthless, but it was even believed to be destructive to crops. But upon this point we have made advancement, and we have proved that these fertilizers do promote the growth of crops.

We need go back but a little while when deep plowing and thorough stirring of the soil were deemed necessary to promote growth. Hence, I repeat, that with correct views upon these and other points, we start with great vantage ground over those who have preceded us.

What yet remains to be explored ?

I think we need to determine the exact operation of the laws or facts controlling agriculture. We know that fertilizers, for example, promote plant growth. This is an established fact; but how they promote the growth of plants is not definitely settled. It is not determined whether fertilizers feed the plant directly, or help the plant to draw from the atmosphere the food it needs.

Now, what we want is to get this valuable process determined—to ascertain, if possible, how far it acts, if at all, conjointly with the sunlight and other agents in the soil, so that we may know just *how much* and *what* it does, and *how* it does it.

We need to attend, also, to the effect of the natural agents of Light, Heat and Moisture. We know that a potato grown out of the light will not have color. We know, also, that a plant without warmth and moisture will not germinate, and that a withdrawal of these will check the growth of plants; but the precise influence of these agents we do not know.

We need to make a more careful classification of the hostile forces which oppose the horticulturist and the agriculturist. And this leads me to say, finally, that the greater and more difficult work remains to be done. We need to understand the character and habits of our insect enemies, that we may protect ourselves against their ravages. There are unfavorable conditions in regard to heat and cold which neeed to be understood that we may fortify ourselves against danger. So in the animal world, we need to understand the precise character of the diseases that attack our animals—and these need to be so carefully ascertained that they become *scientific facts.*

I trust that the day is not distant when we shall have something more than *experimental* science—a science settled down upon the laws of nature, and which shall predict the result and reach conclusions with the certainty of mathematical test.

It is not to be supposed that any art can reach that degree of attainment of the *hand* that guides it. The *art* will always lag in the rear. Science must go before. It says, " thus far shalt thou come and no farther. This is the way—walk ye in it."

So, agricultural science must go before and mark the place where lies possible culture.

FRUIT CULTURE.

INTRODUCTORY LECTURE BY DR. JOHN A. WARDER, OF CINCINNATI.

In standing before you here to-day, I feel that we are stepping upon the threshhold of a new era, toward which some of us have been looking most anxiously for nearly a quarter of a century. Several of the noble citizens who first bestirred themselves upon the great subject of *Industrial Education* are still among us. The influence of their generous efforts has been felt by thousands, of whom many are here present to witness the results of their efforts in our Industrial University.

To them, to these, and to the great public, whom we hope to see deeply interested in the great problem of practical education, a few words may be addressed by one who has long been deeply interested in the subject; who, as a father, has again and again revolved the important question, How shall we best educate our sons and our daughters for the great business of life which lies before them? He hopes that his utterances will be received in the kind spirit which actuates him in presenting them.

Practical Education seems to be a very simple expression, and yet how few of us will agree as to what it shall mean! One may say that it is that education which comes through the fingers, rather than by the means of any of the other senses. It is that which we may learn by absolute practice while we are engaged in our daily work—that surely is practical enough. But it is not enough to satisfy some of us who desire to cultivate all the senses as well as that of touch, and the control of our voluntary muscles.

Others may claim for practical education, that it shall consist only in the instruction of the pupils in that kind of knowledge which will be of every day use, and they would eschew or condemn everything beyond this—alas! what limited ideas of this great desideratum that has exercised the thoughts of some of our greatest minds!

Some would teach mathematics only, as applicable to the various arts, while others will claim the supremacy of languages as the best method of developing the mental powers which are to be the means of improving all the arts.

We have writers who understand the subject, who have given it their serious and studious attention, who know that whereof they affirm, when they give us, as their ultimatum, that it is necessary to educate the whole man in all his faculties to produce the perfect result.

To this proposition we must all agree; still, we demand *practical education;* and properly so, for it is clear that very few of us can ever by any possibility have the time, the patience, or the opportunity to become *perfectly educated.*

If asked to give a solution of this great problem, and to indicate how the important advances of science may be brought to aid the various arts of life and reduced to the comprehension of those who intend to apply themselves to these several pursuits, in the great business of the world, I should with diffidence suggest that the greatest possible amount of good might be done, by inviting sensible and practical men, who are well posted in their special callings, and having them teach the classes—at the same time throw open the doors widely to all applicants for instruction, of whatever age or sex, and give them free choice in the selection of the studies they would pursue Make the institution a university in fact, with its schools of chemistry, of physics, of mathematics, of botany, of geology, of zoology, and especially of mechanics and of agriculture.

The author of the act of Congress, by which this noble grant has been provided, seems to have similar views. Though a son of the pine tree State, on our farthest eastern boundary, Mr. Morrill appears to have caught the true spirit of our prairie call for *Industrial Education*, and to have fully appreciated the very general desire manifested in other parts of the country for the establishment of institutions for practical instruction, which, it was fondly hoped, would supply the want that could not be satisfied by the classical colleges of the country as they were generally conducted.

Mr. Morrill assured me that if the States which accepted the grant made a misapplication of the endowment, they would be held responsible for the result. In his bill it is decreed that the tuition fund derived from the sale of the land shall forever be appropriated to the support of schools for instruction in *agriculture and the mechanic arts*, from which (it was added as a legislative fence-rider), that the languages should not be excluded, and that military tactics should be taught.

One after another, all of the sciences, chemistry, physics, and especially mathematics, will each claim a prominent place in a course of study that may be devised to carry out the spirit of the enactment of Congress; but, the truth must be admitted—we none of us know what we really want, what we need, what we can do, nor what we cannot do. A great experiment is before us awaiting its solution—we are setting out to build up from nothing, these great *schools of science*, schools *of applied science*, as Professor Gilman calls them—there are no well considered, nor well digested plans—there are no well prepared, well drilled classes to receive our instruction—and worse than all, there are few or no well qualified teachers for these schools of applied science. The very absence of such school has made us two great orders of men: those who know only in the way of theory, and those who know only in practice. From either of these two orders we are forced to draw our teachers, and eventually, we hope to find the right men for the right places. It may be only after repeated siftings; therefore, my friends, your kind patience is craved on behalf of the devoted men who have nobly acted as trustees for this institution, next on behalf of us, their agents, who have the honor of being their appointees in the important position of teachers of the classes, whom your Legislature, in its wisdom, has directed to our walls.

Be gentle in your criticisms, and be just in your decisions ; remember that our cause is an experiment, and that if it should not fully meet the wants of the people, your excellent board of trustees have it in their power to introduce such modifications as may appear to be necessary.

And now I beg your patience for a few moments, on my own behalf. When I accepted the honorable appointment of lecturer in this institution, it was with diffidence in my own ability to fill the station as we all wish to see it filled.

To some of you, who favor me with your presence, it will seem as though nothing new was advanced in these lectures. Certainly nothing but well es tablished truths will be taught. To some of you, my seniors in horticulture, these things are already familiar—but it is safest for a teacher to adopt the theory of the absolute ignorance of his class. This will induce and require him to descend to the most trifling minutiæ, which may weary the adept, but they are all important to the novice. The course proposed for these lectures is planned upon this proposition.

Upon the present occasion I propose to occupy your attention with a few general remarks upon the following questions:

Why do not all of our farmers have plenty of fruit?

Why should all who live in the country grow fruit crops, just as they now produce grain, grass, and live stock?

The first question may be answered very readily, for most of those who have no fruits; it is simply because they do not try to have them, and this is the very natural result of their ignorance of the means of obtaining an abundance of these blessings upon almost every farm in the United States.

The latter question may be answered by enumerating some of the great advantages of fruit growing. These are primarily the *health* of the families of the producers, where fruits are freely consumed upon the table at all seasons of the year; next, the *pleasure* attendant upon their propagation, their culture, and above all, the satisfaction derived from the harvesting and consumption of these products.

It is a well established axiom in the medical profession, that the regular consumption of fresh, well ripened fruit, is conducive to health, and it is also a fact, that the* farmers of our country are not so *well fed* as they should be. This is nobody's fault but their own. True, they cannot have so great a variety of meats as those who reside in towns and villages, but they may enjoy the greatest profusion of fresh vegetables, and a succession of ripe fruits the year round, if they will but choose to take the trouble to plant and cultivate even a small portion of their land as a garden and orchard.

An appeal on behalf of fruit culture may also be made to the more sordid motive of money-making. No crops that are produced from the soil yield so great profits. The productiveness of small pieces of land appropriated to fruit culture is truly wonderful, and the money results in some cases are so great as to be worthy of the fashionable term of "fabulous."

It is well for the farmer to recollect that some of our fruit crops may be consumed with great advantage and profit by his stock animals. Hogs, sheep, cattle, particularly milch cows, and even horses, may be profitably fed upon some varieties of fruit. It has been asserted by a recent author, that "fruits of all kinds, but particularly what may be called the large fruits, such as are grown in our orchards, may be profitably cultivated for feeding our domestic animals. Sweet apples have been especially recommended for fattening swine, and when fed to cows they increase the flow of milk, or pro-

See Dr. Flint's *Contributions;* published for the U. S. Sanitary Commission, pp. 18--667.

duce fat, according to the condition of these animals. * * * Orchards have been planted with a succession of sweet apples that will sustain swine in a condition of perfect health, growing and fattening simultaneously from June to November; and the late varieties may be cheaply preserved for feeding stock of all kinds during the winter." The farmer may also be reminded that portions of many farms can be appropriated to the culture of fruits, which are not adapted to crops that require cultivation on arable land. It has even been asserted that a given area planted with fruit trees, will sustain more stock, or fatten more pork, than the same space devoted to grain and forage crops.

I propose to present some facts which will overcome the admitted ignorance referred to in the answer to the first query, Why do not farmers have fruits? In other words, briefly to point out, as a result of long experience and extended observation, *what plants to get, and how to set and tend them.*

The leading classes of fruits will be presented in the order of their importance:

THE APPLE, prince of fruits, will first claim our attention. There is scarcely a farm in the United States where it will not grow, and where some of its very numerous varieties will not succeed. In the extreme north, it may be necessary to resort to varieties of the most hardy character, such as the Siberian, and some other of Russian origin. In the south, many new varieties have originated from seed, which appear well adapted to that region.

Preparation of the soil—Disappointment from bad selections.—Having assigned a portion of the farm to the apple orchard, which sho ld be elevated, and of a light, porous soil, the ground should be well prepared by thorough plowing, if this be practicable, though it is found that fruit trees will thrive in newly cleared land, if set among the stumps; they have been planted on prairie sod, and there are many fine orchards on rocky tracts, where the preparation must be done exclusively with the pick, the spade, and the shovel. It may be the best economy for the owner of such land to appropriate it to the orchard, because it is unfitted for tillage crops. Even the holes for setting the trees may be made with the plow, by simply marking out the surface at the proper distances, and setting the trees at the intersections. This is done after the whole ground has been well prepared by a thorough plowing, and the trees are easily planted in the mellow soil, in which they will thrive admirably. On low and flat lands that have no good natural drainage, tile should be used, if accessible, but even here surface draining may be done with the plow, by throwing the furrows together where the rows of trees are to be set, what the farmers call back-furrowing, two or three times, so as to make a little ridge to plant them on. This will also make open furrows between the rows, that will give outlet for the surplus rain water, or at least lead it away from immediate contact with the roots.

Selection of Trees—Varieties.—Young trees are better for planting than older ones; small ones are more easily handled, and are surer to grow than larger ones. Two years from the graft or bud is long enough for the apple to remain in the nursery. This is true of most varieties, but there are exceptions to this, for some slow growing kinds require a longer period to attain sufficient size. The plants should be stocky and branched, and they should be taken up carefully, so as to preserve the roots.

Varieties are so numerous, and tastes so diverse, that it is almost impossible to make out a list of sorts that will be acceptable to all, and besides this it is well known that the varieties which succeed in one locality may fail in another. Every planter should endeavor to ascertain what sorts have been tested and approved in his own neighborhood. Hardy and productive kinds, of second quality, are more satisfactory than those fruits of greater excellence, which have not these prime qualities of the tree. It is rare that we find all excellence united in one individual.

For the family orchard it is best to have a succession in the time of ripening. The same is true of an orchard planted for stock-feeding. But in the commercial orchard, where a large quantity of fruit is to be produced for shipping, it is found best to plant only a few varieties, and these should be productive, hardy and of such a character as to bear transportation and to command a ready market, less regard being had to the superior quality as table fruits than in the amateur and family list.

APPLE FAMILY—JUNE TO MAY.

Summer Rose, Primate, High-top Sweet or Red Astrachan, Benoni, Summer Queen, Golden Sweet, Jefferies, Maiden's Blush, Lowell, Rambo, Wagner, Western Beauty, Jonathan, White Pippin, Ohio Pippin, Grimes' Golden, Winesap, Raule's Janet.

Planting.—After the ground has been prepared, it is ready to mark off with the plow in two directions, so that the intersections of the furrows shall come at the stations for the trees. This is the best way to dig the holes, for the furrows may be made quite deep enough. Indeed, it is not desirable to set the trees deeply—some even advocate planting on the surface and covering the roots with a little mound of soil, as is done when the trees are set on top of the sod of prairie or meadow. The distance between the trees will depend upon the habit of the variety. Some will require more space than others, but close planting has many advocates, who advance some cogent reasons for crowding the trees instead of the wide planting of former years. A few of these may be mentioned: In the first place, it is now conceded that the land appropriated to the orchard should be given up to the trees and not be used for other crops; therefore there is less necessity for space between them. In close planting the whole ground is shaded and kept from the baking influence of the sun, and thus remains more loose and friable than where exposed. The crowding of the trees also protects them, in a great degree, from the severity of the cold in winter, and from the injury incident to the sudden changes of our climate; but in exposed situations, this close planting especially shelters them from the trying winds.

The planting should always be done with the greatest care; the roots should be spread out in their natural position, the finest soil put next to the fibres and worked in among them with the fingers, so as to be in immediate contact both below and above them. When the roots are well covered, slight pressure may be made with the foot, especially toward the end of the roots; or, if the ground be dry, a few quarts of water may be poured upon it to settle the soil, and this should be covered with more dry earth. All that portion of the tree which was under ground in the nursery must be covered, and, in fall planting, a little mound should be heaped up against the stem to keep it from being swayed by the wind, as well as to turn off the rains from the roots. This mound may be removed in the spring.

Cultivation should be thoroughly kept up in the young orchard for a few years; and, at first, hoed crops, such as corn or potatoes, may be allowed among the trees, but no grain or grass, nor any weeds, should ever be permitted among them. This cultivation may be continued four or five years, until the trees are well established and begin to cover the ground with their shade, when the spaces between them will be so occupied by their branches as no longer to admit the horse and plow. The land may now be laid down to clover—not for a hay crop, but simply to cover the surface as a mulch, for which purpose it may be mowed and left on the ground.

Training and Pruning.—These topics should be considered together, since both have the same object—the forming of the head. The tree should be trimmed early in its orchard life, so as to produce the desired shape. It should be branched low, from two to four feet from the ground. The main limbs should be well balanced and well separated, while the leader must also be preserved; all interfering branches should be removed, and those which are too strong must be shortened in during the summer. All this will require some care and watchfulness, but will need the removal of very little wood if it be done in time, while the tree is small, and this is the best time to do the work of pruning Midsummer is the best season; a strong, sharp knife and a pruning chisel, the best instruments.

Pruning old orchards is quite another affair; and if they have been long neglected, the trees may need a very severe pruning to remove crowded, exhausted and decaying branches, in order to re-invigorate the organism by the production of new wood growth. The application of the saw will now be required, and the mild weather of fall, winter or early spring should be selected for doing the work. All large wounds must be pared smoothly with the chisel, and covered with some mastic to exclude the elements. In such trees it is sometimes better to thin out the branches and shorten them than to remove the larger limbs.

PEARS are delicious fruits, and every farmer should plant at least a few trees. The crops are certain and any surplus may readily be disposed of. The old saw about planting "for one's heirs" must give way before the advances of pomology, for we now have many varieties in cultivation that are early-productive, and modern horticulture has furnished us with means of forcing early fruitage upon those varieties that formerly tried the patience of the orchardist by their long continued wood-growth before reaching that condition of maturity that is attended by abundant crops.

The natural season for the maturing of this fruit being mid-autumn, we find, as a result of cultivation and the production of new varieties, that this period has been considerably extended in both directions, so that the pear season now reaches from July to March, or even longer. A very experienced student and propagator of this fruit has suggested that in thus departing from the normal season of ripening we may expect to find, under the law of compensation, that we shall lose some desirable qualities. The truth of this is a matter of common observation; thus, in quality, most early pears are inferior to those of a later period, and the general inferiority of the latest or winter pears is a matter of common remark. There are exceptions in both extremes, but autumn is the season of the best pears.

Soil.—Any good loamy land, with a predominance of clay, will produce good pear trees, and thorough plowing will be a sufficient preparation after draining, if the subsoil be tenacious and wet. The pear strikes its roots deeply into the soil; it is thus able to seek its food, and it is a gross feeder, but may thrive even on thin soils—at the same time it will be benefited by suitable manures. Analysis of its products shows that it needs lime and phosphoric acid; therefore, bones may be applied with advantage to lands that are deficient in these elements. Planting and cultivation of the pear may be the same as that advised for the apple.

Dwarf pears have been very highly recommended and largely planted; but the majority of planters now prefer to have their trees on free-stocks. These are often erroneously called *standards* in contradistinction to those being dwarfed by being worked on quince stocks. The dwarfs are very satisfactory for limited grounds, and should have high culture and good care in trimming and training to produce their best results. The two styles of trees should not be planted together, as has been advised; they require different treatment.

Training.—Pear trees will bear crowding, as most of them are of an upright habit; fifteen or twenty feet apart is wide enough for the majority, and many will succeed much closer. The trees should not be grown as *standards*, with tall, naked stems, but do much better if trained from the first in conical form, when they are generally called *pyramids*. This object is attained by causing them to branch low, and by curbing the upper limbs at both the summer and winter pruning, thinning them out and shortening them in such a manner as to keep the lower branches always the longest; the result will be the desired conical tree, which shall have all of its twigs, fruit and foliage well exposed to the sun and air.

Culture and Pruning.—The pear orchards may be treated like those of the apple, excepting that the general habit of the former is pyramidal and of the latter globular, so that the pruning will require some modification, though conducted upon the same principles. While young, the ground among the trees should be well cultivated, but after they have attained some size (after six or eight years) they are found to do better in grass than if the cultivation be continued. These remarks apply to the pear upon free-stalks, but those trees that are dwarfed upon the quince or by severe and continued root-pruning will require high culture and even manure.

A select list of pears for family use from June till December:

Windsor, Early Butter, Doyenne d'Eté, Rostiezer, Tyson, Dearborn, d'Amalis, Bartlett, Flemish Beauty, Golden Butter, Autumn Melting, Sheldon, Duchesse, Beurre Diel, Figue, Vicar, Passe Colmar.

PEACHES are always acceptable, easily grown, and they come into fruiting at an early age, generally the third year. Unfortunately they are not constant bearers, as the flower buds are often injured by the severity of winter or by spring frosts. Peach trees will grow on almost any soil, but light sandy or gravelly lands and elevated situations seem best adapted to them. The trees should be one year old from the bud, cut back to a bare stem, about two feet long, before planting. They should be set from fifteen to twenty feet apart in the orchard, planted in the spring, and the ground must be cultivated continually to secure the best results. Mounding the tree has been advocated, but it is an expensive operation, the merits of which have not yet been fully demonstrated. There is a great variety, both in its color, flavor, consistence and season. There are clings and free-stones of all colors. The former are the best, the latter are most popular. The season extends from the first of August until the middle of October in this latitude. Those which ripen earlier or later are of less value.

The following lists are given under their classification:

FREE-STONES.

White-fleshed.—**Early Tillotson, Early York, Hale's Early, Large Early York, Morris' Red, Old Mixon, President, Red Rareripe, Stump the World, Ward's Late.**

Yellow-fleshed.—**Barnard, Bergens, Columbia, Crawford's Early, Crawford's Late, Red Cheeked Melocoton, Smock, Yellow Rareripe.**

CLING-STONES.

White-fleshed.—**Baltimore Rose, Grand Admirable, Heath Cling, Large White, Old Mixon, Rodman's Red.**

Yellow-fleshed.—**Lemon Cling, Orange Cling, Tippecanoe, Washington.**

Deep Red Flesh.—**Blood Cling or Claret, Blood Free.**

THE PLUM is so sadly affected by the Curculio, that few of us know how excellent a fruit this is. Occasionally the rascals stand back, and thus we get a crop, and some cultivators have succeeded in counter-working the enemy so as to preserve their fruit. Trees planted in trodden places near houses have escaped the attacks of these insects, and have borne crops for many years, so that farmers are urged to continue planting plum trees in such situations. There are some varieties, however, which appear to escape these invaders, among them the little Damson, which is well worth cultivating, as it makes good preserves.

The following select list is recommended for those who would plant plums:

Early Orleans, Lombard, Green Gage, Prince's Imperial, Reine Claude de Bavay, Yellow Gage, Washington, Coe's Golden, Smith's Orleans, Damson.

CHERRIES.—This delicious fruit appears to be more fastidious as to soil than any other, for though it will grow almost anywhere, it does not stand well on our rich limestone lands. Those soils that are natural to the chestnut appear to be the most suitable for cherries.

There are some very hardy varieties that seem to do equally well on any kind of land; these are called the *Dukes* and *Morellos*. They are mostly sour and are chiefly valuable for cooking cherries. May be planted ten, fifteen or twenty feet apart, according to their class, as Morellos, Dukes, or Hearts and Bigarreaus, the last being the largest. The trees should not be too old when planted—two or three years from the bud or graft is enough. They should be headed back so as to branch low, and should be grown as pyramids. All the pruning should be done while they are young, as they do not readily heal over the stump of a large limb. These trees are very apt to split and burst their bark, especially where the stems are exposed to the sun by trimming them up as standards, hence the importance of low heads. This accident is most common in the free growing kinds and in rich soils.

The following varieties are worthy of culture;

Heart Cherries.—American Heart, Governor Wood, Black Tartarian, Coe's Transparent, Doctor, Purple Guigne, Black Hawk, Black Heart, Burr's Seedling.

Dukes.—May Duke, Belle de Choisy, Belle Magnifique, Carnation, Louis Phillippe.

Bigarreaus.—Elton, Cleveland, Rocheport, Yellow Spanish.

Morellos.—Common, Early May, English, Kentish, Early Richmond.

QUINCES have been too much overlooked by our farmers, who could not present their families with a more acceptable offering than the fruit from a few trees planted in some low spot of rich, moist soil, such as that which receives the slops and drainage from the dwelling house.

These trees are rather hardy and will occupy little space, as they never grow large, and can be planted eight or ten feet apart. They should be trained to one stem, branched about three or four feet from the ground, and kept trimmed to open heads. The common variety is the *Orange*, which ripens in September, while peaches abound. The *Portugal*, or pear-shaped, and the *Angers* have smaller fruits, which ripen later—in all October. The largest fruit is *Rea's Mammoth* or *Coxsackie*, recently introduced and very highly recommended.

GRAPES.—Every farmer, every cottager, every householder or houseruler should plant a few grape vines. It is a very simple affair, requiring no great amount of skill nor labor to plant, train and trim a grape vine, and its productiveness of fruits, that every body, young or old, can appreciate, is proverbial. Who has not heard of the famous grape cure? Who can object to trying it? Certainly not he who has planted and trained his own vines.

Almost any soil that has been deeply loosened and moderately enriched will cause the grape vine to grow luxuriantly. It may be set in out-of-the-way places, trained to a stake or a trellis, or be made to climb beside the walls of out-houses and cover their bare sides with foliage and fruit, rendering them ornamental instead of ugly.

Training the young vines in an upright direction to encourage their growth, and at the same time concentrating their force into one or two shoots by pinching or rubbing out the others, is a very simple affair and light labor. Pruning them when dormant, cutting them back to two or three eyes in the fall or winter, is no great mystery. The same process of training two strong shoots the next season is but a repetition of the first summer's experience, with mor satisfactory results; and the second fall, with canes nearly as large as the little finger, the pruning is less severe, because we now have bearing wood, which needs to be shortened-in two or three feet in a strong vine. These canes are to be trained horizontally, as the arms of the vine, in which condition they may be left for years, unless they need renewal. In the third and all succeeding years, we must still train the shoots upward, taking care only to remove the superabundance of the growths, by rubbing out early in the season and leaving one shoot, say, every nine inches, which must be trained upward. In the fall of this year we commence pruning these shoots for alternate production of fruit and wood, by cutting one cane about two feet long and reducing the next, the weaker, to a spur with only two eyes or buds. In this way, the bearing wood of the vine is constantly renewed. The mystery disappears when we recollect that all the fruit of the grape vine is produced upon green shoots that grow from the cane of last year's growth. By renewing these shoots annually from below, we can have bearing wood to cover the trellis, and strong new shoots to clothe the whole with abundant foliage. Various modifications of pruning and training have been suggested and may be practiced, but the most simple, common and successful is the one indicated above. All depend upon the annual reproduction of new wood from which to draw our supplies of wood from year to year.

In the multitude of grapes that are now offered to the public, almost any tastes may be gratified, and yet for the most satisfactory, because certain results, we are safe in selecting a few well known varieties that we can recommend to our farmer friends:

Hardy and productive—Concord, Hartford, Ives, Clinton, Martha (white).

Not always healthy—Creveling (very good), and Catawba.

Juicy grapes, very best—Delaware, Iona, Israella, Isabella, Diana, Herbemont, Alvey, Elsinboro.

SMALL FRUITS.

We now come to the consideration of the *small fruits*, which, however, may constitute a very large share of the food, comfort and luxury of a well regulated family, either in the country or city, and which will contribute in no small degree to the healthiness of the people, by substituting their grateful acids and sweets for the calomel, ipecac, tartar, soda and potash, in various forms, that are so freely drawn from the druggist's shelves, either for the cure or production of disease, according as they are administered by the doctor, or by the cooks.

THE STRAWBERRY comes first in the order of the season, and indeed it is the most univesally welcomed and relished of them all. The cultivation of this fruit is so simple, and the returns so speedy and so grateful, that it should occupy a prominent place in every farmer's garden. This fruit will grow in almost any soil, but a good stiff loam, well stirred, is probably the best. The strawberry plants should be well rooted runners, or offshoots from an older plantation; they should be taken up carefully, so as to have good roots. If these have been formed in small flower-pots sunk near the parent bed, so much the better, as the fibres, being confined by the pot, will be less disturbed in transplanting—or the ball may be set entire.

Strawberries may be grown in hills, in rows, or in beds. The latter is the common method, and the beds are formed by planting two or more rows a foot or fifteen inches apart, setting the plants twelve inches one from another in the rows. In the beds, the runners are allowed to grow, and to increase the number of plants indefinitely, so that they are often injured by being crowded too closely together. When planted in hills, they are set eighteen inches apart; the space between them is kept perfectly clean, and the runners are cut as soon as they appear. This results in the greater growth of the original plant, which has an increased number of crowns from which the blossoms and fruit proceed in great numbers. This method enables the producer to have the best possible results in the size and appearance of his fruit, but it is attended with more labor and expense than the bed system. Many cultivators prefer planting in rows, when they set the strawberries about a foot apart, and place the rows two feet or more one from another, according as they expect to use plows or hoes in their culture. In the narrow rows the runners may be cut off, and the fruit will be almost as fine as that grown in the hills, but in the wider rows the runners are generally allowed to strike root, and spread the row into a bed in the course of the first summer after planting.

Spring is the best time for setting out the plants, though this may be done at any time during the growing season. The advantages of early planting are the longer period allowed for the stools to grow and become thoroughly established in the soil. The plants are set by the line, a hollow is opened with the trowel, in this the roots are spread out, then covered with mellow earth and pressed firmly with the fist or even with the heel. If watered at once, a little fresh earth should be thrown in to prevent the cracking, but great care must be taken to avoid placing the crown below the surface of the ground—in other words, the roots must be planted and not the corm, from which the crowns arise. Thorough culture should be given through the season.

Mulching, with old rotten manure, applied after planting, will encourage the growth of strawberries, and keep the soil moist. Winter mulching with clear straw, leaves or other material, should be liberally applied after the ground has frozen, and be left to protect the buds during the winter, and to be removed from the crowns of the plants in the spring. Being left between the rows, the straw will make a good summer mulch, and keep the fruit clean. In hill culture, saw dust and old tan bark have been recommended, and still another material, spent hops from the brewery, has been used with excellent effect.

Strawberries have a peculiarity in their blossoms, from which they have been classified as *Pistillates*, *Staminates* and *Hermaphrodites*. In the first class, the stamens are so defective that the flowers need the fertilizing influence of other kinds, which must be planted near them. These furnish many of our favorite varieties, especially those which are largely cultivated in beds. The next class embraces most of those sorts which produce the largest berries; their flowers are often so deficient in the pistils that a large per centage of them fail to set fruit. This is particularly the case when these varieties are grown in beds and allowed to multiply their runners. They are, however, quite productive when cultivated in hills, and they have formed branching crowns from which spring numerous trusses of flowers. Besides these two classes there is another, in which the two sexes are so evenly combined that almost every flower is followed by perfect fruit. A very few varieties of the strawberry either cultivated or wild belong to this group. These different classes will be indicated in the list by the letters P. S. and H.

Agriculturist, H.; Austin, S.; Burr's New Pine, P.; Dr. Nicaisse, S.; Extra Red, P.; Fillmore, P.: Golden Seeded, S.; Hovey's Seedling, P.; Jucunda, S.; Longworth's Prolific, H.; Necked Pine, P.; Russell, P.; Superior, P.; Triomphe de Gand, S.; Victoria, S.; Washington S.; Wilson's Albany, H.

RASPBERRIES.—Next to the strawberry, and nearly allied to it in its botanical relations, is the Raspberry, which furnishes a fruit of high flavor and exquisite fragrance. It is no wonder that this should be a favorite with all fruit growers, since it is easily produced, hardy, makes quick returns, is easily gathered, and commands a ready sale at high prices. And yet it is equally surprising that so few farmers' gardens are stocked with the raspberry.

Every soil that is cultivable will produce this fruit, but a good loam is best adapted to it. The only preparation requisite, is ordinary plowing of the land, but deep cultivation and manuring are well bestowed upon the raspberry patch, and it should be kept clean by thorough summer cultivation.

The raspberry may be planted in the fall, but the early spring is generally preferred. They may be set about three feet apart, in rows that are from six to nine feet wide, or planted in hills five by five feet, or wider for some of the larger kinds. Planting in rows is usually preferred, but the hills allow of cultivation in both directions, or cross plowing, which saves hoeing, and also permits the pickers to get among the plants more readily.

Trimming the raspberry was formerly done only in the winter, and consisted in shortening the canes, and removing the old dead wood, and the surplus feeble shoots, so as to leave from two to four on each plant or hill. This was done at any mild time between October and February or March. Fall pruning, if done too early, may prove very injurious, if followed by mild growing weather that causes the buds to grow, and thus destroys a portion of the next year's crop. Of course, it is understood that all the varieties and species of this genus, *Rubus*, including the raspberry and blackberry, produce shoots one year that become the bearing canes of the next summer, and then die; an apparent exception exists in the autumnal bearing raspberries, which produce blossoms and fruits upon the shoots the season of their growth.

Summer pruning is now practiced by all good cultivators. This is a very simple operation, and consists in pinching or cutting off the shoots as soon as they are two feet high, which causes them to branch out with strong laterals, and these are to be cut back according to their strength, in the winter. By this means the plants are made more stocky and bushy; they resemble little trees, and are able to bear enormous crops. At the same time, all redundant branch shoots are to be cut away. This method also obviates the necessity for any kind of support, such as stakes or trellis, since the sturdy plants are able to stand alone.

We have two American species of eatable raspberries, the *Strigosus* or red fruited, and the *Occidentalis*, or thimble berry, the black caps. Besides these, the European species, the *Idæus*, furnishes many delicious raspberries, most of which are tender and need winter protection:

Black Caps.—Thornless, Doolittle. Miami, Purple Cane.
American Reds.—"Red Antwerp," Kirtland, Clarke, Philadelphia.
Foreign.—Red Antwerp (true), Brinkle, Hornet, Pilate, Franconia, Naomi (new).

BLACKBERRIES.—The blackberry, though abounding in most parts of the country, is entirely deserving of care and cultivation. In the garden it is under our control, and may be allowed to reach perfection, by hanging until perfectly ripe, which is not the case that must be yielded to the "eminent domain" of any vagabonds who may come along and trespass on our farmers, and glean the fruit from our neglected fields and fence-corners.

Any rich, deep soil, well plowed, will suit this fruit. The plants should be allowed plenty of room, and may be set every four feet, in rows eight or ten feet wide. The ground should be well cultivated, or deeply mulched, and the suckers must be kept down, by cutting them with the hoe whenever they appear between the rows, and these should not be crowded—one stalk every two feet will be sufficient. This being only another species of the genus *Rubus*, or bramble, the remarks as to the habit, and pruning of the raspberry are applicable to this species, and need not be repeated, except that the summer pruning should be practiced a little higher, say from three to four feet, according to the vigor of the plants, and the redundant shoots must be cut off.

Black.—Dorchester, Thornless, New Rochelle, Wilson, Kitatinny, Missouri Mammoth.
Light colored.—Crystal (white), Orange (rose).

THE CURRANT.—In almost every log cabin garden we used to find this health-giving fruit, which offers its agreeable acid in the heats of summer as an antidote or preventive of the billious effects of our torrid season. And yet the currant is a sadly neglected fruit, and in many parts of the country there is not enough for home consumption.

This being a northern plant, it is thankful for a partial shade or protection from the scorching sunshine (in latitude forty or southward). For this object it is well to plant the bushes on the north side of a fence or building, and even in the shade of young orchard trees, where they sometimes succeed very well for a long period, even after the apple trees have occupied and shaded the whole surface.

The currant delights in a deep, rich loam, and will thrive even where the soil is somewhat moist. The bushes should not be crowded, as they require about four feet space, each way.

Trimming is to be done in the fall or winter, as the buds swell very early in the spring. It should consist in shortening two or three of the strongest young shoots, cutting away all the weaker ones, and removing only the oldest and exhausted bearing wood. Unlike the raspberry, currants do not fruit on the young shoots, but upon little spurs that appear only on branches that are two or more years old.

The plantation must be kept clean, and free from grass and weeds. After cultivation in the spring, it is a very good plan to cover the soil with a heavy coating of old hay, straw, fodder, leaves, or other suitable mulching material, which will retain the moisture, and preserve the fruit a long while in fine condition.

VARIETIES.—Common Red, Red Dutch, White Dutch, White Grape, Versailles, Cherry, Black Naples.

GOOSEBERRIES.—Fashion has wonderfully affected the production of this fruit. The fine, large, English varieties were generally so badly affected with a mildew, that their culture was abandoned, except by a few fortunate persons. The introduction of the Houghton, and American red varieties, worked a revolution—everybody planted them, and everybody purchased them at high prices for several years; when lo! the cost of sugar caused a change, and the demand fell off to such an extent that the plantations were rooted up, and there was no longer any sale for the plants, and nurserymen discontinued their propagation. Gooseberries are just as valuable, nevertheless, to the farmer's family as ever they were, and their cultivation is so simple that they may and should be grown in every household garden, and by every cottage.

RELATION OF CHEMISTRY TO AGRICULTURE.

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In attempting to trace the relation of chemistry to agriculture, it may be well to inquire, first, what chemistry is, and, secondly, what agriculture is. Briefly, then, chemistry is the science of the elements. It isolates them, and teaches us their properties, their mutual relations and affinities, the changes which they undergo under different conditions, and the new bodies formed when two or more of them combine, by the action of chemical force. These elements and their compounds, which are infinite in number and in the variety of their forms and properties, their mutual relations, and the changes which they undergo by their reactions on each other in the inorganic and the organic kingdoms, constitute the field of chemistry.

Secondly, what is Agriculture? It may be looked at from two points of view. It may be considered either a science or an art, and both, as yet, in an imperfect state. As a science, it is concerned with the conditions and laws of vegetable growth; as an art, it is, or should be the practical application of the science, in such a way as to obtain the most abundant harvests. In a broader sense, it includes also the raising of some or of all kinds of domestic animals, and in this respect chemistry sustains a most important relation to agriculture; but for our own purpose we shall not consider this view, but confine ourselves to the relation of chemistry to agriculture as a means of raising the best crops.

We shall accomplish our object best, perhaps, by considering the conditions essential to the healthy development of plants, and in what respect chemistry is related to these conditions. And, first, we may inquire, Do all plants require the same conditions for their healthy growth? A little reflection will teach us they do not. Tropical plants will not flourish so well in cold as in warm latitudes, nor will the same species of plants flourish equally well in all soils in the same latitude. Are we then called on to study the conditions peculiar to each individual species? If so, our field of inquiry widens at once into an immense expanse. For the purpose of the farmer, however, it will be sufficient to consider the conditions of those plants in the cultivation of which he is expending his labor and capital. In this State, for instance, Indian corn, the cereal grains and the various fruits and roots are the plants in which he is chiefly interested, and the conditions of whose growth he is especially called to study. We shall accomplish our object on this occasion if we confine our attention to a single species.

The question then recurs, what are the conditions most favorable to the healthy development of plants? For it is by an analysis of these conditions that we shall best gain a clear idea of the relation of chemistry to agriculture. A careful study will teach us that these conditions are of a twofold character. Plants are conditioned by the objects that surround them and furnish them their food, as soil, moisture and the atmosphere; and, secondly, by the forces which act on these substances, as heat, light, electricity, chemical force, magnetism, capillary force, and probably other forces with which we are but imperfectly acquainted. In other words, we have to study the elements of which plants are made; and, secondly, the forces which act on and build up these elements into organic structures. Moreover, all these conditions must exist at the same time, and in the proper degree, that plants may flourish. Soil must be present, of the right kind and in the right quantity. The same is true of moisture and the atmosphere. The necessary forces too must act, and with the right degree of intensity. No single substance or single force would suffice to make a plant. Carbon or charcoal is an essential element in the structure of every plant, but carbon alone could never make a plant, whatever forces might act on it. The same is true of every other element. Heat is a physical agent indispensable to vegetable growth, but heat alone could never produce a plant. In fact, all the elements required by plants, and all the forces necessary to weave those elements into cellular tissue and other organic compounds, must be present at the same time, constituting a kind of complex condition in which a nice adjustment of material and force, the web of the vegetable organism, is woven. Nor is it difficult to see that, of all the conditions within which plant-life is possible, and the range is very wide, certain conditions will be more favorable to its development than any other, and that under these a plant will attain its maximum growth, and mature the most and best seed.

But it must be observed that of these conditions, some the farmer can modify, others not, or only partially. Soils can be modified in quality by adding substances which they do not contain; in texture, by loosening or stirring them by various mechanical means, and by allowing organic matter, like stubble or green crops, to decay in them. In thus modifying his soils lies the chief power of the farmer to increase his harvests. The quantity of moisture, also, is in a measure under his control. When present in excess it can often be removed by drainage, and when scanty it can sometimes be increased by irrigation; but long continued rains or drouths, causing wet and dry seasons, are, for the most part, beyond his control. It is not denied that climate can sometimes be modified by man, so that districts generally dry may receive rain sufficient for ordinary vegetation; but this, even in cases where it is possible, involves agencies extending over a considerable period of time. The atmosphere, too, is a necessary agent in vegetable growth, but the proportion of its gases, with some slight exceptions, cannot easily be modified by man. The physical agents, heat, light, electricity, magnetism and chemical affinity, play a very important part in plant-life, and, although they can be transmitted into each other, so that a given quantity of heat can evolve an equivalent quantity of electricity, and this electricity a corresponding quantity of magnetic or chemical force, and although these forces (if, indeed, they be more than a single force under different phases) may, in their relation to vegetable growth, lie much more in the power of man to modify than has been supposed, still that farmer would be sanguine who, in the present state of knowledge, should think to exercise more than a limited control over these capricious agents.

Thus far we have stated only the general conditions of plant-life, and how far the agriculturist can modify them. We come now to examine these conditions more closely, and to inquire how chemistry is related to them. As already stated, they are of a twofold character. They involve matter and force. First, then, the matter of plants. Our inquiries on this head are embraced in three questions. First, of what are plants composed? Secondly, whence is it derived? and, thirdly, in what form is it taken up by plants? All of these questions are of a purely chemical nature, and it is here, therefore, that agriculture and chemistry occupy common ground, or rather agriculture employs chemistry to solve its problems. If agriculture asks of what plants are composed, chemistry answers by analyzing them, and showing that they are made up of certain so-called proximate constituents, as cellular tissue or cellulose, starch, sugar, gum, pectine, resin and organic oils and acids; also, gluten, albumen, caseine and organic bases, etc.; that some of these constituents, like cellulose, are common to all plants, that others, like the alkaloids, strychnine and brucine, are found only in a few plants, while others, like starch and sugar, etc., are found in many plants, but in variable quantities. If agriculture inquire further, of what these constituents are composed, chemistry answers by resolving them into their elements, and teaching us that, as a whole, they are composed mainly of fourteen of the sixty-three known elements, viz.: oxygen, hydrogen, nitrogen, carbon, sulphur, silicon, chlorine, phosphorus, potassium, sodium, magnesium, calceum, iron and manganese; that some of the constituent, like cellulose, starch, sugar, etc., consist of only three elements when pure, viz.: oxygen, hydrogen and carbon; that others, like some of the vegetable alkaloids, consist of the same elements, with nitrogen superadded; that these three or four elements constitute the great mass of matter in plants, and that the other elements in plants are found there in relatively small quantities, and these even very variable in different species.

But, besides these fourteen elements, which can be detected in most plants with comparative ease, chemistry detects others which exist there in very minute quantity, so much so as to escape the ordinary means of observation. It is only recently that, by improved methods of analysis, the rare alkaline metals Lithium, Calcium and Rubidium, have been discovered in the ashes of plants. In fact it is as easy now to find lithia in the ash of a cigar, as it was formerly to find potash in the ash of the grape, the sugar cane, the beet or the cereals. Fluorine is another element of which traces have been found in the ashes of certain plants, and it is suspected of being in most plants, although in so small quantity as to escape detection. Iodine and bromine are found in sea plants; possibly they exist also in other plants. The strong family resemblance of the elements chlorine, bromine and iodine, and the circumstance that they are almost always associated in nature, and the fact that chlorine is usually found in plants, leads to the suspicion that possibly iodine, and perhaps bromine, may be there too, in extremely small quantity.

Small quantities, too, of lead, zinc and copper are said to have been found in the ashes of certain specimens of the beech, birch and fir; and tin, lead, zinc and cobalt in the ashes of the oak. The ashes of a certain violet are said to contain so much zinc, that places where it grows are selected for opening mines of zinc. Alumnium is found in the lycopodium, and perhaps some other plants.

Fourteen elements, then, exist in most plants in sufficient quantity to be easily found; three or four of these make up the great bulk of the plant, the carbon constituting, in wood dried at 150° centrifugal, about one-half the weight, the ashes from ½ to 1½ per cent., and the rest being oxygen, hydrogen and nitrogen, the first two in nearly the ratio to farm water, with usually a slight excess of hydrogen. The nitrogen averages about one per cent. In addition to these fourteen elements we find one or more of fourteen others in a few plants, in almost infinitesimal quantity, and the number will probably be increased hereafter.

The question arises whether all these elements are absolutely necessary to the growth of plants. Some, we know, are. A plant could not exist without oxygen, hydrogen, nitrogen and carbon, any more than a building could exist without solid materials, like wood, bricks or stone, or the animal without bones and muscles and the materials of which to make them. The same is true, to a considerable extent, of potash, soda, lime and magnesia, and iron and phosphorus. It was a question, some years ago, whether these inorganic constituents were necessary to the growth of plants, and prizes were offered, by societies interested in the subject, for a satisfactory solution of the problem; and it is now a fact, as well established as any in agricultural chemistry, that plants cannot thrive without them. They are a necessary part of the food of plants, and perform functions which make up an essential part of the life of plants.

But how is it with those elements which are found only in very small quantity? Is their presence necessary, or merely accidental? Have the plants absorbed them in some such way as a person sometimes takes harmless or even poisonous substances, by mistake? It certainly is not safe to conclude that their influence in the processes of life is commensurate with the quantity in which they are found, because no fact is more certain than that very small quantities of substances are sometimes very beneficial, and sometimes very injurious—even fatal—to the life of animals. Why may not the same be true of plants? The probability is that no substance, even in very small quantity, can enter the circulation of a plant without modifying, in some way, the processes of life, and imparting to it properties and impressing on it an individuality which it would not have without it. A substance naturally foreign to a system, and even poisonous to it, may, if taken in sufficiently small quantity, not only modify some function without becoming fatal, but create a necessity for its presence, so that life, even, would be endangered without it. The eating of arsenious acid is a case in point. A person may acquire the habit of taking daily a quantity of arsenic, which, at first, would have proved fatal; but when the habit is formed then it must be continued: that is, the arsenic has either created a function, or so modified existing ones as to make its presence necessary. And something similar is doubtless true of plants. Different soils contain small quantities of different substances, which, absorbed by plants, may prove beneficial or injurious to their development, and may have their influence, among other causes, in producing those peculiarities so noticeable in the same species of plants. Why is it that clover, manured with gypsum, is so different from that manured with something else, in the size of its stems, leaves and flowers, as almost to be considered a different species?

But let us return to the elements. Each one of them has certain properties, which are peculiar to it and which distinguish it from every other element; and these properties vary, either in kind or degree, with every change of condition to which the element is subjected. Four of them—oxygen, hydrogen, nitrogen and chlorine—are gases at ordinary temperatures, and the first three have resisted all efforts to condense them to liquids. They are, in the free state, permanent gases. Fluorine should probably be added to the number, although so little is known of it, in the free state, that little can be said of it. The rest, with the exception of bromine, which is a liquid, are solids. In their affinities, or their tendency to combine with each other, these elements are very unlike. Some, like nitrogen, are of an indifferent nature, manifesting scarcely any disposition to combine with other elements. Others, like oxygen, have an active nature. They are strongly inclined to combine with others. Every case of ordinary combustion is an example of energetic combination of oxygen with carbon and hydrogen. The same process, or a similar one, takes place more quietly in decay. In these cases oxygen acts as a destroyer. But it is equally efficient in building up. Indeed, oxygen presents the singular anomaly of an element ever busy in building organic structures, and then, as if dissatisfied with its work, of pulling them down, and with their ruins building new ones. It is this element, more than any other, that causes that ever-recurring cycle of change from life to death and from death to life, which is going on about us; and it is impossible to have an accurate knowledge of the processes of vegetable growth without a thorough knowledge of this element. Possibly, with such knowledge, one may not be able to understand vegetable growth, but it certainly cannot be understood without it.

When placed in peculiar conditions, these elements assume properties different from those which they usually manifest. Thus oxygen, exposed to substances undergoing oxidation, or to the electric spark, or to the galvanic current, assumes properties so unlike those which it usually has, as to appear to be a new element. In this state it is very energetic, combining even with those elements which usually resist oxidation. It is possible, even probable, that the nitric acid of the nitre beds owes its origin to this energetic kind of oxygen; and it is possible, too, when the relations of this substance to vegetation shall have been more studied, and better understood, that it will throw new light on the chemistry of organic life. The influence of this powerful agent in the interior of the plant can easily be conceived to be very great, and the field here for investigation, therefore, is very inviting and promises a rich reward. Other elements, by a change of condition, may indicate a change of other properties. For instance, sulphur crystallizes in two entirely different forms, according to the temperature to which it is exposed. The same is true of many other elements. Why it is so we cannot tell. But it is easy to conceive, in fact it is difficult not to conceive, that the function of an element in the vegetable economy will vary with its changing properties. These new properties, peculiar to certain conditions, often gradually disappear after the conditions cease in which they were induced. Elements in this state seem to be in a kind of unstable equilibrium, and ready to revert on the slightest occasion to their normal condition: like a wheel with an axis not exactly in the center, always tending to a state of rest with the heaviest part downward. These peculiar properties, which the elements manifest, on the normal ones for the conditions in which they were induced; and were those conditions the ordinary instead of the exceptional ones, then these exceptional and unstable properties would become the permanent and normal ones. Chemistry thus teaches us an intimate relation between the properties of an element and the conditions in which they were induced. They stand to each other in the relation of cause to effect, a fact which he should do well to bear in mind and study its significance; for it is a type which finds a fuller exemplification in the higher forms of vegetable life. The importance of an accurate knowledge of the properties of the elements concerned in vegetable growth is manifest. The more accurate and profound it is, the clearer will be our insight into the processes of life and the more will our views and theories be likely to be in conformity with truth.

But if a knowledge of the elements is important, that of their compounds is still more so, for it is mostly in the form of their compounds that the elements are introduced into the plant; and it is through the reactions of these compounds on each other in the interior of the plant, under the action of chemical affinity, modified by heat, light, electricity, etc., that all the different organic compounds are elaborated. If we would trace them, step by step—the changes that take place in the plant—and understand them, be able even to anticipate and predict them, we must know accurately the properties of the substances that come into play. We must know the changes which these properties undergo under different conditions, and the effect produced by the varying intensities of the different forces. It will at once be seen that the subject is a complicated one. It is a problem in which all the quantities are variables. But its difficulties will not be in vain if they impress the student with a sense of their magnitude, and nerve him to corresponding effort. It is only the fatal delusion of thinking we understand a subject, when we have penetrated scarcely beneath its surface, that will effectually prevent all progress. Of one thing we may be assured, that no superficial knowledge, no simple gleaning of an idea here and another there, will ever extend the limits of this field of knowledge. Patient and persevering study is required to understand what has already been accomplished, and he who shall grapple successfully with the difficult questions yet to be solved will not only confer a benefit on mankind, but give the clearest proof of an intellect of the highest order and of the severest discipline.

The next question is, whence are these elements derived: that is, where do plants get their food? There are only two sources—the soil and the atmosphere—from which they can come, for these are the only objects, so far as we know, which sustain any relation to plants with respect to nutriment. But how shall we know whether the atmosphere furnishes plants with food? Evidently by analyzing it and ascertaining, first, whether it contains the elements that plants require, and secondly, if so, whether it really furnishes those elements to plants. As a matter of fact, the atmosphere consists of four elements: oxygen, hydrogen, nitrogen and carbon—the identical ones that constitute the great mass of matter in plants. These elements exist partly in the free and partly in the combined state. Oxygen and nitrogen in the free state make up the great bulk of the atmosphere, in the ratio of about one volume of oxygen to four volumes of nitrogen. This mixture of gases contains variable quantities of aqueous vapor and small quantities of carbonic acid and nitric acid and ammonia. Such is the constitution of the atmosphere. Now, does it furnish plants with any of these substances, as food? Experiment teaches us it does. The very first step in the development of the embryo of the seed is accompanied with the absorption of oxygen from the air diffused through the soil; and when the plant has become sufficiently developed, one of the chief functions of the leaves is to absorb carbonic acid from the atmosphere. It has been, and is yet, perhaps, a question, whether nitrogen, in the free state, is assimilated by the plant, or whether it enters the plant as a compound, in the form of ammonia or nitric acid. In either case it comes originally from the atmosphere—the only difference being, it enters the plant in the former case as an element, in the latter as a compound.

But if the atmosphere furnishes plants with food, may not the soil do so as well? We learn, from the analysis of the plant, that it contains certain solid constituents; and we learn, from experiment, that these constituents are essential to its healthy development. The plant cannot thrive without them. They are therefore essential to the fertility of the soil; for the soil is the only source from which a plant can get them. This brings us to the Chemistry of Soils, and on this subject we have this question: Can Chemistry ascertain accurately the composition of soils? The answer to this question will depend very much on what is meant by composition of soils. If we include, in the term, those infinitely small quantities of substances which must be estimated by the thousand or the ten thousand millionth part of the soil, then it must be confessed that the task would be both difficult and expensive; and yet, these very small quantities of substances often have great influence on the growth of plants. I cannot better illustrate this fact than by referring to sea-weeds. They contain iodine. In fact they are the only source of the iodine of commerce, and they obtain this iodine from the sea-water. But the quantity of iodine in sea-water is so small that it cannot be detected by any known re-agent, without evaporating a large quantity of water, although iodine is one of the most easily detected of the elements. When in solution to the amount of not more than 1–300,000, it is easily detected by the usual re-agents. Now, if one hundred cubic feet of sea-water be evaporated down to one cubic foot, not a trace of iodine can be found by the ordinary tests. This shows how minute the quantity of this element must be in sea-water; and yet the fuci and the algæ absorb a considerable quantity of iodine, and owe to this element, probably, an individuality which they would not have without it. Lithia, too, one of the alkalies, has been found in sea-water taken from the middle of the Atlantic ocean, but it was necessary to evaporate some fourteen hundred cubic feet to find it. These facts will give some idea of the labor and expense accompanying the detection of these very small quantities of substances. At the same time, with the means of research now at command, very small quantities of the alkali and the alkaline earths can be detected, with far greater ease and accuracy than was possible ten years ago. In a mixture of these, weighing not more than a few thousandths or even a millionth of a milligramme, they can all be detected with ease at the same time. In this way it has been found that lithia, which was formerly thought to be exceedingly rare, is very widely distributed in nature, being found in the three constituents of many granites, in limestones of different geological formations, in the spring water issuing from these formations, in the ashes of fruits that have grown on soils formed by the disintegration of these rocks, in the blood, the milk, and even the muscles of animals that have fed on these fruits. We conclude, then, from what has been said, that it is possible to find in a soil exceedingly small quantities of these substances essential to the healthy growth of plants, but that there is a limit at the same time, even with the aid of the spectroscope, beyond which it would not be advisable or practicable to go. In our general estimate of the value of chemistry, as a means of ascertaining the composition of soils, we must bear in mind that a soil analysis of to-day is a very different thing from what it was ten years ago, and that as the means of investigation become more accurate, the more valuable will chemistry become in its relation to agriculture.

But if chemistry can ascertain with great accuracy the composition of the soil, it is still necessary to begin with the analysis of the plant, for how else can we tell whether a soil is suited to the growth of a plant? Different plants vary in the quality and relative quantity of their constituents, and a soil that is fertile for one plant may be barren for another. He, therefore, who analyzes a soil without analyzing the plant to grow on it, or at least knowing its composition, fails to see the relation of the one to the other. The plant, then, must be the starting point. And to illustrate, let us take the wheat plant; and let it be a perfectly healthy, well developed plant, formed under the most favorable conditions, and of such a kind as we should like to see our fields covered with. We analyze it carefully, and ascertain its its composition. We thus learn what materials are necessary to make a wheat plant, and at the same time what materials a soil must have to produce good wheat. The soil may have other materials in great abundance, that contribute little or no food to the plant, and these materials may be very unlike in different soils—in fact they generally are; but the soil must contain, as an indispensable requisite to fertility, those substances required by wheat as food. We do not say that a soil containing these substances will necessarily be fertile, but we do say that it cannot be fertile, for wheat at least, without them. Their presence is one of the conditions of fertility, and but one. If they are present in such a state as not to be available to the plant, they may well be absent, for the plant can derive no benefit from them, and such is the case when they are locked up in undecomposed minerals, like feldspar-mica, etc. Fertility, then, implies not only the presence of elements required by plants as food, but their availability as such.

If, now, we examine more carefully the analysis of the wheat plant, we shall find the number of constituents derived from the soil comparatively small, at least those which need to claim our attention. For there are some constituents of wheat that are furnished by all soils in sufficient quantity for healthy growth; such, for instance, are iron, manganese, soda, silica acid, and we may add, probably, magnesia. But there are others that are not always present in sufficient quantity for the wants of the plant. Among these may be mentioned potash, lime, phosphoric acid, and, perhaps, sometimes magnesia. The number will not usually exceed five or six.

Now, a soil that does not contain these substances is barren for wheat. If it had them once, and has been deprived of them by wheat raised on it many years in succession, it is now, for the purpose of wheat culture, no better than if it had never had them, and a farmer might just as well turn his sheep into a field of weeds or of sand, and think to fatten them there, as to sow wheat on such a soil and think to get a good crop. What, then, is to be done in such a case? Why, evidently, give the plant what it wants to eat; that is, add to the soil a mixture of four or five substances, that the plant wants to feed on, and if the soil does not become fertile, it will be from the lack of some other condition of growth than food. If from any cause the farmer fail, either through want knowledge or inability to add these substances to his soil, and sees his crop diminish gradually from year to year until he gets only twelve or fifteen bushels, when he should have twenty-five or thirty to the acre, then he may conclude he is starving his wheat plants as truly as he would his cattle if he should give them only half enough to eat.

What has been said of the wheat plant may serve to point out the course to be pursued with any other plant. We must know its composition, and then furnish the soil with what will nourish it. This is simply manuring; and hence we see that manuring is only the art of feeding plants. To do this intelligently and well we must know what they feed on, and in what form their food is best assimilated by them; and the relation of chemistry to agriculture in this respect is to teach us the proper kind of food to give them.

Another question yet remains, viz: in what form are those substances taken up by the plants, as elements, or as compounds? Most of the elements occur in nature only in the form of compounds, and of those found in plants, not more than half a dozen are often found free. The inference therefore is, that plants take up the elements mostly as compounds. This is in accordance with a general law, that the higher the organism, the more complicated food it requires. The food of animals is more complicated than that of plants, and that of plants is, for the most part, not elementary. All the metals found in plants enter as salts. Potassium, for instance, as sulphate, carbonate, silicate, phosphate, or chloride of potassium; and so of the other metals—at least, those salts of them that are soluble in water. Carbon enters, as carbonic acid, mostly through the leaves, but also more or less through the roots. Hydrogen passes into the plant mostly with oxygen, as water, but also to a certain extent, probably, as ammonia and nitric acid. Phosphorus, with oxygen, as phosphoric acid; silicon, with oxygen, as silicic acid, and sulphur in like manner as sulphuric acid, pass into plants in the form of soluble salts. Chlorine enters the plant mostly in combination with sodium, as common salt. Much diversity of opinion exists with respect to the assimilasion of nitrogen. Some believe that it is absorbed as a gas directly from the atmosphere, and assimilated as such; others, that it enters the plant as ammonia or nitric acid, and think they have, in the action of ammonical manures, a strong argument in support of that view; others think nitrogen enters the leaves, and there coming into contact with ozone, is converted into nitric acid, or some oxide of nitrogen, and in this form is assimilated. It is not the place, nor have we the time here to bring forward the arguments and the experimental results which are adduced by the supporters of these different views; suffice it to say that the question lies wholly in the field of chemistry, and that if it shall ever be decided, it will doubtless be decided on strictly chemical grounds. Such, then, are the compounds that become the food of plants.

Another question of interest, in this connection, is the state in which these compounds exist in the soil, when taken up by plants. And here again a diversity of opinion obtains. It was formerly supposed, and is so now by many, that these salts, which constitute, in part, the food of plants, are in solution in the soil, and, circulating there, come into contact with the roots, and are absorbed by them. But the opinion now entertained by some is, that these salts are not exactly in solution, but adhere, with a certain force, to other constituents of the soil, like humus, clay, lime, etc., and are thus retained, ready to be given up to the roots as soon as they shall come into contact with them. This force seems to be a feeble manifestation of chemical affinity, very like that by which coloring matters adhere to animal charcoal or to the fibres of cloth. There is doubtless truth in both these opinions; and a careful investigation of the subject will probably teach us that the food of the plant varies, not only in the quality and quantity of its constituents, but also in the condition in which it exists in the soil.

It may not be improper, in this connection, to say a word on conflicting views entertained by scientific men. In the judgment of some, such views are sufficient to throw doubt on all conclusions of science. It must be borne in mind that a new science, or a new application of an old one, is always accompanied with more or less mistakes, even by those best versed in it. The enthusiastic pioneer in a new field of knowledge will be exceedingly fortunate if he do not misinterpret some facts, and frame some theories, which will prove, in the end, more or less visionary. No mind, however keen its penetration, can comprehend at once all the bearings of a science in a new field of application. Hence we must expect some mistakes. And then, too, unless the scientific man is extremely cautious in his use of language, he will sometimes make loose statements, which, although intended to express facts in his mind, do really express something else and mislead others.

But this is not the only difficulty. If mistakes have been made by the investigators of the principles of agricultural chemistry, how many more have been made by those who sought to apply them. With scarcely the rudiments of chemistry, and animated by the prospect of increased harvests, they have hastened to put in practice the principles. The conditions of their experiments have been as varied as quality and texture of soil, temperature and moisture could make them. Precautions, on which depend so much the success of experiment, have been neglected, either because they were unknown or deemed unimportant. And thus, experiment after experiment, made in this loose, haphazard way, has failed, as might have been predicted it would fail, and the failure has been charged to science, when it was due to the well meaning but unskillful experimeter. There can be no doubt that a large proportion of conflicting views and statements, on questions of agricultural chemistry, are due to bad experimenting. This is well illustrated by the beginner in the laboratory. He often fails in the simplest chemical reaction, because he has neglected some precaution: that is, some necessary condition.

His first impulse is to declare the statement false; but when he has learned how to do it, the discrepancy between statement and fact disappears, and he is surprised that so slight a variation in the experiment should have caused his failure. Is it then surprising that the same kind of bad experimenting extended over the whole field of chemistry, applied to agriculture, should lead to conflicting views?

The best way to obviate this difficulty is to become thoroughly familiar, not only with the principles of chemistry, but also with its practice. To experiment successfully without knowledge and experience, is just as impossible as to be an able, successful practitioner in any of the so-called learned professions without years of patient study.

Thus far we have touched only on the outskirts of the chemistry of the plant. Its constitution, its food, and the condition in which its food is taken up, have been noticed. The next step would be to enter the laboratory of the plant, where this food is digested, and to study the reactions which take place under the action of chemical force, modified by heat, light, electricity and vitality—reactions by which the different organic compounds are elaborated This is the field of vegetable physiology. Its province is the functions of the organs of plants. But these functions consist in large measures of chemical reactions. Take the formation of starch in the leaf. The materials of which it is formed are as unlike starch as they can well be. The carbonic acid is absorbed directly from the atmosphere; the water and the alkaline salts pass through the roots up into the leaf, and there in that little workshop these substances, reacting on each other, produce starch, and this process continued, that is, this continuous reaction, constitutes a function of the leaf. Vary the conditions a little—that is, replace some of the reacting substances by others, or change their relative proportions, or vary the intensity of the modifying forces—and tartaric acid, perhaps, or some other organic product, might be produced. And so of all organic compounds. These infinitely minute changes of condition, either in the materials or the forces, on which may depend the nature of the product, can be learned only by the nicest observation and the most patient study. It is the want of a definite knowledge of these changes of condition that renders the reproduction of organic substances in the laboratory so difficult. But if, from the intricacy of the conditions which underlie the processes, we are as yet unable to imitate the processes successfully in the laboratory, they are none the less chemical processes, and show that the relation of chemistry to vegetable physiology is as intimate as its relation to agriculture. In fact, the formation of a plant, from incipient growth to maturity, is largely a continuous and complicated series of chemical reactions, and the plant itself, in so far as it is the result of such reactions, may be called a chemical product.

If then it be true that vegetable growth is largely a series of chemical reactions, resulting in the formation of the proximate constituents of the plant, it is clear that chemistry must sustain a most important relation to agriculture, and deserves the careful study of all who, in their husbandry, would derive from it the benefit which it is suited to impart. Because it has failed to fulfill the extravagant expectations, excited some years since by the writings of Liebig, we are not to infer that it is of no practical advantage to agriculture, and that the study and application of its principles in the growth of plants will be time and labor lost. Very many futile efforts have been made to reduce the gold from Colorado ores, but we are not to infer from this that chemistry is of no benefit to metallurgy. It is without doubt true that a subject of such complexity as the chemistry of plants has not been, and is not yet, well understood. Whatever difficulty there is, lies not in the chemistry of agriculture, but in our ignorance of it. As soon as we have an accurate knowledge of the conditions and laws of growth, and in our efforts to aid nature, work with and not against her, then the discrepancies and apparent contradictions, always incident to a new science, or a new application of an old one, will disappear, and we shall have the greater cause to admire the wisdom and skill of Him who evolves, through this interaction of materials and forces, the many forms of plant life.

SECOND DAY—9 O'CLOCK.

Mr. M. L. Dunlap moved that Dr. E. S. Hull, of Alton, be elected chairman of the Farmers' Institute, now in session.

The motion was carried.

Dr. J. M. Gregory moved that O. L. Barler, of Upper Alton, act as Secretary of the Institute.

Carried.

At the suggestion of Dr. Gregory, Mr. M. L. Dunlap moved that the morning hour of meeting be changed from 9 o'clock to 10 o'clock.

Carried.

Dr. Gregory—I will take this opportunity to announce to the visitors present, that the college library will be open when the lectures are not going on, to which all are invited.

METEOROLOGY.

BY PROF. WM. M. BAKER, CHAMPAIGN.

The subject assigned me in the present course of lectures is not of my own selection; neither is it one to which I feel capable of doing justice, as indeed no man can, in the short space of one lecture. Meteorology is a subject so varied and extensive, that a person is puzzled rather as to what *not* to say, than as to what he shall present. It is very commonly thought, when the science of Meteorology is mentioned, that it relates only to the meteors that occasionally shoot athwart the sky, or to the so-called shooting stars, whose fiery flight we may see almost every night; and it is therefore supposed to have but little general interest. Or, if extended to include Climatology, it is supposed to have reference chiefly to the influence of the moon upon the weather, and to the prediction of storms, or of changes of temperature. Failing in these, it is thought to have no value.

But when it is seen of what this science really treats—the wide extent of investigations it covers—the varied phenomena sought to be explained by it—we shall feel, I think, that, though we are not yet able to foretell the changes of weather with certainty, and though the influence of the moon upon climates is still a matter of dispute, the science of Meteorology is neither a barren nor an unprofitable one.

In the words of a distinguished writer upon this science, "Meteorology treats of the constitution and weight of the air; of its temperature and moisture; of the movements of the atmosphere; of the precipitation of vapor in the form of dew, hoar-frost, fog, cloud, rain, snow and hail; of the laws of storms, including tornadoes and water-spouts, with various electrical phenomena, including atmospheric electricity, thunder-storms and the polar aurora; as also various optical phenomena, including the rainbow, twilight, mirage, coronæ and halos; to which are generally added ærolites and shooting stars."

The extensive field which it covers will thus be seen, as also the futility of attempting to treat thoroughly of even one of the subjects indicated, in the short space allotted me. I shall be pardoned, then, for any lack of continuity or logical sequence that may appear in what I have to offer.

It may be seen, also, from the complex nature of the science, the many and varied phenomena of which it takes account, why it cannot be brought down to strict mathematical certainty. As Humboldt, who devoted a long life to the investigation of this department of physics, says: "The processes of the absorption of light, the literation of heat, and the variations in the elastic and electric tension, and in the hygrometric condition of the vast ærial ocean, are all so intimately connected together that each individual meteorological process is modified by the action of all the others. The complicated nature of these disturbing causes increases the difficulty of giving a full explanation of these involved meteorological phenomena, and likewise limits, or wholly precludes, the possibility of that predetermination of atmospheric changes which would be so important for horticulture, agriculture and navigation, no less than for the comfort and enjoyment of life. Those who place the value of Meteorology in the problematic species of prediction, rather than in the knowledge of the phenomena themselves, are firmly convinced that this branch of science, on account of which so many expeditions to distant mountainous regions have been undertaken, has not made any very considerable progress for centuries past. The confidence which they refuse to the physicist they yield to the changes of the moon, and to certain days marked in the calendar by the superstition of a by-gone age."

If Meteorology could only foretell storms, changes of the weather, etc., of how great value would it be, not only to the farmer but to all classes. When the thermometer and the barometer were first applied to meteorological study it was fondly hoped that this problem would be solved, but years have passed and the end is not reached. Yet great results have been attained—general laws have been discovered, and steady progress has been made, if not as grea as was fondly hoped, yet far from contemptible.

There have not been wanting those who have imagined themselves the discoverers of so desirable a thing as the law which would enable them to foretell with certainty weather changes; but they have all, when tried in the balance of actual experiment, proved wanting. It may be stated as certain, that, with our present knowledge of the science, no man can foretell with any certainty, so as to be of practical use, the changes of the weather or the approach of storms. A few years since one man believed he had discovered a principle or theory which would enable him to do this; but, when asked by the Regent of the Smithsonian Institute, as a condition to their publishing his book, that he would foretell the weather of one month in each season of one year, he declined the attempt.

Turning now to the other subject of popular expectation, viz; the influence of the moon upon the weather, what shall be said? Throughout the whole community, nearly every person has some sort of a belief in the influence of the moon over planting and all of the operations of the farm. It seems impossible that so wide-spread a belief should not have a good foundation, and yet extended and careful investigations leave us still in doubt upon this point. Olbers compared carefully for fifty years the moon's positions with the weather, and stated that he could see no effect that it had.

It may be of value to state here that the Herschels deny any belief in the existence of any system of lunar influences, and especially repudiate the weather table often attributed to them.

Samuel Horsley, L.L.D., in 1775—then Secretary of the Royal Society—states as the result of his investigations, after quoting largely from Greek and Latin writers: "On the whole I do not deny that the observant husbandman will find a variety of useful prognostics in the appearance of the moon and the heavenly bodies in general, but they will be prognostics of no other kind, and for no other reason, than the sputtering of the oil in the industrious maiden's lamp, or the excrescences which gather round the wick, *i. e.*, they are in our own atmosphere."

At the meeting of the American Association for the advancement of Science, last August in Chicago, Prof. Loomis, of Yale, a well known meteorologist, read a paper upon the influence of the moon, of which the following is a synopsis: "Several meteorologists have attempted, by a comparison of a long series of observations, to determine whether the moon exerts any influence upon the weather. From a comparison of twenty-eight years of observation in Germany, Schubler, in 1830, deduced a sensible influence of the moon; the number of rainy days at the time of the second octant being twenty-five per cent. greater than at the time of the fourth octant. From a comparison of observations made at Paris, Orange and Carlsruhe, Gasparin arrived at results not differing greatly from those of Schubler. By a comparison of sixteen years of observation at Greenwich, nine years at Oxford, and sixteen years at Berlin, Mr. Harrison, of England, has obtained results which are remarkably consistent with each other, and which indicate that the moon exerts an appreciable influence upon terrestrial temperature—the maximum occurring six or nine days after the new moon, and the minimum about four days after the full. The difference between the maximum near the first quarter and the minimum near the last quarter is two and a half degrees, Fahrenheit. These results, which are so different from what might have been anticipated, Mr. Harrison explains by supposing that the moon really attains its greatest heat about the last quarter; but that the heat which the moon radiates to the earth is entirely dark heat and therefore absorbed by our atmosphere. This heat raises the temperature of the air above the clouds, causing increased evaporation from their surface, by which they are dispersed, and thus there is an increased radiation of terrestrial heat to the sky, and consequently a diminution in the temperature of the air near the ground. He supposes that opposite results must occur at the period of minimum heat in the moon. Upon extending the comparison to forty-three years of observations at Greenwich, Mr. Harrison finds still a fluctuation of temperature, but the range is reduced to one degree and one minute, instead of two degrees and five minutes. Mr. Ballat, on tabulating a series of seventy years' mean daily temperature, according to the moon's age, found that the highest temperature occurred during the seven days after full moon, being almost precisely apposite to the results of Mr. Harrison. Schiaparelli has made a careful analysis of thirty-eight years of observations, made at Vigirano, near Milan, in Northern Italy, and has attained results which are also remarkably consistent with each other. They show that about the time of the last quarter of the moon there is a maximum in the number of rainy days, as also in the frequency of storms and in the degree of cloudiness." The Prof. then exhibited a table of results which he had deduced from seven years' observations, and drew the conclusion that the moon did affect the weather, and maintained, in direct opposition to Prof. Herschel, that the moon, just before its full, influenced the weather toward cloudiness rather than clearness, and followed the same law as the sun.

When, after so long and careful investigation, philosophers are still in doubt, it would seem that the moon's influence may be disregarded in practical life. The air we breathe—that which, in its freedom, sweeps past us and bloweth where it listeth—who has ever fathomed its mysteries? Perhaps that which we are this morning inhaling was breathed by the lips of beauty thousands of years ago. Since creation it has swept around the world—now over the burning sands, and then over arctic snows—over orange groves, and across the stormy ocean, it has traveled, and how little we heed it. Thousands of years ago, vegetation, by the help of sunlight, secreted in earth's treasure house some of its ingredients, and now, as we burn the coal, we liberate them, again to play their parts.

The causes of the various winds are not completely understood, but extended investigations show the following results as to the direction of the prevailing winds over the globe. Throughout the equatorial region of the globe the winds show a remarkable uniformity. On the north of the equator they blow almost uniformly from the north-east quarter, while south of the equator their direction is from the south-east. These form the trade winds, so-called. In the Atlantic, the north-east trades extend, on an average, from near latitude 7 deg. north, to latitude 29 deg. north. The south-east trades extend to 20 deg. south. Between these there is a belt of variable winds, or of calms, extending from 150 to 500 miles in breadth, according to the season. The center of this belt of calms is north of the equator. Beyond the influence of the trade winds we find also a belt of calms, or variable winds, the northern one being called the calms of Cancer, the southern the calms of Capricorn. These also vibrate up and down according to the season; the extreme vibration of the calms of Cancer being from 17 deg. north to 38 deg. north, the center being somewhere near 30 deg. north. Beyond these belts of calms it is found that the prevailing surface winds are in a contrary direction from the trade winds, *i. e.*, from 29 or 30 deg. north, to near 60 deg. north. The prevailing winds are from a south-westerly direction—the westerly winds in one latitude being to the easterly as 5 is to 2. Beyond 60 deg. north, again, there is a belt of comparative calms, north of which the prevalent winds are again from a northerly and easterly direction. As the surface currents are so prevalently in these directions, it follows of course that there must be upper currents in the opposite directions, to restore the disturbed equilibrium of the atmosphere.

But, it may be said, this is only theoretical, how can it be proved that such upper winds actually exist? Strict proof in such a case is, of course, difficult to give, and yet we are able to give what amounts very nearly to a demonstration. Ashes from volcanoes are occasionally thrown higher than the prevailing surface winds, and falling into the upper current, are by it carried in the opposite direction, and by their fall tell us of this current. Thus, in 1812, the volcano of St. Vincent threw out an abundance of ashes. Much ashes fell at Barbadoes, ninety miles east, though the wind was directly opposite. In 1835, from Cosquina, in latitude 13 deg. north, on the shores of the Pacific, ashes fell upon Jamaica, 700 miles north-east from the volcano, while ashes were carried westward more than 1200 miles. In southern Europe, at Genoa and Lyons especially, a fine dust occasionally falls, which has been generally supposed to be from Sahara, and taken up by the siroccos. But Ehrenberg, upon subjecting it to a microscopical examination, found that it contained organisms peculiar to the valley of the Orinoco, and the conclusion is inevitable that it comes from South America, and not Africa. On the summit of Maunakea, at the Sandwich Islands, the wind is generally found to be strong from the south-west, while the trade wind at its base is south-east. The Peak of Teneriffe is not of elevation sufficient to reach the limit of the lower half of the atmosphere, and yet the wind on its summit is often contrary to the wind at its base, while the clouds over the peak constantly move in a direction opposite to the trades.

In the middle latitudes the upper current moves from a northerly direction, as is shown by the following facts. In 1783 Mount Hecla emitted smoke and ashes for more than two months. The smoke rose to a great height in the atmosphere, and spread over nearly the whole of Europe, forming what was called a dry fog. From the north-west it extended south and east to Italy, and even to Syria, thus showing that, during those two months at least, there must have been an upper current contrary to the prevailing surface one. During another eruption of this volcano, in 1845, great quantities of ashes fell as far south as the Orkneys. Æronauts who have ascended to the height of 10,000 feet in the middle latitudes, usually find the wind blowing from the west, and if they ascend higher, from a point north of west. If, during a specially dry time, clouds are observed at a great elevation, they are usually found to move from a point north of west.

The system of atmospheric circulation may be stated thus: Within the tropics the surface current moves toward the equator, and the upper current from the equator. In the middle latitudes the surface current is moving from the equator, and the upper current toward the equator. In the polar regions the surface current is from the poles, and the upper one toward the poles. These currents are, of course, modified by the revolution of the earth, which makes the trades north-easterly and south-easterly, and the winds in our latitude south-westerly.

In regard to storms also, some laws have been learned which may now be regarded as settled.

1. All great storms are generally rotary.

2. North-east storms begin in the west and do not come from the east. The storm, on the contrary, advances east, and is generally followed by a west wind.

Thus the telegraph enables the cities east of us to know, hours before its arrival, the coming of a north-east storm.

Cyclones, or whirlwinds, are revolving storms of a more intense character. It is found that in the northern hemisphere they revolve contrary to the direction of the revolution of the hands of a watch, while in the southern hemisphere they revolve with the hands of a watch. Therefore the navigator is enabled by heeding the direction of the wind to sail out of its power.

Storms generally move eastward at the rate of from 300 to 800 miles in 24 hours. The north wind felt in our own latitude is not always, nor perhaps usually, from the north. Indeed the lake districts are often warmer than the countries south of them, or at least have a milder average temperature. Thus in Michigan they raise the peach without difficulty, which is here so uncertain a crop. Generally the west is to be scanned to judge about the weather to be immediately expected, and the currents as indicated by the clouds give the best proof.

The question is often asked, where does our rain come from? It cannot come from the land, as only three-tenths of the surface of the earth is land, and the rivers are continually acting as drains to carry off the surplus. Obviously, then, the most of the water annually precipitated must be raised by evaporation from the oceans, and as nearly all the large rivers of the earth are in the northern hemisphere, presumably much of it from the southern oceans, being brought north by the upper currents, and others precipitated. The annual fall of rain is estimated at five feet. If this were taken from the torrid zone entirely, Lieut. Maury estimates that it would be equal to a river 3,000 miles wide, 16 feet deep, and 24,000 miles long. But the mean annual fall of rain is not alike at all points. Some places, as a point on the Himmalayas, have a fall of 50 feet annually, while others, as the deserts of Africa and Arabia, of Gobi, the table land of Mexico, and about 5,500,000 square miles of the western declivity of the Andes in Peru, are nearly or entirely rainless. We have a mean annual fall of a little more than 30 inches. A question of interest to us is, where do the waters of the Mississippi basin come from? Some assert that they are brought from the Gulf of Mexico, while others contend that they come from the Pacific, passing in the upper current over the comparatively low range of the southern spurs of the Rocky Mountains, and descending to the earth at the calms of Cancer, thence to be distributed by the prevailing south-westerly winds along the extent of their course. It is a well known fact that mountain ranges have a tendency to cause condensation and deposition of moisture. Thus the prevailing trade winds from the south Atlantic, laden with moisture, sweep over the broad level of the plain of the Amazon, and by the Andes, being forced to deposit their superfluous moisture, are dry winds in Peru and Bolivia, while east of the mountains is a region of almost constant rain. At one time, at the White Mountains, I saw a storm detained a whole day by the mountains, it raining on the eastern side nearly 24 hours sooner than on the western.

Another question, towards the solution of which the science of Meteorology has made much progress, is as regards the causes of the difference of climates of places under the same latitude. We find England and Labrador at about equal distances from the equator, one with a mild and equable climate, the home of civilization, while the other is scarcely inhabitable. In the Orkneys, ponds are not frozen in winter, while in corresponding latitudes in British America, they are scarcely thawed in summer. And so throughout, the western coast of Europe has a much milder climate than the corresponding coast of our continent. So on our western coast, Sonora and California have climates very similar to Persia and to Palestine, while Vancouver and Sitka bear a resemblance in this respect to Great Britain and Norway. These differences are caused by the warm currents of the ocean impinging in either case upon the eastern shores, and thus elevating the temperature of the air and modifying the climate. It is found that the isothermal lines, or lines of equal temperature, ascend higher upon both western coasts. In the Mississippi basin we have, from our position, a high summer and a low winter temperature.

In regard to changes of the climates of different countries, a distinguished meteorologist says: "The climate of a country remains constantly the same from century to century. Observations for more than a century show no change in the mean temperature of the year, or of separate months; no change in the range of the thermometer; none in the time of the last frost of spring or the first frost of autumn; none in the annual amount of rain or snow. It is not certain that the climate of any country in these respects has changed for 2,000 years. By destruction of forests, streams dry up and droughts are produced, which are relieved by replanting, but this seems not to affect the mean amount of rain, or mean temperature." Thus we can predict the probable character of any month in any year. So, if several months in succession have been unusually warm, or unusually cold, we may expect that the following months will be of an opposite description. Prof. Loomis gives some prognostics, drawn from the face of the sky, clouds, etc., which may be of some practical value to some one, and I will therefore give them.

1. When the upper clouds move in a direction different from that of the lower clouds, or that of the wind then blowing, they foretell a change of wind.

2. When the outlines of cumulus clouds are sharp, it indicates a dry atmosphere, and therefore presages fine weather. Small, inky-looking clouds foretell rain. A light scud, driving across hazy clouds, indicates wind and rain.

3. Remarkable clearness of the atmosphere near the horizon, and an unusual twinkling of the stars, indicate much moisture in the upper regions of the atmosphere, and are therefore indications of approaching rain.

4. Halos, etc., indicate rain or snow.

5. Dew and fog indicate fine weather.

Having thus, in so disconnected and hasty a manner, run over some of the points of this interesting science, I cannot close without expressing my belief that, from the multitude of observers now at work, and of observations now being made, greater results than have yet been obtained are at hand. To a true theory of the science, every accurate observation, however humble, prepares the way. Nowhere is there more need of such observations than over the broad prairies of the northwest. Why may not every one now before me contribute his mite to this, and thus, in enriching others, enrich himself a thousand fold?

DISCUSSION.

Mr. M. L. Dunlap said that he had given this subject some attention, with a view of making some practical use of it in accounting for the many eccentricities of our climate. He believed that this science could be made available in a great many instances, but was well aware that it needs, to understand it, an immense amount of study and investigation. What the lecturer had said about the direction of the prevailing winds, and the philosophy of storms, accorded with his observation and experience. The direction of these storms often appeared to be from the north-east, but they came, in fact, from the west. He noted, as a singular fact, that a storm, starting at a given point, and moving forward with accumulating force, would pass over certain portions of the country harmlessly, while other portions were swept with terrible force. Our periodical eastern winds are indications of storms that may or may not bring rain. If the atmosphere is charged with moisture, we are liable to have a rain storm. When we have these eastern winds, you may note the fact that we are very apt, soon after, to read of a storm on the Atlantic coast.

In speaking of the trade winds, he showed that they were the cause of the cold south-west winds which sweep up through the Mississippi valley, to the injury of our fruit. Our productions are virtually grown in one climate and wintered in another—they are grown in the tropics, and wintered in the cold winds of the north.

This will account for so great loss of plants and trees. There is no way to remedy the evil but to plant timber belts; and it is for this reason that I have always urged upon farmers the importance of planting trees for the purpose of serving as shelter belts. There is another advantage in this. If we plant more timber, we will, of course, make the climate more moist, and clouds passing over timber lands give down the rain just as the mountain ranges wring out the last drop of water from the passing clouds. I think these observations will be found to be correct in the main.

Prof. BAKER, in answer to a question, said that the average rain fall over the whole earth was five feet per annum. We have here about 27 inches. The water is taken up by evaporation and falls in rain, in quantities as stated in the lecture. In regard to the great amount of water taken up by evaporation, we stated that it would form a mighty river, 16 feet deep and 24,000 miles long! So that the great Mississippi, as it flows to the gulf, has its counter Mississippi invisible in the air, bringing its waters back.

Mr. FREEMAN—The Prof. spoke of the necessity of timber belts as a protection against the influence of malarious diseases. Now this reminds me of a remark made to me by a man who went to Natchez 60 years ago, where they had the yellow fever. Natchez is situated on a bluff, opposite a marsh, to which they attributed these malarious influences from which they suffered. He spent 30 years there, and finally went to the north. He said that the better class of people began to move out into the woods, back from the river, in order to escape this influence, but, until the country was opened up back from the river, they suffered from the diseases of the country. But after the country was opened up around them they seemed to enjoy immunity from these diseases.

Mr. ROBINSON—I would ask the Prof. what difference he finds in the thermometer when exposed to the wind—suppose the wind blowing from the east, you carry the thermometer from the west side to the east side of a belt of evergreens, what change is effected in the thermometer?

Prof. BAKER—The thermometer does not tell us how cold we are, but is simply an indication of the degree of cold.

Mr. ROBINSON—That is only a partial answer. I want to know what benefit the belt of evergreens is going to be. Now my experience is, that the thermometer will not show any difference. The degree of cold indicated is the same on either side when a evere wind blows, although there is a difference, perhaps, of ten egrees.

Prof. Baker—It is true that the evaporation caused by the pasage of the wind over the plants would affect them, as animals are ffected by it, and they would really suffer from the cold winds as nimals suffer from them, though the thermometer indicated the ame degree of cold in and out of the wind.

Dr. Gregory—Dr. Draper asserts that there is actual heat geneated in the tree. Bore a hole into a tree, and let the tree cool rom the warmth from boring, and insert a thermometer, and you vill find the tree of uniform temperature, warmer than the atmoshere. Now if this be so, the tree has the power to give off heat, nd the wind blowing upon the tree would liberate more heat and ake away moisture. These observations of Dr. Draper seem to ne to be exceedingly interesting, and worthy of consideration.

Mr. Periam—My experience is, that a thermometer placed upon he east side of a belt of evergreens in the afternoon, at a distance of 20 feet, when the wind is blowing from the west, will show a ange of ten degrees. The thermometer will sink ten degrees ower on the west side than on the east side.

Mr. Dunlap—It is easy to show the great advantage of evergreen belts in moderating the climate and warming the atmoshere. They take in heat in the daytime and give it off at night. That is the reason for the practice of some in planting every fourth ree in their orchard an evergreen. It is simply a matter of expeience and observation that evergreens temper the climate. By lanting these belts we will save our fruits, and may plant many arieties in the north which would fail without this protection. The practicability and advantages of this practice we expect to lemonstrate in this institution, and to illustrate upon these grounds his, one of the great and leading facts essential to success in fruit culture, especially in the northern part of the State. There is no question but there is a vast amount of truth in the assertion of Dr. Gregory, that trees give off heat. Let us recognize this important truth, and not cease our tree planting until we are fully protected by these timber belts.

Mr. Robinson—It will take twenty-four hours for frost to penetrate to the heart of a tree two feet in diameter. It may be frozen externally, and not frozen at the heart.

Prof. STEWART—I have no doubt with reference to the tempera ture of trees being higher than the air about them. The tree i a living being as much as an animal. As the temperature of an mals is higher than that of the surrounding atmosphere, so w may expect to find in plants a temperature higher than that of th atmosphere. There is this consideration, also. What is it that i going on when plants are growing? Plants grow by a series c chemical combinations, and where these changes are going o there is heat evolved. You cannot have chemical action withou heat being evolved. Chemical action is that which produces hea in animal life, and the same is true in the life and growth of plants We should naturally infer this from the nature of the process tha is going on. I also desire to say this respecting the influence c the moon upon the weather, which matter has been alluded to i the lecture. I place no reliance upon the supposition that th moon has any influence upon the weather. I would sugges whether these contradictory results, arrived at by so many carefu observers, are not attributable to local causes. Every section o the country has its peculiar climate, and may not these local cause produce these different results, instead of having to go to th moon to account for the weather? Had we not better stay upo the earth, instead of going off to the moon, and find causes a home, instead of abroad, for these changes of weather? I think if we understood the matter fully, we should find that the moo had very little to do with the weather.

Dr. GREGORY suggested, in view of the fact which seemed to b established that trees generate heat, whether they have not, i this, the power to resist frost. The human system, if frozen, dies He was inclined to the opinion that if a tree was frozen to th heart it would die also. But all this looked so much like mer theory, that it was hardly safe to advance such an idea.

Mr. ROBINSON questioned the position of Prof. Stewart that hea always accompanies chemical action. He was under the impres sion that there were cases of chemical combinations where hea was not evolved. Is it not so?

Prof. STEWART—I know of no instances of this kind. If yo take the oil of vitriol and mix it with ice, there will be a chemica combination, and there will be produced a very low temperature Still there is at the same time heat produced. I have not th slightest doubt of this. I know of no instance where there i hemical combination without producing heat. With reference to he chemical action in the growth of trees, this of course explains he increased temperature, for chemical action produces increased emperature. In the summer, when the process of life is going n, when the different parts of the tree are forming these different hemical combinations, there will be heat.

Mr. Dunlap—There is no question the tree has a twofold power—one of growth, and one of hibernation. In a state of growth there is going on chemical action, and of course there is heat produced. In a state of hibernation it has power to resist cold. The tree may freeze to the heart and not be seriously injured. There is another point to which I wish to call attention, and that is with reference to the influence of the moon on vegetation. In my practice I pay no attention to the moon. But there is this fact—and I wish the students here would give it their attention. If the moon fulls about the tenth of September we are more liable to have early frosts than when it fulls at any other time. If the moon fulls about the 20th of September we are less liable to early frosts than otherwise. It does not always so happen, but this is generally true. If this fact was regarded in the time of planting corn, and the estimate made of the time to mature the corn crop, which is 125 days, it would perhaps be well. This is the only practical fact about the moon's influence, and there is a good deal in it. If I am correct, we can save our corn crop from the frosts by early planting. At any rate, there is need of further investigation in this direction.

THE SOILS OF ILLINOIS.

BY H. C. FREEMAN, OF THE STATE GEOLOGICAL SURVEY.

The lecturer gave as the definition of the word soil, that part of the surface of the earth in which plants grow. It is a compound substance, formed from the decomposition and disintegration of rocks, and is peculiarly fitted to furnish food for plants. He gave an account of the origin of soils, which led to a minute description of that portion of the earth known as alluvium, terrace, loess, drift and tertiary. The disintegration of rocks which form our soils is caused by mechanical and chemical agencies. But there are other forces at work—the deposit and admixture of this debris is due to river and ocean currents, and to the ice in the glacial period.

The lecturer stated that the soils of Illinois were of themselve the study of a lifetime, and made mention of their varied form i the different portions of the State. At LaSalle, an upheaval ha brought to the surface the St. Peter's sandstone, which is mucl used in making glass. It has the appearance of white sugar This sand, appearing on the Illinois river, near immense beds o coal, suggested that the time would come when an immense busi ness would be built up in glass manufacture.

We have at Peoria a different formation of soil, a sort of modi fied drift, known as the terrace formation, the result of the action of water currents. The yellow clay of other localities, and the soil peculiar to the prairies, were all mentioned, and the statement made that each variety of soils required different treatment, depending upon moisture, climate and drainage. The soil near Cobden seemed, to a great depth, to possess elements of plant growth. In one instance, in digging a cistern, a root of a peach tree was found, reaching down to the rock-bed, a distance of nineteen feet. The inference is, that the soil in this great fruit region has good drainage.

The lecture was illustrated by a diagram of the elevations throughout the entire length of the State, from Cairo to Dunleith.

The lecture was instructive to those who heard it, but it partook so much of the style of a recitation in a class-room, the life of which was all on the blackboard, that it was impossible for your reporter to take it verbatim and do justice to the lecturer, and he has not attempted it.

SECOND DAY—EVENING.

DR. WARDER'S LECTURE ON THE MANAGEMENT OF SOILS.

Mr. President: It would be well could we imitate an illustrious example set before us. A gentleman was asked to make some remarks upon a public occasion, and his reply struck me as one having force and sense in it. It was this: "When I have anything to say, I am always willing and happy to say it, and when I have nothing to say, I do not say it." Though I have been much interested in the subject assigned me, I yet feel that there might have been a much better selection made than you have made for the discussion of this topic. I would suggest a different wording of my subject. I would prefer to limit the subject and talk to *earth-working*. The management of soi is too large a question. I think it is better that I should confine myself to simply earth-working. This will be found to include all those operations which have for their object the comminuting of the soil, and that treatment of the soil and plants called cultivation, whether done by one implement or another. The various kinds of utensils used in working the soil will be a leading topic of the lecture. The instruments in general use are the plow, the harrow, the roller and the cultivator, adapted to the draft of horses or cattle.

There are also other utensils used, with hand-power, such as the spade and different varieties of hoes, the "split hoe," as it is called by Virgil. Mr. Hexamer calls it the "pronged hoe." We find this one of the best of hoes. We have also the scraping hoe, used for the purpose of destroying weeds upon the hard ground, and the grubbing hoe. These, however, are not so serviceable as the pronged hoe in stirring the soil. There is another class of tools—the rake and the brush.

Earth-working, therefore, covers all cultivation of the soil, and all cultivation of the soil necessitates the use of implements of some kind. The plow stands at the head of these implements. It is wonderfully interesting to trace the history of this implement, and see the great progress that has been made since the earliest times. The figure upon the left (here the lecturer referred to diagrams drawn on canvas and hung up before the audience) is a fair representation of the implement used in early times for plowing. Before this, even, there was in use a ruder instrument still, a sharpened stick. But this diagram is said to be the original representation of that instrument—the plow. It is simply a stick, with a branch or fork, one of which branches is sharpened, and a limb is left to be used as a handle.

The plows in our own country in early times were almost as rude. Some of us can perhaps even remember the wooden mouldboard, chopped out with an axe. A little later we had a strip of iron attached, which was a step in improvement. It was the old-fashioned *bull-plow*, a sort of shovel-plow, which seemed to do pretty good work in its time. You need not go beyond the limits of your own State to find this style of plow. As we progressed in knowledge, the plow improved in style of manufacture, until, not to go into details, we now have reached the perfect plow, so nicely made and fitly fashioned, that it passes through the soil almost without resistance. Among the modifications of the plow are the trench-plow, the double Michigan-plow, the gang-plow, the object of which is to economize human labor. Then there is a style known as Dr. Grant's trench-plow. We have, also, steam-plows, with the object of saving horse labor, as the gang-plow economizes human labor. There is still another modification of the plow. I refer to the rotary spader, which proposes to thoroughly stir and comminute the soil.

In considering the history of the plow, he showed that the progress from the rudest implement to the modern plow was very slow. He showed a diagram of a rude instrument used in Palestine for loosening up the ground, something as a hog or mole would do. It is called the Caschrone, and is used to this day in some of the outer Hebrides in Europe. The wooden portion is one single piece, and was doubtless selected on account of the natural crook in the timber. When the plowman wished to run his plow deeper he would raise up the handles on his shoulder; if his plow ran too deep, he pressed downward on the handles. This plow had an iron point. Mention was made of the Rotherham plow (supposed corruption of Rotterdam) at the commencement of the last century. It was a wooden plow, shod with iron. It entered the land on the principle of burrowing, rather than that of clean chisel cut.

Jethro Tull gave preference to the old Berkeshire plow, which was inferior to the last named in ease of management and ability to do work. He believed in "elbow grease." His plow was one with four coulters. He thought that this arrangement more thoroughly divided the land. But this implement was never generally used, and no improvement worthy of notice, from that time until the commencement of the present century, was made, when one of our own countrymen, Thomas Jefferson, had his attention directed to the improvement of the plow. He saw that the plow should be an instrument with power to act upon the soil vertically and horizontally. This would require a nicely fashioned curve. He had his plow put in operation on his own estate, where it worked satisfactorily.

The lecturer here stated that he would rather read from authorities on this subject than to present his own ideas. He accordingly read frequent and copious extracts from a work which he characterized as an exceedingly valuable one. It was the report of the plow trial at Utica, New York, in September, 1867, held under the auspices of the State Agricultural Society, and prepared by Hon. John Stanton Gould. The extract read had reference to the improvements made in the plow.

Two or three names mentioned in connection with the improvement of the plow, the speaker considered worthy of note. Mr. Newbold was the first American, after President Jefferson, to improve the plows in common use. He spent $30,000 in his efforts in this direction, and made the first American cast iron plow. He used the plow himself, but could not pursuade his neighbors to do so. They said it poisoned the land and promoted the growth of weeds! The patent for this plow was granted on the 26th June, 1797. From this time on, a great many patents were taken out for improvements, when, in September, 1819, Jethro Wood, of Scipio, New York, took out a patent for an improved plow, and from this pattern he never varied. Very many plows were made from patterns furnished by him, and even at the present day, in different parts of the country, there are plows made that differ very little from principles laid down by Jethro Wood. He was the first man who made a plow in three parts—the mouldboard, share, and landside. But the mouldboard was too full in the middle; it was not sufficiently concave. Measuring from the point of the mouldboard, the landside measured two feet and three inches long.

One of the next great improvements made was put forth by Withero and Pierce. The principal feature in this improvement was in the curve of the mouldboard. The object sought was to have a cycloidal curve. Samuel A.

Knox, of Worcester, Massachusetts, made an improvement worthy of note. Also, a Mr. Burrow, of New York, was another who was quite successful.

The great desideratum in a plow is not simply to turn over the ground, but it is to break up the soil as finely as possible in turning it over. We hear a great deal about spade husbandry, and it has this merit, that it does comminute the soil in a most thorough manner. We have many plows that do not break up the soil. These are not satisfactory. But again, we have plows—the double Michigan, for example—that do break up the soil in good style. I say double Michigan plow, because this is a plow having the right kind of a mouldboard for this work.

The lecturer next treated of subsoil plows, and gave a definition of subsoil. It is the *under* soil, the soil below the top soil. Suppose we have a plow that lifts a furrow twelve inches deep; now, if we wish to go still deeper, we use a subsoil plow, or trench plow. Dr. Grant has constructed a plow which is a true trench plow—a plow that throws up the under soil, and mixes it with the top soil. Dr. Grant claims that this is good practice. It may do for his soil, but there are soils where this will not do. It would be temporarily ruinous to bury up the top soil with cold stiff clay subsoil.

In deep plowing it is not desirable to plow too deep at once, but gradually to deepen the furrow at each subsequent plowing. In this way no bad effects will be experienced, but, on the other hand, a decided improvement in the land. I hope there are those here who can give us their experience upon this subject.

The subsoil plow proper is an implement that does not bring the under soil to the top, but simply breaks it up, and leaves it in its natural position. When this idea of a subsoil plow first entered the head of the inventor he thought it must be a turning plow, that it must have a mouldboard, and he proceeded to construct the plow upon this principle. It was thought that the plow was good for nothing unless it raised the earth into the air! The great objection to a plow of this kind was that it required too much power to move it—the draft was too heavy.

It was not until Prof. Mapes invented his plow, that progress in this direction was made. He invented a plow without a mouldboard—a plow which did not throw out the subsoil, but only loosened it, and left it in its proper position. The elevation of the earth was not more than two inches, so that the draft was comparatively light. The ground was loosened up so as to admit the air into the soil. This was all that was needed, and this was easily effected by this implement. I can entertain you better by turning again to our authority. [Here the lecturer read a long extract from the Report, elucidating still further the history of the plow.]

The great object in plowing is not only to reverse the soil, and to put the grass and weeds out of sight. It is to do this, and also for the sake of commingling the different portions of the soil together, and breaking it up by turning it over. The spade is a superior instrument for this work of comminuting the soil, and for this reason has advantages over the plow. In the process of digging the mingling of the soil is more thoroughly effected.

We will turn once more to our authority. The extract had reference to the objects sought in plowing. The object was not only to kill weeds, but to secure that condition of the soil enabling the roots of plants to readily permeate it in their search for food. He again commended the Report, from which he had made such copious extracts, as an exceedingly interesting and valuable document. It was prepared by one of the best minds of the country.

But after all the improvements made in the plow, the result obtained is not just what we want. The plow that will do good work in gravelly soil will not do on our rich prairies. After all the learning and skill and labor bestowed upon this instrument, the plow is a very unphilosophical tool. After having been brought nearly to perfection, and even giving satisfaction, it is still an unphilosophical instrument. And that is not the worst of it; while it remains what it is, and retains its present form, this must ever be the case. Since action and reaction are equal, there is and must be a great loss of power in this implement. We see this in the working of the plow. We see it in the condition of the soil beneath the plow—that condition which farmers call "furrow-trod," the ground becomes harder. For every pound weight lifted there is a pound exerted downward. The effect is known to all. Again, for every pound weight lifted, there is pressure of a pound upon the landside. The effect is apparent, and you will see the land *shine* after the plow has passed by. We live in hope of further improvement in that very useful tool, the plow.

DISCUSSION.

Mr. Dunlap—We have a plow, invented in this county, that is not liable to the objection of which Dr. Warder has spoken. But if there is any instrument, other than the plow, that is to come into use, and that will do the best service, I believe it will be Comstock's Rotary Spader. I have had hopes of this instrument, and some day may have them in use. It has already been put in use in this vicinity, on seven or eight hundred acres, and in certain conditions of the soil works well. When we underdrain our soils I think we shall find the rotary spader a very desirable instrument for stirring and comminuting the soil. Until that day does come, until we will drain our lands, so that we can work a dry soil, we will not be able to work the spader satisfactorily, for the reason that, on wet soils, it would sink, from its great weight, into the soft ground.

It seems desirable that we should have plows on wheels, in such a way as to carry a man. Then we can put upon these plows the maimed soldier, the boy of 12 or 14 years, who is not strong enough to work day after day. Even the invalid could be put upon it, and made to render valuable service. But the objection is the expense. They cost from $60 to $70. Still their use is economical in the way I have mentioned, besides they break and mix the soil together, like a garden cultivator, and as a result, we have an increase of the crop, and the great satisfaction of working with good tools.

Dr. Warder—I would like to know if any one present has tried to use the rotary spader, and with what result.

Mr. Dunlap—It has been tried in this county, and we find, from its great weight, that it mires in soft ground. On dry soils it has done good work.

A voice—It weighs 900 pounds.

Mr. Dunlap—In regard to deep plowing, or trench plowing—a subject introduced in the lecture—I believe that deep plowing, on most soils of our prairies, produces the best crops. We find that trench plowing brings good crops. I suspect that chemistry has something to do with this. There are soils which might not be so much benefited by deep plowing. He referred to Mr. Alexander, the "big farmer," who plows eight inches deep, with good results.

Mr. Lovell had some experience in this matter, and spoke of the practice of Mr. Sullivant, now of Iroquois county, who plowed but eight inches deep, and obtained crops of corn, 60 bushels to the acre.

Mr. Dunlap—The soil on Mr. Sullivant's farm is, perhaps, different from ours. It is more arenaceous, is it not? A soil of this description would bring large crops without very deep plowing.

Mr. Lovell—No, it is not such a soil as you speak of. It is very much like our soil here, I think. Perhaps it is a little more gravelly, otherwise it is much like the Champaign county lands, where the land is high.

Mr. Gardener—I am well acquainted with one of Mr. Sullivant's foremen, and had a talk with him not long since. He stated to me that all the land that he tended yielded from 50 to 60 bushels to the acre. Some of the land was high, and some low. Take the land as it runs, I think it is much like our land.

Prof. Bliss—I have had some opportunity of observing, and also have had some little experience in this matter of trench plowing. So far as my observation goes, it has been that crops on ground not trench-plowed succeed very well if the season is favorable, but if the season is a little dry, the crop suffers, and perhaps dries up, when, if the ground had been trench-plowed to the depth of seven or eight inches, the drouth would not have produced so damaging an effect.

Mr. ROBINSON, of Tazewell county, prepared a hundred acres of wild prairie land, and planted to corn, and obtained 75 bushels to the acre. The sod was turned over to the depth of eight inches, and turned over in such a manner as to leave holes for the air to enter, which rotted the sod much quicker than would have been the case had the sod laid down close. After the plowing, the harrow was put on. It requires considerable time to pulverize the soil sufficiently. The yield on this occasion was very satisfactory. This past season I put in a few hundred acres, on drained land, in a similar manner. The prairie was raw enough to cut a good crop of prairie grass. The soil was a little more sandy, but not black sand. The season was extremely dry, and we obtained but 40 bushels to the acre. I have every reason to believe that had the season been wet, we should have gathered 60 bushels to the acre.

Mr. FANGENROTH, of Madison county—I wish to make some statements with reference to the common mode of plowing in lands, always and forever throwing up the ridges along the outer edge of the field, and in so far scooping out a basin for water in the central portions of the field. These *dead furrows* necessitate a great loss of land.

He deprecated this method of plowing, and proceeded to describe his method. He begins in the center of the field, whether of five, ten or twenty acres, strikes his furrow, stops short of the end of his row, (distance across the field,) and then back-furrows, and continues to back-furrow till the work is done—turning *gee* if his plow is right-handed, and *haw* if a left-handed plow. This leaves the plowed surface level, throws the soil continually inward and away from the fence corners, where it is especially heaped up and *kept dry* in the old system. Another advantage in this new method. The horses do not turn on the plowed ground (but upon the unplowed) and injure it by trampling.

Mr. ROBINSON was not in favor of riding-cultivators. He had not succeeded with the gang-plows. He thought that almost all those who had given it a thorough trial had discarded it. It might answer a good purpose for that class of men—maimed soldiers, boys and invalids—of which Mr. Dunlap has spoken; but the machine is too heavy, and the weight of the driver only adds to the difficulty. There may be gang-plows that work well, but I have not seen them.

Mr. PERIAM—But the weight of the man would not add 150 or 200 pounds to the draft of the plow.

A VOICE—Have you ever put in a crop with the gang-plow?

Mr. PERIAM—I have not. I was only speaking of the popular objection as being no very serious matter, after all.

Mr. OSBORN—I have used the gang-plow, and do not like it. I have tried it for the whole season through, and still I do not like it, and I don't want to try it any more. It will kill the horses.

Mr. ROBINSON—I have seen hundreds of acres plowed with the gang-plow, and have always found the horses poor at the end of the season. Besides, four horses do not work well abreast. Yet I hope there may be some improvement in the gang-plow, for I much prefer to ride.

GRASS.

A LECTURE BY DR. L. D. MORSE, OF ST. LOUIS.

The subject assigned me on the programme is "Grass." Some of you, I presume, probably most of you, think that it is a small subject, and comparatively unimportant. Certain it is, that farmers in general bestow much less thought, care, study or science, on the grass crop than they do on the grain crop. How many farmers know the names of the grasses which are growing in their fields? Not one in ten thousand. Many of them seem to be scarcely aware that they have, or need to have, any other varieties than timothy, blue grass, clover, and rarely a little red-top; and of course they do not understand the peculiar properties and relative values of the different species, and their adaptation to various soils and conditions, and for various purposes.

Instead of my subject being of minor importance, I suspect that it would not be difficult to show that it is by far the most important of any subject that has been or will be brought to your attention during the present course of lectures. In order to present a few of the prominent features of the subject, I propose to consider,

1. What is grass?
2. The importance of grass.
3. How to grow grass.
4. Some of the varieties of grass.

WHAT IS GRASS?

1. Grass is the most common herbage with which the earth is clothed; giving us the "grassy banks," "wavy meadows," "sweet fields arrayed in living green," and the "green things growing," of which poets have sung

from time immemorial. Grass is so common, so extensive, so beautiful, so essential in the landscape, and important to the welfare of mankind, that scarcely a poetical production of rural character can be found in which allusion to grass is not made.

The family of grasses, in botanical language the *Graminæ*, embraces nearly a sixth part of the whole vegetable kingdom. Most of the grains, as wheat, rye, corn, barley, rice, etc., are true grasses. In common speech these grains are not recognized as grasses, while some other plants, such as the clovers and lucerne, are familiarly called grasses, but are not entitled to the appellation, belonging as they do to quite another family, the *leguminosæ.*

The grasses may be described as plants having a cylindrical, jointed stem, the nodes being solid and the intervening joints hollow, or filled with a pith-like substance; the leaves long, narrow, not serrated at the edges, having parallel veins running along on each side of a prominent central vein or mid-rib; the leaves alternate, one of them originating at each joint, embracing the stem with its base, and forming a sheath, which is slit down on the side opposite to the leaf to its origin; and the flowers are protected by a peculiar kind of calices called glumes or husks.

Guided by this description, it will not be difficult to recognize the true grasses wherever found, and it is readily seen that the grains mentioned belong to the grass family. It will suit our present purpose best, however, to leave the grains out of consideration as grasses, and to include the clovers among the grasses, as they are, to a considerable extent, so understood, and used for the same purpose.

A forcible and expressive definition of grass is that given by a French writer, who says that the term grass is only another name for beef, mutton, bread and clothing. A short and comprehensive definition is that of scripture, "all flesh is grass." A well known New York author, in an address at an agricultural fair, a few years ago, said:

"Grass is king. It rules and governs this world. It is the very foundation of all commerce. It is the most important crop ever grown upon the face of the earth. Without it the earth would be a barren waste, and cotton, gold and commerce all dead. Grass is the all in all to all men. No wonder then that he has always been considered a wise man who said, 'He that maketh two blades of grass to grow where only one grew before, is greater than he who buildeth a city.' That is, builds a mart of commerce—a storehouse for cotton—a place of deposit for gold."

IMPORTANCE OF GRASS.

2. The importance of grass is already quite well indicated. It is found growing throughout the world, in all places where vegetation of any kind can grow, and where grass is not found, there is found the most absolute desert—the most entire absence of the means of supporting life of any kind. Other families of plants are restricted to narrow belts of latitude, but the grasses everywhere spring up spontaneously, adorning the earth with refreshing verdure, and affording the chief means of subsistence for almost the whole animal creation.

An all-wise Providence has wonderfully provided for the propagation of this class of plants. The seeds are small, light and easily transported from one place to another. The roots are creeping or fibrous, and send forth many shoots which quickly cover the ground; and by the yearly decay of the stems and leaves a constant supply of decomposing matter is afforded for the nourishment of future growth. Most of the grasses are perennial, and although the leaves and stems be cropped and destroyed, they are soon reproduced. The creeping roots, though bruised and hurt, are not destroyed, and the winter's cold and summer's drouth are alike unable to extinguish the principle of life in these most important of all plants to mankind.

The great value of the grasses is further signified by the wisdom of Providence in the great number and variety of the species which he has created. There are no less than three thousand distinct varieties known and described by botanists. Thirty varieties have been counted in a single sod taken from a rich natural pasture. Mr. Flint, author of "Grasses and Forage Plants," describes one hundred and twenty-five varieties growing in the state of Massachusetts. In the Natural History of New York, Prof. Torrey describes forty varieties of the genus *Poa*, twenty-seven of *Agrostis*, six of *Alopecurus*, fifteen of the *Festucas*, and thirty-four of other varieties, amounting in all to one hundred and twenty-two varieties existing in the state of New York.

Six-tenths of the whole cultivated area of the state of New York is occupied by grass; and the annual value of this crop may be fairly estimated at $75,000,000; an amount fully equal to, and probably exceeding, the value of the entire grain crop of that state. Where, within the United States, can be found more beautiful or more wealthy localities than in the best grass-growing districts of New York? How often do we hear the remark from men who have traveled much and observed closely, "wherever you find a good grass farm, you are sure to find wealth and prosperity." Mr. Samuel L. Boardman, of Maine, has written as follows: "A district of country which is exclusively or mainly a natural grass-growing section, has within itself all the elements of successful agriculture, provided its operations are conducted with system and economy. With grass we have all kinds of stock; with stock the means of working and dressing our farms, furnishing our tables, providing our clothes, and all else that is desirable or necessary. A county having a soil naturally adapted to grass, is, in a great measure, able to live within itself, and not be dependent upon an exchange of commodities with other districts. The same is true, though in a less degree, upon a single farm. If the soil is natural to grass, strong and moist, the farmer has at hand the means to secure whatever he desires; or, to apply the old proverb, he has corn, cattle and manure. In fact, grass and stock husbandry is really the only branch of farming which seems to render a man independent."

A committee of the Maine Board of Agriculture, reported to the board in 1864, as follows: "We have no hesitation in saying that the hay crop of our state is far the most valuable and important crop that we produce, and generally all our farm operations, particularly in the older portions of the state, should be conducted with a view to increase the fertility of our grass lands, and augment the hay crop. We believe that the thrift of those who attend to farming exclusively, and who pursue a mixed husbandry, as do most of the farmers of this state, may be very correctly estimated by the amount of hay they cut."

Scores of such opinions as these could be given, and there are ample facts to prove that they are well founded. If so, then it is evident that the most serious and radical defect in our Western agriculture is, that too little attention is paid to growing grass. It is a defect that is becoming year by year more serious, and unless a change in our system of farming is inaugurated, the utter impoverishment of a very large portion of our beautiful and naturally fertile country is merely a question of time. Indeed, a number of counties in the State of Illinois are already measurably worn out and exhausted by bad management, and chiefly by the continual cropping with grain.

Illinois is claimed to be the best agricultural state in the Union. It has been called a great cattle raising state. Statistics show that it is most emphatically a grain producing state. Illinois produces annually over ninety bushels of grain to every individual of her population, while the state of New York produces only about nineteen bushels to each individual of her population. New York is a wealthy and very prosperous state. In her agriculture, I think it will be generally admitted that she is in advance of any other state in the Union. Her farmers generally pursue their calling with as great a degree of intelligence and success as the farmers of any region on this continent. It becomes an interesting inquiry then, in what consists the prosperity of New York, while she produces but little more than a quarter as much grain in proportion to population as Illinois.

In comparing other products the proportion cannot be so readily adjusted as with grain. Illinois is larger than New York in area, by some ten or twelve thousand square miles. The population of New York numbers a little more than twice as much as Illinois. According to the census of 1860, Illinois raised considerably more than twice as much grain as New York, the figures being 156,219,448 bushels in Illinois, to 72,890,861 bushels in New York. Illinois produced 1,774,554 tons of hay, to 3,564,786 in New York, or about half as much. There are more acres in pasture in New York than in meadow. In 1865 the figures were 4,296,720 acres of meadow, and 5,819,694 acres in pasture. If the yield from the pastures is worth as much as the yield from the meadows, then the grass crop produces more money probably than the grain crop in New York state; while in Illinois, estimating by the same rule and at the same rate—which is much too liberal—the grass crop is not worth half as much as the grain crop. In 1860 the live stock in Illinois was valued at $72,501,225; in New York, at $103,856,296. Illinois had 522,634 milch cows, while New York had 1,123,624.

It appears that in all products from grass, New York is largely in excess of Illinois; and yet not very much in excess of her own grain crop in value. She practically recognizes the old Belgian proverb, "No grass, no cattle; no cattle, no manure; no manure, no crops."

It appears evident, also, that the farmers of Illinois depend for their profits chiefly upon growing grain. This is sent away to market; most of it finds its way to the Eastern States, and not a little of it goes eventually to enrich Eastern grass farms. Of course it brings money to our farmers, though it is doubtful whether it brings as much for the time being as grass would; but the most important point which should be considered is the end to which such a course inevitably leads—such a continual sending away of the wealth of the soil never to return.

You have all heard of the peasant who possessed a goose that every day laid a golden egg. This small supply of gold was sufficient for the daily wants of the peasant and his family, and their only care was to preserve the life of the remarkable animal from which they derived their support. But at length the peasant, stimulated by unnatural desire, required more gold, and unwilling to wait the tardy operations of nature, cut open the body of the goose to obtain the coveted treasure, and thereby killed the animal and lost his means of support.

The soil is the goose that annually lays a golden egg in the lap of the farmer, and will continue to do so to all time if properly fed and tended, but the practice of many of our grain farmers will as surely starve and destroy the goose as did the knife of the peasant in the fable.

The preservation of the fertility of our soils, and the profitable and even increased production of the cereals, both of which objects may be secured by the growing of grass extensively, and by the manure resulting therefrom, are certainly matters eminently important and worthy of our consideration and study.

"The effect of grass on the growth of the cereals is well illustrated by a comparison of the agricultural statistics of France and England. France has fifty-three per cent. of its cultivated area under grain crops, while England has but twenty-five per cent.; but in grass and meadow, the natural food of live stock, England has fifty per cent. and France has only twenty-two per cent. You may be surprised to hear, that notwithstanding the enormous disproportion of area of grain land, England produces 5 1-9 bushels of grain for every individual of her population, while France produces 5 ½ bushels for every individual of hers. Thus the production of the former is within seven-eighteenths of a bushel of the latter to each head of her population. How is it that England is so nearly on an equality of production with France, while her cultivated area is very much inferior? The answer is plain. It is on account of the manure furnished by her grass lands. Every acre of English grain land receives the manure from three acres of grass, while in France the manure from each acre of grass must be diffused over two and a half acres of grain. Let not the eloquent teachings of these plain statistical statements be lost upon us. Let us ponder them carefully when contemplating the splendid rewards which nature offers for a thorough obedience to her laws." (Address of J. Stanton Gould.)

HOW TO GROW GRASS.

3. It is not the simplest thing in the world to grow grass with complete success, though judging from the examples most commonly seen, it might be presumed that it is generally so considered. Without going very much into

the details of grass growing, I wish to mention a few essential considerations, most of which are too commonly neglected or overlooked.

First, underdraining, on a large portion of our lands, is essential in order to secure the best results in grass.

On all heavy soils, with retentive clay sub-soil, that hold the water that falls until it evaporates, and on such lands as are full of springs, the grass crop will be doubled, on an average, considering quality and quantity, by underdraining. It deepens, ærates, warms and enriches such soils in a wonderful degree, making them capable of withstanding the effects of cold, wet weather, and especially it enables them to go through the long, scorching drouths without material injury to the crop of grass. It is expensive, but when well done will last a life-time, and the increase in production will very soon pay the cost.

In the second place, it is essential that the ground be properly prepared for the reception of the grass seed. It should be smooth, in fine tilth, and free from weeds and foul growths of all kinds. We rarely find a pasture or meadow that is not more or less filled or infested with noxious weeds or worthless grasses. These occupy and take the strength of the land, continually encroaching upon the valuable grasses until the pastures, and especially meadows, become almost worthless from the abundance of "white weed" and other trash. He is not a successful grower of grass whose pastures and meadows are thus infested.

Plowing in midsummer, the summer fallowing as sometimes practiced, puts the land in good clean condition for seeding to grass in August or September. A crop of sowed corn may be grown to the height of a foot and a half and then turned under with the plow, if desirable, affording manure and clean land for seeding, Sowing grass seed upon oat stubble, as I have found it practiced in this immediate vicinity, I think must be an excellent plan. The oats, if sown in February or early in March, as they must be to succeed well in this latitude, and especially south of this, get an early start, and quite effectually choke out most of the weeds. Then, if the grass seed be sown on the stubble early in September, either with or without harrowing, it gets a good start before winter, and the oat stubble and the young oats that start from the seed scattered in harvesting, afford some winter protection to the young grass. Good success is sometimes obtained by seeding to grass in February or March, but is generally considered much more uncertain, and so also is the practice of sowing grass seed with grain.

These hints in regard to preparation for seeding, apply generally to meadows, and in most cases to pastures. Circumstances alter cases. There are hill lands that may be properly seeded to grass as soon as cleared, without plowing even, and kept constantly in grass. Weeds, sprouts, etc., may be killed out of such pastures by mowing or cutting out, or much better by pasturing with sheep. Our unbroken prairies may be seeded with grass, and thus converted directly into better pasture or meadow than they were before; and in a few years the tame grasses will almost entirely take the place of the wild.

One very important cause of lack of better success in growing grass is that farmers do not sow varieties enough. This is true in more than one sense. Different varieties should be chosen for different objects, for difference in season of ripening, and different soils. Again, a mixture of varieties should generally, if not always, be sown.

Some of the grasses flourish on dry sandy or rocky soils, but perish in wet soils; others grow vigorously in wet soils, but die in drier ones. Some will only flourish on alkaline soils; some require excess of potash, others excess of light. Some are adapted to the sunlight, others love the shade; some are valuable for hay, but not for pasture, and vice versa. One species abounds in that kind of nutriment which enlarges and strengthens muscles; another, ill adapted to nourish the muscular tissues, will lay on fat rapidly; another which is deficient in both these respects, is rich in those elements which support respiration and furnish the fuel for the production of animal heat. Certain varieties are highly valued for making a superior quality of butter. It seems very evident that in the judicious selection of different varieties of grass, to occupy different localities, and to subserve different purposes, a wide field is afforded for the application of physiological, botanical, geological, meteorological and chemical knowledge. It is the province of practical agriculture to find out the peculiar qualities of each variety, and to place each in the locality and under the circumstances most favorable for its most profitable development.

We should sow a mixture of varieties, for several reasons; one is that it is an object to produce as much good herbage from the land as possible, and at various seasons; another is the importance of occupying the ground as completely as possible with valuable grasses, so that noxious weeds and worthless grasses will have no chance to get a foothold. It is an established fact, and one easily demonstrated, that one or two varieties will not perfectly occupy any soil. This is the rule, to which there may be exceptions. Different soils vary in the number of plants of a certain variety that they are capable of maintaining; yet, on any soil, however thickly the seed of a variety may be sown, only a certain portion of the plants will live; the rest perish and leave vacant spaces of soil, which eventually become occupied by foul grass, weeds or moss, more or less to the detriment of the grass crop. Therefore, by neglecting to sow a sufficient number of varieties, we fail to obtain a full yield of grass, and what we do obtain is deteriorated by the mixture of weeds, the tendency of the latter being to increase and encroach upon the grass.

Mr. Flint says, "I hold this proposition to be indisputable, that any soil will yield a larger and more nutritious crop if sown with several kinds of nutritious grasses, than when sown with only one or two species. Indeed it is a fact, well established by careful experiment, that a mixture of only two or three species of grasses and clover will produce a less amount of hay than can be obtained by sowing a large number of species together. There may be some exceptions to this rule, as in the cases where the yeld of timothy and red-top, owing to the peculiar fitness of the soil for them, is as great as can stand on the ground where they grow."

Mr. Flint gives several lists of mixtures recommended for pastures and meadows, varying in number of varieties from nine to sixteen. In all natural and old pastures we find quite a number of varieties of grasses growing together in all cases. This is nature's plan for completely occupying the soil, and every farmer who observes carefully will be convinced that it is an essential point of success in grass-growing.

One more essential consideration in regard to success in growing grass, I will mention lastly, though not by any means of least importance, namely, the planting of trees, and the preservation of forests. Every pasture should have upon its borders, and upon the highest points, a sufficient number of trees for the comfort of stock, especially to protect them in the heat of the day from the scorching sun. Meadows may be bordered by trees, and a few scattering ones in the field will not be badly out of place. But these are minor considerations compared with the importance of growing and preserving trees for their ameliorating influence upon the climate. One of the most serious obstacles in the way of successful grass-growing is the long and scorching drouths to which our country seems to be more and more subject.

"The researches of modern science," says Professor Kedzie, of Michigan, "accurate and careful observation, as well as the history of the past, show that a country abounding in forest is more moist, has a more copious and equable rainfall, abounds more in springs and streams, and, in consequence of all these, is more exempt from great and sudden fluctuations in temperature, from late frosts in spring and early frosts in fall. Thus Egypt, from earliest periods of history, has been spoken of as a rainless region; but since Mahomet Ali has made his immense plantations of trees, showers have become frequent. The controlling influence of forests over rainfall is also shown by the fact that countries once supplied with forests, and having abundant rains and immunity from frost, their forests being destroyed, have been scourged by drouth and frost till the forests were restored, when they once more became fruitful; or, if the inhabitants would not restore their protecting forests, the stern hand of famine threatened to wipe out a race that would not reverence the order of nature. Thus the Cape De Verde islands, so named from their greenness, have been stripped of their forests by their improvident inhabitants, since which time they suffer terribly from periodical drouths; sometimes no rain falling for three years at a time, and 30,000 inhabitants, or one-third of the population, have perished. Thus famine cuts down the inhabitants as pitilessly as they cut down the protecting trees."

Abundant evidence can be found in our own country in proof of the favorable influence of forest upon the climate. There cannot be one present who has not vivid and painful recollections of long periods when the pastures were as heaps of dust, and when every living thing seemed in danger of famishing almost for want of a green thing to eat. It is safe to say, that in one hundred years from now, unless more attention is paid to tree planting and the preservation of forests, the farmers of this region will not be able to make a living from their lands.

SOME OF THE VARIETIES OF GRASS.

4. The importance of studying the varieties of grasses has already been stated. It is a subject of too great magnitude to admit of being thoroughly presented at this time. A few prominent features only, in regard to the varieties and their uses, will be presented.

The importance of using a mixture of varieties in seeding to grass has been stated. We should also seek to stock our pastures, and especially our meadows, with the most nutritive grasses. To aid us in this respect, we have the experiments of Mr. Way, the chemist of the Royal Society of England, who has given us an analysis of twenty-one varieties of grass, and has thus disclosed to us, as well as chemistry can do, their relative values for feeding to animals. These experiments constitute, probably, the most valuable contribution which chemistry has ever made to agriculture. From these experiments we learn with surprise that one hundred pounds of quaking grass will give 28½ pounds more of dry hay than one hundred pounds of vernal grass; that it will require 237 pounds of vernal grass to supply an animal with as much muscle-making matter as is afforded by one hundred pounds of Timothy. It will take 319 pounds of soft brome grass to lay as much fat on an animal as 100 pounds of timothy would do. One hundred pounds of timothy will support the respiratory process as long, and afford as much animal heat, as 260 pounds of vernal grass. Chemistry teaches us, what every observing farmer knows, that timothy is the most valuable grass that we have, especially for hay. It is much to be regretted that further experiments like those of Prof. Way have not been made, and also that the chemical results have not been thoroughly verified by actual experiments at the manger, conducted with care and precaution to guard against mistakes. Such investigations, regarding the nutritive value of the different species of grasses, would help to determine important questions relative to agricultural profits.

In the next place we should select varieties for our meadows with reference to their period of ripening. It is often, if not generally, important to have the meadows of a farm come successively to maturity, and with this end in view, we should sow such varieties together as flower at the same period. Hay is most nutritious and most palatable when cut at the period of flowering. I am aware that this is to some extent a disputed point. There are many farmers, especially in the West, who believe that timothy should not be cut until it is ripe. They say that it gives more weight of hay when left until it is ripe, which is doubtless true, but that its value is thereby lessened, there is scarcely room for doubt. Chemical analysis, and the practical trials of the best farmers in the oldest grass-growing regions, concur in showing that the period of flowering is the best time to cut grass for hay, having reference to its nutritive value. At this time it contains more starch, sugar and albumen, which can be assimilated by animals, than at any other period; after this, these substances are converted into woody fiber and other compounds, which cannot be favorably acted upon by the digestive organs, and are, therefore, wasted. If reference is had to the best authorities in this country or Europe, it will be found that they all agree in considering this an established principle. At the discussions held during the New England fair in September last, this subject came up, when very many of the farmers of New England, where grass is the leading crop, most emphatically urged the importance of cutting timothy at the flowering period in order to secure its maximum value. Considering this point established, it follows that great loss must be sustained by cutting together those grasses which flower at different periods. If cut when the earlier grasses are in the proper condition, the later ones are watery and innutritious. If cut when the later grasses are in flower, the earlier have passed into woody fiber and other insoluble compounds. We see an example of this want of fitness in the practice, common all over the country, of sowing timothy and red clover together, the clover being much the earliest.

If orchard grass and red clover are sown together, a much better crop for early mowing is obtained. Again, it follows, with farmers who have a large quantity of meadow, that if they are restricted to one or two varieties, great loss must be suffered for want of help sufficient to cut it all when in its best condition, the period of flowering; and every day that it stands after this diminishes the nutritive value. To prevent this waste, meadows may be so divided, and such varieties selected, as to have part come to maturity in June, another part in July, and the remainder in August.

In regard to grasses for pasture, the case is quite different. The period of flowering of the different varieties in the pasture should differ us widely as possible. It is important to have those varieties which will afford the very earliest growth of herbage in the spring, and then to have a constant succession coming to perfection in every month from spring to fall.

I will not weary you with descriptions of varieties of grass, but will name a few which may be considered as adapted to the various purposes alluded to. In order to obtain a succession in meadows, on the principle pointed out, the following varieties may be taken for a beginning:

For early mowing, and for light sandy lands.—Orchard grass, red clover, annual spear grass, meadow foxtail.

For later mowing, and for clayey and calcareous loams.—Timothy, red-top, crested dog's tail, tall fescue, hard fescue, Italian rye grass, and oat grass.

For latest mowing, and for clayey lands.—Wire grass (*Poa campressa*), and foul meadow (*Poa scrotina*).

These different mowings will occur in the months of June, July and August, later or earlier in the months, according to latitude.

For seeding lands for meadows or pastures, a few leading varieties may be mentioned as adapted to different soils.

For sandy soils.—Lucerne, though a legume, and not a true grass, is admirably adapted to sandy soils resting on porous subsoils; meadow foxtail, orchard grass, Italian rye grass, hard fescue, tall oat grass, meadow soft grass, and the red and white clovers.

For calcareous loams—especially adapted—Kentucky blue grass, timothy, and annual spear grass.

For tenacious clays.—Perennial rye grass, crested dog's tail, red-top, wire grass, and tall oat grass.

For permanent pastures, with a view to securing a succession in the time of blossoming, covering as much of the season as possible, Mr. Flint recommends the following mixture, giving the number of pounds of each for an acre:

Meadow foxtail	flowering in May and June,	2	pounds.
Orchard grass	" " "	6	"
Sweet-scented vernal	" in April and May,	1	"
Meadow fescue	" in May and June,	2	"
Red-top	" in June and July,	2	"
Kentucky blue grass	" in May and June,	4	"
Italian rye grass	" in June,	4	"
Perennial rye grass	" in June,	6	"
Timothy	" in June and July,	3	"
Rough stalked meadow	" " "	2	"
Perennial clover	" in June,	3	"
White clover	" from May to Sept.,	5	"
		40	pounds.

This gives us forty pounds of seed for an acre, and twelve varieties; and would give, according to Mr. Flint, over 54,000,000 seeds! "In an acre," he says, "there are 6,272,640 inches, so that the mixture would give about eight seeds to the square inch." This he considers a very large and liberal seeding, allowing a large margin for worthless seeds, for imperfect sowing, and for destruction of plants by insects and frost.

In conclusion I must say that I have sincerely regretted having had at my command so little time—merely odd hours snatched from other duties—in which to prepare a subject of such primary importance to our agriculture, and in regard to which there is so much need of awakening more interest among Western farmers. If, however, I have presented facts and thoughts sufficient to induce any farmer to study the subject who has heretofore neglected to do so, he will probably supply himself without delay with such a work as "Flint on Grasses," where he will find very much of what I have stated in this lecture, and a vast deal more, of the greatest importance for him to know. It has been wisely said, that he who makes two blades of grass grow where but one grew before, is a public benefactor. I have at least made an effort to accomplish something in that direction, and I hope that each of you will become public benefactors by contributing to double the amount of grass now produced.

DISCUSSION.

Mr. Freeman, of South Pass—I would like to ask the Dr. a question. Whether there are two species of red-top?

Dr. Morse—No, sir; I think not. We find that grasses vary greatly, according to the soil in which they grow. If upon thin soil, it does not grow more than one and a half feet high. If on rich soil, it grows large, and the general appearance is such as leads one to suppose that there are two varieties of red-top, when there is but one.

Mr. Dunlap—There were one or two points in the lecture that struck me with force, and some statements made that I would not like to have go out without explanation, and which seem to be indorsed by the speaker. I understand him to recommend sowing forty pounds of mixed grass seed to the acre. Now, if we look at it in the light of dollars and cents, we find that the expense is great. This gives no encouragement for commencing grass culture. Now I think a much less quantity of seed is sufficient. I find that four quarts (of timothy?) is better than three pecks, if properly sown. We can dispense with three-fourths of the quantity named. It is the practice of some to sow in the spring, with other grain, especially with oats.

The gentleman tells us that timothy is the most valuable of the meadow grasses, yet he tells us in conclusion that June grass, mixed with timothy, is equal to timothy and oats. I suppose the gentleman can explain this. Let us understand this matter. We know this June grass under the name of Kentucky blue grass. It is not especially adapted to calcareous soils. It is known in New England as June grass. It is known in Ohio as June grass (*Poa compressa*). The question as to whether it is profitable grass in the meadow, is not doubtful. It is indiginous to this country, and makes good pasturage. We can make just as good butter and milk as Orange county, New York.

Dr. Morse—In reference to the points stated by the gentleman who has just taken his seat, I would say farmers generally sow too little grass seed, and I would prefer to recommend too much rather than too little. In my practice I sow more than my neighbors do. I wish to have the ground completely covered. Thick sowing does no harm. In regard to the cost, I believe every farmer raises his own grass seed, or ought to do so. Many varieties he cannot buy. Besides, if he sows his own seed he knows what he is getting. If he buys his seed, he does not know what he is getting; he not unfrequently gets weeds. If the farmer will save his seed he will avoid the cost and be sure of pure seed. In the experiments of Prof. Wade, timothy is the best for hay, and blue grass the best for pasture. He read extracts from authorities on this subject, indicating the difference and comparative value of Kentucky blue grass and June grass, the one having a hollow stem and the other being solid. Working horses can not be kept on this ? grass.

Mr. Dunlap—Is there not here a reference to green feed alone?

Dr. Morse—I think there is.

Mr. Dunlap—That will explain it.

Mr. Periam—I think theories and facts are both valuable, but facts are better than theories. In regard to the difference in these grasses—that which is known in the East as June grass and Kentucky blue grass. That there is a difference in these two grasses I receive as a fact. In New Jersey, where I was raised, this so-called wire grass, or June grass, is worth double that of timothy, especially for what are called fancy stock, and raising of horses. In reference to thick and thin sowing, I would say half-bushel to the acre was enough.

Mr. Scott—I have some little experience in this matter. I was born and raised in the state of Kentucky, and came to this State some years ago. I noticed a difference in these grasses, and I frequently asked persons if there was a difference. There was evidently a marked difference in the appearance of them. Afterward I sent to Kentucky and bought seed and sowed it, and also sowed the seed saved from the farm, and there was a very marked difference in the quality of the two grasses. As to the quality of the Kentucky blue grass, I think it is, for grazing purposes, unsurpassed.

Mr. Robinson—For hay, I find nothing better than timothy, clover, and, on low land, red-top. As to the quantity of seed, I should say one bushel to the acre, if the ground is properly prepared. This will give a seed to every square inch, which is enough. Also, in reference to the different kinds of grasses, I think there are three varieties similar to the blue grass—one of larger growth, another of smaller growth, and a third which stays green all winter. It does not exceed six inches in height. We find a considerable of it along the Illinois river. It is worthless as hay, but good for pasture.

Mr. Freeman—I got hold of Mr. Talpa's little book, "Chronicles of a Clay Farm," about ten years ago. I took particular notice of what he said about the different kinds of grass, and the soils best suited to each. I then made a selection of six or seven varieties, those which I thought best adapted to my soil, mixed them together, and sowed the seed with the best results. I had a magnificent growth. In this mixture I had Kentucky blue grass, orchard grass, red-top, red clover (I did not put in any timothy), sweet scented vernal grass, and some other varieties.

In regard to the time of sowing, I think the spring is best with us, owing to the heavy action of the frost. Our soil is not as moist as that of Central Illinois. We prefer to prepare the soil in the fall and sow in the spring, say in February or in March. Last summer, along the banks of the Big Muddy, in Williamson and Jackson counties, I saw fine fields of red top—forty-acre fields of red-top—presenting a fine growth. In a few instances timothy grass was seen, but chiefly red-top. I found no one to talk about it and give me information. The subsoil in particular is much the same as Cobden Ridge, but the situation is especially favorable to the growth of this grass. The soil there is, I think, always moist. It is certain that it was, in the early part of the season, excessively wet.

Mr. DUNLAP—In relation to this quantity of seed, I would like to have it understood as to what is the proper quantity. Take it for granted that a man can raise his own grass seed—and he *can't* do it—I still think it would be better to use one-fourth the seed, and sell the balance. The difficulty is the sowing is not properly done. The seed is scattered upon a half-prepared soil and covered too deeply. I protest against the very common mode of sowing grass seed. It is not good farming. Grass seed, buriedone inch in depth will never germinate, but if properly done every seed will germinate. The land should be well plowed and then rolled, the seed sown and again rolled. This will cover the seed to a sufficient depth, and I will guarantee that one-fourth the quantity of seed will make a better stand than the whole sown in the ordinary way. This method also commends itself in that it is less expensive.

Another word in regard to the Kentucky blue grass and its identity with our June grass. I have the statements of good judges that, when grown side by side, they were to all appearance identical. The only difference I can see is, that we find in the one ergot or smut, and do not find it in the other. I have never seen ergot in the wire grass (*Poa compressa*). There are doubtless three kinds, or more, of grass upon this park. There is more or less of red-top, and several other grasses I do not know, and among them are some of the wild grasses. I am satisfied that the best seed comes from Kentucky, and this will account for the seeming difference as to variety. The subject needs further investigation and trial, which we expect will here be given to it. This institution has a thousand acres of broad prairie, upon which we expect to test the value, not only of grasses, but of many other things.

Dr. WARDER—This question with regard to these grasses goes to show how intelligent farmers may aid us, by their observations, in arriving at truth. Yet we may derive much aid from scientific research in a direct line. I am happy to learn that there is a memorial, asking the Legislature of this State to provide for a Botanical survey of the State. This question would be answered in a moment by one who had made the survey. One observation could not furnish the data upon which to base our conclusions.

The Kentucky blue grass is undoubtedly the same botanical plant (*Poa compressa*) as the June grass of New York and the spear grass of Pennsylvania. For pasture it is very highly valued; so much so that meadows where this grass abounds are often, after three or four years, turned into pasture. It is very difficult to cut this wire grass. I once asked a farmer if he knew this grass. He shook his head suggestively. He did not *want* to know it. "We call it," he said, "wire grass; when you strike your scythe into it you will almost fall over." But this grass is extensively used in Ohio as pasture, for which it is very valuable. It is a common saying in Pennsylvania that a pound of blue grass will make an ounce of beef. I hope something will be done in the way of obtaining a Botanical survey.

Mr. PERIAM—I wish to call attention to one more point. I have always held that the grass crop was an important and profitable one upon the farm. One-half the farm should be in grass—in pasture and meadow—and the grain raised should be fed upon the farm, for the reason that the manure may be put back upon ground. This is a fundamental principle in English husbandry. We know that the grasses and the turnip crop have done everything for the English soil. They have increased the productiveness of their farms one-half within the present century. I wish to call the attention of our farmers to this subject. We are depriving our soil of its fertility year after year, and the probability is, unless we change our practice, that within the next century it will become so barren that it will be hardly able to support the increased population which will follow from emigration to this country.

CORN.

ADDRESS OF M. L. DUNLAP.

Ladies and gentlemen: The few remarks that I propose to make on the subject of corn will be mainly devoted to its culture, leaving the analysis of soils, manures and the crop itself to other hands.

It is my purpose to deal with facts rather than theories; not so much what it is possible to accomplish as that which will make the best returns for our labor.

It is estimated that the wheat crop of 1868 amounted to 225,000,000 bushels, while that of corn figures up the enormous quantity of 900,000,000 bushels, or nearly four times greater. In 1866 the total crop in the United States of this grain was reported at 880,000,000 bushels, of which this State produced 155,844,350 bushels, nearly one-sixth of the entire crop of the whole country, being an average of 31.6 bushels to the acre, on 4,931,783 acres, and valued at $67,013,070.

We have no official figures for the crops of 1867 and 1868, but that of 1867 must have been considerably in excess of that of 1866. The entire value of this staple of the farm for 1866, including also wheat, rye, oats, barley, buckwheat, potatoes, tobacco and hay, in the State of Illinois, were estimated at $160,148,704; deduct the corn, $67,013,070, and we have for the other staples named, $93,135,634.

These figures show the great importance of this crop to the people of the State, and must place it at the head of our agricultural resource, not only for domestic use, but for export.

WHAT WE DO WITH THE CROP.

Chicago is called the most extensive grain market in the world, receiving a large share of the surplus of our crops from at least the north half of the State; yet for the year 1866 the shipment of corn from that point was only 25,288,526 bushels, a part of which came from Iowa and Wisconsin. We also ship East by various railroads, and South by the Mississippi river. On the whole, we must ship less than one-third of the crop, the remainder being used for domestic purposes, the manufacture of highwines, and the feeding of pork and beef. If we estimate that one-third of the crop is manufactured into highwines, beef and pork, this gives us a double profit, adding to the value of our pasturage and manufactures.

To this source we must attribute the greatest share of the prosperity of the State, in supplying the sinews of commerce, that have enabled us to stand the crash of commercial disasters, among which may be classed those of 1857, 1861 and 1862, memorable years to the business of the country, when the currency of the State melted away like dew before the sun; but, thanks to the potent power of the corn crop, the stream of business was again supplied, and the State moved forward with a steady progress.

THE AVERAGE YIELD.

The average yield for the State is put down at 31.6 bushels for the year 1866; Indiana, 36.5; Ohio, 38; Michigan, 32; Kansas, 34; Nebraska, 29; Maine, 33; Massachusetts, 34; New Jersey, 43.3. As we go South we run down the scale, South Carolina being 5.9; Georgia, 6.2; Alabama, 9, and Louisiana 17 bushels per acre.

If we take these statistics for our guide we must consider New Jersey the best, and South Carolina the very worst state for this crop. The general average being 25 bushels to the acre, this State is but a little above the average, notwithstanding its rich soil and genial climate; the fault being in our superficial culture. While we should stand first on the list, we are in fact the twelfth, five out of six of the New England states leading us in the yield per acre.

This condition of things is not very gratifying to our Western pride, but as it is a condition of things within our power to change, we should address ourselves to the task. When we boast of our millions of bushels of this staple we ought to keep out of sight the millions of acres that we run over to obtain the quantity. But I fear these ugly figures will continue to be paraded before us until we change the result by improved modes of culture.

THE POINTS INVOLVED.

At present we are under no particular necessity to produce the greatest yield that the soil is capable of, without regard to cost; for population makes no such demand upon us, nor will such a course prove the most profitable. We must therefore seek for the best returns for our labor and our capital. When land is cheap and labor dear, we may use more land and less labor to produce a given quantity of grain, and thus receive as large a percentage on the capital invested; but as land grows dear this plan of management must be changed to conform to the changed condition of things.

If the New England states produce more corn to the acre, it does not follow that they produce it at a less cost; on the other hand, we know that we can deliver corn at any point on the seaboard at a cheaper rate than they can, a fact that is daily demonstrated.

The profit of any crop is the sum that it commands in market over and above its cost. Now what most interests us is to widen this margin, and there is but one way in which we can do it. We cannot raise the price in the market, for that is a matter regulated by many other considerations besides the quantity of the particular crop on sale. As we cannot raise the price, and thus widen the margin between the cost of production and that at which it is sold, we must see if it is not possible to reduce the cost of producing the crop, either by lessening the cost per acre, or to increase the yield, without adding to the cost, by a better system of management and of culture.

In the first place, that part of the crop that we consume for the ordinary use of the farm, such as the feeding of teams, pork and beef for the family, is not affected by the market price; but the surplus, that which must find a market, to be exchanged for other needs, is the subject of further consideration. Shall it be sold in bulk or fed to animals and sold in the form of beef and pork? And yet, in this case, if so fed, how shall it be done? In the ear, in the shock, or sent to the mill and ground, and then fed raw or cooked? These are all questions pertinent to the subject, and must have a place in considering the margin of profit. For this part of the subject we have not the time at command, and will leave it until we come to the subject of the feeding of cattle and hogs for beef and pork, and the manufacture of high-wines.

SOIL FOR CORN.

This grain may be considered the staple crop in all parts of the State, and is grown on every farm from Cairo to the Wisconsin line, and in nearly every case with a view to a surplus for market, either in its raw state or its products in beef, pork, mutton, butter or poultry. We may then say that all the various soils of the State are suited to its profitable production. This is true as a general thing and to a certain extent, but it would not be good advice to recommend corn as the leading crop on every farm and under all conditions of things; yet every farmer will find it profitable to a certain extent in a rotation of crops, in all parts of the State, and in every variety of soils; whether in the driftless region about Galena, the loess, the prairie drift, the modified drift, the arenacious flats or the river deposits, all are more or less valuable for this great staple of the West.

SCIENCE VS, ART.

Until within a few years the culture of the soil, and especially the culture of this crop, was an art only to be acquired by a long toilsome apprenticeship, and had this university been established before the days of Liebig it would have been simply a manual labor school, or a farm for the practical teaching of farm apprentices, but since the application of chemistry and vegetable physiology to rural industry, the culture of the soil is taught in the schools on the same general plan as that of any other science. This school having been established for the teaching of those branches of learning relating to agriculture and the mechanic arts, it is your business to teach the science relating to these departments, rather than the arts themselves. I could not be expected to take this audience into the field, or march them over the State, to point out the various soils, and to have them demonstrate their relative value by direct application, but we may teach them the science upon which rests their success, when they return to their several homes and apply these theories to the art of culture.

A NATURAL CORN SOIL.

Climate has much to do with this crop, while soil is also to be largely taken into the account. I have shown that the stony and comparatively sterile soils and frosty climate of New England produce an average cereal product above that of our rich prairies and genial climate, thus proving that there are certain conditions, subject to our control, that have much to do with results.

A natural corn soil must be rich, well drained, and capable of withstanding drouth. Such a soil is the

LOESS OF OUR RIVER BLUFFS.

We always find "Illinois River" corn to command the highest price in the Chicago market. It matters not how indifferent the crop may be in other parts of the State this corn is always graded No. 1, or "extra," always produces a good crop, and is always reliable. When the general crop is poor the millers inquire for this corn, and if it is not on the market a man is started down the river, in the neighborhood of Lacon, Beardstown or Havana, for a supply.

The reason of this superiority is mainly in the mechanical condition of the soil. It may not be any richer in the elements of plant growth, but it is thoroughly comminuted and drained, and hence is in a condition, at all times, to be plowed or cultivated. The spring rains do not retard tne planting, nor do they prevent culture for the killing of weeds. In this respect it is like sandy soils in a high state of fertility, with greater power of resisting drought. This soil covers no large area, but is found in patches along the rivers, sometimes mixed with the drift, and sometimes underlying it from one to ten feet, its presence always affecting the soil with which it comes in contact.

For the culture of the vine and orchard products it is held in high esteem, while for corn, from the first settlement of the State, it has continued to maintain the superiority over all other soils. With such a soil, all we have to do is to plant early and keep down the weeds, and the crop will be assured.

The depth of plowing on this soil is a matter of little moment, for the roots easily penetrate to any desired depth, as the soil is always friable and readily penetrated by the rains, and never holds stagnant water. It can, therefore, never pack, even if plowed immediately after a heavy rain, as in the case of our rich loams and heavy clays.

We may take this soil as the standard for the corn crop, by which to measure the relative value of other soils, and by which to change them by artificial means so as to approximate their value.

To add sand and organic material to the clay soil to make it correspond to the loess, is practically out of the question; but we can underdrain this soil and add fertilizers, so as to put it in a condition that it may produce good average crops, perhaps equal in value, though at an added expense.

If we had sufficient area of loess on which to grow all the corn required, it would be the best possible arrangement, and beyond competition; but such not being the case, we must make the best of such soils as are at hand.

This leads us to the consideration of

TILE DRAINING.

We all know that the gasses that are washed out of the atmosphere by the falling rain have a stronger affinity for the soil than the water when the water can pass through the soil. This absorption is effected naturally in the loess, but not so in the clays or clayey soils. The water cannot pass off through them without artificial assistance, and this is accomplished by the aid of tile, laid deeply in the subsoil and offering a free outlet to the water, the soil holding the gasses on account of its greater affinity to them. This is one of the principal reasons for the uniform fertility of loess formations, as they always retain the ammonia and other gasses of the rainwater. It will be seen that tile draining has a similar mechanical effect on the soil, hence the great value of tile draining. But this is not all the value to be obtained, for a soil thus treated, like the loess, is nearly always ready for the plow, and thus in the condition to be planted early in the season—a point of great importance, as I propose to show in its proper place.

The question of drainage involves another one—of capital—a condition that most farmers might not find it convenient to comply with; and this brings us to the inquiry in regard to using more capital and

LESS LAND,

or rather to turn part of the land into active working capital, with the intention of doubling the crop per acre. All our lands may not be so largely benefitted by tile draining, but a large share of our clay loams, or heavy clay soils, as well as some of the sandy clays of the carboniferous limestones. The sand ridge that crosses the Illinois Central Railroad at Onarga is an example of this latter variety of soil, containing a large or greater percentage of sand than the loess, yet it holds water like a sponge, and can only be made available by either tile or surface draining.

Wherever the water can pass through the soil, the air can and will follow, and, as it supplies a large share of the elements of plant growth, is of the utmost importance to the crop.

In the soil, the tendency of water is in two directions—the one downward, by natural or artificial drainage, for the purpose of depositing ammonia and other gasses, and the other upward, by capillary attraction, to supply moisture for the elements of fertility. To enable water to perform this double duty, the soil must be finely comminuted, and not liable to pack or become tenacious. The passage of water and air downward through the soil has the effect to put it in condition for the ready penetration of the roots through its strata, and for the easy access of water from below by capillary attraction.

The old theory of composts has been rendered obsolete by this new science of draining, as it has been proved that when the water can pass through the soil the fertilizing elements are retained, unless the soil is very sandy or has not sufficient clay to absorb these gasses, and this has led to the new mode of applying manure by top-dressing.

On many of our soils

SURFACE DRAINING

by back-furrowing into seed beds, has proved useful in a general way and exceedingly valuable to this crop, not so much on account of aiding the fertility of the soil as to allow of early planting and prompt culture after a heavy rain. These seed beds may be two to four rods in width, and ought to be laid out in the direction of the natural drainage, and in case of crossing a depression a cross drain should be made to lead off the water. Repeated plowings will raise these beds to any desired height, and thus keep the surface free of water and allow of easy and prompt culture. In a wet season this is of the first importance, for corn will make little or no growth while water is standing on the surface, while the weeds are not affected by the same cause and rob the crop of those elements so essential to its growth. When we must destroy weeds between showers or rainy days, the surface must be in a condition to dry quickly, or the next shower will be in the way of their destruction, and the crop will suffer by their continued growth. There is no further extra cost in farming these seed beds than the slight trouble of laying them off of a uniform width. Should the land be tile drained, the dead furrows already made will facilitate the operation, and, by reversing the plowing, the surface can easily be made to assume its original level.

We shall next consider

THE TIME OF PLANTING.

In Central Illinois, say on the line of 40 degrees of latitude, planting ranges over a period of sixty days, as the extremes, or from April 20th to June 20th. Plowing for the crop often precedes this by ten or twenty days. In all tenacious clays it is not desirable to plow when the ground is very wet, as it packs the soil, and thus, for the season, locks up its fertility.

In this early plowing it often occurs that the heavy spring rains so pack the soil that the surface will need a stirring with a cultivator to render planting possible, and to destroy the first crop of weeds.

As a general rule, our farmers prefer to plant from the first to the middle of May, and only from necessity plant outside of this time. Last spring a small amount was planted in April, all of which had to be replanted on account of rainy weather and the want of tile or surface draining. These heavy rainfalls occurred over the entire State, and active planting did not take place until the 18th of May, and continued until June 20th. That part of the crop planted as late as May 25th matured in about 125 days. Some of it was injured by the frost of September 17th and 18th. All of the later planted was more or less injured by frost. We may set down 120 to 125 days as the average period necessary to mature a crop of Dent corn, from the time of planting to its immunity from frost.

A warm arenacious soil, a free use of manure, and clean culture, will, of course, modify these figures to some extent; nor must we lose sight of the condition of drainage in this connection, for in a cold wet season it warms the soil, and thus hastens growth.

PLOWING AND PLANTING.

If we could follow up our daily plowing with the planter we should have less cause to complain of the want of a good stand; but this is not always obtainable, sometimes for the want of a corn-planter and sometimes for the object of check-row planting. When it is necessary to plow a certain field, or part of it, before it is planted, it must then be marked one way and planted at right angles to this marking, by depositing the seed at the point where the lines cross each other. In this mode of planting the field can be worked both ways with the team, which is very desirable.

Several efforts have been made to construct a planter that would plant a land, or one of the seed-beds before described, as plowed, and at the same time check-row, but thus far the success has only been partial. So desirable is it to plant immediately after plowing, that many farmers plant their rows in one direction, sometimes in drills, but mostly in hills with the common planter. In this way the young plants have the start of the weeds, and will be ready to work at the close of planting the field, if it is of a size to require some days to complete the work. In this way no time is lost, the working follows the last planting, and the weeds are easily kept in check.

No one thinks of planting by hand, and the entire crop of the State may be said to be planted with automatic planters drawn by horse power, and planting ten to fifteen acres a day. The "Illinois Corn Planter," made at Galesburg, like the Moline Plow and Fairbank's Scales, is the standard of excellence by which all corn planters, plows and scales, in their several departments, are measured.

THE DEPTH OF PLOWING.

This depends much on the condition of soil in regard to moisture, porosity, color, drainage and mechanical texture. A heavy clay, like our timber ridges and dry prairie swells, should be plowed deep, say eight to ten inches. Without deep plowing on this class of soils the crop will be uncertain, while on clay loams shallow plowing, followed with thorough culture, will be found quite another thing. On sandy soils the depth of plowing is of even less importance, and the same rule holds good on all tile and surface drained lands, for the reasons before stated.

ROLLING.

There is nothing that has more distinctly marked the progress of corn culture than the general introduction of the roller. It serves to pulverize the soil and to render it more finely comminuted, adapting it for a supply of moisture by capillary attraction. It has also great advantages in insuring a good stand. If we plant deep when the soil is cold or wet, the seed is lost; if shallow, without rolling, and the weather becomes dry, with high wind, the seed will be liable to fail of germinating; but if planted shallow in a finely pulverized soil, closely packed on the seed, the warmth of the sun, however slight, brings it forward, and the drying winds will have little influence in retarding its germination, and we thus insure a good stand under almost all conditions of the weather. In case the soil is a little wet, so that it packs, however slightly, it is of great importance to have it pulverized and made friable. After the winter's frost ceases, the only remedy left is to accomplish this by mechanical means, and the roller offers the best facilities for this purpose.

CULTURE.

My time will not permit of going into all the minutia of culture, and I will therefore proceed to give in detail a system that is simple and well adapted to cheap lands and dear labor, not one that will produce the greatest possible yield, but one that will make good returns for the capital and labor employed.

I will take it for granted that the soil is well drained, either naturally or by raised seed-beds, as previously described. The plowing and planting to go hand in hand; the roller to precede the planter; two or three days after planting to be harrowed and again rolled. The object of this operation is twofold—to comminute the soil and to pack the surface closely on the seed, so as to hold the moisture necessary to its germination. It is also desirable as enabling us to cultivate at an earlier stage of its growth.

We may then follow up the culture weekly, or as often as desirable, until the period of laying by the crop.

WILD UNBROKEN PRAIRIE

that has been pastured for some years, when broken up to the depth of six to eight inches at the proper time for planting, is found to be among the most valuable and certain of a crop, giving a better yield than the old lands. This suggests the propriety of a rotation of crops with the meadow and pasture.

We might give some figures of the cost of cultivating forty acres in the mode we suggested:

To plowing forty acres eight inches deep, one and a half acres per day, at three dollars per day	$80 00
Rolling, three days	9 00
Planting, three days, including use of the planter	12 00
Harrowing, four days	12 00
Rolling, three days	9 00
Working with two-horse cultivator, four times, twenty days	60 00
Husking and cribbing 2,400 bushels corn at seven cents	168 00
Five bushels seed	5 00
Total cost	$355 00
Cost per acre	8 87
Cost per bushel	10⅝

If we allow one-third for the rent of the land, as is the custom, we have the corn delivered in the crib at 22 18-100 cents per bushel to the tenant, while the owner of the land has twenty bushels to the acre for the use of his land, which, at fifty cents a bushel, gives him ten dollars an acre as rent. I do not suppose that any person conversant with corn culture in this State, will consider this estimate above the average yield under such a system of culture.

MANURES AND HOEING.

As a general thing manures are not applied to the corn crop in this State, but in every trial it has been found profitable.

No one thinks of going into our large fields with a hoe, but the price of land may advance so as to make this an object, with a view to increase the yield per acre.

I have but lightly sketched a few of the more prominent features regarding this great staple that has given to the State a large share of her material prosperity, that has placed her in the front rank of the states of the Union, and the central commercial power in the Northwest, and that will continue her in her onward progress.

DISCUSSION.

Mr. FREEMAN—One year ago last fall I had occasion to stop and feed my horse, and I noticed that the man had red corn in his crib. On inquiry, I found that he raised red corn exclusively. He had grown this variety for many years. His reason for it was, this corn yielded more per acre—100 to 110 bushels, by weight. It was admitted that he was ahead in corn growing of his neighbors, and that he was ahead 30 years ago. My father raised 100 bushels to the acre, but he did it by putting on bone dust.

But what I wish to speak of more particularly is of the varieties of corn in selecting for seed. I saw in some paper the statement of the fact that a chemical analysis of the common white corn and the Tuscarora showed that the white corn had double the amount of phosphates that was contained in the other. Now this being the case, it is important to observe the fact (if it is a fact) in making our selection, and to take that which will exhaust the soil least, providing we get equal weight in corn. I have an impression that an analysis of corn of different colors might indicate that we should get this man's red corn. The color of corn, if it is sound, does not seem to affect the price of it very much. Last year, having occasion to buy seed corn, I went to my neighbors to get it, and found that they had colored corn. I got some of it and planted it, and it was very curious to note that the horses and mules would take to it more readily than to the white corn. (Here various samples of corn were shown by the speaker.) The corn generally grown in this region is, I believe, of the Dent variety.

The gentleman says one way to increase the crop is by improved culture; I think another way is by studying the varieties and learning what variety will produce the greatest weight with a given amount of labor.

Dr. MORSE—My friend Mr. Dunlap took me to task for some statements that I made, for which I am very much obliged to him. I wish now to pay him off in his own corn. [Laughter.] He says that the corn in Southern Illinois is wanting in nutrition, as compared with corn grown further north, because it lacks a full proportion of starch. Now I say all corn grown south has more starch than corn grown in the north, and for that reason is lacking in nutritive qualities. Because starch makes a man's collar stiff it does not follow that it stiffens his back bone. [Laughter.] In regard to the nutritive value of different varieties of corn, we think the New Jersey corn the best. This corn should not be fed whole but ground.

Mr. DUNLAP—I am very happy to give the Doctor an opportunity to return the compliment, and I only regret that he did not take advantage of it. It is a fact that when we come to look upon the corn of Central Illinois we find a corn that will make perfect whisky, and is food for everybody—the like is not grown in the south. Doctor, anything more?

Dr. MORSE—I believe you have not told us whether it is profitable to grow corn for fuel.

Mr. DUNLAP—That shows the ignorance of the people of the East, who still think that we out here breakfast on young Indians cooked! Why, we have seven feet of coal; we don't need to grow corn for fuel; we have something better.

One other point. No food is more nutritious than corn, for the reason it contains the phosphates in large proportion. It is solid food, and can be used three times each day. I regret that it has not been introduced universally as an article of food for man.

Mr. ROBINSON—Ordinarily the white corn is worth ten cents per bushel more than yellow corn. Still-houses make no difference in the price. The glutin is equal in the two varieties, but the oil and the starch is different. I think that stock do better on yellow corn.

That idea of burning corn is not so ridiculous after all. I have seen corn used for fuel. When corn is only eight and ten cents per bushel it does not pay to take it to market, and would not pay for digging up the coal. And about eating young "Injuns." We do eat Indians, but it is in the form of Indian corn. [Laughter.]

Prof. STEWART—It seems to me that gentlemen labor under a slight mistake in reference to the origin of whisky. It comes from the starch of corn. The starch is converted into sugar, and the sugar into alcohol. That corn which contains the most starch is the best for the distiller. Hence white corn, having more starch, is the most valuable for his purpose.

Mr. ROBINSON—Distillers make no difference in the price they pay. The starch manufacturers will give eight cents more for the white than for the yellow.

Mr. DUNLAP—This is because of its whiteness.

Mr. ROBINSON—They make no difference in the price. There is Missouri corn, with ears eight feet from the ground, but the Illinois River corn brings the highest price in the Chicago market. I think there is no reason for it, except that it goes by canal, and gets into market in better order.

Prof. STEWART—What varieties of sweet corn, for table use, do you recommend?

Mr. DUNLAP—There is one variety called early sweet corn. This is the best for the first planting. Then comes three or four other varieties; among them, Stowel's Evergreen, which has long ears, and is, perhaps, the best.

Prof. STEWART—I have not had success, as a general thing, in raising sweet corn and having it early. I have raised King Phillip corn and had it for use by the first of July. It may be bitten off by the frost to the top of the ground a dozen times, and it will still come, and we will have it by the first of July. We plant it in March, say about the 20th or 25th, planting about half an inch deep. I remember on one occasion planting corn in my garden—only five rows. This brought me $16. A few days later corn was not worth anything, comparatively. I have been in the habit of raising it for my pigs. I sent East for ten bushels of it, planted in July, which hardened up before frost.

Mr. DUNLAP—The Tuscarora corn is grown in the place of sweet corn.

Mr. PERIAM—My practice has been to plant very early. I should prefer to plant King Phillip corn in March rather than the first week in April; for we know that corn will sometimes grow planted in the fall, when planted in April it will not grow. The

Burlington corn ripens in 85 days. It is the earliest corn I know anything about. I would advise the planting only of the extra early kinds, and plant these *very early* in the season, about the time of sowing oats.

Dr. MORSE—I recently traveled East, and found the people growing corn for the purpose of canning. Now it seemed to me that this was a good thing for western farmers to go into. I said to one man, "I should think western men would go into this," but he replied, "they can't do it."

I remember, also, visiting a cheese manufactory. "Well," said the gentleman showing me around, "one thing you can't do out West, you can't compete with us in making cheese." I replied, "we can beat you all to pieces." "You have no springs," he retorted. "There is a man," I said, "who has invented a milk-cooler, and we don't need your springs." Eastern men try to convince us that we can't do what they can.

Prof. STEWART—I never saw any corn that was canned fit to eat.

Mr. FREEMAN—It is a very simple operation. I will give an illustration. I put up a dozen cans one season. I was assisting my wife in putting up the corn. We were going out that day, and were in a hurry to complete the work, and did not give the corn time to boil. It was soldered up cold and set away. A small hole was punctured in each can, and they were boiled the next morning, and every can of them kept perfectly, and all who ate of the corn said it was fresh and good as when cut from the cob.

A VOICE—Is there any danger of the steam bursting the can?

Mr. FREEMAN—No, sir; not at all.

A VOICE—How long do you boil it?

Dr. HULL—Four hours is the time.

Mr. FREEMAN—From observations made in the southern part of the State, we gather the following interesting facts: In the elevated regions about Cobden we must plant early, but 30 miles south of there, on a fine bed of loess, they plant corn on the first of July and make fine crops. They are there about sixty feet above water-marks. Cobden is 500 or 600 feet above.

Mr. DUNLAP suggested that it would perhaps be easier and safer to grow corn and *dry* it, instead of canning, a process not always successful in all hands.

DR. WARDER ON THE PLANT.

What is a plant? The question appears to be a very simple one, and one which almost every one feels himself capable of answering. And yet learned men are puzzled to answer it.

A plant is certainly different from an animal. It is different from a stone. We might perhaps be tempted to rank it between an animal and a stone. But we observe that it has an organized being. Linneus gives this definition: Animals live, grow and feed; plants live and grow, but do not feed. But stones neither live, grow nor feed. Stones, we say, do not grow. They increase in size by accession, or accretion. By additions of rocks on rocks, they increase in size.

Now this definition, considered satisfactory, is not so satisfactory, after all, when we come to examine the lower orders of animal life, and the highest orders of plant life. We have animals that do not move, the oyster for example. We have plants that, while we cannot say they see or feel, yet they seem to be exceedingly sensitive. We have a plant called the "sensitive plant," which is an example and good ilustration of what I say. If you approach it it seems to be aware of your presence, and its words are "touch me not."

In the study of the general attributes of plants, we are scarcely able to separate them from animals by any absolute character. Animals are, for the most part, incapable of multiplying by mechanical or spontaneous subdivision of their trunks, and are supported by nutritious matter carried into their system by an internal bag or stomach. Plants are, for the most part, a congeries of individuals, multiplying by an artificial division of their trunks or axes, and supported by nutritious matter conveyed into their systems by the absorption of their outer surface, chiefly by their roots. Generally speaking, plants are fixed to some substance, from which they grow, are destitute of locomotion, are able to digest their food by the action of light upon their skin, and form starch at some period of their lives.

Animals, on the contrary, seem never to form starch. In the simplest animals and in the simplest plants are vesicles, or vesicular threads, the most complex of which may be regarded as indefinite multiples of such vesicles, arranged in definite forms. These are composed of tissues, out of which elementary organs are constructed. Tissue, when first formed, consists of a substance called cellulose: carbon 24, hydrogen 20, and oxygen 10. That is in its simple form, but its chemical nature is rapidly altered by other matters, and especially by an increase of the relative proportion of carbon.

There is another remarkable property of tissue. It is a hygrometrical substance, possessing adhesiveness, elasticity, extensibility, irritability and vitality.

Its adhesiveness enables the elementary organs to grow and adhere to one another when in contact. Its elasticity permits the tissue to bend and recover its position—to stretch and contract itself. The former property is essential to plants, in consequence of their exposure to the disturbances of the atmosphere, from which their want of locomotion prevents their escape. The latter is demanded by the emptying and filling processes, which are incessantly in action in the elementary organs while growing. Its extensibility enables it to enlarge as new matter is added to it, and to take in the fluids and gases received from without. Its irritability renders it susceptible of the influences of light, heat and other external forces. Its hygrometrical quality causes it to absorb water greedily when presented to it, a quality or condition that is essential to vegetable life. The next property I will name is that of vitality. This keeps all the other qualities in play, enables plants to digest and assimilate their food, and their various organs to perform their manifold functions.

Now there is another property to be named. The various forms are held together by an organic substance called *mucus*, out of which the tissue is generated. This is called intercellular substance, or *cambrum*, when exuded on the parts of an already organized plant.

Tissue appears in various forms. In the form of cellular tissue—the woody fibers, the vascular form; the pitted and the laticiferous forms, variously modified—constituting the elementary organs. We now come to consider these elementary organs, and first, cellular tissue. We have endeavored to give a representation upon the blackboard of cellular tissue. This is the only elementary organ found in plants. It is composed of vesicles. Each vesicle is a distinct individual, cohering to its neighbor. When separated they are round or oblong. When compressed slightly they assume another shape—hexagonal. When stretched they are prismatic, cylindrical, fusiform. We have here on the board what was intended to represent cylindrical cells. The whole may be considered as a cylinder. There is a representation also on the blackboard of what we call pitted tissue.

Woody tissue is made up of long cells, tapering to the ends, closely compacting the plant together. The growth of cells consists in the deposit of matter in these thin tissue formations. That they are cells is seen when immensely magnified by the microscope. We see it in cotton. In cotton the cell is elongated. [Here the lecturer illustrated the formation of cells in cotton on the blackboard.]

If any of you have ever been stung with a nettle you have experienced the power of a single cell of that plant. [Explained upon the blackboard.] It is the poison of one cell only that escapes and enter syour body. [Vascular tissues and spiral vessels were explained on the blackboard.]

The anatomy of plants was studied long before the true physiology of plants was understood. In the earlier investigation of this subject it was supposed that these cells were air vessels. These vessels do perform important functions. They offer a subject for investigation full of interest, but it is almost impossible to illustrate and explain this subject without recourse to the microscope.

I have spoken of the growth of cells by the deposits laid upon them. This was further illustrated on the blackboard. To the question, "how do plants get anything to eat and drink, and thereby develop growth?" it was answered, they can grow only by absorption from that which is without.

On the subject of the development of cells and the growth of plants, the following was given as the contents of proloplasm—the vital vegetable substance:

Amyloid-jelly, starch, chlorophyl, chromule, wax, oil, camphor, resin chrystals or raphides, sugar, gum, dextrine, tannin, caoutchouc and alkaloids.

We cannot dwell much longer upon this part of the subject.

One of the first things or parts of plants that will attract our attention is the outside—the outer skin, called epidermis. At points in the epidermis there are openings which open and shut at the will of the plant—some plants at least seem to have life. These serve as *stomates*, or little mouths of plants, through which they take their food by absorption. The epidermis, stomates and hairs were given as simple organs.

I wish now to say a few words about compound organs—the axis and its appendages, formed from a spore, an embryo, a leaf bud, by the development of a root in one direction and a stem in the opposite direction. This root downward and stem upward is the first thing that strikes us in the development of a plant. I have here on paper a picture of an ideal plant, showing the seed, the axis ascending and descending. We will explain these terms, spore, embryo and leaf bud. A spore is a young plant, produced in the interior of another without the agency of the sexes, and having no determinate points of growth.

An embryo is a young plant, produced by the agency of the sexes, developed with a seed, and having determinate points of growth. Take a Lima bean and soak it, and you can see the embryo.

A leaf bud is a young plant, produced without the agency of the sexes, inclosed within rudimentary leaves called scales, and developed on the outside of a stem.

A spore, or an embryo (seed) propagates the species; a leaf bud propagates the individual.

When excited the tissue develops in three directions: downward, the descending axis or root; upward, the ascending axis or stem; horizontally, the medullary system. Every part which grows from this axis in a symmetrical manner is an appendage; the leaf is the type of all. The stem is always produced by the successive development of leaf buds. In proof of this we state the fact that if you carefully extract the bud from the axil of every leaf the stem will not increase in size. If you make a notch below the leaf bud it will not increase in size. You may tie a string tightly around the stem and parts below will not increase, but parts above will increase in size remarkably. We saw this beautifully illustrated at Bunker Hill, in the orchard, I believe, of our friend Mr. Jon. Higgins. The sap could flow from the roots and stem upward through the wood, but could not return through the inner bark below the bandage.

The diameter of exogenous trees, that is trees that increase by accretions on the outside, increase in proportion to the number of leaf buds. But there is another class of trees called endogens—those which increase from within—inside growers. [Explained by reference to diagram on the board.]

A word in regard to the leaves, which are the appendages of plants. Before the leaves appear the seed lobes perform the functions of the leaves. By-and-by the leaves appear, becoming more complex as they ascend the stem, with various arrangements and modifications. Finally appears the flower, embracing the seed buds and becoming the seed leaves! a plant, perfect in all its parts.

Now you see that buds are little plants, seeds are little plants, embryos are little plants.

We have these two methods of propagating: If we propagate by seed we propagate species. If we propagate by buds we get individuals. Occasionally a bud will "spurt," but, as a rule, you may plant a bud with perfect certainty that you will have a result like the tree from which the bud was taken.

DR. WARDER'S LECTURE ON THE NECESSITIES OF PLANT LIFE.

In attempting to portray the world of teeming nature, as it has been spread before us by the Creator, the poet philosopher, the celebrated Goethe, makes Faust say "A thousand germs come struggling forth in drought and damp, in heat and cold." And yet, under these most opposite conditions, each germ appears to be perfectly satisfied with its surroundings, different as they are. The fact is that various plants require just these opposite conditions for their development.

The protococcus, which delights in the snow and ice of the northern polar circle, could no more exist in a heated atmosphere than could tropical plants if removed to our latitude. Wisely and well it has been arranged by Him who doeth all things well, that each portion of our globe where plant life is at all possible shall have its own peculiar flora and fauna, so that wherever life is practical, some beings shall be found to enjoy it. Hence, also, the charming diversity of organized beings; and by the aid of Geology, with its adamantine records, we find that such has been the case ever in all ages of the world's history, only that the conditions of many portions of the globe must have been entirely different, as to heat and moisture, at certain epochs, such as those at the coal formation from those with which we are familiar in our own times. Even in the latter portions of the quaternary period, perhaps just before the historic era, when man was introduced upon the earth, these broad and undulating prairies that surround us were vast pools of shallow water, filled with confervæ, that could subsist only under such conditions of moisture and temperature as then existed. Though no human eye was here to watch their progress, to study their mode of growth, to examine with the microscope the curious changes going on among their cells, the all-seeing eye of Omnipotence was superintending and directing the process of growth, development and decay that was preparing for us the fine rich prairie mould from which we are now deriving our sustenance, and from the productiveness of which you are enabled to feed the world.

To sustain them plants must have food. But what constitutes that food? You were told by Prof. Stewart, in his excellent lecture, of all the different chemical elements that are found in vegetables; these, therefore, must have existed in the food of the several plants, but you will recollect he informed us that of these elements four only constituted the chief bulk of plants—carbon, hydrogen, oxygen and nitrogen. These, then, are the chief or most important parts of plant food, though some of the others are equally essential to the healthy growth of a plant, even though they be taken in smaller proportions.

Do the plants need these elements in a free or in a combined state? This we do not know, but the inference is that they are taken only in a state of combination, except oxygen, which is diluted in the atmosphere, held in suspension and mingled with nitrogen rather than chemically combined with it. Water and air are the great means of presenting and bringing food to the plants, and it is probable that water is essential to the digestion of the food, to the production of the fluids and to their passage through the organisms. So what we call crude sap is really a weak solution of substances that are taken into the circulation, carried up along the so-called air vessels of the alburnum, and diffused through the organism, variously modified by and producing various modifications upon the materials it meets in its progress of cell circulation. The compounds thus taken into the tissues of the plant are resolved into their elements, or rather they are transformed into other compounds by the curious and hidden processes of the vegetable laboratory. We must not forget, however, that the functions of the leaves are not simply to act as exhalents, throwing off the surplus watery fluids by evaporation, but they are also absorbents, drawing in from the atmosphere carbonic acid, from which, under the influence of sunlight, they retain the base and throw off the oxygen.

But to return to our topic. Let us consider the necessities of the embryo, the seed which we intrust to the tender mercies of the earth. It has within its own organization the elements of its future growth, but in very limited amounts. It can create nothing, and if the resulting organism increases in weight, as we know it does, and with great rapidity, let us inquire what are the conditions that will favor this development, and what the materials to be added.

As a rule we desire to exclude the light, hence we cover the seed with the soil, and here, practically, we must observe that this covering should not be too great, and that the smaller the seed the less the covering should be. Next our seed needs moisture, and the soil will furnish this in the right proportions, to be absorbed through its teguments, that willingly receive it, sooner or more slowly, according to its physical condition. Sometimes this is very slowly indeed, with seeds that are invested with a horny or woody covering. The air must have access to the seed, and this is always present in sufficient quantities in well prepared and properly comminuted soil, though excluded by an excess of water, as sometimes occurs after heavy rains. This air is needed for the sake of its oxygen, which is the great vivifying principle or element.

Carbonic acid is also at hand, held safely in store by the humus of the soil, but ready to be transferred to the radicles so soon as they are formed, if indeed it be not taken into the germinating seed itself. Ammonia, or its carbonate, is also held in the same manner by the soil, which is the great disinfectant of the atmosphere, as well as the filterer of the rains which wash the ammonia from the air in every shower. Nitric acid, and perhaps sulphuric acid, is also washed from the air by the same means and left in the soil.

Here then we have a rich banquet spread out for the young embryo that is to be developed from the seed into the coming plant. Its necessities are all supplied—light, heat, moisture, air and appropriate food. Thus we have considered the necessities of the plant, which is to be produced from a seed, but it has been shown that the bud plant is only another form of the development of the seed and its embryo, or rather, we should say, that the seed embryo is only another form of the leaf bud, modified by the morphological action of the plant—apparently changed—certainly different in its characters, and capable of undergoing a longer separation from its parent stock, capable of being transported to a greater distance, and also capable of producing a new variety, somewhat different from its parent.

We should therefore consider the necessities of the plant in this form, also—the bud. For we may as well consider each of these organizations, henceforward, as a distinct plant, rather than as a part only of a plant. So long as it retains its connection with its parental organization it needs only such treatment as is bestowed upon its parent. There it may remain for a long time dormant, even until the destruction of the entire plant, the complex organization with which it is connected, or, as is usually the case, it may develop into an axis of growth with its necessary appendages, and produce more buds, or even modified buds—seeds.

But when separated its necessities will be somewhat different. It has already been demonstrated—and you may verify this at your leisure by making longitudinal section of any large terminal bud, as that of a lilac—it has already been demonstrated that a bud has an axis of growth, just like the stem of a plant, though shorter, but it also has leaves, the scales, as they are called, which invest it closely and serve as a protection from the elements. And these are evaporating surfaces, that would soon exhaust the plant of its moisture, therefore the bud cannot be safely exposed, like the seed, but requires sooner to be placed in conditions more favorable to its preservation. These are, that when separated, as in any of the methods practiced in propagation, it should be placed in a confined atmosphere in contact with the soil, if possible, with a sufficient but not excessive amount of moisture, and with the proper degree of heat and a diminished amount of light.

It must not be overlooked, however, that these bud plants may be safely transferred from one plant to another, under favorable circumstances, and that they may be made to grow in their new situation, not directly in contact with the soil, and only connected mediately with it, as in budding and grafting. It is better, however, to consider first the necessities of our bud plant when placed in immediate contact with the soil itself. Bear in mind that our bud has already the organs necessary to constitute a plant, to-wit: the stem and the leaves. The former may be very short, the latter very rudimentary. In this case we need almost the same conditions as with the seed, only that as we desire to extend the axis or stem downward to form the roots, we need to encourage the development of cell growth, for the formation of a callus and roots, before we excite the development of the ascending axis or stem, with its leaves and appendages, because we must seek to supply additional moisture to keep up the waste by evaporation that would occur if the leaves were developed first. To effect this we encourage the cell growth of the base of the bud or short cutting, until, by the accumulation of new cells, a callus is formed, from which, by a further development of cells, arranged in a continuous line, rootlets are formed to absorb nourishment from without, just as occurred in the seed by direct absorption of water through its tissues, before the development of the embryo into the plantlet, with its radicles and plumule.

The bud cutting is then ready to have its upward growth developed, and this should now be encouraged. All this is perfectly under our control, and it depends upon the amount of heat and the mode of applying it. This stimulant should be withheld from the upper portion and increased at the lower. In the language of the gardener, we should apply "bottom heat," keeping the soil a few degrees warmer than the air, until the rootlets are formed, and then applying it to the surface to stimulate the development of the bud and encourage its upward growth.

DISCUSSION.

Mr. Dunlap—With your permission, Mr. President, I would like to ask the Doctor one question. In relation to the growth of plants or trees, we observe that all do not grow in the same manner. What terms do you use in describing these different forms of growth?

Dr. Warder—I will answer, there are outside growers and inside growers. The one is called *exogens* and the other *endogens.* We have on the board a representation of outside growers. The rings indicate the amount of increase in the several seasons.

Mr. Dunlap—Now I can make up my notes.

Dr. Warder—I hope your notes will be complete. [Laughter.] One word in regard to taking notes. I do not think it is advisable for the students to take extensive notes upon this subject. Do not attempt to take down notes verbatim. Seize upon the point presented, and endeavor to retain it. Jot down a word here and there, to aid the memory, and fill out your notes, if you wish, in your room. But endeavor to get the idea.

Dr. Gregory—I am glad that Dr. Warder has mentioned this subject. It is a matter of importance that you give your undivided attention to the subjects presented in the lecture. It is essential that you hear. Get the thing that is said, and get *everything* that is said. Never attempt to write out the whole sentence. I would suggest also, with Dr. Warder's permission, that the young gentlemen take occasion to read up on the subjects presented from time to time in these lectures. You will find that it will help you to understand and profit by these lectures, as you would not otherwise be able to do.

Dr. Warder, in answer to a question about the failure of cuttings to grow, said: You will probably find, on pulling up the cutting, that it had not even formed a callus. The plant did not have force enough to develop itself and produce roots, and for the reason it was not placed in a condition favorable to such development. If the cutting had been placed in a position favorable to the growth of roots, then when the upper bud starts into growth the leaves would bring up the juices from the soil, through the roots, and secure the life of the plant. Plants die simply because they have used up the nourishment provided for them. There is only a definite amount of food in the cutting, and when this is exhausted, without further supply, there is nothing to do but to die.

Dr. Gregory—You stated, Doctor, that your opinion was that heat was simply a stimulant. What is meant by heat stimulating plants? What is this stimulant?

Dr. Warder—We know that when plants are allowed to grow in a dark place—the potato growing in the cellar is a good example—they are deficient in the qualities that belong to a healthy plant. But let a ray of sunshine and heat strike it, and how soon a change is made. There is stimulus—what we call stimulus. This develops increased action, and the result is the elimination of oxygen, thrown off in the air by the leaves. You have seen the long, slender, watery stalks of the potato growing in a dark cellar. They have no color, because it requires the action of light to produce the coloring matter. Plants fully exposed to sun and air have the chlorophyl, those not exposed have it not. The stimulus of light in the growth of plants is essential to their healthy development.

Mr. Freeman—Can electricity be regarded in any other aspect than that of heat?

Dr. Warder—Perhaps not.

Dr. Hull stated that he had a different way of putting this matter. He explained that plants derive much of their sustenance from the ground, and that they die because, being placed in unfavorable conditions in this respect, the supply of food is cut off. He started the question as to whether manure was not food for plants.

Mr. Dunlap—I am glad, Mr. President, that this matter of manures is to be settled here. I understand the Doctor to take the position that manures are food of plants.

Dr. Warder—I consider all manures food for plants, but I prefer my own language.

Mr. Dunlap—It is a question whether manures are food for plants directly, or indirectly by rendering the conditions favorable for the plants to obtain food from other sources, and I want to have the question settled now.

Dr. Warder—I do not think we can settle it. That manure acts as food for plants, either directly or indirectly, is my conviction, and what I wish to say is, that which in its crude state is a nuisance, may be composted into most valuable food for plants. He spoke of clay as being a good absorbent, and of earth-closets as being the most efficient and economical way of saving and deodorizing human excrement.

Mr. Dunlap—It strikes me that this is a subject that has been overlooked in this course of lectures, and I am glad that our attention has been called to it. There can be no doubt that portions of manure are plant food, but its great service is as *holders* of valuable gases known to be food for plants.

WHEAT.

A LECTURE BY W. C. FLAGG, OF ALTON.

The semi-tropical summer of the Mississippi Valley points to corn as the most natural and valuable grain that can be grown within our borders. But wheat, from its easy culture, its ready sale, and its universal and acceptable use, even upon soils and under skies not at all propitious to its growth, is second only in importance. We even find wheat grown where corn is the more profitable crop; something which I can only account for on the supposition that the quick returns of the wheat crop are an irresistible temptation to the thriftless farmer.

In Southern Illinois I find, upon fair calculation, that the cost and value of an acre of good corn and wheat are about as follows:

	Corn.	Wheat.
Plowing	$1 50	$2 00
Harrowing	20	20
Laying off	20	....
Planting	25	20
Seed	25	2 50
Tending	80	....
Gathering	2 50	....
Cutting	....	1 00
Binding	....	1 25
Stacking	....	1 10
Shelling	2 40	....
Threshing	....	2 40
Hauling	1 80	60
Total	$9 90	$11 25
Product estimated	60 bushels.	20 bushels.
Price	75	2 00
Gross value per acre	45 00	40 00
Net value per acre	35 10	28 75

This makes an excess of $6 35 per acre in favor of corn, supposing it is shelled and sold in the market. Fed on the farm, it could of course be made much more profitable. In that case profits from feeding could be added, and the manure of the stock to which it was fed would go to enrich the land and prevent the exhaustion of the soil.

In face of such facts as the above, I believe that, in certain counties of our State, wheat growing has steadily increased, while corn barely holds its own. In Jersey, St. Clair, Monroe, Randolph and Clinton counties, lying near St. Louis, the acreage of wheat, according to the Auditor's report just rendered, exceeds that of corn. In Monroe county three acres of wheat are grown to one of corn. St. Clair has nearly two acres of wheat to one of corn, and Jersey about three to two. Other counties are following in their wake, and even Boone and McHenry, on the north line of the State, give more spring wheat than corn. No cattle worth mentioning are kept on these wheat farms. The straw is burned in the field, and the only return, if we may call it such, made to the soil, is generally a clover crop turned under, and, in a few instances, a scanty manuring from the stables of the horses kept to plow the land. In some cases no corn is grown on the farm, but is purchased with the proceeds of the wheat crops.

The wheat grower therefore must look about him and seek better methods, or he will rightfully be accused of bad economy. He may hardly be able to show that, even with the best management, he can make wheat replace corn in profit in the State of Illinois; but as part of a rotation, as one of a succession of crops to fill the year with labor and harvests, he may be able to show that it has a fitting place and a profitable use, whilst its excellence as a bread stuff renders it almost indispensable.

Premising thus much by way of protest against the terrible waste of agricultural wealth now going on all over the West, by growing and exporting this valuable grain, and robbing posterity without real benefit to even our own generation, I will undertake to say, in the want of a fit person, a few words on wheat growing.

In Illinois, according to the State Auditor's last report, we had, in 1867, 2,083,189 acres in wheat, against 4,725,386 acres in corn. Of this two millions of acres, probably somewhere about half was winter wheat, mostly grown in the southern part of the State, and the other part spring wheat, generally grown in the northern portion. The spring wheat seems best suited to the cooler springs of the northern portion, although I have known instances of thirty bushels to the acre as far south as Alton. The winter wheat, owing to the snowless winters on our plains and the looser character of the black soils, is more easily winter-killed in the central and northern part of the State, and is limited to the white soils of Southern Illinois for its most fitting place and successful growth.

The best soil for winter wheat, so far as I have observed, are the white oak ridges along the Mississippi bluff. The crop is there quite certain, and the quality of the grain and the flour made of it quite superior. The poorest soils for wheat are the wet and rich prairie lands of the creek and river bottoms. I suppose the wheat of Jersey, Madison, St. Clair, Monroe and Randolph counties, is about the best in the State, and is, no doubt, one reason of the crop having been so excessively grown in that part of the State. The hot climate of the southern part of the State, while I think it reduces the average yield per acre, probably has an effect similar to that of Southern Europe in producing a harder wheat, containing more gluten and producing a finer quality of flour.

The best rotation of crops in which wheat makes a part of the course, is, I think, the following, commencing with corn on sward:

First year year, corn.

Second year, corn.

Third year, oats, barley, or other spring crops.

Fourth year, wheat.

Fifth to seventh year, grass, as meadow.

Eighth to tenth year, grass, as pasture.

Thus for every year we have for every acre of wheat two of corn, one of oats, or other spring crop, three of meadow, and three of pasture. I am not prepared to say that this is the best possible rotation, but I think it is a good one, especially in its proportions of grass and grain.

Wheat, therefore, succeeds oats or other spring crop. It is a good succession to clover plowed under, and propably also to ordinary sward when pretty well rotted; but as a matter of convenience I prefer the above rotation, and let the stronger and ranker condition of green or other manures spend its first force on corn, while the wheat draws more from the better decomposed material and the original elements of the soil.

The stubble of oats should be turned under as soon as possible after cutting, in our climate, to a greater or less depth, which should vary according to the fertility of the soil and the weight of stubble. The poorer the soil, the deeper it should be broken up. The practice varies between breaking up once in this manner and running a cultivator or harrow over the surface occasionally, to keep down weeds until sowing time, and plowing a second time just before seeding. All agree, however, in saying that the ground should be finely pulverized first, and then well packed together by rolling, or some other treatment, so that when the drill is brought into requisition it may find a hard, firm, fine soil to receive its flukes.

I say the drill, because all our experience in Southern Illinois, so far as I know, is strongly in favor of drilling in preference to sowing wheat. The drill saves seed, deposits it at pretty uniform depth, and leaves the plant sheltered in a shallow furrow by the adjacent ridges, whence the disintegration of winter's frost and thaws covers the roots instead of laying them bare. In the Michigan woods, where snow lies throughout the winter, I find drills in less universal favor.

Why wheat succeeds best when drilled in a hard soil, is, I take it, from the fact that such a soil heaves less readily, and does not admit frost to the roots so easily. This probably is one reason also of the superior success of winter wheat in the silty soils of Southern Illinois. The soil is there finely comminuted and comparatively free from vegetable matter, whilst here it is coarser, more friable and loose.

Owing to the ravages of the fly, farmers with us are now practicing later sowing than formerly. In avoiding this evil, however, it is a question whether we do not fall upon a greater. This late sowing necessitates the sowing of early ripening varieties, which are not the most productive, endangers the plant in winter from insufficient rooting, and delays ripening in summer, with consequent danger from heat and rust. The past season extreme heat, by its direct action, very materially lessened the yield per acre in our part of the State. But the rust is the disease most dreaded by our cultivators. This may be regarded as the result of extremes of heat and cold, drouth and moisture, whereby the vitality of the plant is lowered, and its tissues ruptured and made the prey of fungoid growths.

The culture of wheat has been rarely attempted in this country, although Jethro Tull and his Horse Hoe Husbandry were introduced by William Cobbett to American farmers over half a century ago. One gentleman who is present with us to-day, and who will, I hope, give his experience in the discussion, has told me that he fears spring cultivation because it increases the plant growth and delays too much the period of ripening, and endangers rust. Others, however, claim that harrowing in spring has been attended with a great increase of crop; and the drill itself suggests a use of that or a similar instrument to cultivate the ground between the rows of wheat.

This danger of late ripening, resulting from late sowing and spring cultivation, suggests renewed attention to the subject of early sowing. It ought, if possible, to be effected; and I trust Dr. Walsh and his co-laborers may sometime help us to it. Failing in that, we need to know more of those fungoid growths attending rust, potato rot, and the many diseases so fatal to the farmer and fruit grower. Here we feel the necessity of a State Botanist and Botanical Survey, which shall, among other things, develop and make understood the various rots, rusts and mildews resulting from the changes of our variable climate.

The time of cutting wheat is a point upon which I have little personal knowledge, but which is a matter of great importance. It is a very common opinion that early cutting produces a plumper grain, a larger product, and a better flour. This opinion, however, is probably not correct, or at least only in part. During the past very hot and dry harvest, early cutting was, in one case that came under my observation, attended by absolute injury.

The methods of cutting, within the memory of many who hear me, have wonderfully changed and improved. First came the sickle. Not much before 1830 the grain cradle came into use in our State; ten or fifteen years later came the reapers and harvesters, the clash of whose shuttle-moving sickle bars are now heard upon all our broad prairies. These, like the "mighty night" of Euripides, brought comparative "repose to over-burdened men," but gave a new and probably excessive impulse to the growing of small grains.

Of reapers I have used only Hussy's, a heavy implement, only endurable when we had no better, and John H. Manny's, which I liked well. But I learn from others that Marsh's harvester and reaper, which carries two men upon it, who do the binding, is in many places doing excellently well. There are, however, a large class of reapers, all doing good work, and varying only in unimportant details, among which there is little choice.

Harvesters or Headers—so far as I have observed, I have no experience—are generally objectionable. First, because of the risk of waiting until the grain is dead ripe, resulting often in great loss from storms, and the "shattering" of the grain, and, secondly, from the difficulty of properly stacking and saving the grain in the present want of proper buildings.

The best method of taking care of the grain before threshing, unless threshing is done in the field—and this is a very wasteful process—is, in my opinion, putting it into open barns, thus securing good ventilation, and avoiding the common evil of waste from bad stacking and heavy rains. In England, with a very humid atmosphere and no violent rains, stacking is preferred, as keeping the grain in better condition; and stacking and thatching of stacks is there done with great thoroughness. In our usually dry climate wheat can remain in barns uninjured, whilst our occasional violent rains will penetrate almost any stack. By housing wheat early, moreover, we get a clean straw, which can be very advantageously used in farm economy, as feed, litter, etc.

Threshing grain is the least satisfactory of our improved processes. The old days of the flail, and tramping out with horses, are almost preferable to the present state of things. Threshing the present year, in several places in my neighborhood, has cost from 18 to 25 cents per bushel, or from one-third to one-half of the entire cost of production, which is 50 to 60 cents per bushel. A man with a flail could do as well as that, and probably more cheaply and better.

Of varieties, red and white May are generally preferred with us.

DISCUSSION.

Mr. FLAGG—I would like to call upon Mr. Fangenroth, of Madison county, who is giving much attention to the growing of wheat, and who is largely experimenting with the different varieties.

Mr. FANGENROTH—I am sorry that I cannot give the information that I would like to do. I can only speak of one kind of wheat, that is fall wheat. I have had no experience in growing spring wheat. I must say here that wheat lands may be made very productive. I have for the last four or five years raised wheat in defiance of insects, rust and mildew. I will endeavor to give you my experience.

First, in regard to my method of plowing for wheat. It has been said that trench plowing for wheat is injurious; it was so considered in my neighborhood when I undertook it. But I have practiced it for a number of years, and to this I now attribute, in a great measure, my success. We have generally had, in our neighborhood, failures in a wet spring, and have inferred from that that the wet spring was the cause of the failure. Now if we can overcome this difficulty by trench plowing, as I believe I have, I think we ought to succeed. When I came upon the farm which I now occupy it was considered worn out; the failure of crops was a common thing. It had never been trench plowed, but had been plowed only in the common shallow method.

Mr. DUNLAP—How deep?

Mr. FANGENROTH—Not more than three or four inches deep. The land was considered worn out. The first time I put in the trench plow I was not able to get down more than two and a half to three inches deep, for the reason that the ground was "furrow-trod," and so hard that it could not be plowed. At each additional plowing I went a little deeper, until this fall I have plowed my ground thirteen or fourteen inches, using the subsoiler, for the reason that I could not run the trench-plow deep enough. That which first led me to the practice of deep plowing was to get rid of the superabundance of water on the land in the spring, which seemed to be producing the frequent failures that occurred. Fall wheat, in particular, requires an early spring in order to ripen well.

I attribute also my success, in some measure, to the care I have used in selecting my seed, and if wheat growers would experiment with different varieties of wheat I think they would do well for themselves and for others also. Last season I grew nine varieties of wheat. Of these, two varieties, the California and Tuscarora, were injured by the rust, which also was the case with other wheat which stood thick upon the ground. I also have red Alabama wheat, white May wheat, red May wheat, blue stem and Tappahannock. These varieties were sown in precisely the same manner, and with the same quantity of seed. The only way to find out just the variety that is best for your soil and location is by trial. The man who lives and grows wheat upon a clay soil cannot prescribe for a man who lives upon a different soil. Timber lands are more favorable for wheat growing than rich prairie lands. Where the ground is not drained the soil on the prairies is later than on the hills. The difference is frequently between eight and ten days in the ripening of some kinds of wheat; I have, therefore, always advocated the view that those living on the prairies should sow the earliest wheat, say the red May and white May. The latter is a very superior wheat. Next comes the Tappahannock, which has not been as satisfactory as desired or expected. The bearded wheat has not been much grown in our section of the country.

In selecting seed wheat I always take the best, and that which ripens together. It is all selected in one day. I will not have shrivelled wheat for seed. With proper care in selecting seed, and in preparation of the soil, there is no difficulty in raising good crops of wheat where heavy crops of clover will grow. I repeat there is no trouble about it. I regard deep plowing essential to success. It matters not how deep you plow, whether five inches or two feet, there will be found beneath the plow a hard crust, known as "furrow-trod." I would say use the subsoil plow first, and when there is formed this hard-pan beneath then put in your drains. It is too expensive to tile drain first, and is economical to use the subsoiler, as it will answer the purpose of draining for a time. Wherever there are low places in the field you must put in your tile drains, if you have an outlet.

My method of plowing is also different from that of any with which I am acquainted. [Here the speaker went to the blackboard and drew a diagram of a field of fourteen acres.] If an oblong field, I commence in the middle of the field, throw up a ridge and back-furrow. I stop short of the ends of the field, a distance more or less, according to the size and shape of the field. The object is to plow in such a manner that the field may not be left in the shape of a basin, to hold water, as is the usual method. When the land is plowed in a way to throw the dirt continually outward, leaving a ridge along the fence row, which prevents proper drainage, I back-furrow the whole field, throwing the dirt continually inward, and away from the fence row. This leaves the land elevated rather than otherwise in the central portions, as it should be to secure proper drainage and prevent, on rolling land, the washing away of the soil. If you plow in lands or "seed beds," in the usual way, the water will carry off much of the soil. My method also enables me to turn upon the unbroken land, better for the land and easier for the horses.

Some say, as we before stated, that trench plowing is injurious. It may be at first, if the work is done in the spring, just before seeding. It is best to trench-plow in the fall and seed in the spring. Deeply plowed lands will retain moisture and stand drouth without injury when crops planted on shallow plowed land would burn up. I would advise all farmers to try deep plowing. Do not go to the greatest depth at first, but deepen gradually, and you will have all the benefits and none of the evils of deep tillage. Plow in the fall, and plow early enough to give the weeds a chance to rot before the cold freezing weather commences. If you plow early they will have time to rot and furnish food for plants; if you plow late they will not rot, and will hinder spring plowing and be in the way of the growing crops. The young plants will grow as long as they find nourishment. If the season is dry they will not find sufficient nourishment in the top soil, and certainly not in the weeds turned under late in the fall and remaining unrotted. Those farmers who do not practice deep plowing may get a good crop in a wet season, but they will get a poor one in a dry. My wheat crop, on poor land, averages 24 bushels to the acre, with an average weight of 62 pounds to the bushel. In regard to artificial fertilizers, I would say I have used them slightly, and at the same time I have applied a sprinkling of barnyard manure, with no very important advantage to this crop, on my farm.

Dr. GREGORY—What was the character of your season?

ANSWER—Very dry in the latter part of it, and wet in the spring. Our wheat is more injured by the dry weather than by the wet. New ground is sufficiently porous for drainage purposes; clover roots furnish drainage downwards. Then plowing in the method I have described, throwing your furrows inward, you will finally get rid of surplus water. I plow with a right-hand plow, and, as before stated, the team turns on the hard ground, which makes it easier for them, and the plowed ground is not injured.

Dr. GREGORY—Happening to be at Madison county fair, and seeing some fine specimens of wheat shown there, I begged for a few kernels to put in our cabinet, for the inspection and study of all interested in the matter. I now wish to request others to do the same thing, and send up specimens of the different varieties of wheat for the cabinet, and also for sowing here for trial. This is a matter of some interest and importance, and would doubtless do some good.

Dr. GREGORY—I wish to inquire whether any one has tried the plan of mulching the wheat plants as we mulch the strawberry. Have you seen this tried?

Mr. PERIAM—I would say it has been practiced in Cook county with most excellent results. It prevents the heaving of the ground, which exposes the roots of the plant and breaks them. This heaving is caused by the constant subjection of the land to freezing and thawing. It throws out the roots entirely above the ground.

Another fact which I have observed, that the localities for wheat growing are traveling west. We can raise wheat on new lands, but as the soil becomes old and worn we fail to get good crops. Sod land is the best for wheat. Wheat does not freeze out in sod land. We see an illustration of this in the vigorous stocks in the fence corners.

Mr. FLAGG—We have discussed pretty fully the preparation of the ground, and should now give attention to some other points. I therefore submit the following motion: I move to take up the question,

1. Of drilling and sowing broadcast.
2. The cultivation of wheat.
3. The time of cutting it.
4. Then of stacking it.
5. Next the question of threshing ot wheat.
6. And, in the last place, the value of wheat as a farm product.

Adopted.

Mr. Robinson—In sowing wheat on the Illinois river we first summer fallow our ground. We plow our ground, if possible, in early summer, and pasture till fall. At seed time we plow again. I prefer, however, simply to run the cultivator. We sow about a bushel and a quarter to an acre. If the ground is weedy we sow a bushel and a half.

Mr. Jewell—I am here to learn from the people of this State. I am not acquainted with farming in this country. I consider that a farmer in Michigan is not necessarily a farmer in Illinois. That is, he may understand farming in Michigan and not understand it in Illinois. In Michigan my experience is to plow early, even before harvest, and then not plow any more, but harrow in the grain on this early plowing. The farmers of Michigan find that they can raise from 20 to 40 bushels to the acre by this method. Formerly they raised but 10 to 20 bushels. In Illinois I have no knowledge of wheat culture.

Mr. Fangenroth—I use the drill. If I can't use the drill I don't sow. I drill the same way that I plow my land, commencing in the center of the field and running with the furrows.

Mr. Flagg—How much to the acre do you sow?

Mr. Fangenroth—A bushel and a quarter.

A voice—How deep?

Answer—One and a half inches.

Mr. Jewell—I understand that you recommend the drilling of wheat. Our drill in Michigan is not like your drill. Our drill is not a tooth drill. The tooth drills are all being thrown aside for our Michigan drill, which is supposed to be worth two bushels to the acre more than any other drill. The speaker gave a description of the drill. It consisted of wheels instead of teeth, and acted on the principle of the roller. In Michigan, on sandy soil, they work admirably, but how they would do in this soil of yours I do not know.

A voice—Does this drill leave the ground level?

Answer—It leaves it just as the other drills leave it. I may say, from my experience, the nearer the top of the ground you place the seed the better off the plant is. It will have a stronger growth and be better able to resist the frosts of winter. I sow all the way from one to two bushels. I would prefer one bushel if the land was in good order.

Mr. Fangenroth—Sowing should be delayed until the ground has settled, otherwise the seed will be buried at an uneven depth and cause the ripening process to be uneven.

Mr. Jewell—In regard to thick and thin sowing. I have seen wheat thin upon the ground produce 30 bushels to the acre, and I have seen wheat very thick not produce more.

Prof. Bliss—In regard to the quantity to be sown, I would favor the thin sowing, and depend for a heavy crop on the care with which the soil was prepared. One half the amount, sown on well prepared soil, will produce more bushels of wheat than the whole quantity sown in unprepared ground. This is my experience on prairie soil. I would say three quarters of a bushel, with the drill, is enough. I usually sow one bushel; but the yield from three quarters of a bushel is usually as great as the other.

With regard to the time of sowing, and the raising of wheat in general, I think we must study the particular season, and put as many things as possible in our favor. Drainage is as important as anything. It is quite as important that you plow your ground early enough. It is essential that the plowing should be early if you have a heavy stubble to turn under, that it may have time to rot. If you sow too early the fly is apt to injure the crop. If too late the frost will injure it. I would say from the 20th to the 25th September is a good time as a rule. Where there is a good deal to put in you must run from the 10th of September to the middle of October. Late sown wheat is also liable to be injured by the rust.

POTATOES.

A LECTURE BY JONATHAN PERIAM, SUPERINTENDENT PRACTICAL AGRICULTURE, ILLINOIS INDUSTRIAL UNIVERSITY.

The Potato, miscalled Irish, and botanically known by the name of *Solanum tuberosum*, or Tuberous-rooted Nightshade, is said to be found growing indigenous from Carolina in the United States to Peru in South America. It belongs to the vegetable order *Solanacea.* Among the edibles in this order of plants are the Tomato, Potato, Egg Plant, Pepper, the Ground Cherry, and that plant of doubtful utility, Tobacco. As a food producing plant among civilized nations, the potato ranks second in importance, has added millions to the human race, and has averted those famines which formerly swept over Europe, occasioned from a partial or total failure of the grain crops. An entire destruction of the potato crop, as was some years feared, would bring gaunt famine and death among the poor throughout the civilized world. It may be well, therefore, to consider the history and diseases of this esculent, containing, as it does, so many elements conducive to human health, whose increased or diminished productiveness carries with it so much of weal or woe to the human family.

The natural history of the potato leaves us in some doubt as to its original nativity. It was carried to England, in 1565, by Sir John Wamkins, from Santa Fe de Bogota, where it is found growing wild, at an elevation of from 8,000 to 13,000 feet above the ocean, in elevated valleys surrounded by high mountains, and above the range of Indian corn. The climate is dry and cool, and, being near the equator, is not subject to great extremes of heat and cold. An attention to this fact will be of advantage to cultivators of this crop in climates not so well suited to it. It is said to have been known, at that early day, in various parts of North America; and after its introduction into England from Virginia, by Sir Walter Raleigh, in 1586, it began to attract more and more notice, until, at this day, the potato, as one of the root crops, and maize among cereals, have been among the most valuable food producing plants ever bestowed upon man. From a history of the potato, by Bonjean, published in 1836, and translated by Henry Meigs, we find the following: That it came originally from the intertropical parts of the American continent; that it grows spontaneously from Carolina to Valparaiso, in Chili.

The celebrated Joseph Pavon, one of the authors of the Peruvian Flora, found it growing wild in the vicinity of Lima, Peru, where the Indians cultivated it abundantly for their subsistence. Lopez de Tomera, a Spanish priest, in his general history of the Indies, published in 1553, mentions the *Papas*, the name by which it was known to the Indians. Joseph Acosta says that the Peruvians employed it in lieu of bread roots, which they called *Chunno*, or they ate them fresh and boiled.

Before its introduction into England it had already been very extensively diffused throughout the south of Europe. The botanist, Charles L'Ecluses (Clusius), about the year 1588, is said to have been the first European writer who mentions the potato. In 1631 he published a description of the root, and says that it was then so common in some parts of Italy that it was eaten by men and fed to hogs. He doubts whether it was known to ancients; thinks that it may have been the *Arachidna* of Theophrastus. Cortusus, another botanist, supposes that it was the *Pycnocoma* of Dioscorides. In 1590 Gaspard Bonhin received from Scholtz a colored drawing of the potato, and recognized it as a Solanum. Mathiola afterwards described it in his commentaries upon Dioscorides.

It was in Italy that potatoes were first cultivated to any extent, and from thence it began to be spread over Europe, about the year 1550. The Italians called them Tartoffoli, or ground huffles, and from this is said to have come the German name, Kartoffle. Parmentier, in 1783, succeeded in introducing the potato into general cultivation in France, and spent much time and research in demonstrating, by chemical experiments, that the potato was both a healthful and nutritious food. The following is a summing up of an analysis of the potato, by the author first quoted, Bonjean:

Starch, peculiar animal matter, bitter aromatic resin, Parenchyma (fibrous matter), Solanin, Asparagine, colored Albumen, a sugar principle, a gum principle, citrate of lime, citrate of potash, phosphate of potash, phosphate of lime, free citric acid, Silica, Alumine, Magnesia, Manganese, oxide of Iron, Iode, Brome and water of vegetation.

An analysis of the Mercer potato, conducted by Charles T. Jackson, M. D., of Boston, Mass., gives in 100 parts by weight:

Water	75.80	per cent.
Starch	12.54	"
Cellulose	3.62	"
Other matters, not separated	8.04	"
	100.00	

In an analysis of the ash of the potato, according to Professor Norton, it contains:

Carbonic acid	10.04	per cent.
Sulphuric acid	7.01	"
Phosphoric acid	11.03	"
Chlorine	2.07	"
Lime	1.08	"
Magnesia	5.04	"
Potash	51.05	"
Soda	trace.	
Silica	8.06	"
Iron	0,05	"
Charcoal in ash, and loss	0.07	"
	100.00	

After its introduction into England, by Sir Water Raleigh, it was cultivated in Ireland in 1610, in Alsace in 1720, in Scotland in 1728, in Switzerland in 1730. Since this time its cultivation has been extended to every civilized country, and many barbarous ones, from the equator to the 64th parallel of north latitude, has added millions to the population of the earth, and has rendered almost unknown those famines which so often desolated the civilized world. Indeed, it has been said that if the sanguinary wars of the French revolution had occurred before the introduction of the potato, that Europe would have been decimated by famine.

How thankful then ought we to be, even in this day of degenerate potatoes, that they are left us at all, and how well spent would be the life of that man who could restore to us the potato in its original vigor and productiveness.

Very many theories have been, from time to time, promulgated relating to the deterioration of the potato, principal among which are degeneration, or a wearing out of its vital forces, which nature herself has disproved by recuperating, in a measure, this valuable esculent.

Another theory is that the disease is produced by excessive cultivation and high manuring, thereby inducing an extremely succulent and watery growth, and consequently a greater liability to be affected by atmospheric and other changes which are constantly taking place. That it is due to this cause, measurably, is patent to my mind, from the fact that the potato, when given its normal condition, *i. e.* a cool and equable temperature, allowing it to make its growth without subjecting it to violent atmospheric changes, it uniformly produces fair crops, as, for instance, if we plant early York, Sebeg or Goodrich in this latitude in March, upon new or fibrous soil, however well manured, we may confidently expect to harvest a good crop about the first of August; and also, if we plant in June, we may expect to gather a crop in September or October, if the season is proper, that is, not wet and hot; these are conditions that are not suitable to a healthful growth of the potato. In fact, a season that produces good wheat is apt to produce good potatoes, but a season that is subjected to violent extremes of heat and cold, especially upon highly manured soils, is sure to deteriorate and reduce the potato crop.

The present season, for instance, was noted for an excessively hot and dry June and July; now if these months had been alternated with wet and cold, as well as heat, it would have followed that the potato crop, both early and late, would have been totally destroyed, but the early crop having covered the ground with their vines before the extreme drouth set in, they were enabled to mature a fair crop. Those planted later succumbed to the drouth, while those planted late in June grew slowly until the fall rains set in, and then perfected a reasonable crop.

Now the effect of high cultivation, and strong and especially green manures, is such as to induce an extremely succulent growth of vines, and while in this condition, if such weather occurs as would cause rust in the wheat plant or rot in fruit, the cells, being gorged with sap, are ruptured, and decomposition taking place, it is immediately seized upon by microscopic fungi, and unless seasonable weather succeed the poisonous matter is communicated to every part of the plant, and a total destruction of the plant ensues. That it is due to atmospheric causes, in a great measure, there is no doubt, and it is also as true that a hot murky atmosphere is the superinducing cause.

Indeed, the disease has not been confined exclusively to the potato, for, about the same time, we have accounts of similarly affected bulbs and roots, as tulips, hyacinths, the sweet potato, various vegetables and fruits, as tomatoes, the yam, the cocoa, apples, peaches, pears and other fruits. That it is due to engorgement, or something analagous, I believe—the rupture of the plant cells presenting a proper nidus for microscopic insects and fungi, the vitality of the plant is more and more impaired, until finally, as in the case of annuals, they are completely destroyed; but perennials may linger from year to year, until they finally succumb, or, during more favorable seasons, eventually recover. This is a principal reason that we find certain plants growing within certain isothermal lines, or where the temperature is natural to them, and it is not strange that the potato, requiring as it does such peculiar conditions for its normal development, being transplanted to such a variety of climates, should become diseased, and the seeds of that disease be carried, perhaps, to every country where it is cultivated. It is to be hoped that the examinations now being made, relating to microscopic fungi, under the auspices of our State Horticultural Society, and also by scientific individuals, may ultimately lead us to the point from which we may more satisfactorily account not only for this but other mysteries connected with plant life.

Under the influence of heat organized bodies expand. So do some at least under the action of cold, taking 32 deg. Farenheit as the initial point; under the influence of electricity, however, some are resolved into their component parts; under the action of heat and moisture, tbe circulation of plants becomes active, and under that of light, plants, through their leaves and otherwise, form their organized structures, from organic and inorganic materials. All material substances exist either as solid, liquid or gaseous. Chemistry teaches us that all substances consist of atoms. We know how inappreciable the spores of microscopic fungi are; that, under a power of 500 diameters, some are so infinitely minute that they are scarcely perceptible, and yet they are *composed of atoms*, a single one of millions. Perhaps there exist animalcula so small that it would take many millions aggregated together to become visible to the natural eye of man. Now since atoms mass from everything with which we are acquainted, their arrangement implies contact, and who shall say that the attraction and repulsion of these atomic bodies may not produce disorganization, decay and death.

Atoms, however, remain unaltered. They are unchangeable and indestructible. But organized substances are destroyed or changed according to the arrangement of their component atoms, and herein a field for the chemist lies. In determining the true condition of matter in the healthful plant, and the variable modifications produced by abnormal agencies, not in the abstract, but as by means of external and internal influence, as, for instance, in what manner the normal condition of plants are changed by various agents, since all matter is made up of proximate atoms. So do the various combinations of atoms produce and reproduce everything visible and invisible—the air we breathe, the forest, the microscopic animalcula, or the prize ox, swelling with fatness. And so does an abnormal arrangement of these atoms produce disease, decay and death; not by degeneration, but from disorganization. And the student in vegetable physiology, who solves the problem relating to the derangement of vegetable organisms, and the means of prevention, even proximately, will deserve as well of his fellows as the savior of a nation. In the meantime we must use such means as we already can compass.

I have already stated that the potato required a cool equable climate. Michigan and Wisconsin are celebrated for their fine crops of potatoes, so are Maine and Nova Scotia. Now it is known that the climate of Michigan, nearly surrounded as it is by extremely deep water, and protected besides by dense forests, has a comparatively equal climate; it is warmer in winter and cooler in summer, not subject to so violent alternations of heat and cold as are the more open countries in the same latitude lying west of Lake Michigan. In fact the delicate Carter potato is successfully grown on the eastern shore of Lake Michigan, 200 miles north of Chicago, upon the clearings of the dense forests, for the reason that their summers, although short, are marked by a steady degree of heat and moisture, sufficient to mature the crop; so of Maine and Nova Scotia.

Wisconsin is subject to greater atmospheric variations, lies nearer the great treeless prairies, but is at the same time sufficiently protected to be exempt from the more violent extremes.

Indian corn requires a much greater average heat to mature its crop than the potato, but at the same time it will stand greater extremes of heat and cold. The least frost blackens the potato vine, but the corn simply turns yellow, subsequently recovers, and under favorable conditions as to moisture and heat matures its crop.

Let us look for a moment at the theory of degeneration as producing the potato rot. It is essentially this, that reproduction, by extension as by layering, by cuttings and by eyes, tends to so impoverish the vital energy of the plant from generation to generation, that it continually becomes more and more weakened, until finally it dies. Now plants, as well as animals, may be called both viviporous and oviporous, not scientifically, but, if I may be allowed the word, as a condensed illustration; and some plants, as the potato, dahlia, artichoke, etc., are both oviporous and viviporous—oviporous as reproducing themselves from seeds or ovules, and viviporous, reproducing themselves by tubers, or offsets or buds. Now the seed, in order to reproduce the living organism, must first undergo certain changes, must be placed in its nest and be hatched; but in reproduction from the bud, it is fed by the sap itself until it has put forth its roots and leaves and is enabled to draw from the earth its proper nourishment. It seems to be a law of nature that the more we refine either the animal or plant, the more susceptible it becomes to climatic and other changes; that the more we refine the more delicate becomes the tissue; that the higher we feed the more liable are we to engorge, and with engorgement comes rupture, disease and death. We have forced the potato, by high feeding and extreme culture, into excessive growth; under certain atmospheric or other conditions, engorgement ensues, the cellular tissue is ruptured, the vitiated sap decomposes, fungi attacks it, and unless assisted by other conditions favorable to the normal condition of the plant, finally ends in its complete destruction, or partial disorganization, leaves it in so feeble a condition that it is not able to fully elaborate its starch, and instead of the dry, mealy potato, we have the soggy, waxy and watery one. It is no argument, for it is only a theory, against the theory that reproduction from seed does not bring it back to a healthful condition, for the seed being but a minute part of the whole plant, may necessarily be diseased from the parent, and might, perhaps, continue so for generations, until it wears out, just as fever and ague wears out upon the human patient. But under fortuitous circumstances, it may at last regain its original health and vigor. That it has not done so yet is apparent from the fact that to-day there is not in the United States a potato that combines the good qualities of the Mercer potato for an early variety, or, for a late variety, the pink eye of thirty years ago.

Horticulturists recollect the consternation that was created by disease and death in the apple orchards of Southern Illinois a few years since. It was laid to a variety of causes, principal among which was the theory that root grafting was the cause, producing disease and decay, or in other words it was degeneration, or a wearing out of the plant from decreasing vitality. Careful observation, however, showed the roots to be infested by the apple tree root-louse (*Pemphigus Pyri*), and now, under the microscope, we find fungoid growth also, which may eventually be proved to have as much to do with it as anything else. The warty excrescences, produced by the Aphis perhaps, inducing fungoid growth, and a poisoning of the whole texture. It is a great field that is being opened, this one of microscopic examinations, and facts are proving every day that our best teachers are those who are investigators as well.

It may and does seem to many persons, otherwise intelligent farmers, that this labor of investigating the nature of microscopic fungi, both Phænogamous and Cryptogamous, so minute, as has been before stated, many of them, that under a microscope magnifying 500 diameters, the spores appear only as a fine mist, and it is quite probable that these tiny vegetable atoms may cause the loss of our potato crop, destroy our orchards, and render futile the exertions of the agriculturist. It is eminently proper that our legislators should foster institutions having for their aim the diffusion of scientific knowledge, relating to chemistry, botany, vegetable physiology, mechanics and microscopic examinations, connected with the arcana of animal and vegetable life.

It is to be hoped that the Legislature of the great State of Illinois, one of whose citizens conceived this grand idea of industrial education, the education of the masses to their several pursuits in life; we say that we hope that the State of Illinois will not be allowed to fall behind in this great scheme of industrial education because we have not the purse of a munificent and philanthropic Cornell among us, but will especially foster those schools which have for their aim the education of the industrial classes—the farmer and the artisan; one of which shall more easily feed the multitude, and add millions to the population, while the other shall harness yet undiscovered powers—an Archimedean lever that shall move the world.

The history of potato culture in Illinois shows plenty of failures, resulting from plantings in the month of May and early in June, for the reason before stated that the hot sun and dry atmosphere of July and August, or else the sudden alternations of wet and dry, hot and cold, are not conducive to the steady growth which the potato requires. But even under these circumstances, we may measurably succeed, by mulching, when the conditions are such that early planted ones do not perfect their growth before the heat of summer ensues. My own practice, upon clay or heavy loams, has been to plant as early in the spring as possible, upon deep fall plowing, by marking the land three feet apart, making a deep narrow furrow, which will of course be left filled with the fine earth. If you plant in hills, mark the other way, two feet apart, and put two strong single eyes in each hill. If in drills, plant the eyes about ten or twelve inches apart, stepping upon each piece in order to press it firmly into the earth, or if two rows are planted at once, this must of course be omitted, in which case a roller may be passed over the land before covering by the cultivator or hiller. Notwithstanding the assertion that it makes no difference whether the eye lies uppermost or not, I consider it bad practice to allow some eyes to lie up and some down, since they do not appear above ground at one time. Have them lie in the furrow as they are to grow, the eye up; cover about four inches deep. As soon as the weeds start, or the ground becomes encrusted, harrow thoroughly with a light drag, and continue to do so as often as necessary, until the rows can plainly be seen, then, with any suitable implement, turn a light furrow away from the potatoes, and within four or five days turn it to them again, and continue to earth them from time to time, until at the time of blossoming the vines will be supported by a moderately broad and high hill. If the vines now grow so as to cover the ground and shade the ridges or hills, you may confidently expect to harvest a crop, unless the season is unfavorable, that is, wet and hot, or with alternations of heat and cold. I have gathered fine crops by filling between the hills with litter or fine manure, to obviate the effects of heat and drought. What the potato most craves is a moist, equable temperature of the earth, which can only be obtained, in variable seasons, by having the ground covered with the vines or mulch. If these conditions are secured you will not be much troubled with weeds, but if so you must get them out by hand or otherwise.

Neither potatoes nor any other crop will thrive among weeds. In case blight attacks them severely cut the tops, but if slight leave them alone—they may recuperate; and in no case, when attacked by disease, should you dig them to save them, they are safer in the ground than out, unless the land is very wet, in which case, if they are dug, they should be spread thinly, and some absorbent, as lime, powdered charcoal, or dry muck, mixed with them. When thoroughly ripe they may be dug and placed in narrow piles to sweat and dry, after which they may be stored where they are to remain through the winter.

I have often been asked whether I would plant certain seeds in the old or new of the moon. This planting in the moon, as it is called, is mere heathenish superstition, but like other pagan practices, which some of us follow, has fact mixed up with error. Seeds sprout more quickly in the dark and grow faster in the light, and therefore if we plant that which is slow to germinate, as the potato, in the old of the moon, it has the dark nights in which to break, and appearing above ground just as light nights come on, it absorbs carbon, grows apace, and vice versa. If we plant peas, which germinate quickly, in the new moon, *they* have the light nights to grow in; and so the fogyish, unscientific and superstitious planter has the facts on his side, only he does not know *why*. Therefore, if you must plant potatoes late, do it in the old of the moon, if it comes after the middle of June, but in this latitude I should prefer to plant, especially if early sorts, the first of July, rather than the first of June.

This brings us to varieties. After having tried all the new sorts, except such as sell at one to three dollars per pound, I still plant Early York, or Buckeye; if it is Buckeye, in March, for early, and in June and July for the late crops. And now about sorts. Last season I found but little difference in productiveness between Early Goodrich, Chenery and Sebeg; they ripened about together. Early York, however, produced the best crop. A new sort, Titacaca, said to have been brought from a lake of that name in South America, was two weeks later in ripening, and were perfectly hardy in tuber, seed and vine. The first eatable potatoes were produced upon Chenery, June 15; upon the 20th Goodrich, Sebeg and Early York were eatable; Jackson White, Calico, Peach Blow and Harrison were affected by the drought to such a degree that they were a very light crop. They were all planted March 21st. More attention should be paid to the storing of potatoes than is generally allowed. Those intended for eating should be kept as much as possible from the light and air, and all potatoes should be kept at such a temperature as to prevent germination; but potatoes intended for planting certainly sprout more kindly and more quickly if they are exposed to the air sufficiently in the fall to become even greened before storing, on the same principle, perhaps, that the roots of trees dug in the autumn and healed in, get calloused and ready for growth in the spring. The planting of small potatoes cannot be too much deprecated, and why otherwise intelligent farmers will practice planting inferior and small potatoes, and at the same time be so careful in saving seed of corn and other cereals, is something wonderful. I have reduced a crop one-half in four years by the experiment.

A single strong eye, with a liberal quantity of tuber attached, is as good as more. In planting whole potatoes none but the strongest eyes grow, while if all the apparent eyes are cut out there will still be latent eyes, which, under favorable circumstances, will germinate. The small potatoes, however, in this day of high prices, may be utilized thus: Select a certain portion of the best potatoes, sufficient for the seed of the next year to be saved from, and if you continue this practice from year to year, you may plant the small potatoes for the market crop; but in no case must seed be saved from the produce of these small potatoes.

It is not necessary that we send long distances for change of seed. I have proved, from my own experience, that plants will not degenerate if care is taken to save seed from the best specimens, but will, on the other hand, improve.

DISCUSSION.

Mr. Parks—I would like to ask for the experience of potato growers in regard to the Colorado potato bug. I wish to learn whether this bug attacks the potato in its perfect state.

Mr. H. Dunlap—Yes; they will attack the potato patch in the spring, and literally eat it up.

Mr. Periam—I may state that I have watched this thing. I have not seen them actually feeding upon the potato in the spring, but I have found holes in the potatoes that might have been made by this insect. My experience extends only through two years.

Mr. Daggy—I think I have seen the perfect insect feeding upon the young plants in the hot-bed, early in the spring.

Mr. H. Dunlap had seen the same thing, and had his attention particularly called to it.

Mr. Rice inquired whether potatoes should be planted in hills or drilled.

Mr. Periam—You will get one-quarter more crop in drills. It is a question of time and labor. If you have time and labor enough plant in drills, otherwise in hills and in rows—both ways, so you can work with horse-power. I would prefer, in large fields, to plant in hills, three feet apart one way and two feet the other, just sufficient to get through.

Mr. Miner—I would ask in regard to sod land. Can we succeed in sod land in growing large crops of potatoes?

Mr. Periam—The finest crop of potatoes that I ever raised was by dropping the potatoes under prairie sod every other row. Still I do not think there is any economy in planting under sod if you have other land. It costs more to dig them from sod land. You must plow in the fall if you would raise a perfect crop of potatoes, and not fail in the spring to bring the ground into perfect condition.

Mr. Colman—I would prefer to turn over the sod in the fall if I wished a crop of early potatoes. I recollect one season, I did not plow my ground until May or June, and planted my potatoes in July, and started out on a lecturing tour, returning on the 8th of August. On examining the potato patch, found no potatoes there. Was again absent for six weeks, and when I came back I never saw such a crop of potatoes! I could not dig them all. [Laughter.] I would always recommend planting potatoes on sod land. The sod decays and furnishes excellent fertilizing material, suited to the potato.

A voice—Did you trench-plow?

Mr. Colman—No, sir; the season was rainy and just such as suited this crop.

Voice—What kind of potatoes?

Mr. Colman—Neshannock.

Mr. Galusha—I have raised excellent crops of potatoes on sod, but the labor of digging is considerable, if dug in the usual way. This labor may be saved by taking the plow and turning the sod back again. The potatoes do not go into the ground, but lie just under the sod.

Mr. Robinson—I have been in the habit of raising potatoes on sod, with the best results. I turn two furrows. The first furrow is turned just as shallow as possible, to get a firm sod, and the second furrow just as deep as possible.

Mr. Colman referred to the method of growing potatoes under straw, and said that they would bring ten cents more per bushel in the market.

ROOT CROPS.

A LECTURE BY JONATHAN PERIAM.

Root crops may be classified as follows: First, those having long tapering tap roots, more or less fusiform, as the beet, carrot, parsnip, radish, turnup and salsify or vegetable oyster. Second, tuberous rooted plants, as the common potato, the sweet potato, Chinese potato or Japanese yam, the chufa or earth almond, and the artichoke, and bulbous roots, as the onion, leek, shallot, garlic, etc. These, therefore, hold before enlightened nations a most important place as sustainers of animal life, increasing always in importance according to the density of the population. Only within the last one hundred years have they occupied their proper place in the economy of animal life and the rotation in farm cultivation, and have enabled Great Britain, especially, to keep pace measurably in her agricultural development with her commercial and manufacturing interests.

The rudest form of husbandry known is the occupation of a herdsman, but one remove from savage life, inasmuch as the savage hunts, kills and eats wild animals, and the herdsman breeds, slaughters and eats domesticated or half-wild cattle.

From thence, by another step, we have the cultivation of cereals, then the planting of vineyards and orchards, and lastly comes in the cultivation of roots, herbs and flowers. A combination of these arts results in agriculture, horticulture being but a branch thereof, (the poetry of agriculture,) pomology, arboriculture, floriculture, etc., being subdivisions again of horticulture, just as the breeding and fattening of stock, or the cultivation of the cereals, or of the grasses for hay, are subdivisions of agricultural art. Science, in a high degree, can only be displayed by an individual in the study of one of these branches, and yet this subject, agriculture, has been too often looked down upon as being only fit to be subordinated to every other profession and art in life—this agriculture, which feeds the millions, and actually sways the destiny of nations.

It is altogether useless for the slovenly or negligent farmer to attempt the cultivation of root crops, since being of slow growth at first, produced from minute seeds, and requiring much labor, as compared with corn, wheat and other grain producing plants, he will be sure of failure. In fact, the so-called gardens or truck patches, of many otherwise good farmers, are a by-word and laughing-stock to the passer-by, the home of every vile weed that will grow in the climate.

There certainly is need of Agricultural Colleges in a country where more than one-half of the farmers are content to live for three-fourths of the year on bread and meat, with perhaps a scanty and precarious supply of vegetables, when one hundred dollars, expended in seed and labor upon a single acre, would produce more healthful and better sustenance than double the amount expended in pork and flour, and doctor's bills, besides the enhanced pleasure in a higher enjoyment of life, produced by a table laden with various vegetable productions, important among which are tuberous and other root crops.

It is absolutely essential to success in the economical cultivation of these crops, that the land be in high condition, or it will be necessary to bring it so by deep plowing, heavy manuring, and the cultivation of some hoed crop of easy culture, as corn and potatoes.

Attention is also necessary to the nature of the soil. If it is wet or tenacious it must be rendered dry and friable by drainage and manures, which will act mechanically as well as chemically, always bearing in mind that root crops, except alliaceous ones, as the onion family, do not like recent manuring, unless it be compost, since it causes them to grow forked and knobby. The time spent in properly preparing the land will be amply repaid in the perfection and quantity of the crop. We stated in this morning's lecture that the potato ranked second among vegetable productions as a sustainer of human life. I now state that root crops come next in the scale of value as food-producing plants, and rank as follows: In that class, the beet, carrot and parsnip—all as esculents; and also the beet as a sugar-producing plant, the carrot as a promoter of digestion, and the parsnip for its saccharine qualities and as an excitant to the appetite. In the second class named in this lecture the common potato has already been noticed this morning. The sweet potato is well known for its saccharine and other nutritious qualities. The Chinese potato (*Dioscorea Batatta*), like other humbugs, has had its day, and therefore needs no other mention, but the chufa (*Cyperus Esculentus*), or earth almond, I think ought to have a place upon every farm. It is a perennial plant of easy culture, the foliage being grassy or rush-like. The tubers are produced at the end of creeping roots, varying in size from a hazlenut to that of an almond, which, when dry, they very much resemble, and are a highly pleasant and nutritious food, especially sought by children. Their cultivation is easy. Plant the tubers in May, in drills two feet apart, by six inches in the row, cover two inches deep, keep them free from weeds, and dig and dry them in the fall after frost comes.

The Jerusalem Artichoke (*Helianthus Tuberosum*) also is another plant which I think is generally under-estimated. It is of easy culture. It is not so rich in fat-producing principles, but in nitrogenous matter it is richer, as in sugar dextrine, albumen and casein, producing nerve, muscle, etc.

The next in the list for consideration among root crops are bulbs. The only one of principal importance, in an edible or sanitary point of view, being the onion (*Allium Cepa*), and deserves more than a passing notice. Notwithstanding the fact that over-fastidious persons object to its use, it still holds its rank, as it did among the ancient Israelites, as being one of the first among vegetables. It belongs to the same natural order (*Liliaciœ*) as asparagus, the hyacinth, tulip, squills, etc. The onion delights in a rich mellow loam, resting upon a dry subsoil, heavily manured with rotton manure. A good preparatory crop is peas, the land to be kept clean by frequent plowings; after removing that crop more manure may be added and a crop of turnips sown after, which will leave the land in a fine condition for the next season's crop. Make the land thoroughly fine by repeated harrowing and rolling, it having of course been fall plowed deeply; sow the seed in drills fifteen inches apart, leaving the plants close enough in the drills so that they will not crowd each other when swelling, at which time it is beneficial to draw the earth away somewhat from the bulbs. Do not work the ground deeply, but keep the surface mellow, that it may easily absorb the dew and rain; when the tops are dry the crop may be pulled and thrown into thin windrows to harden and mature, after which they should be stored thinly in a cool, dry place until wanted. The cultivation of garlic, shallot and top-onion are identical with that of the common onion, except in the case of the garlic the cloves are broken off and planted, and shallots and top-onions are produced by separation and planting of the small bulbs. The cultivation, as with onions, is to keep free from weeds, and gather when dry.

The cultivation of the sweet potato (*Convolvulus Batattas*) is attended with considerable expense, but not so much as to preclude its cultivation as a field crop in the central and southern portions of the State. About the usual time that farmers commence plowing for corn the whole tubers should be laid upon a gentle hot-bed, upon about three inches of sand, on good earth, placing them about two inches apart, and covered with four inches of leaf mould or some other exceedingly friable soil. The land where they are grown should also be made as mellow as possible by deep plowing and thorough working. The ridges upon which they are to be planted should be raised, in any convenient manner, as high as possible, three and a half feet apart, and the slips planted therein at a distance of sixteen to eighteen inches apart, and kept perfectly free from weeds, and the vines not allowed to root from their joints. They should not be planted, however, until all danger of frost is over, and the ground is thoroughly warmed by the increasing heat of the sun. In the autumn, if the season has been favorable, a crop ranging from 100 to 200 bushels, and occasionally to 300 bushels, per acre, may be expected.

Beets, parsnips, carrots, salsify, ruta baga and turnips, in garden culture, should be sown in drills about sixteen inches apart, and thinned in the row to about six inches, except ruta baga and turnips, which should be thinned to twelve to fourteen inches apart.

Radishes may be sown in drills one foot apart, and thinned to about three or four inches.

We now come to the field culture of the beet, parsnip, carrot, ruta baga and turnip. It is not for a moment to be supposed that the cultivation of root crops are of any economical value as compared with the corn crop, as estimated according to the value produced for a given amount of labor. If it costs ten dollars to produce an acre of corn, yielding fifty bushels, it will cost eighty dollars to produce an acre of beets, yielding 1,000 bushels. Your corn stands you in twenty cents per bushel, your beets stands you in eight cents per bushel, therefore we can produce 400 bushels of corn for the same labor that we can 1,000 bushels of beets.

Ruta bagas and turnips will cost somewhat less, but are not so good for feeding.

Parsnips and carrots will cost as much as your beets, and will not produce so much per acre, but are richer for feeding.

Consequently, it is useless to argue with the stock farmer, at the present time, to prove the economical value of roots as a fattening crop, when raised upon old and recently manured land, but place root crops in their proper place in the rotation, and they will make a different exhibit.

In breaking up a clover lay, trench-plow a portion of it in the fall ten inches deep, paring the sod as thin as possible. Harrow and roll in the spring, when dry, until it is perfectly friable, drill your beets in before corn-planting time, thirty inches apart, tend with a horse as much as possible, and besides once thinning and once hoeing, you should have but little more to do until they are gathered. This will reduce the cost one-half, and you may confidently expect from seven to nine hundred bushels per acre.

Ruta bagas may be sown upon sod. Trench-plow in the spring, say about May 20th to June 1st, and turnips, broadcast, after early cut grass, or even as late as August 1st.

Mangle wurzel beet is the sort particularly adapted to field culture, from its habit of growing one-half of its length out of the ground, and instances are on record of fifty tons having been produced per acre. It is eaten greedily by cattle, sheep and hogs, both tops and roots, and four bushels will fatten as far as one bushel of corn, as usually fed, and they leave the land in the best possible condition, without replowing, for any crop of small grain.

But it is especially to the farmer of but few acres, who wishes, nevertheless, to fatten as much stock as possible, in order to keep up the fertility of his soil, that root crops are particularly valuable. Upon the farm of 160 acres, and less, half may be devoted to grass and hay, twenty acres to root crops—beets, ruta baga, turnips, carrots, parsnips and potatoes, as follows : ten acres to beets, five acres to ruta baga and turnip, three acres to potatoes, and two acres to carrots and parsnips, the latter two to be fed to horses and milch cows, twenty acres to wheat or barley, twenty acres to corn, and twenty acres to oats or rye.

In the rotation here mentioned, the manure should be applied to the corn land and the sod before trenching for the root crop.

Within five years I should not be afraid to guarantee, if all the crops, except wheat, barley and potatoes, were fed to stock, and the manure saved and faithfully applied to the land, that the produce of the farm, in each ordinary season thereafter, would be, starting with good arable prairie land, faithfully worked, 160 to 200 tons hay, or its equivalent in meadow, 15,000 bushels beets, 5,000 bushels ruta baga and turnips, 600 to 900 bushels potatoes, and 800 bushels each of carrots and parsnips. This would give nearly 22,000 bushels of roots, besides potatoes, which should produce 50,000 pounds of beef, mutton and pork, annually, which, at five cents per pound, would amount to $2,500 per annum, as the product of the twenty acres, besides the value of the potato crop.

But it is to the villager, or occupant of from one to five acres, that the cultivation of root crops are especially valuable. We have shown the quantities of the different root crops that can be raised per acre, and they are not fancy sketches by any means, but are far below what are often raised. I myself assisted, when a mere boy, in the cultivation of two-thirds of an acre of ruta bagas, in 1839, the produce of which was 1,300 bushels per acre, individual roots weighing twelve to sixteen pounds each; and I have also in mind a prize crop of parsnips raised in the Isle of Jersey, in 1839, of 27 tons 8 cwt. per acre—30 tons 1,440 pounds of the present day—1,229 bushels per acre, at 50 pounds per bushel. The carrot will produce, usually, more than parsnips, and four bushels are considered as good for feeding as one bushel of corn meal. The principal value of carrots, however, is in feeding with grain, from its peculiar principle pectine, and its action on the digestive organs, enabling them to more readily assimilate the other food. But to return to the village farmer. Half an acre in beets will produce 750 bushels, and the mature leaves, stripped off from time to time, will feed a cow at night and four hogs principally during the summer and fall, and give for feeding, for six months in the year, over four bushels per day, which will fatten one cow and feed another for milk; and a quarter of an acre of parsnips will thoroughly fatten the four hogs, besides feeding four more growing ones until the next spring. Thus the village farmer of five acres may raise one and a-half acres of beets, parsnips and potatoes, half an acre of other vegetables, one to two acres of strawberries and other small fruits, besides corn and other crops.

The sugar beet, I believe, is destined to work a great change in the husbandry of many portions of our prairie land, and I see no reason, judging from its success in France and Germany, why it may not only supply us with sugar, both for consumption and export, but, in the vicinity of the establishments for its manufacture, so alter the system of rotation, as to be of great benefit to the farmer. Its success once established, will add millions to the agricultural wealth of the State of Illinois. It may be brought into the rotation once in four years, or oftener by the application of manure. A good rotation, where cattle are fed on the refuse of the sugar mill and the manure applied to the land, would be twice in a five-year rotation, viz: on sward trench-plowed, to be followed with small grain, then corn with all the manure, then beets, to be followed by small grain and grass, half of the farm to be in grass all the time, which would give 32 acres each year devoted to the production of sugar.

The cultivation of root crops, which has added so many millions of dollars annually to the agricultural wealth of Great Britain, and enabled that country to support its millions of population, is not simply due to the actual money value of the crop produced, but to the enhanced value accruing to the land by the feeding of cattle, sheep and hogs thereon, thereby increasing the production of the cereals by more than double over former years, and it is humiliating to us, with our deep rich virgin soil, that we do not produce of wheat, oats, rye and grass one-half that produced per acre by the English cultivator, and the difference is principally owing to the introduction of root culture in that country, with its attendant necessity, deep plowing; and the time is certainly coming when we too must adopt some such system to renovate our already partially worn land, and it is to be hoped that we may soon be enabled to institute experiments here that will tend to elucidate the facts connected with the renovation of our soils by drainage. Deep culture, rotation of crops, a knowledge of soils and their adaptability to certain crops, and the economical value of feeding carefully upon our farms the product of our soil. This very county of Champaign, which was formerly noted for its fine stock, is now dependent upon Texas and the Red river country for the steers she fattens. In order to keep up the fertility of our land we must engage more in mixed husbandry, and in order that our land may carry its full maximum of stock, we must come sooner or later to the raising of root crops, unless something shall be discovered hereafter which will take their place. I should consider it one of the most important and interesting experiments that this university could institute, not that I suppose that an experiment in any direction, instituted and carried out by any public institution, could be prosecuted as cheaply as by a private individual, on account of the fact that the minute record kept, and other obstacles attending any public undertaking, tends to enhance the cost thereof; nevertheless, the results arrived at are certain, and consequently carry weight with them.

I have compiled from various sources the following facts:

Indian corn or maize contains about 20 per cent. of water and woody fiber; wheat 30; barley 30; oats 36; rye 22 to 32; buckwheat 40; potatoes 79; turnips 90; carrots 88; mangle wurzle 87; the artichoke 86; the parsnip 86. According to another analysis the parsnip contains more water than the potato, and less than the beet and carrot, a larger per cent. of starch and dextrine, and less nitrogen than the beet and carrot. Experiments in feeding show, however, but little difference in their value for feeding, except in the case of carrots, which, by promoting digestion, thereby enhance the value of dry food.

A curious fact in the cultivation of roots is that stated by Mr. Stevens, embodied in the agricultural report of the Patent Office for 1847, that in the cultivation of Swedes, the drills 27 inches apart and the plants 12 inches in the row, an average weight of 8 pounds would give the enormous yield of 69 tons, 4 cwt., English, or 155,000 lbs=2,582 bushels per acre. Therefore, if we reduce the average weight per root of this crop 2 pounds, or would diminish the yield 645 bushels per acre, at 10 cents per bushel, it would pay the whole expense of cultivating and gathering the crop, hence we see the necessity in root culture of rich clean land and careful cultivation, and, in fact, a lesson may be learned thereby that will suit as well for many other crops. As regards the feeding of root crops, the flat white turnips should be fed first, then sugar beets, if any are raised, then ruta baga, and lastly mangle wurzel. These last may be kept good even to June or July, with care. I would not, from any remarks herein set forth, have it understood that I consider that the time has come for making the cultivation of root crops an economical or necessary part of Illinois agriculture at present, except in the case of small farms and village plats. The great drawback, however, is the scarcity of proper help for their cultivation at the right time; nevertheless, I do assert that, as the country is more densely settled, it will become more and more necessary, and that even now, near cities and villages, where help and manure is plenty, it may well become an important part of ordinary husbandry.

DISCUSSION.

Mr. FLAGG—Speaking of the value of the root crop for food for stock. I would not wish to depreciate or undervalue this crop, especially as I am not familiar with it, but this I would like to say. It is my impression that in Southern Illinois, and in a great part of the West, we will find it more profitable and cheaper to grow apples than the root crops. I think that will be the case for many years to come. I would advise growing the sweet apple for food for stock. First, for the reason that the cultivation is comparatively easy, and, secondly, it is much less expensive to grow apples than root crops.

Mr. PERIAM—I would state that I do not consider the growing of root crops, in any country, of any money value so far as the crop itself is concerned, but it is chiefly on account of the condition in which these crops leave the land. I do not value the root crop except in this way. It has a prospective value. I do not know that the time has yet come when we can engage largely in growing root crops, but ultimately we shall find it of great importance, as is now the case in England.

Mr. FLAGG—I would ask how the root crop thrives in our country as compared with this crop in England. Is not our climate too dry and hot?

Mr. PERIAM—The turnip is not easily raised here, but the beet will do well on ground in a high state of cultivation. In good soil, thoroughly pulverized, the beet will grow smoother. In soil recently manured you will probably have side roots. They will go where there is food for them. The greatest value of root crops is in fitting the ground to receive other crops.

Mr. H. DUNLAP—I planted two ounces of beet seed and had beets enough to feed a milch cow for three months.

Mr. ROBINSON—Is it profitable to grow beets for sugar? and what per cent. of sugar is contained in beets?

Mr. PERIAM—I have not given attention enough to answer this question satisfactorily; I think, however, they will give 12 or 15 per cent. of sugar.

Mr. H. DUNLAP—Mr. Emery, editor of the Prairie Farmer, visited a sugar factory in this State, and I think they stated to him that the beets contained 6 per cent. of sugar.

Mr. PERIAM—It is probably 12 or 15 per cent. of nutritious matter, made up of sugar, starch and other substances.

AGRICULTURAL BOOK-KEEPING.

A LECTURE BY CAPT. EDWARD SNYDER.

The subject on which I am about to speak certainly does not offer as many attractive or interesting features as many others. Perhaps the simple reason for it is that book-keeping is not a science, it is an art. That is to say, it is something to be done rather than to be known. It is one of those branches of knowledge that have been called into existence by necessity and fostered and improved by experience, following in their development and completion the exigencies of time and business.

It would be a vain endeavor for me to put before you in the short space of time allotted to me the history of its development, or a review of all the different systems of accounting that have been devised by men, or engage in a scientifical discrimination of their respective advantages, merits and faults. I must, by necessity, confine myself to presenting you a few general views and points, which I shall divide in two parts, the usefulness and bearing of strict accounting in common life, and its application to the administration of agricultural establishments of a farm. I propose in the outset to face one objection, and to reply to it, which is too often made against book-keeping, and that is the almost utter denial of its being of any use. There are a great many men, more than is generally thought, whose ideas on the subject might perhaps be expressed in the following words: "What is the use of all that scribbling and cyphering? Why, if I were to keep a hundred books, they could not increase my income one cent; if I would double the number, they could not decrease my expense by one-half cent. Let us have as little of that bore as possible. The only chief book which I take care of is the pocket-book; I grasp that tightly. I make what I can, I spend no more than I must. That's the way I keep books."

Well, it is true, books have never been devised to increase income, nor to decrease expense—we cannot change the past, even by the most careful record; it has been and is done. But for all that, those men are sadly mistaken. There is no man on earth who would not sit down some time and go over the history of his toil and his pleasures, of his earnings and spendings, for those words are synonymous. I repeat, those men are mistaken, they do keep accounts; the only difference is that they keep them in their heads, subject to all the mistakes of that faithless ally, memory, that refuses to serve us very often when we need it most; the difference is that they must try hard to guess where they ought to know.

The usual excuse for the neglect of accounting with these men is the work; there is too much writing to be done; entries to be made every day in some big books, and that is too much work after a day's labor. And then, as they said before, the game is not worth the powder. That is their reason, or, rather, that is the reason they give, for in truth there is another deeper reason lurking behind, which I will proceed to give for their benefit.

Men dislike to account for what they do. They have a perfect aversion against every restriction, be it even in the innocent form of a record of what they are doing. And this is especially true in money matters; they don't want to be reminded always by a record that they have been using hard-earned money foolishly and uselessly; if it happened so, let it rather be covered by the veil of oblivion. That is the true reason, though a very poor one. Now men would never think of, or consent to, handling somebody else's money or funds without keeping accounts, without being able to satisfy that party and themselves as to the use they make of it, and how they succeed in persuading themselves that they and their own interests are second to everybody else, is one of those strange freaks of human nature that are difficult to comprehend.

Now, for the sake of illustration, let us take a man, any man, let us just reach out into the throng of the thousands and grasp the first we meet with. Let him be a mechanic, or follow any pursuit of life, and let us see whether or not it would pay that man to keep accounts. Let us suppose that man is not engaged in any speculative enterprizes, but simply works at something for a living, earns what he can, and tries to conform his expenses to his means. Well, some day or another he will sit down and review the state of his finances. He takes out his pocket-book—the only book which he keeps—and, after counting and recounting its contents, he puts it back into his pocket with a great deal of disappointment, and a vague idea is in his mind that there ought to be some more money there—somebody must have assisted in expending his money, for he never used all that. He is puzzled and out of sorts, and goes over to the grocer to settle his account. He asks for his bill and finds it almost double the amount he reasonably thought he might expect, comes very near accusing that gentleman of cheating: but in looking over the bill he finds every item correct; he adds the column, no mistake there, so he sighs and pays. On turning the corner his tailor meets him and very politely puts him in mind of a little debt of some twenty dollars, which he ought to have paid months ago, but had forgotten it. He hastens to apologize for his forgetfulness and foots the bill, but goes home in a vague fear that on the other corner somebody might make a charge on his purse in the shape of some long forgotten bill. He tries very hard to remember whether he owes other bills, is very angry with himself, forms a resolve to keep things in better order in the future, but generally that feeling subsides, and he goes the old round over and over again. Now, gentlemen, would it pay that man or not to keep accounts? Would it pay that man or not to know where his money goes?

Leaving the answer to you, I digress to present to you another aspect of the case. Suppose that man had, by some adverse accident, to reduce his expenses to a certain degree, to meet a diminished income, how would he be able to tell which of them are real necessities and which could be possibly avoided? He will be in the same dilemma as when he explored his pocket-book; he will fail in the attempt sure and certain.

The fact is but few men know what they really want for living, excluding all unnecessary expenses. It ought to be the duty of every man to ascertain that. It would arm him against every reverse of fortune, and if for no other reason this alone should be sufficient for every man—I admit no exception—

to keep account of his earnings and spendings. Success is the aim of life, of every business, but our success in life will be much affected by the intelligent use of our means, and our well being will almost chiefly depend on our ability to supply all our reasonable wants. Wealth in general, or money, is the mean s of procuring and satisfying all our material wants, and we cannot be too careful in handling that powerful element.

It is true, wealth is a relative quantity, every man carries his own standard of wealth within himself. One might be satisfied with a few thousands of dollars, another's desires might exceed a million, but I persist that if we succeed by strict account and control to ascertain the sum of our wants, we shall certainly be better able to work for the attainment of that aim.

Another thing deserves mention here, and that is the fact that in our present age many men incline to live beyond their income. The form of society, fashion, the multiplicity of wants which civilization naturally carries in its train, and the tendency of well living to gratify all the longings of a refined and cultivated mind and taste, may be the reason of it. Now I pretend that if anything can possibly check this tendency it is the keeping of accounts. I declare it incompatible with common sense to have, every time we foot the pages of our book, those silent witnesses of dissipation stand out in bold relief, and not to think of remedy. And the thought once conceived, half the work is done; plans to amend the deficiency will suggest themselves, action will follow the thought, and, if anything, that might cure.

Returning to the relation of book-keeping to life, I desire only to say that it has the same relations to practical life as every other and all the other sciences and arts in the broad field of human knowledge and experience. That is, it will become important just in proportion as it is found to be useful. Let us take any of the sciences to illustrate this theorem, for instance, chemistry. When at first, in the dark ages of the Mahometan conquests, taken up scientifically, men grasped the discovered principles with the full ardor of enthusiasm; leaving behind them the demands of practical life, they strayed off into the realms of speculation. Science, principles and theories were all, their connection with practical life nothing. They rose up to those sublime heights of science, wrapped in mysteries and clouds, and removed from the view and comprehension of common people. Chemistry was a mere pure science then, but did it enjoy the universal esteem, was it thought of so much importance as now? No, and deservedly not. It was only when it stooped down to our wants, when it went out into the field with the farmer, when it entered the workshop of the mechanic, in one word, when chemistry came to live among us, that we conceived its importance, just in proportion as we found it useful.

To-day it has entered our households; the time is near when our ladies will not be satisfied with the common fact that when they put cream in the churn and move the handle up and down the result will be a lump of butter; they will inquire into the reason, and I hope that the solution of such questions will afford them not only satisfaction and pleasure, but also benefit them. It is only when we admit an art or a science into our very household, when we grow perfectly acquainted with it, that we can avail ourselves of its aid and judge of its practical value.

I have recently been reading an Essay on Economy, of a French author, who, in speaking of Holland, says that the ladies of that country are the most economical, the most intelligent economists he ever met. He ascribes this to the fact that the Holland ladies are required to keep formal accounts of their domestic expenses and receipts. That they make out yearly statements, showing what was spent in every department of the household, and that they take a great deal of pride in the accuracy and correctness of those accounts, exhibiting fully the judicious use they made of their funds. He quotes, as a singular coincidence, that the Kingdom of Holland has scarcely any national debt, a singular exception to the heavily indebted European countries. It is a strange coincidence we must admit, but there is a connection between those two facts, nevertheless. The financial affairs of the Kingdom of Holland are simply a reproduction and the sum of all its domestic affairs; the sense of order and economy, inculcated by their mothers, carried their effect into public life just as sure as the reverse would have done.

We might inquire here, what is economy? Is it the saving, the hoarding of the almighty dollar? Is it the stingy and miserly self-denial of life's enjoyments for the sake of accumulating wealth? No; it is just as far from the one as it is from the other; just as far from the spendthrift as it is from the miser. It is the right use, the intelligent use, of money or wealth. How many, how very many, men will take a five dollar note and spend it uselessly, satisfying the desire of the moment, gratifying one passing thought, without thinking that that amount represents the weary toil of nearly a week's hard work of the average of men. For what is money but the conventional mark of men and women's work? Gold and silver have not the power to satisfy any of our desires or wants—in their form a mere matter—nor has their substitute, the paper currency. Men and women's work is the only value on the face of the world. Everything is esteemed and valued by the amount of work that its production cost. If a barrel of flour cost $15, it is because it takes just as much work to produce it as there is work in $15.

But in order to arrive at the intelligent use of money, of that product of our toil and work, into our intellectual faculties, we must control that use, must call ourselves to account for every part of it which we employ to satisfy our desires and pleasures.

As soon as we step out into life and business, the importance of well regulated accounts becomes at once more prominent. A merchant can never think of being without correct accounts and books; it is forced upon him by necessity; it becomes there the very next thing after the business itself. It would be useless to recommend it to them, they know and appreciate its value. And still there are many, full too many, instances of indifference, incompetency and negligence, even among those men; but there the results are so striking that there are comparatively few that would not do their best to fill the bill, for we know by experience that in nine cases out of ten we can trace every failure in business, every bankruptcy, to that very source, to the deficiency of accounts, to which we ascribe many a ruin in common life.

The farmer is a trader; after buying a farm he is a merchant. His success depends partly on what he grows, most on what he sells and how he sells. If producing is the first condition, the selling is certainly the second condition, and the conforming with the demands of the market just as important for him as for the merchant. What has been said of the merchant is equally true of the farmer; no intelligent management of his business is conceivable without full and correct accounts, because the information to be derived from them is just as indispensable to him as it is to the merchant.

Here we must insert a definition of book-keeping. In most of the text-books we find the following: "Book-keeping is the science of recording business transactions." This definition I believe, leaves out the main requirement of book-keeping. Why, the mere recording of a transaction would not satisfy any business man; a schoolboy could write down everything that happens in some form of a record, but that still would not be book-keeping. I say we must be able, from our books, to learn at any time the whole state of our business. We must keep, always ready, our records in such a form that we may be able to condense them without much work into one statement, where we can encompass at one glance all our affairs, and also their results.

There it is where many make so strange mistakes, and waste their work in the mere form of recording. I have often been told by parties, "Why I did keep books, and I have taken a great deal of pains to have them full correct, but somehow they failed to satisfy me—they did not show what I wanted." Where was the mistake? That man had certainly recorded everything that he thought worth knowing, perhaps too much of it. Well, he succeeded admirably—his work was a record and nothing more.

It is always so in nature: we must be disappointed if we expect from given causes more than their natural effects. Cash-book, day-book, ledger. We are driven here to the conclusion that in framing a system of books, we must steadily keep the end in view; we must clearly and fully ascertain what we want our books to show, then give our records the necessary subdivision and bearing; we thus avoid disappointment.

The question suggests itself here, "What do we want our books to show?" We might condense the answer in five points.

1. What we have.
2. What is owing to us.
3. What we owe.
4. What we have gained or lost.
5. How much we have.

Here we must mention the two great divisions in the various systems of book-keeping—by single and double entry. They are just what their names imply. The first records record every transaction once, as I might say in answer to the question "Where is it?"

The second is a more complicated system, whose origin we can trace back as far as the twelfth century, and which is said to have been hit upon in Venice, Italy. Its chief characteristic is that a twofold entry is made of every transaction, as if it be in answer to the two questions, "Where did it come from, and where did it go to?" Of the above given five requirements of a set of books, single entry will fill the first three conditions, the fourth it will answer indirectly. In order to have them all correctly answered we must keep books by double entry. As I have demonstrated to you that the closing of books, the producing of a statement of our business, is the chief aim of books, I present to you herewith the close of a set of books of single and double entry. [Demonstrated.]

In the balance-sheet and loss and gain account of the double entry closings I have indicated the account which I think must be necessarily represented in a farmer's books. And here the reason comes in why agricultural books, by the very nature of the business, are more complicated than the books of the common merchant. It is because the farmer is something more than the merchant; he is also a manufacturer, and he must therefore adopt in his accounts part of the system used in manufacturing establishments—that is, the balancing of the cost of material and labor against the produce, or else his account will leave him in the dark about wherefrom and how his gain comes to him from this or that department.

If the farmer wants to know, not to guess, how much a bushel of wheat costs him, and consequently how much he makes on it, he must do exactly the same way. If he thinks it desirable to know the produce of his orchard, he must keep account of that part of his farm. He is free to make his choice between the two systems, let him select whichever he sees fit, but abide by the results; but never accuse the art of its incompetency of fully tracing all the phases of business, if rightly used. I will also put in here the remark, that though the double entry system might seem complicated it does not require much more work. The work of recording will be the same; it is only the place to be carried to, and the way of systematizing, that is the difference.

I am perfectly aware that I have not thrown all my remarks into the path of agricultural book-keeping and its form, but in taking you over the technical dry forms that have been devised, to intelligently discriminate between their merits and uses would have taken more time than I possibly could occupy, and I am afraid would have tired out the larger part of my audience. I hope and wish that some future day I shall be permitted to put before you systematically the arrangement and development of a full set of farm books, also to give you a synopsis of the so-called tabular system, which is used in the administration of the larger estates of Middle Europe, and shall be ever eager and willing to confer my mite to the advancement of the agricultural interest of our country. For if we cast one searching glance into the future of this country, we can easily discern that agriculture and the industrial arts will be the great basis of its development and grandeur. We never shall be a warfaring nation of conquerors. The very nature of our institutions, the form of our government, will protect us from that disaster. We hardly ever will be a people of traders; our seacoast may, but the great inland stretch of 4,000 miles from east to west, will be the emporium of agriculture—of agriculture in such perfection as the world never beheld before.

This reminds me of a quotation, which is ascribed to Franklin, where he says, "There are three ways for a nation to acquire wealth. The first is the way as the Romans did of old, plunder the neighbors, and carry off what they have. This is robbery. The second is trade—but great profits in that lirection naturally imply cheap buying and high selling, which has a tinge of cheating in it that we know by experience never proved beneficial to the character of a people. The third and the only honest way for a people to acquire wealth is agriculture and industry—we must grow and manufacture what we want, and so much more to exchange for the necessary products of other soils and climates."

America has indeed followed Franklin's opinion; she is under full headway to establish her grandeur on the broad honest basis of agriculture and ndustry.

ORCHARD FRUITS.

A LECTURE BY DR. E. S. HULL, OF ALTON, ILL.

ORIGIN OF ORCHARD FRUITS.

To grow orchard fruits you must have orchard trees, and to grow either or ooth successfully, requires a knowledge of the laws of vegetable growth. These laws are so complex as to require careful observation, much time and hought. It is not our purpose to enter into a full explanation of these laws, nd yet reference to some of them will be necessary in order that we may now how to modify their effects on our trees and on our fruits.

All our trees bearing improved fruit have been brought to their present ondition by reproduction from one or other of the wild or unimproved species to which they belong. If we carefully compare the wild or uncultivated ree with one of their descendants, we shall at once be struck with the change hich has been effected. The wood, the leaves, the fruit, how changed! One ready to ask, can it be possible that such large and luscious fruits as Howl or Beurre Bosc pears could have descended from the harsh fruits of the orny trees indigenous to the European and Asiatic forests. The apple, too, hich has been called the king of fruits, once existed only in thickets in the me countries with the pear, as a thorny, compact tree, whose fruit was nall, and of a quality not better than the fruits of our native crabs. From ese, and from similar beginnings, all our improved fruits were derived. his great change was produced in the simplest manner, viz: mainly by stimating the growth. In this way an enlargement in the leaves, and a slight crease in the size of the wood cells, was effected. From trees thus wrought on seeds sprang up; these in turn being subjected to similar treatment, in e next and succeeding generations were further removed from the wild type, til at length the small, compact and thorny branch has been turned to e much smoother and larger, the fruit of which is of the highest excelnce.

How great the change is which has been effected, will best be understood hen we state that among all the species of fruits which are now grown in ir orchards, not one of them, when in their wild state, could at all compare quality with our persimmon. But all this has not been done without to some extent affecting the hardihood of the trees. The cells of both wood and fruit, the leaves, the branches and the pores, all are so enlarged in our improved trees as to retain only a semblance of the native stock from which they were derived. With the structural parts so enlarged comes countless blights and diseases, which have, in the course of a few years, spread to all parts of the land. To some of these diseases, also to the structural change which takes place in the amelioration of fruits, we shall again briefly refer.

NURSERY TREES.

Orders for nursery trees are generally given to nurserymen residing north of the place where the trees are to be planted. This is done under the impression that northern grown trees are hardier than trees grown at home or south. When or how this conclusion was arrived at we do not know; that it is erroneous we think may be shown. For example, if we examine trees grown far north, we find that their growth is often checked by frost at a time when the new cells, although perfectly formed, were yet soft. These soft cells resemble more those of succulent than hard wood plants. There will also be found to be present a large supply of unorganized materials for the formation of other cells which cannot be elaborated by the tree in its present condition; these young trees are therefore gorged with crude juices, which are greatly expanded by the severe frosts of winter; the new cells are burst, and the unorganized materials in the tree ferment and destroy the healthy parts with which they are in contact. On the other hand, trees grown very far south are, on the approach of winter, sometimes in a situation so similar to trees grown at the north, as to deserve a passing remark. Owing to the great length of the warm season, trees at the south often cast their leaves at midsummer, and after a short period of rest they make a second growth of leaves, which cannot be matured before they are killed by the frosts of winter. When this occurs, both the northern and southern trees are in the same condition; both are largely supplied with crude matter which they cannot mature, and hence the trees of both sections will be found to be too tender to withstand, uninjured, our mildest winters.

If the facts we have stated are borne in mind, they will afford a clue to the treatment trees should receive at the two extremes of latitude at which it may be desirable to grow them. For instance, a tree at the north should be so treated as to enable it to mature its growth some days or weeks earlier than they would do if cultivated as they commonly are. On the other hand trees grown at the south should receive such culture as would prolong growth to as late a period as possible, and thereby avoid the summer rest and tendency to a second growth. If these conditions are secured, the trees of both sections will be as hardy as those which grow at an intermediate point, where they mature at the proper time without artificial aid.

SPONGIOLES OR ROOT HAIRS.

The removal of trees necessitates the loss of by far the larger part of their small fibrous roots, but not of spongioles, as is erroneously supposed, since, a the time trees are at rest, their roots are destitute of spongioles. That this is so may be known by inspecting the roots in the spring. At this season of the year roots will be entirely destitute of spongioles, but as the period of growth arrives, from their sides, especially of the smaller roots, will appear many small warty excrescences. These excrescences are made up of a vast number of little bladder-like cells; each new cell, as it enlarges, divides into two, and each of these again divides and is added to those already made. In this way it is, by the multiplication of cells, that new roots, as well as other parts of trees, are formed. It is to the sides of these newly formed rootlets that the spongioles are attached. These spongioles, or root hairs as they are sometimes called, are not roots, nor do they ever become such, any more than leaves above ground become branches. The office of the spongioles appears to be to extract food from the earth needed by the tree in the season of growth; they act in concert with the leaves, and in the autumn they separate from the roots. Therefore, from the fall of the leaf until growth commences in the spring, all our deciduous trees may be said to be spongioless as well as leafless.

Shall we grow our trees with branches starting from the ground, or shall we prune; and to what height? These and similar questions are now often asked. We think it would be superfluous to give any instructions in growing fruit trees to low heads, since for the past sixteen or eighteen years all our journals, both horticultural and agricultural, have vied with each other in descriptions how best to accomplish, as they supposed, so desirable a result. Indeed so much has been written on this point that we have gone from trunks six to eight feet high down to those of as many inches. These low-headed orchards, on coming into bearing, have disappointed, or must soon disappoint, their owners. The conditions attending the growing fruits are now so changed from what they were but a few years since, that trees with low heads are in the main no longer a success.

They increase the labor of cultivation many fold. The low branches cut off the under circulation, inducing disease in the foliage and not in the fruit. They invite insect enemies, and make it difficult if not impracticable to arrest their ravages. In short, low heads are a failure, and the sooner we can induce people to start the heads of their trees at a proper height, the sooner will it be possible to successfully destroy insects, to ward off diseases, to insure color to the fruit, and make it practicable to cultivate quite up to the trees by means of horse power.

In planting an orchard we select trees according to their kind—apricot, peach, plums and cherries, one year old, from bud or graft; apples and pears, two and three years old.

The four first named, if well grown, will be not less than five or six feet high, and will have many side or lateral shoots branching out horizontally from the main or vertical stem. In addition to the side branches, there will also be found numerous buds, extending from *the ground to the top of the tree.* Cut away all the branches and buds to the height of twelve or fifteen inches. Next cut away all the buds below the point at which it is intended the tree shall form its head, except six or eight buds, which are to be left at regular intervals and on different sides of the stem. These last mentioned buds will push into as many branches *as there are buds*. It will be necessary to keep these side branches pinched back to ten or twelve inches during the summer, to prevent them from running off with the growth and robbing those buds and branches selected for the future head of the tree. Sometime after the fall of the leaves and before growth commences in the spring, reduce the side branches to one bud each, and when the branches from these buds shall extend to ten or twelve inches, pinch them as directed in the first year. The treatment will be the same the third year as we have directed for the second, except at the end of the season cut away all the side branches except those intended *to form the head of the tree*. The object of the side branches, of which mention has been made, was to strengthen the stem or trunk of the tree. Without them the trees would have become top-heavy and bent the trunks. Trees grown as we have described will have straight and tapering stems, which will be of sufficient strength in their fourth year to stand erect.

BUDS, GASSES STORED, ESCAPE OF GASSES, CAUSE OF DEATH, ETC.

To show the effects which frost, overbearing, and succulent growth have on the fruit buds of orchard trees, it will be necessary that we briefly describe those parts of the bud to which we shall refer. The buds of stone fruits of orchard trees may be separated into two classes. First, those which contain single germs of fruit, as the apricot and peach. Second, buds that inclose several germs, of which most varieties of the cherry are examples. Since the structure in both of these classes of buds differs only in so far that several of the latter are folded in one envelope, a description of one class will answer our purpose for both. The germ of all our stone fruits at first consists of a single cell, and this is situated in a small cavity, which, according to some botanists, consists of an embryo leaf, folded by the tree into a form much like a vase, but more tapering at the top; the sides or wall of the cavity thus formed is made up of numerous small cells. To appearance these cells are built up around the germ cell much as a mason would inclose a conical space with brick, with the ends pointing to the center. The cells at first are soft and readily press together so as to perfectly touch each other and make a close wall. The forms of these cells differ from wood cells in so far that the exterior and interior surfaces are not pressed upon by other similar cells, as in woody structure, and hence they appear, when viewed from either surface, to be of an oval form.

The parts of the bud we have described, and to which we shall refer, are covered with the corolla, which is the colored part of the flower, the calyx, which forms part of the envelope of the bud, and the scales, which inclose the whole.

Large and improved varieties of fruit we produced only on trees which have much larger wood cells, annual twigs and leaves, than seedling trees or those with small fruit. The buds of improved varieties are also large, and the scaly portions covering the interior parts of the bud are folded together more loosely than in smaller ones; so large and loose are some of these exterior scaly coverings, as in the Melocoton family of peaches, that it frequently happens that moderate freezing of the buds, especially while they are wet, partly unfolds them, so as to admit of the escape of what is believed to be carbonic acid gas, which, so long as it remained, protected from frost the little wall of cells which inclosed the fruit germ, as in the peach. Gasses or fluids not only inclose and protect from the effects of frost the exterior wall of the cells that surround the germ cell, but the cavity in which the germ cell is inclosed is also filled with carbonic acid gas or other fluid, as has been ascertained by puncturing, and to which experiment we shall again refer.

Hence it never occurs that the germ cell, or the interior surface of the wall of cells surrounding it, can sustain injury until an opening is made in the wall by separating one from another the cells of which it is composed. But so soon as an opening is made the gasses or fluid escape and the germ is killed.

That the escape of gasses or fluids stored in fruit buds is destructive to them, as well as to the embryo leaves inclosed in the leaf buds, may be known by piercing the buds with a small broach not larger than a hair. If this is done in cold weather, the bud, whether it be leaf or fruit bud, is immediately killed by freezing; but if we perform the operation on a warm day, the bud will retain its vitality until frozen. If we delay, and puncture the bud after freezing weather is past, then the germ of either leaf or fruit will grow as though the puncture had not been made, except that in the leaf a small hole will appear, and the fruit will develop a scar at the wounded part.

It not unfrequently occurs that, very early in the spring, a small brown fly pierces the side of the wall of cells to obtain the sweet substance stored within. This it often does without preventing the growth of the germ.

In view of these facts it appears that the gasses or fluids are stored in the buds of trees only as a protection against frost. It will be asked, if the buds are protected against cold as we have stated, why the leaf buds are not killed at the same temperature that kills the fruit buds? The answer to this is, that the fruit buds have a larger share of nutriment stored in and around them, with which to commence growth, than is stored in leaf buds, and it is perhaps on that account that the fruit buds are most excited and are first to expand. But, most of all, the less power in the fruit bud to resist extremes is due to the premature separating of the calyx and scales covering the bud, induced by growth of the interior parts of the bud. This inside growth of the bud is due to the increase in size of the individual cells that surround the germ, and as these enlarge they expand the outside coverings of the bud, so as to make them more susceptible to moisture and ruptures by frost.

Therefore, the power of buds to resist cold is determined by the condition of the buds at the time the freezing occurs. For example, in the winter of 1856 and 1857, at Alton, the thermometer indicated 20 deg. below zero, and when carried a few feet away from the building it sank to 27 deg. below zero. Notwithstanding the severity of the cold, the Alton district was, the following summer, noted for its great yield of peaches. Our observations at the time went to show that the injury to the buds was only as one in eight.

Perhaps at this point we ought to explain the conditions combined to produce such favorable results. The trees having borne no fruit the summer preceding the winter to which we have referred, continued to grow until near the period of frost. There was, therefore, no premature swelling of the buds, as is quite common in the fall. The scales covering the interior parts of the buds were closely folded. Even the large and pointed buds of the Crawford's early and late varieties, which are classed among the tender peaches, were in a condition seldom seen at so late a period. The ends of the calyx and scales, which in these varieties usually appears to be partly open at the end of the bud, were so closely folded as to exclude moisture. In short, the buds were perfectly developed, and, up to the time of the severe freezing, had not frozen in the least, and were, on that account, in a condition to resist the lowest temperature possible for buds of the peach to endure.

Perhaps no injury sustained by fruit buds is more common than the bursting of a single cell in the wall inclosing the germ-cells. When hard freezing occurs, it sometimes happens that some of the cells pointing at the outer surface are ruptured; when this happens to only one cell, the exterior coating of the cell is held in place, and the fruit grows as though the injury had not occurred; except at these wounded places a scar will appear on the surface of the fruit. Also, in the early stages of growth, these wounded parts afford resting places, to which some of the cryptogamous plants attach and rot the fruit.

All our orchard fruits are more or less liable to this casualty, but most some varieties of pears; next, the English Morello, the Heart, and some of the Bigarreau cherries; peaches and plums somewhat less, and, as a rule, apples least. The germs of all fruits are most liable to injury in the way we have described the winter after they have produced heavy crops.

When two, three or more contiguous cells are burst, the fruit-germ generally perishes within a few hours or days, or, if the bud blooms and the fruit matures, the scar remains and arrests growth at the wounded part. When several ruptures occur, but on different sides of the wall surrounding the germ-cell, and the fruit matures, as is sometimes the case with some varieties of apples, then the fruit becomes knobby and of little value.

It not unfrequently occurs that fruit buds are changed to wood buds in the season of growth; this takes place only in trees, or parts of trees, that are making a very succulent growth.

All who are familiar with the practice of budding the peach will readily call to mind examples of this in stocks budded early in the season. If, under a microscope, we examine fruit buds taken from a tree of very succulent growth, we find in some the single cell or fruit-germ is wholly wanting; in other buds it is present, but the little wall of cells, of which we have previously spoken, is incomplete, one side being built up to the proper height, while in another part much is wanting, and in others the wall cells are so loosely placed as to suggest the possibility that many of the little cells had perished, leaving openings that remind one of a brick wall with many of its bricks pulled out.

This kind of defect in the buds of all our fruit trees is by far more common than is generally supposed, and often is induced by a cause directly the opposite of the one we have described, as will be known by an examination of buds grown on trees which have, the previous summer, produced an over-crop of fruit. A large proportion of buds on trees that have been overtasked are so like those of trees which make too succulent growth, that a description of one answers for both.

We well recollect the congratulations we once received of some fruit men, on viewing a vigorous peach orchard of ours in its fourth year, which was then full of bloom. We also remember how hard it was to make them understand, on account of the vigor of the trees, that, on the whole orchard, not a single peach would probably be produced.

Similar examples with the pear must be known to many now present. It is not uncommon for estimates of pear crops to be based on the fine display of fruit buds, and for the whole to prove abortive, from one of the two causes last named, but especially to the latter, and not to imperfect fetilization, as is generally thought. All, doubtless, are familiar with the fact that certain free growing varieties of apples, as Northern Spy, Yellow Bellfleur and others, on rich land, are many years barren of fruit; the trees bloom but the germs are defective by reason of the wood growth carrying away the nourishment needed to perfect the fruit-germs. The tendency of some varieties of fruit trees to produce overcrops one year and to pass through the following or alternate years without fruit, is well known. The varieties of fruit that are complained of are those only in which the tendency to wood growth is early completed, and at a time when both the roots and the leaves are active in elaborating plant food.

In some varieties all the food collected by the trees seems naturally to go to the formation of woody growth; in others it seems just as natural for the wood growth to cease in time for a portion of the leaf buds to change to fruit buds. When the terminal buds on the current year's shoots show themselves early, then the leaves continue active in the production of plant food, which is stored in all parts of the tree; buds which before were only leaf buds are changed to fruit buds. Sometimes a large proportion of the leaf buds are so changed, and so large an amount of nourishment stored that a tree has been known, the following spring, without the action of the roots, to produce leaves and a full crop of fruit to more than half their natural size.

We have experimented with apricot trees by keeping their roots frozen so late in the spring that many of their leaves were fully grown, and the fruit had acquired more than half its natural size. Similar examples might be cited. For instance, grapevines have been planted in open borders and afterwards passed through the walls to the inside of a conservatory in which fires were kept up. Such vines have produced both leaves and fruit of considerable size, while the border, in which the roots were, was yet frozen.

It is wholly within our means to prevent overbearing or barrenness in trees. And he who is ambitious to grow fruit of first quality, or to the most profit, should thoroughly understand the peculiar habits of each variety and the method by which both barren or alternate year bearers may be made to yield a full annual crop of fruit.

To understand this we must refer to the trees active in growth. Trees which expend all their forces in the production of wood growth can produce little or no fruit. Indeed, it is not possible for any tree to perfect a fruit-germ and not again in some way disorganize it, unless the wood growth shall cease in time for the leaves to elaborate food enough to grow both leaf and fruit the following year, or until a part of the leaves shall attain to nearly or quite their full size. That this is so will be apparent when we consider that the leaves, which first appear in the spring, were formed in the buds the previous year, perfect in all their parts, and in the embryo state contained each individual cell found in them when fully grown. But we are asked, if there is no addition to the number of cells, how do the leaves grow? The answer is, that the only difference we can see between an embryo leaf and one full grown is in the size of the leaf cells. As growth begins in the spring, these small cells, which were formed in the previous year, begin to expand. Each individual cell thus enlarges until the whole of the numerous cells of which the leaves are composed are of full size.

To further illustrate this, let us suppose in a brick wall that each brick at the same time was gradually to expand several hundred times its present diameter, and you have just what takes place in the growth of an embryo leaf. Here we find the tree in possession of a full grown leaf. This leaf did not form itself, but was formed by the tree in the preceding year. To produce and sustain this cellular enlargement there had been stored the previous year a large share of nutriment in the buds and in other parts of the tree; this nutriment or plant food must not only be sufficient to feed the embryo leaves, but must also be sufficient to produce the small warty excrescences, the rootlets and spongioles. These new leaves and spongioles are the tree's laboratory. And those leaves and spongioles first grown were made, with the exception of moisture, wholly out of the materials that were stored by the tree during the growth of the previous year. When these vegetable stores are in sufficient supply to do this, and nourish the fruit-germs also, then we shall hear little about imperfect fertilization. On the other hand, had the food been consumed the previous year by ripening an overcrop of fruit, or by making a very succulent growth, then the tree would not store a sufficient amount of plant food to perform its threefold office in the production of leaves, roots, with their spongioles, and fruit. In this condition a part of the leaf, and the larger part or all of the fruit buds, yield up their nourishment, which goes to the production of root and leaf growth. The tree, therefore, is barren of fruit for the summer, its whole growth being required to recuperate the vigor of the tree. Such trees often bloom freely and cast their bloom. When this occurs uninformed persons often attribute this to want of fertilization, or suppose that the rains have washed away the pollen, and the like.

Having thus hastily referred to some of the causes of our fruit production and wood growth, we will now return and state, first, how we treat trees bearing alternate crops, and second, how to bring unproductive trees into fruit. First, then, alternate bearing trees are such for the reason we have endeavored to explain, viz: exhaustion. What we have to do, then, is to economize and equalize the forces of the tree. If it be a Heart or Bigarreau cherry on which we are to operate, our first duty will be an inspection of the buds, that we may know what proportion of them is perfect. But before we proceed we will have to state that the fruit buds on most cherries are produced on little spurs, as they are called; these are two, three and four years in forming. Each of these will likely have five, ten or more fruit buds, and each bud will contain several fruit-germs. When all the germs were perfect, we have known as many as sixty fruits produced from a single spur, when not more than a dozen or fifteen could be properly grown.

Understanding as we now do the position of the buds on the cherry tree, we next determine their condition by an inspection of them, as detailed in our remarks on buds. Probably we shall agree, for a tree of which the diameter of the trunk is four inches, one-half bushel of fruit may be reasonably looked for, and for each additional inch in diameter four quarts may be added. Now let us further agree on the number of cherries required to fill a half bushel. As our way will double and perhaps triple the size of the leaves, the fruit will be correspondingly large. Hence we reduce the usual number five thousand to eighteen hundred, to fill the measure. Next, we estimate our buds, so many to each spur—five will be about right. Now each of these buds ought to yield three cherries, fifteen to each spur; we shall need, then, only one hundred and twenty such spurs, but we will allow a few, and say one hundred and thirty, to provide the required amount. This determined, some time before the buds open in the spring we prune away all the spurs except the requisite number, leaving those that are to remain evenly distributed throughout the tree. In addition to the spurs already formed there will be a great number of small one year old spurs developing for fruit for the next and succeeding years. Each year thin these out, always leaving as many again as you ultimately expect to reserve for fruit bearing, as some of them, under the treatment we have described, are pretty sure to run off into wood growth. Alternate bearing trees managed in this way cannot overbear one year, and hence will not require a whole year's rest in which to restore their exhausted energies, as would be the case had the trees received the ordinary treatment.

We now come to the second class, or trees of great vigor of growth that show but little or no fruit, of which, among cherries, Napoleon Bigarreau is a good example. For a long time both cherry and pear blooms greatly puzzled us. It was easy to know that no tree could bear fruit without bloom, but it was not so easy to assign a scientific cause why vigorous trees, in full bloom, should produce none. But after repeated microscopic examinations of fruit-germs taken from trees that had made luxuriant growth, we determined the cause to be due solely to imperfect organization of the fruit-germs, superinduced by want of nourishment. This, then, we suppose to be the condition of a barren cherry tree which we now propose to bring into full bearing. Trees that show great vigor of growth produce a great excess of large and small branches. We will then first prune off this excess of growth so as to fully expose what is left. Next, with a sharp spade, we open a trench as deep as the lateral roots penetrate, and quite around the tree, cutting off all the roots. We vary the operation according to the habit of the tree, so as to cut off what we estimate to be from one-third to two thirds of all the root growth. Having finished the operation of shortening the roots, we fill the trench and give thorough cultivation to near the end of the season.

Peaches and nectarines have sported into many varieties, and of each there are early and late. For instance, the Hale's Early peach, at Alton, ripens about July 28, and the Heath cling at least six weeks later. Why the long interval in the ripening of the two fruits? With our present knowledge we cannot explain further than state that, on trees of the same age and under similar treatment, early and late kinds all bloom at precisely the same time; or, if any variation as to time of blooming occurs, it will as often happen to one sort as the other. Therefore, the statement so often made, in the spring after severe frosts, that the buds of early peaches must be killed, has no force.

Another fact in relation to this fruit that we do not recollect to have seen noticed, is that all varieties, early, medium and late, grow alike at first, all at the same time reach the point at which the stoning or hardening of the pit commences; from this time, until the stoning process is perfected, the peach does not enlarge; therefore, the only difference in the time required to mature varieties must depend solely on the time required to harden the pits. There are yet other points to which we desire to direct attention. Varieties of both peaches and nectarines are divided into three separate classes, founded on certain characteristic markings on the leaves. First, varieties with globose glands; second, reniform glands; third, those whose leaves are deeply serrated without glands.

Glandless varieties are subject to mildew in the branches, in the leaves and in the fruit, in so marked a degree as of late to be wholly worthless. In selecting varieties to plant, this fact should not be lost sight of. Why it is that mildew most affects this class, in the way we have stated, is a point on which we earnestly desire light. Can any one tell us the office of the leaf glands?

Pruning the peach is probably not correctly performed by a dozen persons in the country. We have visited hundreds of orchards, west and east, in not one of which was there the least evidence that a correct theory had guided the hand in performing this important operation. It is singular what a hold false theories will take on the minds of men when disseminated by high authority; and perhaps none have worked more harm than those which relate to pruning the peach. We can no more teach this specialty on paper than we could anatomy.

Yet we can state some of the theories that must be recognized to insure complete success. First, and the most important of all, is a recognition of what we term true fruit leaves.*

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* This term is arbitrary, but answers our purpose.

We have already mentioned that a certain portion of the leaves, as well as fruit, was made out of the food stored in the tree the previous year. We have often queried, when reading learned dissertations on pruning, if this fact was had in mind, or whether it had ever occurred to the authors that the leaves of later growth, as well as the fruit from the time of stoning, were grown by those leaves that wintered in the bud. Leaves do not create themselves, but are in the main made by other leaves; hence every facility should be given to these first leaves to perfect themselves without much competition of leaves of later growth. We have demonstrated by repeated experiments that the fruit on any twig or branch will correspond to the size of the first leaves. Hence our term fruit leaves. We now see the importance of large leaves, and our next step will be to secure them. This we do first by thinning out such large branches as should be removed; then cut back to some small branch or shoot which points in the right direction, those that are extending too far or are likely to become pendant under the weight of fruit. Having done this, we next estimate the capacity of the tree for fruit bearing. For a tree six or seven years old, six one-third bushel boxes will not be too many. To fill these we allow forty-eight peaches to the box. If we allow two peaches to each twig, we shall require two hundred and eighty-eight such twigs. Cut away all others, except where new branches are desired. Many of these small twigs, or last year's shoots, on which the fruit is borne, will often have from ten to twenty, or more, young peaches, leave these until they are as large as a hazel nut, then reduce from one to three to each branch according to strength.

Before we close our remarks on the peach we will refer to a new difficulty attending its cultivation, mention of which we do not recollect to have seen. As soon as peaches are as large as a pea, a snout-beetle makes a small round hole, reaching quite down to the pit, or into the kernel, on which it deposits an egg; this egg soon hatches, producing a small white larva. The fruit drops to the ground soon after the egg is hatched.

We have often noticed these small fallen fruits, without, until recently, understanding the cause. So small is the round puncture made, by means of which the pit is reached, that it escapes notice unless the downy substance covering the peach is removed. We believe that the operations of this insect do not extend beyond six or ten days. As soon as the fleshy parts of the peach thicken so they cannot reach the pit, their depredations wholly cease. Can it be that the mischief is done by the Plum Gouger, of Walsh, or has some one of the numerous nut-beetles left its legitimate calling for the more genial pursuits of horticulture?

APPLES.

Until within a few years the apple was grown almost without care. Of late, however, so numerous are its diseases and insect enemies, that in some districts its culture is no longer attended with success. And unless we combine our efforts against its insect enemies we must wholly abandon its culture, or be contented to feast on the few wormy and knotty specimens which reach maturity.

So rapid has been the increase of the plum curculio and the apple curculio that in some districts these two insects, or even the plum curculio alone, are in sufficient force to totally ruin the apple crop. Hereafter, so far as we can now see, no escape from the ravages of these insects need be looked for, except by united effort in their destruction. So numerous have curculios become in our own grounds and surroundings, that for the past two years our Janet apples have been destroyed, and other varieties made worthless, except for cider. In the future we shall have to bestow the same care in catching curculios on our apple that we do on our plum trees. Except in very early apples, the larvæ of the plum curculio do not perfect themselves, but the parts wounded by them furnish resting places for fungi, where it multiplies and spreads to all parts of the orchard. Horticulturists must recognize the fact that as we increase the production of any fruit, we at the same time increase its peculiar insects and diseases.

PLUMS.

Thus far we have devoted no remarks specially to the plum, nor would we further trespass on your time were it not probable that some varieties of this fruit may be grown to a profit in all parts of the State, doubtless, in many parts, with far less care than will hereafter have to be bestowed on the apple.

In this country the curculio has so long held undisputed dominion over the plum that a knowledge of the varieties of plums has passed out of mind. We shall therefore refer to some of the best, that those who desire to enter the field against the "little Turk" may have fruit in quantity and of a quality to reward them for their labors.

For a single variety, for family and for market, we place the Jefferson at the head of the list. Three best for family, to ripen in succession, add Washington and Coe's Golden Drop. Four best, add Smith's Orleans. Five best, add Imperial Gage. Columbia is a desirable sort to plant in apple, pear and peach orchards, on which to catch curculios. The curculios would be attracted to these trees when in fruit, where they might be caught. The Columbia plum generally discharges so much juice into the passage made by the larvæ of the plum curculio as to drown them. On this account it is that we recommend it as a protection to our orchards.

River's No. 1 is one of the earliest plums with which we are acquainted. It bears moderate crops annually.

Dominie Dull.—Since the prevalence of the peach rot this and the following were the only sorts that have wholly escaped rotting.

Ghiston's Early.—Tree grows slowly, very productive, quality good to very good.

Lombard.—Tree a moderate grower, alternate bearer, quality only good. We should have omitted the mention of this variety had not an impression obtained that it was curculio proof; perhaps no sort is more preferred by the curculio.

Diamond.—One of the most productive and showy plums, of first quality for cooking, but too harsh for the desert.

Reine Claude d'Bavay, McLaughlin and Red Gage are good plums for the table, and may also be grown, to a limited extent, for market.

DISCUSSION.

Mr. H. C. Freeman—Do I understand Dr. Hull to say that fruit buds may be changed into leaf buds?

Dr. Hull—Yes. A vigorous growing shoot has the power to push into a leaf, starving out the fruit-germ.

Mr. Freeman—The practical inference then is, that, in the operation of budding you need not be particular what kind of a bud you take.

Dr. Warder—It is always safer to put in a leaf bud.

Mr. Freeman—Mr. Pullim, of Centralia, informs me that many of the buds seeming to be leaf buds are really developed into fruit buds. He says it is difficult to tell the difference until they blossom.

Mr. Miner—What is the proper time to trim the peach tree?

Dr. Hull—Any time after the fall of the leaf.

Mr. Miner—Can you trim safely when the tree is frozen?

Dr. Hull—You can prune any time in the winter. If the limbs are frozen you must take care not to bend them. It is the bending of the limbs when frozen that does the injury.

Mr. Wright—I would like some information in regard to growing the peach tree. I find, in this portion of the country, we have no peach trees. They are generally destroyed by this worm at the root of the tree. I don't know what it is called. I have bought trees two years old infested with this white worm. It seems to me useless to try to grow peaches unless we can kill this worst enemy of the tree. I do not believe there is a tree within five miles of this place that is not injured by this grub.

Prof. Stewart—I remember a case where a woman scalded the tree at the roots, and she never before had such an abundant crop.

Mr. M. L. Dunlap—I knew a similar case in the city of St. Louis; the party scalding the tree for the purpose of killing it, but the tree received the seeming harsh treatment kindly and bore an abundant crop.

Mr. N. J. Colman, of St. Louis—I have heard the story of pouring on the hot water, but I heard it as happening in South Carolina. [Laughter.] I know that Edward Bates knew it tried in South Carolina. I have known other parties to locate the story in Virginia. It is immaterial, however, where it is located. You will hardly be able to make water too hot for the grub; the only way to get him out of the tree is to bore him out. Some mound up trees six or eight inches. That practice is quite extensive in Southern Illinois. But the remedy is as we have stated. He who would grow peaches must go for the borer with a sharp stick. I have an orchard of eight thousand trees, and depend on nothing else. I know that Dr. Hull advises planting the peach tree deep in the ground—from four to six inches. I do not know whether this answers the purpose or not.

Dr. Hull—It does.

Mr. Colman—Upon the subject of high or low trimming I will say I do not expect to see our prairie farmers adopt the high trimming system. I have seen a great many orchards in Missouri, and the best orchards I have seen are those with low tops. It is true you cannot get under them to cultivate, and it is not desirable to do so. I am inclined to think low heads the best, say three or four feet. That would be my plan, and the further north I went I would go correspondingly lower.

Dr. Hull—When I said that low heads were a failure I made the statement from careful observation. What are the facts in the case? Take the fruit district from Centralia to Cobden. These orchards are all failures! Their failure amounts to millions of dollars for that one district alone. Twenty-three years ago I planted trees with low heads, and I raised good fruit. By-and-by others began to plant orchards and to grow fruit and *curculios.* I discovered the danger just in time to save myself. I had constructed a curculio catcher, and I must from necessity get it under the trees, and for this purpose, among others, I began to change from low heads to high heads, and I think the result has justified my conclusions in recommending high heads. We should remember that the conditions of fruit growing are changed from what they were years ago, when some of us commenced in this business. We should look this fact in the face and shape our practice to meet the necessities of the time. It is a hopeless task for me to plant an orchard with low heads and expect to gather fruit from it.

Mr. M. L. Dunlap—About this peach grub. I find that he will not pay any attention to your patent remedies. He must be dug out. Smiley Shepherd told me that he tried planting tansy, which was recommended to keep out the borer, but he found the tansy was worse than the grub! [Laughter.] The knife is the sure and best remedy. This remedy, faithfully applied, will not fail. Try it. In regard to the codling moth, we can use Dr. Trimble's bands of hay or straw, placed around the trunk of the tree. Examine the band frequently and catch the worms.

Dr. Hull—I would like to hear Mr. Dunlap on the subject of high tops.

Mr. M. L. Dunlap—I differ as to the height of the tree in part. Or rather I would adopt a modified system, between the high and the low. The high winds on our prairie orchards are a serious obstacle to growing high headed trees. On the other hand, we must provide for catching the insects. I would say trim your tree to two feet in height, and then let the heading of the tree commence. This will give room to run the curculio catcher.

Dr. Hull—Many are deceived as to the presence of the curculio in their orchards. I have examined trees supposed to be exempt and found them in abundance. In my plum orchard I go through the ground about three times. The curculio does not fly at a temperature of 70 degrees, but does fly at a temperature of 80 degrees. It is almost impossible to protect an orchard in the vicinity of other orchards unless there is a systematic warfare waged against these insect enemies. But if my neighbors wont work I must work the harder. I cannot use the catcher to advantage under trees headed only two or three feet high, hence I trim higher.

Mr. Rice—At what time do you commence to catch the curculio?

Dr. Hull—From the first to the fifteenth of May.

Mr. Rice described an insect that had troubled his plums and peaches, said he had never seen anything like it before, and wished to know what it was.

Dr. Hull—It is probably the plum gougher, of Dr. Walsh. It attacks the fruit and lays its egg next to the pit of the peach.

Mr. Robinson recommended the practice of mounding up around the trees with hard clay, to prevent the peach borer from depositing its egg. He had known this practice prove beneficial.

Dr. Hull—My observation is that the peach borer lays its eggs six inches below the surface of the ground, and below the collar of the tree.

A voice—How many years since the borer first made his appearance?

Mr. Robinson—I saw them ten years ago.

Mr. Wright—It is the opinion of some that they made their appearance about the time Mr. Dunlap came to this country. [Laughter.] I look upon this as the most serious thing connected with peach growing. The remedy proposed for the grub is death in time to the tree. I had a few trees in my yard and had grubs in them. I went at them with a "sharp stick," and kept digging at the trees and killing grubs, and about the time I had succeeded in killing the grubs I had killed the peach trees. So it seems to me that if Mr. Dunlap's method of getting rid of the grub is the only remedy, I think we may as well cease to try to grow peaches. If you will tell me some method to kill the grub, I will insure a peach crop at least every other year.

Mr. Freeman—I wish to inquire in reference to the loss of the quince crop. I have attributed it to a beetle that destroys the blossom.

D. Hull—They fail simply because they are not fertilized.

Mr. Edwards—I am perfectly well satisfied that if success in the cultivation of fruits is to attend our efforts, we have got to work for it. I believe we have got to have good industrious Adams and Eves in the garden, to "keep it." It is high time that every one of us understood that "eternal vigilance" only will guard our fruits.

Mr. Edwards asked Mr. Dunlap to explain Dr. Trimble's method of catching the codling moth.

Mr. M. L. Dunlap—Dr. Trimble's method of catching this moth is to make a band of hay and bind it around the tree. The insect spins its cocoons under the band, where you can easily catch and destroy them.

Question—At what time do you bind this on the tree?

Answer—About the middle of May, and leave it on till the last of June.

Dr. Warder—I would say, put on in the spring and take off in the fall. I am more and more satisfied that we ought all to subscribe for the Entomologist, published in St. Louis, and edited by our much esteemed friends Dr. Walsh and C. V. Riley.

A Voice—Who is the agent?

Dr. Warder—I am. [Laughter.]

GRAPES.

A LECTURE BY HON. GEORGE HUSMANN, OF HERMANN, MO.

"The old has passed away, and all things have become new."

In these days of railroads, of telegraphs, and of machinery, when space and time are almost annulled, a great revolution is silently, quietly, but for that reason, perhaps, all the more powerfully working its way through all classes of society, through every branch of industry, in the accoutrements of war, as well as in the graceful arts. Mankind travels with railroad speed in thought as well as in action; and in no country, perhaps, is this more true than in ours. We are a fast people, perhaps too fast in some things; but it s characteristic of the nation that we take hold of everything we undertake with an energy which is really startling to other nations. Young America is a giant, uncouth sometimes, perhaps, but with a vein of good common sense running through all he undertakes, and generally with a shrewd eye upon the almighty dollar.

That this is eminently true of American Grape Culture I hope to demonstrate to you in the course of the following remarks.

Only short twenty years ago, Cincinnati and the banks of the Ohio river were almost the only location in the country at all noted for grape culture. If beginnings had been made in other locations, they were not yet important enough to be worthy of universal notice. Now, the whole country, from the Atlantic to the Pacific, is alive to the importance of grape culture; and there s hardly a locality, even at the extreme north, where some varieties of the grape are not now grown successfully. Then, only one variety was considered valuable as a wine grape, the Catawba; now, we count them by hundreds, to which every day still adds further. Then, about two hundred and fifty gallons of wine to the acre was thought a large average yield; now, we are not satisfied unless we average from six hundred to twelve hundred gallons, and he crude attempts at wine making of those bygone days, and their products, would make but a sorry show by the side of our Cythiana, Norton's, Hebermont, Delaware and Taylor wines of to-day; wines with which we can safely challenge the choicest vintages of Portugal, France, Burgundy and Germany. Then, we were entirely dependent on the seasons in the produce of our vineyards and the quality of our wines; now, the science of Gall, Petiot, Captal and Frings has come to our aid, and we can count with mathematic certainty upon having good wines always and in every season.

But it is not alone in the quantity and quality of our wines and grapes that we have improved. We have also learned to grow them with much less labor. Instead of laboriously and slowly trenching the soil with the spade to the depth of two to three feet, and burying the genial surface soil beneath the subsoil; instead of reversing the order of nature, we have become convinced that the grape vine, the most sun loving of all plants, flourishes better if the soil is left in its natural position. Where formerly the slow work of trenching and reversing the soil cost from one hundred and fifty to two hundred dollars per acre, we now take the plow and subsoil plow and prepare an acre in a day, at a cost of about twelve to fifteen dollars. When formerly the vines were trained to stakes in the old slovenly manner, which took an acre of timbered land to supply the stakes for an acre of vines, we now make our light wire trellis, with a post every twenty feet, with half the cost and half the labor in tieing and pruning. Formerly the vines were not summer pruned until long after blossoming, when they had become one tangled mass of shoots and tendrils, and the knife, and very often the sickle, was resorted to cut the Gordian knot, slashing and maiming the shoots, and denuding the fruit, thereby causing stagnation of sap, sun-scald, and nearly all the evils to which grapes are subject. Now, we have learned to summer prune with the thumb and finger, thereby only gently checking the undue exuberance of growth, leading it into its proper channels, and simplifying the whole course of management, so that every boy and girl of ordinary mental capacity can now do the work in their father's vineyard. And last, but by no means least, we are growing thousands of pounds of grapes now, where there was one grown twenty years ago. The noble grape, the healthiest and most luscious of God's fruits, is no longer the rich man's luxury, but is within the reach of all.

There is no laborer so poor but he can now grow or buy grapes for his wife and children, so that it has become a *universal* fruit. And what is more where one gallon of wine was made twenty years ago, tens of thousands are made now, and we are on the road to become a temperate people. For, my friends, every wine maker among you is an apostle of temperance; and if you produce that most innocent, healthful and inspiriting of all stimulants good pure wine, thereby supplanting those abominable poisonous compounds which are now palmed off on the public as brandy and whisky, you do more for the cause of true temperance than Gough and all the total abstinence lecturers in the country. Is it not an insult to a *free* nation to try and fetter i by Maine liquor laws, to try to force people to behave like decent beings, and to forbid them to become beasts!

Look at wine-growing districts of other countries. Wine is there th every day drink of the laboring classes, and yet drunkenness is of very rar occurrence. And then look at our country, look at England, Ireland, Sco land! What do you see? Pictures of misery and degradation everywhere the image of God transformed into a hideous mockery, family ruin and strif neglected children, deserted wives. And have so-called temperance law proved efficient against this? Quite the reverse. Man is so constituted tha he will have a hankering after forbidden fruit. Say to him "touch not," an many who would not perhaps have thought of it before, will now try to ge a taste of it, find it sweet because it is forbidden, and indulge oftener. It an insult to manhood, in this, the freest of all countries, to try and shack the will of man by law. Punish disorderly conduct and drunkenness as s verely as you please, treat the drunkard as what he is, a nuisance to societ but do not say to the sober, industrious laborer, "Thou shalt not refresh th self with a glass of good wine when thy muscles relax from severe toil, whe thy tongue is parched with thirst, because thy neighbor makes a beast of hin self by drinking whisky and brandy to excess."

This, my friends, is the noblest mission of American Grape Culture. Let us offer a glass of good light wine, at a low price, to every laborer in the land, to cheer him on and invigorate him at his toil. He needs it more than the rich epicure at his well spread board, with every luxury at his command. And we can do it. We can grow and make good drinkable wine at seventy-five cents per gallon, and when it comes down to that, or even a dollar per gallon, its consumption will increase to a degree which will astonish those who are now afraid that the thing will be overdone, and the market glutted.

We do not need a single drop of European wine in this country; we can grow all that is consumed here, and we can, and will, *export* American wines. We have proved already, in these short twenty years, that we can produce wines equal to the best of other countries. Where is the Burgundy equal to or better than our Cynthiana and Norton's? Where the Claret better than our Creveling, Clinton and Concord? Where the Rhenish wine with which our Delaware, Taylor, Hebermont and Cassady need fear comparison? And where is a better Sherry than our Rulander and Hermann? I have tasted wines from all countries, at fabulous prices, but I predict to you here to-day, and I wish you to make a note of it, that in twenty years more we will rival and surpass them all.

American Grape Culture is only in its infancy; the young giant is hardly awake, but he begins to see daylight, and when the child becomes a man he will fill the land, and we will make wines so good and so cheap that we can abolish the protective tariff and still drive foreign wines from the market with our native produce. May we all live to see that day.

But, my friends, these are only generalities. I have tried to show you that the new era in American Grape Culture has commenced, that "the old has passed away, and all things have become new." But, myself a farmer, I speak to farmers, and I know that they are practical men. Generalities will not suffice with them, they must be shown the why and wherefore, they want facts to convince them. If, therefore, you wish information upon any point, I would rather it should come in the shape of questions from you and answers from me; and you can rest assured that the answers will be candid, straightforward and explicit, to the best of my ability. My knowledge is but limited, but while I do not pretend to be an authority, I acknowledge none, and have no secrets, for we all seek the truth, and should gladly impart what little knowledge we may have gained to our fellow laborers.

DISCUSSION.

Mr. Edwards—I wish to inquire of the lecturer if it is his opinion that our clay subsoils should be underdrained?

Mr. Husmann—I would like to inquire if the subsoil is very tenacious?

Mr. Edwards—Not generally very tenacious.

Mr. Husmann—Does it hold water in any considerable degree?

Mr. Edwards—Not like hard pan. In wet seasons, however, it retains a considerabl· amount of water.

Mr. Husmann—I should think it would be necessary, and certainly desirable, that such soil should be drained. My experience leads me to think that all the varieties belonging to the class o grapes called Labrusca require a richer soil than the class Æstivalis. There are exceptions to this rule.

A voice—State the characteristics or types of the two classes.

Mr. Husmann—The Catawba, Concord and Hartford Prolifi are types of the Labrusca class. The Æstivalis is the commoı summer grape in our woods. The Norton's Virginia, the Cythiana, the Hebermont, are types of this class of grapes.

Question—Where do you class the Delaware?

Mr. Husmann—It comes in the class Æstivalis.

Question—Where do you place the Isabella?

Mr. Husmann—It is Labrusca.

Question—Where do you place the Hebermont?

Mr. Husmann—Æstivalis.

Mr. B. F. Johnson, of Champaign—We have, I believe, tw kinds of wild grapes.

A voice—What are they good for?

Mr. Husmann—Not much, so far as we have tried them.

Mr. Campbell—At what distance would you plant the Cocord?

Mr. Husmann—6 by 10.

Question—Do you protect the Norton's Virginia in winter?

Mr. Husmann—I do not.

Question—Is the Ive's Seedling as early as the Concord?

Mr. Husmann—I think so.

Question—What are the particular varieties that you wou recommend for general planting?

Mr. Horsmann—I would plant the Norton, Cynthiana, Maxtawy, Clinton, Hartford Prolific, and some of Rodger's Hybre say Numbers 1, 3, 4, 8, 9 and 22.

Question—What number is the Salem?

Mr. Husmann—No. 22.

In answer to a question, Mr. Husmann stated that many varties of grapes had a tendency to overbear, and this favored d ease, mildew, etc. The Delaware would do this until we trimm it very short.

Mr. B. F. Johnson—What is the best aspect?

Mr. Husmann—We take a southern slope where we wish to grow grapes for the purpose of making the best wines.

Question—Is it not considered that the fruit that ripens under the sun of the first half of the day is better than that with the last half.

Mr. Husmann—We do not find it so.

Question—Do you renew your wood as often as possible?

Mr. Husmann—Yes, in the case of some varieties.

A voice—Will you give your system of pruning.

Mr. Husmann—We modify the system according to the variety.

It was suggested that he take the Concord, and show his method of training the grape. Mr. Husmann here went to the blackboard and demonstrated his method of pruning the Concord vine. He fruits this variety mainly upon the laterals. He explained the practice of summer pruning, first and second pinchings.

Mr. Jewett—When would you make this second pruning?

Mr. Husmann—Just as soon as the shoots become long enough in the summer. Indeed, I don't know that I have a great deal of system in pruning; I go to work and prune just as I please. With the Catawba, in particular, we practice the renewal system.

Mr. Campbell—What height do you make your trellisses?

Mr. Husmann—Five feet.

Mr. Campbell—Do you use wires?

Answer—Yes.

Quesiton—How many?

Mr. Husmann—Three.

Mr. Husmann said, in answer to a question, we change our treatment, as I have stated, with the variety we have to deal with. The Norton's Virginia fruits better upon old wood; so does the Taylor, and also the Clinton. We fruit these varieties on spurs.

Mr. N. J. Colman—What is the best variety to succeed the Concord?

Mr. Husmann—I think Rodger's No. 4 the best.

Mr. Campbell—Is it as hardy as the Concord?

Mr. Husmann—It is hardy enough for us.

Mr. B. F. Johnson—What is your soil? What its geological formation?

Mr. Husmann—It is a sandy clay subsoil, overlaid with a black loam, and underlaid with sandstone.

QUESTION—Is it good grain land?

ANSWER—Yes.

QUESTION—Do you manure your vineyard?

ANSWER—Very seldom.

QUESTION—Are animal manures injurious?

Mr. HUSMANN—Good native soil is the best manure.

QUESTION—Are bones good manure for grapes?

Mr. HUSMANN—They are, but we can't get enough of them.

Mr. CAMPBELL—Do you plant anything in your vineyard?

Mr. HUSMANN—Sometimes we plant potatoes, but not too near the vine.

Mr. CAMPBELL—Do you ever seed the ground down and leave it?

Mr. HUSMANN—No, sir.

Mr. CAMPBELL—How late do you cultivate?

Mr. HUSMANN—I cultivate all through the spring and summer, late and early.

Mr. CAMPBELL—With the one-horse cultivator?

Mr. HUSMANN—Formerly I used the cultivator, but now I use the single-horse plow.

QUESTION—Do you not disturb the roots?

Mr. HUSMANN—I do not.

QUESTION—Is it any injury if you do break the surface roots?

Mr. HUSMANN—I think it is not.

QUESTION—Do you mulch?

Mr. HUSMANN—No, sir; it is better to stir the soil.

Mr. N. J. COLMAN—How deep do you plant your vines?

Mr. HUSMANN—I try to put my vines about ten inches below the surface. I do not wish to force my vines to go down.

QUESTION—What grapes are best to preserve for winter use?

Mr. HUSMANN—We generally preserve them in a liquid form. [Laughter.]

A VOICE—Perhaps the gentleman means to ask what grapes will keep the longest.

Mr. HUSMANN—Yes, I understand the question.

Mr. N. J. COLMAN—Do you have to shoot the birds?

Mr. HUSMANN—We shoot some, now and then.

Mr. COLMAN—Do they damage your crop of grapes?

Mr. HUSMANN—Yes; they have damaged us a great deal this season.

Question—I wish to ask if you have ever tried Fuller's system of training?

Mr. Husmann—Yes, I have tried it. It is a very pretty looking system put on paper. Paper is very patient, but the vine is not always so patient; it is sometimes positively obstinate. This is the difficulty in the system.

In regard to the quality of wines, Mr. Husmann stated: We distinguish between aroma and bouquet. Bouquet is the product of the action of the air upon the juices of the grape, or acids contained in the grape. One may have a great deal of aroma and very little of bouquet, and vice versa. If we gather our grapes early, when they contain a great deal of acid, we shall have more bouquet and less aroma. If we want bouquet we gather our grapes before they are fully ripe.

A voice—The Concord makes the best wine, with the addition of sugar, does it not?

Mr. Husmann—There is no accounting for taste. Some people prefer this and some prefer that. Grape growers in Germany have pure good wines, for the reason that they are careful to pick out all imperfect berries.

Mr. N. J. Colman—What quantity of water and sugar is used in the manufacture of wine?

Mr. Husmann—That depends upon how heavy the must is. Take the Catawba, that will weigh 85, we use two pounds sugar to one gallon of water.

Question—Have we any grapes adapted to making raisins?

Mr. Husmann—I do not think we have a raisin grape.

Dr. Warder—We have no raisin grape in this country. There are three classes of grapes—

1. The American grape, represented by the Fox grape, called the Pulp grape. Everybody knows it.
2. The Juice grape.
3. The Flesh grape.

This last class of grapes, the flesh grapes, is the only kind of grapes suitable for making raisins.

Mr. Colman—From what grapes do they make raisins?

Dr. Warder—I do not know the names of the grapes. I suppose, however, they make raisins from the Malaga grape.

Mr. M. L. Dunlap—They have at Alton a system of pruning the grape vine. I wish to call upon Dr. Hull to give us some information upon this subject.

Dr. Hull—The system is a very simple one. I wish to refer to the diagram on the blackboard, for illustration. This system of pruning was devised on recognizing the fact that particular leaves have certain functions to perform, and that these leaves are best adapted to bring the grape to perfection. Now what we have to do is to keep these leaves perfectly healthy, and not to admit of competition. Our plan gives us eight leaves. [Reference was made to the diagram, and minute description given.] The plan is to twist the cane around a stake, so as to throw all the buds outward, and when the laterals have pushed out at sufficient length they are pinched one leaf beyond the last bunch of grapes. A second pinching is made, when the vine is left to itself. About ten buds are left to each cane, and but one bearing cane to the vine. This twisting of the vine will cause the buds to burst evenly, and this keeping the leaves fully exposed, and not crowding them, will double their size and improve the size and quality of the fruit.

DR. WARDER'S LECTURE ON PROPAGATION.

Seeds and buds are the basis of propagation. The distinction between them has already been explained. We also propagate by other methods than by seed or bud. We propagate by layers, where a portion of the plant is brought in contact with the earth. We propagate by *stolons*. The strawberry is an example. Runners are thrown out, and the plants rapidly multiply. Plants produced by stolons will be like the parent plant. There may be occasional departures from this rule, but these are rare exceptions.

We have another means of propagating, and that is by suckers. These are simply shoots starting up from the roots of plants, as in the case of some varieties of the raspberry, which are to be separated from the parent plant. There is another method of propagating. I refer to propagation by *corms*. Take the strawberry plant—the woody portions of the plant—and you will find points of growth in it, so that the corm may be divided into as many divisions as there are points of growth.

Propagation by tubers is another method. Still another way is by root cuttings. These are analogous to propagation by suckers. The propagation by means of root cutting is a sort of artificial suckering.

At the present time we will take up the idea of propagation from seeds. This is the common method of propagating where mere stocks are wanted. We also use this method when we wish to get new varieties. You will remember that I told you upon a previous occasion that seeds were used to multiply the species, and the buds to multiply the individual variety. Now the first consideration respecting seeds is their vitality. There is a great difference in the degree of vitality in seeds. Some will retain for a long time the vital principle, others very soon loose this vitality. It is stated, with a good degree of evidence, that the raspberry will retain its vitality for one hundred years.

As a rule, seeds upon separation from the pulp should be dried and kept perfectly dry. Take the apple or pear seed, if not kept dry and at a proper temperature, there appears a fungus growth among them, which destroys their vitality. As soon as fermentation takes place the life of the seed is gone .Seeds, even when well dried, should not be put away in large bulk together. It is safe to put apple and pear seeds in sand, and it is safer not to wet the sand until just before planting, and when wet they must be kept in such a temperature as not to germinate. Some freeze them. This will do, providing you keep them sufficiently cool till planting time.

It is best to plant in the spring. The chief reason is, we avoid the trespasses of little animals that destroy them. The seeds of the raspberry and strawberry are mashed out from the fruit, and as soon as dry rubbed with sand. Wash and dry them again, or sun at once. It is safer to sun in boxes. They may be made to germinate at once and fruit the next year. I have eaten strawberries in eleven months from the sowing. Currents and gooseberries treat in the same way.

Now we come to consider the seeds of the stone fruits—the cherry, peach, and plum. The cherry, being a small seed, is apt to become dry. The seeds of stone fruits are exposed to the frost of winter for the development of the germ, when they are planted in the usual way. Some plant the seeds directly in the place where they are to remain. Others, again, allow them to grow in a bed for a while and then take them up and plant as you would cabbage plants. This practice is adopted more especially in the case of plums and peaches. The same practice is pursued in planting timber. In the case of oaks, it is better that acorns be gathered in the fall and placed in a moist soil, favorable for germinating in the spring.

But we come back to the seed-bed. The seed-bed should be good soil, finely pulverized, when it is ready to receive the precious germs. But the depth to which you plant is important. We estimate that seeds planted twenty times deeper than the diameter of the seed will fail to vegetate. Seed should be planted at an average depth of from half an inch to two inches. That will be deep enough.

With regard to the time of planting. This will depend upon the condition of the soil. If we wish to avoid loss we had better plant in the fall. Still the majority of persons plant in the spring. Some question as how to plant these seeds, whether with a drill or otherwise. The speaker favored the use of the drill. The wheat drill could be used in planting many crops by stopping up every other drill, or such portion of them as may be required to give the needed space to the rows. But in whatever way the seed is dropped, it is desirable to have it properly covered. The method of some is to cover with the foot, a very simple and effectual method where the soil is sufficiently mellow. Another way is to take a rake and cover the seed, or it may be with a hoe. Any method that covers the seed with finely pulverized soil from half an inch to two inches, according to the size of the seed, is effectual and satisfactory.

It takes some time for the seed to vegetate. This is especially so in cold ground. If there is sufficient moisture, there are certain weeds that will immediately spring up before the seed. These may be destroyed by brushing over the top of the soil with a rake, or other instrument, before the seed planted comes up. This can be done by horse-power, using a brush. We run the brush across the drills for the purpose of more effectually destroying the weeds just starting up. I think the use of the brush or harrow at this time very great economy of labor. [The process of the development of the seed was given in detail on the blackboard.]

Grains have but one seed lobe. But there is a large class of seeds, the bean for example, that has two lobes. You will observe this on breaking them open after soaking them in water. The germ of the seed lies between these lobes. One produces the root and the other the stem. The descending axis becomes the root and the ascending axis becomes the stem. The special function of these seed lobes is to furnish food for the embryo plant until it is sufficiently developed to draw its nourishment from the soil and atmosphere. They fill the office, for the time, of digesters. At any rate, by the addition of moisture, they are capable of developing the young plant, and sustaining it until it is able to take care of itself.

The next point for our consideration is the cultivation of these seed plants. The object of all cultivation is twofold. First, to stir the soil and put it in such a condition that it may receive moisture and air, and, secondly, to destroy all intruders, by which we mean weeds. Air and moisture are essential to the growth of plants, and these are best secured by the frequent stirring of the soil.

QUESTION—Is it not possible to keep our seedlings growing too long, that is, too late in the season? Will it not be better to stop the cultivation and check the growth before late fall?

ANSWER—It is important that all wood growth should be mature before cold weather, otherwise our trees are liable to injury from frost. But seedling plants are seldom injured in this way.

It is desirable to take up seedling stocks in the fall and heal them in, or store away in the cellar for the winter. Even if the weather is not very severe, so as to destroy the plants, the character of the roots is such that the expansion of the ground by frosts tear the roots, and thus do serious injury. We do not believe that freezing will injure the plants providing they are not frozen in the air and thawed in the air. We wish to avoid this condition of things, and so take up the seedlings in the autumn and store in your cellar, if you have one; if you have not, bury them out of doors. It is very desirable, however, to have them where you can get at them. In taking them up they are bound in bundles, assorting them as to size. Our remarks have particular reference to apples and pears, but will also apply to plums, and even to cherries.

In growing peach seedlings the pits are either frozen or cracked, and planted out in rows, and given thorough cultivation. In the case of berries, the fruit is mashed and the seeds washed out and planted in boxes, or seed-beds, filled with soil and sand. Grape seeds are planted, not for stocks, but for new varieties only. The seeds are taken from the grape and sowed at once, in the autumn.

If you desire new varieties it is best to take the fruit of the best kinds from which to propagate.

The lecture closed with some remarks on the subject of crossing and hybridizing.

Crossing is the bringing together different varieties of the same species.

Hybridizing is the bringing together of different species. The result is a mule, or, as it is called, a hybrid..

DISCUSSION.

Mr. M. L. Dunlap—You have heard from the Doctor how to propagate plants, and how necessary it is to pulverize the soil, and how necessary it is that the soil retain air and moisture, and the importance of stirring the soil to destroy the weeds, etc. Let us now make the application to agriculture. Suppose we plow a piece of land for potatoes. We will then harrow, plant, roll, and harrow again, and then let it lay there until the potatoes come through and the weeds make a start. You then apply horse-power to destroy the weeds and let in the air. This is all right. But would you not accomplish the same object with less labor if you had left your land rough until the weeds had started, and then taken your harrow and pulverized it? We think this will accomplish the same result. We have a fine soil, letting in the air, and all the weeds destroyed.

Mr. Ludlow—I wish to state that at one time I prepared an acre and a half of ground, and had it in fine condition. Having harrowed it I planted it to potatoes. I dropped the potatoes ten or twelve inches apart, run with my harrow through the center of the row, and threw the ground back upon the potatoes, and let it lay until the potatoes came through, when I again ran through with the harrow, and in the fall sold the potatoes for sixty dollars in the ground.

Mr. Parks—I wish to ask the Doctor, if it is a fair question, whether plants receive more substance or food from the earth than from the air? It is true that plants receive food from both the earth and the air. Scientific men, who have given this subject their attention, agree as to this, but there are a great many men who do not believe that plants receive food from the air, but that all comes from the ground, and that the plant depends upon the manurial qualities of the soil alone.

Dr. WARDER—There is no doubt that a large portion of every plant comes from the atmosphere. The carbon of plants comes from the absorption of the leaves, taken from the air. Hydrogen is received from the moisture in the air, as well as from the water in the earth. No man can say that only a small portion of substance is received from the atmosphere. A large portion is received from this source—how large a portion we do not feel authorized to say. Still, the earth is essential to plants.

SMALL FRUITS.

A LECTURE BY SAMUEL EDWARDS, OF LA MOILLE, ILL.

Within the recollection of many who do not consider themselves old, the cultivation of an assortment of small fruits was confined almost exclusively to gardens of the wealthy, or for marketing in large cities.

Formerly the apple and other orchard fruits succeeded admirably in nearly all parts of the Northern States, with but little care and attention. There were few varieties of noxious insects injuring trees or fruit, and they so limited in numbers that their depredations were scarcely noticed. By importations from the old world, the rapid increase of them and our indigenous varieties of insect enemies, the cost and uncertainty of growing orchard fruits has been greatly increased.

In sections of our country originally covered with dense forests, their almost entire demolition has occasioned climatic changes so great as materially to lessen the products of orchards.

The small fruits being exempt from injury by the insect depredators of our orchards, and as most of them blossom so late as to run much less risk from damage by spring frosts, the ease with which they are protected from injury in winter by covering—maturing their luscious, health giving products at just the season of the year when most acceptable to the palate and beneficial to the system—there is abundant reason for rejoicing by those who love horticultural progress, as we see the general, rapidly increasing, attention being given to their culture. Many, with only a few rods of ground, now enjoy them in variety and abundance, and their numbers are yearly increasing. Those owning homesteads whose dimensions are counted in acres, should improve their borders and sides of fences by planting small fruits. On the south side of a fence fruits are hastened, on the north retarded, in ripening.

The strawberry, in its different varieties, is adapted to a great range of soils; most of them succeed finely on dry prairies, which produce fruit of better flavor, though not of as large size as are grown on the borders of a slough. Doubtless this deficiency could be remedied almost wholly by underdraining, deep culture, and special manures, though these have not, to my knowledge, had a thorough trial in our State. Where grown for market, trench plowing, followed by the subsoil lifter, clean culture in hills, mulching for protection from the cold of winter and dirt in spring and summer, are more profitable than a less expensive course; yet the pioneer without capital will feel himself more than paid for his labor if he plants liberally of them on his ordinary prairie breaking, giving them no after culture except a slight mulching at the first beginning of severely cold weather, indicating that winter is near.

Where cultivation is to be done by hand, rows eighteen inches to two feet apart, plants a foot apart in the row. In field culture, rows three feet apart, plants a foot asunder. Use a line in planting, as the cultivation is much more easily done where rows are perfectly straight. A bit of twine, tied to mark each foot of the line, facilitates dropping plants at the right distance apart. We use a steel dibble for this kind of work, which opens a hole large enough to receive the roots well spread out, taking pains to press the dirt firmly about them.

Well rooted young plants only are suitable for setting. They should be taken up with a spade, being careful to retain the roots as much as possible, and to keep them from drying. Trim off any dead leaves, and shorten the roots to two and a half or three inches in length. Puddle roots of all plants and trees.

Early in spring, as the land is in good friable condition, as a general rule, is the time for planting.

Good success is sometimes had in planting until near the middle of May, also, if rather moist weather, just after the crop is gathered.

In one instance, an acre set in August made a good stand with me. Have had several serious and one complete failure of several acres planted at that time. Autumn planting is not successful here, except the weather is unusually wet, advice of those who wish to sell plants to the contrary notwithstanding.

Thorough, deep, clean culture is to be given the first season, taking care not to injure the roots to any considerable extent. For stirring the soil deeply, a half-inch bar of iron, pointed at the lower end, fastened in a plow beam with handles, is drawn by one horse as deeply as the ground has been previously plowed, doing the work better than any other implement known to me.

Runners are cut by hand with a hoe, or with a rolling coulter attached to a cultivator. Always bear in mind that it is much easier to stir the soil and kill weeds as they are starting than when they have attained the height of a few inches, besides the added benefit to the plants by two such workings, at less cost than one when too long delayed.

Some prefer to grow in what is styled the matted row system—planting in rows three and a half or four feet apart.

As the runners appear train them along the row, forming a mass of plants a foot or more in width.

In all cases it is absolutely necessary to mulch just before commencement of winter, covering the plants slightly with prairie hay, corn stalks, or similar material, which has no weed seed in it if possible. Straw is used when no better article is convenient, but it is objectionable for the reason just stated. The mulching should be loosened up early in spring, when danger of severe freezing is over. It may remain until after the fruit is gathered, unless there is danger of so many weeds as to injure the crop, in which case it may be removed to alternate rows the latter part of April, in my latitude (41½ deg.), earlier at the south; give one good thorough working, remove the mulch to the rows cultivated, when balance is stirred. The work is finished by placing the mulching around the plants, protecting them in case of drouth, and the fruit from dirt.

After gathering the fruit cultivate between rows; if on the matted row system turn under a part of the plants, leaving a strip of them six inches wide. Draw a little earth around crown of plants, to receive the new roots, which put out above the old ones. Cut off tops of plants just above the crown, which causes the new roots to start at once.

The decaying mulch is, on our new soil, generally all the manuring required. In poor soils, annual dressing with compost, containing a liberal proportion of wood ashes, is recommended.

By permitting runners to occupy space between rows, the old plants can be turned under, after bearing three or four crops. With the successful cultivators of this vicinity, and other parts of the State, present, the discussion to follow these brief introductory notes must prove very valuable. The value of different varieties, in various soils and localities, is a subject of great interest. We all know the Wilson—there are some varieties of a finer flavor, and new candidates for public favor, in considerable numbers, are annually announced as being far superior to any now generally disseminated. Some of these have proved very highly remunerative—to the self-sacrificing philanthropists who distribute them; but most of us are contented to defer purchases until plants are sold at less than $1 each, or $10 per dozen—the customary rates.

The Raspberry is one of the most valuable fruits for drying and canning, by many deemed equal, and even superior, to the strawberry at time of gathering.

A deep rich loam, rather moist than dry, is adapted to best success in the culture of the hardy American varieties. Deep tillage is very essential in preparing for a plantation. The ground can be laid off for planting with a small plow, run shallow. Where land is cheap, and it is desirable to do most of the cultivating with a horse and cultivator, six feet apart each way is a proper distance. Potatoes, cabbages, or some other crop, can be grown in the spaces until the raspberries are of full size. With limited space, three feet by six is adopted generally, planting strawberries between the rows. Use only thrifty young plants, covering the crown a couple of inches. They may be set in the fall or early spring; if the former, a forkfull of manure should be placed over each one, removing it before the plant grows through its covering of earth in spring. In case the dirt appears to be liable to bake before the young shoot makes its appearance, the crust should be carefully loosened with a fork down to the roots. Thorough clean cultivation should be given. Latter part of August cut back to within a foot of the base. If this is neglected they are seriously injured, and sometimes die outright, in consequence of bearing a full crop the next year. Each succeeding year shorten the main stock to four feet, leaving the branches about a foot long. By this mode they grow strong enough to need no staking, yield more fruit, and of larger size than if left to grow unpruned.

The old wood should be broken down, with any feeble young shoots; leave five or six of the best in the fall, and give a heavy mulching of some kind of coarse litter.

The foregoing remarks have reference to the tall growing American varieties, which are propagated by layering the tips, covering them with two inches of dirt in September.

The Miami, Doolittle and Purple Cane have been well tried and are desirable varieties of this class; plants are hardy, bearing abundant crops of fine fruit.

The varieties which sucker from the root can be planted more closely; three feet by five is a good distance, setting three plants six inches apart, in triangular form, for each hill. The preparation and culture is the same as for the taller growing varieties. Suffer five or six shoots to remain in each hill, treating any others that come up as weeds. Tips of shoots should be cut back one-third their length in the fall.

Brinckle's Orange, like many others of this class, is tender; in severe winters kills to the ground. Its very fine quality induces many to grow it, covering the canes with earth late in the fall. With one hand to bend down and keep them in place, while another covers them with a spade, a couple of hours suffices to secure enough to give an ordinary family a taste of them daily through the season of ripening. The Philadelphia is a very abundant bearer; fruit of only medium quality; believed to be hardy enough to endure our winters, generally. Plants of this class are increased by suckers and root cuttings.

The so-styled Everbearing varieties have not proved of sufficient value in my locality to make them desirable.

The Blackberry requires more space than the raspberry; six feet apart each way answers very well. They require shortening back late in summer, and thinning out of suckers, as recommended for the raspberry, and, for best results, very heavy mulching. Of late they are very often winter-killed in the northern part of the State. W. H Hausen, of Lee county, protects with corn fodder in winter, having the plants grown rather thickly, in hedge-row style, for greater convenience in covering.

Mr. Merritt, of Battle Creek, Michigan, has practiced laying down the canes in fall and covering with earth. The roots are laid bare at the base, with a fork to manage the tops; one man places his foot against the stock at surface of the ground, bending the root to bring tops down to required position, another man covering with spade.

Lawton, when fully ripe, is fine; more tender than our natives. Kittatinny and some others are said to be hardier. The general mode of propagation is by root cuttings.

The Currant and Gooseberry require treatment so similar throughout that their culture will be described in connection. A deep rich loam, rather moist than dry, is best adapted to them. Although, for a time, in rich soil, they give abundant crops of fruit when neglected, yet they are greatly improved in quality and quantity by liberal manuring, mulching heavily, or clean cultivation. The bush form is preferable, in our hot and dry climate, to growing them as trees. Late in summer, early autumn, or early in the spring, are proper times for planting cuttings. Wood of one year's growth is best, cut in lengths of eight to ten inches; set four-fifths their length in well prepared, rich soil, press dirt firmly at the lower end, filling in loosely at top.

If cuttings are not planted until spring, it is best to cut them before severe freezing, wintering in moist sand in cellar. They frequently form roots an inch or two long during the winter, and make much more growth than if left on the bushes till planting time. They must, in every case, be cut before growth begins.

Vigorous plants, one to three years old, or thrifty offsets, are suitable for setting in permanent plantations, four by six feet, good distances apart. Manure liberally each autumn, or cultivate clean but shallow early in the season, mulch heavily before very hot weather. When they are of full bearing size, shorten long shoots of the current year one-third their length each fall, remove feeble shoots and old mossy and decaying branches, thus keeping up young vigorous wood for bearing. Burn up all trimmings to destroy currant borer.

By planting in shade of buildings, fences or trees, or by covering with some inexpensive material, they may be retarded in ripening and retained on bushes, for use, several weeks.

Red Dutch, White Grape, Black Naples, Victoria and Long Bunched Holland, leave nothing particular to desire for variety of near thirty varieties of currants tested. Cherry and La Versaillaise are large—may be identical.

Downing's Seedling, Houghton's Seedling and American Seedling are good varieties of gooseberry. The large English varieties are so liable to mildew as to render them worthless.

The currant worm is very troublesome in Eastern States, and is kept off by dusting the foliage, when wet, with soot from wood ashes.

Cranberries have been tried to some extent. Have never known of their paying for cultivating in our State.

The barberry, from its extreme acidity, is not desirable for cultivation to any great extent; so far as noticed it does not seem to be nearly as productive as in the Eastern States.

Though we have once seen the Chicago market glutted with small fruits of some kinds, there is room all over our State, at our own doors, in most localities, for selling large quantities of fine fruits, at prices paying much better than ordinary farming. This was the case in Bureau county at the time alluded to, when it was better to leave it to rot than pick for Chicago, without taking into account what can be used at home—worth more than money. For more than twenty years I have found a home market for hundreds of bushels of small fruits.

Our Allwise Father made no mistake when He gave man the fruits of Eden for his food, nor has man, by his wisdom, found a diet more wholesome or acceptable.

Anticipating confidently the presence of a large number of thorough, practical cultivators of small fruits, believing that the time would be more profitably spent in discussion and hearing the results of their experience than in listening longer to one, my endeavor has been briefly to introduce the subject for the evening.

DISCUSSION.

Mr. RICHARDS—I would like to ask what the currant worm is like. I am troubled with a worm, but don't know that it is the currant worm.

Dr. WARDER—This worm is related to the caterpillar. It is voracious, and entirely strips the leaves of our currant bushes.

Mr. RICHARDS—The worm to which I refer is striped and strips off the leaves from the bushes.

Dr. WARDER—I think the gentleman has the currant worm. I would like to have Mr. Rice tell us how he grows his big crop of strawberries.

Mr. RICE—I do not grow them, they seem to grow themselves, and with no difficulty. I prepare the ground by trench plowing, fifteen inches deep. Set the plants out in rows, three feet apart and eighteen inches in the row, and keep them in rows. I think now I shall adopt the plan of keeping them in hills. I keep the runners cut off. In the fall, when the earth begins to freeze, I cover with hay. I gathered from four and a half acres 610 bushels of strawberries. This year I did not have as large a crop as last. The price of berries this year, however, has been, as a rule, greater than last year. I think it is one of the easiest crops to raise. I would as soon raise a crop of strawberries as a crop of corn, after the labor of setting is completed. I remove the hay in the spring from the top of the plants, and, using the fine prairie hay, I can go right in with the cultivator; this is why I prefer the fine hay to the coarse.

Mr. H. J. DUNLAP was called upon to give his experience in strawberry culture. He said: I do not know that I can say anything more to the point than has been said by my friend Mr. Rice. Plow deep, set good plants in well prepared soil, cultivate clean, keep the runners cut off, and you cannot fail to have a large crop of this fine berry.

Dr. Warder explained the philosophy of cutting off the runners. By cutting off the runners branches were added to the corm, increasing the number of buds, and consequently increasing the quantity and size of the fruit.

A voice—Tell us how long these plants will live and bear.

Dr. Warder—That will depend upon the manner of treatment, and upon the variety you have. Some varieties expend themselves very soon, or run out, as we term it. Indeed this is the case with all varieties when cultivation is neglected. Other varieties, with good treatment, will continue to bear for many years. It is best usually to renew the strawberry plantation every three or four years. It is less trouble than to cultivate or clean the old plantation. Some advise a new plantation every two years. I have seen strawberry beds four years old bear well. In New Jersey they do not practice this system or method of cutting the runners. They plant in rows, five feet apart, as early in the spring as they can, and cultivate occasionally with hoes. The runners are encouraged to grow until they fill the row, and sometimes become a mass of plants three feet wide. This is their condition in May, thirteen months after planting. Instead of the hoe they take the plow and turn a furrow over the path; this is all the cultivation it receives the second and third years. The bed is then shifted to that which was the path, the runners having previously taken root there, when the old bed is plowed up and becomes the path. In this way they renew their plantations and succeed in growing large crops.

Mr. H. Dunlap—How long will a plantation of Wilson's Albany remain good?

Dr. Warder—Till the third year, at least. We do not discard the Wilson's Albany, but we do not think it so good as some others.

Mr. Rice—I think the soil of New Jersey is different from ours, and that they may, perhaps, adopt the method spoken of, while in our soil it would not be best.

Dr. Warder—Some one must try the experiment and see if it will do on the prairies. I would like to see this continuous row system thoroughly tested among us.

Rev. Mr. Riley—I would ask about the dewberry. Whether it can be cultivated to advantage. I am informed that there is a gentleman on the Cincinnati and Louisville Railroad who is cultiting these plants and selling them through the country. It is desirable to know whether they are good for anything or not.

Mr. EDWARDS—I have been growing the dewberry for ten years and am now ruling them out. They are not worthy of cultivation.

Mr. DUNLAP—I have attempted to raise the dewberry for ten years. I have had them in bloom, but have never succeeded in raising a berry. I will give twenty-five dollars to any party who will grow and send me one bushel of these berries.

Mr. H. DUNLAP—I understand that the Wilson Blackberry is sometimes mistaken for the dewberry.

Dr. WARDER—You might mistake them in the first year. The bush grows low, like the dewberry. Some think it is best to pinch the shoots of raspberries and blackberries before the ripening of the fruit, with a view of encouraging the growth of laterals, and not have, as otherwise we would have, long slender canes that could not support themselves. The result of shortening the canes at this time is to make a little tree—it is more like a tree than a bush.

QUESTION—How many branches would you leave upon a single root?

Dr. WARDER—One is better than two, and two are better than three. In the case of the blackberry, one is enough, in the raspberry, two. Every one of these will throw out shoots next year, covered with an enormous amount of fruit.

The Doctor recommended cutting back the canes in the growing season. He had taken a lesson from his old cow, that had broken into his raspberry patch and browsed them down to within one foot of the ground. He never had so heavy a crop as the spring following.

Mr. RICE—I would like to hear from Hiram Dunlap, who is a successful grower of small fruits.

Mr. H. J. DUNLAP—I suppose the diagram on the blackboard will show better than anything I can say as to the proper course to pursue in training and pruning the raspberry. Some canes will run ten or twelve feet if left to themselves; but if you want any fruit you must, in the second year, cut them back to one foot from the ground. These will throw out laterals, which are also cut back to two or three inches from the main cane. The next year the plants throw up strong canes. I usually put in three stakes to the hill, to which the canes are tied. As soon as the fruit is taken off cut out the old stems. I do not know that this is necessary. The second year the raspberry patch should receive thorough cultivation, and, if expected to produce good berries, should not be neglected at any time. There is one drawback in growing raspberries. It is the borer that gets into them and destroys the cane.

Mr. Ludlow—I would like to hear from Mr. Dunlap if, in setting out a new plantation, there is any choice in the plants?

Mr. H. J. Dunlap—I have never seen any choice.

Mr. Galusha—Mr. Edwards speaks of special fertilizers. I have tried special manures, but not upon our common prairie soil. I have tried it, and to advantage, upon light sandy soil for raspberries and blackberries. I have used bone dust, superphosphate, plaster, etc., with good results upon certain soils. I do not know that it would be good for our prairie soil. Would be glad to know if any one has thoroughly tested it on onr prairie land, and with what results.

Mr. Rice—Good corn ground is good enough for raspberries, without manure.

Mr. Galusha—If by good corn land you mean land that would produce one hundred bushels to the acre, I think it is good enough. [Laughter.]

Mr. Edwards—On poor soils manure is recommended.

Mr. Galusha—In regard to varieties, I think the Philadelphia is, among raspberries, what the Wilson's Albany is among strawberries. It stands at the head of the list for general cultivation. It bears enormous crops of berries. The fruit is not so rich as that of some others. The fact is we do not want, for family use, the richest varieties of raspberries. You can eat your fill of them.

Dr. Morse—I have had three crops from the Philadelphia raspberry, and can corroborate what the gentleman who has just taken his seat has said. It bears enormous crops and is hardy. The quality is good enough. I have heard it stated that they are hard to pick. The reason is they turn red before they are ripe. When ripe they come from the stem easy enough.

Mr. Bubach—That does not agree with my experience. I got my plants from Pardy.

Mr. Periam—What the strawberry most wants is deep plowing and thorough working of the soil.

Mr. EDWARDS—I believe we shall yet be able to grow blackberries from the seed that will be h ardy and that will give large crops of excellent berries.

He spoke of a seedling that he had that was promising well, and said that he would be glad to send some of the plants to this university for trial. He did not propose to sell any.

Dr. WARDER—I would inquire about the Missouri Mammoth. What is the promise of this berry, about which we have heard so much?

Mr. BUBACH—I have the plants, but no fruit.

Mr. ROBINSON—In regard to the Dorchester. I have examined it upon a neighbor's farm, who has now discarded it in favor of the Lawton.

Dr. HULL—I want to say a word about these strawberries. I have drawn upon the blackboard a figure representing the roots and top of the strawberry plant. Dr. Warder has explained the fact of runners made from the plants, and the practice of some in cutting them off. But he did not make the application exactly that I would have done. We have all heard of Mr. Knox's success in strawberry culture. What is the secret of his success, for example, with the Jucunda? It is simply this, he keeps the runners cut off and directs the forces of the plant to the development of the berries. Now the Wilson produces heavy crops, sometimes without all this care in cutting away the runners, for the reason that the Wilson does not so readily make runners. Hence I sometimes call it the lazy man's variety. The Longworth's Prolific will produce runners to the end of the season, the Wilson will not. We like sometimes to get big berries; we therefore cut away all the buds but two. We by this means force all the power of the plant into these two buds, and when the berries make their appearance we take away all but three or four of them, and these grow to an enormous size. I have sometimes practiced this.

Mr. GALUSHA—I wish to add my testimony to the value of the American Entomologist, published in St. Louis, by Dr. Walsh and Mr. Riley, to fruit growers, and to second Dr. Warder's efforts to enlarge its circulation.

Dr. HULL—May it not be valuable to the farmer as well?

Mr. PERIAM—It is as absolutely essential to the farmer as to the fruit grower.

Dr. WARDER—We get, in the American Entomologist, ten dollars' worth for one dollar.

DISCUSSION ON CATTLE.

The lecturer appointed to talk on Cattle did not make his ap pearance. The following discussion was had upon the subject:

Dr. Morse—I have looked forward to the time for the lectur on cattle with much interest, perhaps with more interest than tha of any other lecture in this course, and consequently I feel a grea disappointment that the lecture has failed. I wish, in the few re marks that I shall make, only to say something that will draw ou discussion on this subject.

I endeavored to show in my lecture last week that the cultiva tion of grass was very important. It is a crop too much neglectec in the State of Illinois, in favor of grain growing. We endeav ored to show that there was a downward tendency in this kind o: farming. The remedy is a resort to grass growing. It is an old adage and has much of truth in it—"No grass, no cattle; no cattle, no manure; no manure, no crops." We certainly need, then, cattle, in order to convert grass into beef, butter and cheese, and also to convert grass into manure, that the fertility of the soil may be kept up, insuring good crops.

Now there may be, and we think there is, too little attention given to the care of cattle. Even where men keep stock, they are negligent and careless in their attention to them.

In many quarters there is carelessness on the subject of breeding. A farmer has twenty or thirty head of cattle, and gives no attention to the manner of breeding. The bulls used are such as come up by accident. A young animal has been, from neglect, allowed to grow up a bull, and this is the animal used for propagating his stock. This is all wrong, and the degeneracy of the stock will sooner or later show it to be wrong. Now we have established improved breeds of cattle, and we can propagate the good qualities of individual stock. We can propagate any qualities desired, even to that of color. If you have a bull of good stock, whose mother was a good milker, you will have good cows for milk. I would not take the scrub bull for nothing, when a good bull could be had for twenty dollars. I would consider it a disgrace to accept of the services of one of these animals. Every man should select his breed with reference to the object he has in view in growing stock.

Upon the deep prairie soil there is perhaps no breed of cattle qual to the Durham or short-horn, equal to any other for beef, ertainly, but not perhaps equal to some others for work and other urposes. It should be borne in mind that they require a great eal of feed, and should be able to get that without having to run bout for it. The color prefered is red and white. The Durham s a breed of cattle with which most of you are familiar.

Another breed of cattle is the Herefordshire, which makes a ery superior beef. There are very few of this breed in the country, but from talk I have had with cattle dealers I find they appreciate the Herefordshire highly.

For beef cattle I consider the Devons the best. The Devons are distinct race of cattle, and there are no cattle that are capable of begetting their own qualities with so much certainty as the Devons. If you put a Devon on scrub stock you will see the calf take the characteristics of the Devon. I have occasionally seen a little white about the back, but doubt whether it is the best mark of Devons. The only objection to this breed of cattle is that they are small. There are families of the Devons which give rich milk, but usually they are bred without reference to the qualities of good milkers, for beef and working cattle. There are no cattle equal to the Devon for working qualities. They have great strength and endurance in the yoke.

We mention in the next place the Ayershire, with which farmers are more or less familiar. These breeds of cattle mentioned are of English origin. If we had time, and you had patience, we could give you a little of the history of these breeds, which would be interesting to consider. The Ayershire is a Scotch breed of cattle. It is a milking breed, and has been bred for perhaps seventy-five years with a view to the production of milk.

Mr. M. L. Dunlap—Is it not a Dutch breed, improved in Scotland?

Dr. Morse—There are different views on that point. I cannot speak positively in the matter. The color is usually red and white, sometimes brown and white. The colors are distinctly marked. There is no intermixing of colors, always distinct. They are handsome colors. They give the largest quantity of milk—larger than any other breed we have. It is rich milk also, but not as rich as the Alderney gives. But in cheese-making, and where the object is to produce milk, I would use the Ayershire, or a cross of the Ayershire on native stock. The Jersey or Alderney cattle are celebrated for their milding qualities. There is a little variation in some of these cattle. Their color is more varied than that of the Ayershire. They have also more bone.

The Jersey cattle are brown and white, sometimes almost black and white, others nearly all brown. Frequently they are red and white, and nearly always fawn-colored around the nose, eyes and legs. The milk produces the largest quantity of cream and butter. The Herefordshires give more milk, but not so rich in cream and butter, but equally rich in every other respect. When the milk of the Alderney cow is skimmed it is very poor. The milk of the Alderney is nearly all cream.

Another breed is the Holstein. There is no doubt the Holstein is valuable for milk. The color is black and white, distinctly marked, sometimes large spots of white and black. We speak of color, and especially in the milking breeds consider it of some importance.

There is one other breed that we will mention, that is the Galloway, or no-horned cattle. They are a hardy, healthy cattle, and make good beef.

Perhaps I have occupied sufficient time in this way, and I will now give way to others who may wish to talk or ask questions.

Mr. Cobb was called for. He said: I have not much experience with cattle. I can give you a few facts in regard to the breeding of cattle in a limited way. About the year 1862, I turned my attention to farming, and commenced with the means I had, on the plan of a mixed husbandry farm. I started with a few cattle and a little of everything. My first idea was to have good things of the kind, if it was but little. Being a new comer, my motions were observed by the neighbors, who said "there is Cobb, who is buying new things; he will soon lose momey." My reply was, "I have but little to lose, and I will run the risk," and so started out with the view of having good things. I went among the farmers and bought the best cows for from $25 to $35. I got a herd of twenty cows, and then I went down into Kentucky and bought a bull for $400. That was carrying out the idea of my neighbors, that "a fool and his money are soon parted." The result is, so far as the cattle are concerned, I have a very fine herd of cattle after the space of seven years.

In regard to the feeding qualities of cattle, this is my experience. In 45 days feeding, side by side, with meal, the graded stock increased 25 per cent. over all others, and then when sent to Chicago, they were sold in a separate class a cent per pound in advance of the others. This ought to convince any one that if he can afford to have anything he can afford to have a good thing. It is a thing I have been trying to impress upon our farmers in the case of hogs. I sent to Pennsylvania and got two pigs, that cost me $30—Chester Whites—notwithstanding Long John says the Chester White is no breed, only a white hog. I have sent to Chicago pigs that, at 14 months old, weighed 400 pounds. Besides, I find at home ready sale for my pigs for breeding purposes. So that my investment of thirty dollars has made money. We do not lose money when we buy good stock. The farmer who speculates in stock may fail, but the idea is, let the farmer know what he wants, then get the best, or at least that which is good; let him have a certain way of doing things, and then follow up his plan.

Dr. Morse—I think the gentleman has just hit the nail on the head. It does not pay to keep poor stock, and what is more, if you keep poor stock there is a downward tendency, the stock degenerates.

Mr. Cobb—There is another idea. If you have good stock you like to show it to your neighbors, otherwise you don't want them to see what you have got.

Mr. M. L. Dunlap—I wish to ask Col. Colman this question. We know very well that our Eastern friends tell us that our dairy cows do not produce the amount of butter that theirs do. Why is this?

Mr. Colman—Mr. President and gentlemen: I do not know that I can add anything to what has been already said, and very well said, by the gentlemen who have preceded me. I will give some of my experience with stock and answer Mr. Dunlap's question.

In raising cattle I think we should generally select that breed adapted to our locality. I have a large farm in Missouri. The farm being hilly I preferred the Devon, and consequently I procured the Devon. I am very much pleased with this breed for my locality. I would prefer, probably, on these prairies, the Durham. I find the Devons excellent for milk. I purchased a three-quarter Devon of the Hon. W. C. Flagg, of Alton. This cow raised one calf, and excells as a milker. One reason is, perhaps, I take good care of her, and give her the stuff that makes milk, and if farmers generally would take care to slop their cows they would get more milk and butter. You cannot expect a cow to give milk unless you give her something that makes milk. If you give the cow only prairie hay and corn, this does not produce the most milk. I have found bran best; corn meal and clover hay are good, together with bran.

The reason why the Eastern cows give more milk and make more butter is chiefly because of the better care and keeping that they have. They have better pastures, better and a greater variety of food, and that of the right kind and in the proper quantity. With them how to make the cows give milk is a study. It is becoming a science with them. They have large barns and give their stock protection. What is the shelter that our stock in the West get? It is, perhaps, the poor shelter that a fence will give. We can't expect cows to give milk treated in this way. We should give our cows comfortable quarters, and then they will give milk. I know farmers who have got five or six cows, and never have all the milk and butter they want. They do not feed the cows. They do not shelter them. I tell you, sir, a well supplied barn helps to make the breed. I tell you, also, that the corn crib, the hay and the bran, helps to make the milk.

In regard to breeds, I think very highly, as I have stated, of the Devon. I know there are different families of them. I think that which Mr. Flagg has is the best. I can recommend that breed. I have a bull of that breed, and I can see all through the country thereabout the great good that he has done, and the people are thankful to me that I brought him there. I do not think as much of the Hereford as Dr. Morse does, but we will find that if we will take care of our cows of any good stock, we will have good milkers. Feed and shelter kindly, and they will appreciate it. For milk, that is for dairy purposes, I suppose the Herefordshires are generally preferred.

Mr. Baldwin—I have been for many years raising cows for dairy and other purposes, and will state my experience. I would, for dairy purposes, take some animals from the various breeds. The secret of having better milkers East, I think, lies in this—they are bred in that direction. If, for example, you have a cow that is an excellent milker, a cow that gives milk up to the time of breeding; you cross with any good stock, and you by this course obtain a good dairy cow. This is the answer to Mr. Dunlap's question. It will take, perhaps, years to reach the degree of success attained by our Eastern friends. But in a short time the qualities of our milkers may be improved very much. I think the Devons make the best working stock; they are also always good milkers.

Mr. PERIAM, in answer to a question, said that seven-eighths was considered full blood.

Mr. PARKS—I think the gentleman is certainly in a mistake as to what constitutes full blood. I never considered sixty-three-sixty-fourths full blood, although it is nearly so. I would not consider nine hundred and ninety-nine-one-thousandths full blood. There is one peculiarity of the Durham cattle—they have the habit of feeding better than other cattle. They will be hunting for food and eating all day, while the common cattle will hardly have energy to move from their places in search of food.

Mr. PERIAM—I do not want the impression to go abroad that I am mistaken in what is considered full blood. I say seven-eighths is regarded full blood. That is, it is good enough. I do not confound "full blood" with "thoroughbred." Full blood is good enough.

Mr. COBB—Full blood is not good enough. We must have the best that we can command all the time. I think that Mr. Periam thinks so.

Mr. PERIAM—What I did say, or what I mean to say, is that full blood is good enough for the many, the thoroughbred for the few. I am willing that the farmer who can't get the full blood shall have the half-blood, and from that go on improving all the time.

COL. N. J. COLMAN'S LECTURE ON THE HORSE.

Mr. President and gentlemen: I received an invitation from the Hon. W. C. Flagg, Corresponding Secretary of this Institution, to talk to you upon the subject of Horse. The word "talk" pleased me, and to this fact, perhaps, that I was requested only to *talk horse*, you are indebted for my presence at this time. I like that good old Anglo Saxon word *talk*. It reminds me of the times when the aboriginies of our country assembled around their fires and talked over the affairs of their tribes, and if our farmers would hold frequent councils and talk over the affairs in which they are interested, it would be better for the pocket and better for the intelligence and morals of the community.

I am glad that the great State of Illinois has taken the lead in this matter of holding councils, where the farmers of the State may convene and talk over the matters that directly interest them. I shall, in the discussion of the subject assigned me, give you the results of my experience and observation in breeding horses, just as those who have preceded me have given you the results of their observation and experience in the various and particular pursuits that have most interested them.

Dr. Hull, for example, talks to you upon orchard fruits, and gives you his experience through a long life upon this subject. Mr. Husmann talks to you on the subject of grapes, and we all feel that we have profited by his experience in vine growing. This is just what we want, viz: the particular and individual experience of farmers in that branch of agriculture or farm work to which they have given chief attention.

Now, in regard to horses, they are certainly very useful animals, but let me inquire for what do we want horses? Farmers want horses to work upon the farm; they also raise them to sell, just as they raise cattle and sheep and hogs to sell. These are the purposes for which farmers grow this stock, first for their own use, and then to sell in the towns and cities.

I do not propose, gentleman, to give you a history of the horse, going back to the days of Pharaoh, and tracing the story of the horse all along down to this date. Nor do I propose to give you a history of the various breeds of horses. I propose to deal with the present, and take the horse as we find him.

Small horses are adapted to a hilly country, but are not suitable for the purposes of the farm, particularly on our rich fertile prairies. They cannot haul loads large enough, nor turn furrows deep enough. We want, on the farm, horses that we can use for all purposes.

The Percheron, or Norman horse, is a breed that is being largely imported into this country. It is a good breed for draft purposes. We have a horse in this country—we have them in Missouri, you have them in this State—a horse favoring the build of the Percheron. He can haul immense loads, but he is too big boned and too clumsy for other purposes. He is not adapted to riding. He is not a good buggy or carriage horse.

The farmer, as we have said, wants a horse good for all purposes. He wants a horse that can draw heavy loads; a horse that he can take from the plow and put in his carriage and take his family to church. He wants a horse also good in the saddle. Now, these large clumsy horses are not active enough for all purposes; they are admirable draft horses, but when you have said that you have said all. [The lecturer at this point introduced the Morgan horse, and showed a picture of him as given in the Prairie Farmer.] There is no beauty about him. He is not a horse that I think farmers should breed from, except it be for the single purpose of obtaining draft horses, and even then I would not advise in favor of the Morgan horse. I would say to farmers wanting a draft team, breed from the Percheron, or Norman, horse. I will tell you what I think farmers should raise. I am, on the horse, as some others are on cattle, I want to get back to the thoroughbred race of horses. I know it is said that these horses are not large enough. I admit that all thoroughbreds are not large enough, but we have those large enough for any purpose. You have them in this great State of Illinois.

How large a horse do you want? About 16 hands high. I would say 15½ hands high is large enough. But some of these horses are 17 hands high There is Patona, 16½ hands high. Do farmers want a horse larger than that? The horse Bonny Scotland is full 16 hands high. Mr. J. C. Simpson has a thoroughbred over 16 hands high. We have at St. Louis (Derby) 16 hands high and over. The imported horse Lexington is full 16 hands high. Now if we can get a thoroughbred horse of sufficient size, what better do we want? For one I would not wish to go back of that for my type to breed from. I like the thoroughbreds. Here is muscular development. Here is life and spirit adapted for any purpose. If you want a saddle-horse, no where will you find one that will answer the purpose so well. If you want a draft team you can find it here. They are the most intelligent horses in the world. Treat them with kindness and they will appreciate and repay you well.

In regard to breeding horses. I say get a thoroughbred horse of good size, and then take your largest and best mares, and you will not fail to have good horses for the farm, and also good for the market. You can take them to St. Louis, Chicago, or New York, and get a big round price for them. It is a shame to use our finest specimens of thoroughbreds on the race course, when they could be used to such great advantage in breeding purposes. There is just as fine a chance for farmers here to go to raising horses, if they will give it the proper attention, as to raise cattle, sheep and hogs.

There is a prejudice against race horses, and perhaps I share somewhat in this prejudice. But allow me to say, it is the race course that has developed the qualities desired in a horse. We want to get *action* in a horse. We do not and would not get the action we ought to have, without proper training. But here we get the trotting action. Having one of these horses, you have a most profitable horse from which to breed. I own two stallions. You see I value the thoroughbreds, and I have found the raising of these horses profitable. I sold last year to Mr. Loomis, of Chicago, a horse for $4,000. You could not now buy that horse for $10,000.

Who can help being pleased with the appearance of a beautiful and well trained horse? God has made us to admire the beautiful in nature and art.

Well, I must say something to you about the race course. I do not wish to recommend my farmer friends, and especially my young friends, to waste their time at the race course, or to make trotting trainers of themselves. I believe that the influence of the race course is bad. I do not recommend the raising of horses for the purposes of the race course. The influence is not only bad, but tends directly to neglect of business.

Now in regard to racing at our fairs, and here I know I am treading upon the toes of some. But for the exhibition of horses at our fairs we could hardly sustain them. At St. Louis, at the State Fair last year, we took in $100,000 in eight days. If we had not offered large premiums for fine horses we would not have taken in one-half of that amount. We have got to get money in this way in order to sustain the institution and make it a success. But really we do not, at our fairs, have racing in the legitimate sense of the term. The horses go round, and the one making the quickest time gets the premium, and if our Illinois friends would adopt this plan and allow the exhibition of speed (each horse trotting alone) they would succeed better. This is only my opinion.

Now a few words in regard to breeding. We should have a thoroughbred stallion, with trotting action. If you get one of this description he will impart himself, even to color, to the colts. Out of forty or fifty colts from a stallion owned by myself, only three have been of a different color. He has simply imparted himself.

I go, for color, largely on bay. I think it is best. I get a colt with fine trotting action. I do not expect to train them. I expect the rich merchants and bankers, and fast young men, will want just such a horse, and I expect to sell him to them.

There is another thing in regard to breeding. Those who keep stallions do not handle them properly. They pamper them and over feed them, do not give them proper exercise. Hence their offspring is not what it should be. Your horse should be in the highest state of health. In order to this, you must give him plenty of exercise, plenty of light, and plenty of air. He should be brought up to a fighting condition almost. Train him as they train a man for boxing. I tell you if you want your stallion to do credit to himself you must give him muscular development, a heart and lungs in perfect health and action, else he can't impart these to his offspring. This is one of the great secrets in good breeding.

I do not believe that a pampered and grossly kept bull is capable of giving the best results. It is not, however, so important in cattle, inasmuch as they are bred for the purpose of being slaughtered. But in the horse these things are of first importance, as he is bred for a very different purpose.

Now in regard to the kind of mares to breed from. Most farmers know what kind of stock they want in a mare. Large mares, or mares with large roomy abdomens, are best. The horse may be comparatively small if the mare is large, with good results. But if you breed a large stallion to a small mare, you may expect to have a wishawashy colt.

In a stallion you want strength and power in the least possible space. It is not so with the mare. She may be, and it is better she be, large and roomy.

You will find that you can work these mares in a moderate way. I have forty brood mares, and I can work them all I wish to do. It is better they be worked or exercised a little every day. After you have the colt the work should be very moderate.

Handle the mare and colt constantly, otherwise the colt may be wild as a deer, and will not be so easily controlled at breaking time. The mares should have comfortable stables and good care in all respects. Colts handled from the first are very easily broken. I have never known one that I could not handle. Perhaps I have got too much notoriety in St. Louis in this respect.

In handling horses I treat them as animals with intelligence. I let them know that I am their friend, and treat them accordingly.

The horse can see better than you can; he can hear better than you can; he can smell and feel jnst as well as you can. In your treatment of them bear these facts in mind. You have all heard of the great success of Mr. Rarey in his horse taming power. I can take a horse as wild as a deer and soon have him under my control, and it is simply because I convince him that I am not going to hurt him, and that I am his friend. You have got to approach him by degrees. Let him smell of your whip. Get on his bridle. Get the bridle in your hand and you are his master, and in ten minutes you will find he will lie down completely your slave. It will require but a few lessons of this kind for him to know his place and obey your voice. I have broken hundreds of colts, a great many of which I have been able to put at once in the wagon and drive them with whip in hand.

It would be just as reasonable to take a child who had not learned his letters, and flog him because he could not read, as to take these colts and beat them into the harness. You should talk to the horse; he has intelligence that is good "horse sense," and knows when you speak kindly to him. When you want him to stop say "wo." Be patient with him till he gets used to the harness. Let him learn your language, your wishes, and you can do anything with him you desire. You can get him to do anything if you will only let him know what you want. You can get on him and ride him to death, when he could, if he would, dash you to death for such horrid abuse of a poor horse.

That is one of the great secrets in training a horse—let him know what you want. Talk to him just as you talk to your child, and treat him as kindly, and you will never have any trouble with him,

What a noble animal the horse is! And yet how frequently is he the subject of thoughtless and wicked abuse at the hands of his master, he has served so faithfully and so long. He is driven upon the road all day, with perhaps but little water, and upon half rations. He is taken home at night, all mud, and left in that condition, and still with hardly enough food to sustain nature.

I am here to-day to plead for the horse, and to ask for him kindlier treatment than this, noble animal that he is. On the other hand, a great many persons kill their horses by kindness. The stables are too close, too little light and air. The horse is an animal that has lungs; he consumes a great deal of oxygen. Go into tbe towns and you will find the horse confined in a close stall, almost forbidding him to lie down. The horse wants an abundance of air and light. One reason why we find so many horses diseased in the eyes is because they are confined in dark stables. Then let me urge the necessity of providing for an abundance of air and light in the construction of horse stables. Have windows for your horses eyes as well as for your own. Light is necessary for perfect health. We make a great mistake when we build dark stables.

There is another subject that should be mentioned, and with this I will close these remarks, which I have made with little or no previous reflection.

I refer to the importance of acquiring a knowledge, as far as possible, of *veterinary science.* Quack horse doctors are to be let alone with a vengeance. Wherever there is an intelligent veterinary surgeon it is best to consult him in all important cases. Students in agricultural colleges, and others who have to do with horses, ought to be taught this science.

I thank you for the kind attention you have given me in these rambling remarks. I said in the beginning that I came here only to *talk*, and now my talk is done.

DISCUSSION.

Prof. BAKER—I wish to inquire of Mr. Colman how he would proceed in the management of a balky horse?

Mr. COLMAN—I will give the gentleman a practical illustration of how I would proceed with a balky horse. [Laughter.]

Mr. M. L. DUNLAP—You might take the Professor for the subject of your illustration. [Laughter.]

Mr. COLMAN—I do not pursue Mr. Rarey's system of throwing horses. Some horses balk in one respect and others in another. I have a mare, once owned by Mr. Alexander, of St. Louis. He was offered $2,000 for her. Afterwards the negroes broke her and spoiled her. She became one of the worst of balky horses. Finally he sold her to me. I proceeded in the first place to get up a new dictionary—at least a set of new words and phrases. I then put the mare in my sulky with another animal by her side. I had a large and strong sulky. She would lead but would not drive, so I got a boy to ride this one and lead the mare, while I was behind in the sulky, using the new words. [Laughter.] We went to the city in this shape without much trouble. In going home the mare came to a stop and refused to proceed any further. I was now driving her without the boy. The mare stood there, and I let her stand. By-and-by, when she got tired standing, she made another start, and for a time all was well, when she made another stop, more stubborn to all appearance than ever. I did not fret her nor urge her forward, but let her stand. We staid there till nearly dark. I had made up my mind to stay there as long as the mare wished to stay. But as night came on the balky animal became as anxious to get home as I was, and needed but little urging to continue the journey. [Laughter.] She has not, from that day to this, given us any trouble, and is just as kind and gentle as any family horse need be. She took the premium last year at our fair, over many others.

Mr. WHITE—What is a thoroughbred horse?

Mr. COLMAN—If the gentleman knows what thoroughbreds are, there is no difference between a thoroughbred horse and a thoroughbred bull. We trace all our thoroughbreds back to the English racehorse, and they take theirs back to the Arabian. There is a great difference between thoroughbred animals. I would give a hundred times more for some animals than for others. Old Boston never had his equal; and so with Lexington, and perhaps we may say the same of Red Eye.

Mr. BURROWS—Let me ask Mr. Colman if there is not a thoroughbred draft horse? You have spoken only of speed horses.

Mr. COLMAN—It is not so regarded. None but race horses are considered thoroughbred.

Mr. BURROWS—The lecturer, in speaking of crossing horses, said that if we crossed a large stallion with a small mare we got a wishawashy horse. That I believe to be a good principle in certain classes of stock. But can we cross in that way for training stock if we are to get that which is good for nothing?

Mr. COLMAN—I regret that the gentleman was not in to hear what I said on that subject. This is the very position that I take. The point of my talk was that we should have, as farmers, horses good for all purposes, and if with this we can get the trotting action, so much the better. The farmer does not want to train horses, but he does want horses combining all good qualities. My friend is very far wrong in supposing that thoroughbred has any reference to draft horses.

Mr. RICE—Are "thoroughbred" and "full blood" terms signifying the same thing?

Mr. COLMAN—Not at all, sir.

Mr. WOODS—As I understand the term thoroughbred, it is a specific term, and not generic. If you make it a generic term, then you may speak of thoroughbred draft horses, but as a specific term you cannot.

DR. WARDER'S LECTURE ON THE GRAPE VINE.

THE GROWING VINE.

The lecturer considered first the growing vine. In the growing vine there is commenced an extension of growth called a "shoot." The shoot is at first soft and sappy, not having yet deposited any fibrous matter. As growth advances woody matter is deposited and we have the strong canes of the vine.

We notice that the shoots are made up of joints, or, as they are called in botany, "nodes." The space between the nodes or joints is called the "internodes." The leaf is always started at the nodes. At the axils of the leaves there are buds, which, in a beautiful development, expand themselves into other shoots called laterals. Just as soon as they shoot out another bud appears, and just here is a curious and interesting arrangement. The bud appears first upon the right side, for example, and then upon the left—right and left all the time, this arrangement always remains. [This was illustrated by exhibiting a vine and verifying the fact stated.]

These lateral shoots can be easily controlled at an early period. At the end of the season, when the leaves drop, the name of the shoot is changed, and we call it a cane.

It is important that we get a proper understanding of these terms, in order that we may know what we are talking about. The cane is that portion of the grape vine from which new growth emanates, and upon which fruit is produced. It is the only wood upon the vine that can produce fruit. It is the growth of the season just past, and if we want fruit another year we must save of this wood. Take these canes away and your vine is barren. The cane is the ripened shoot. The stem is the harder and older portion of the vine and is covered with two layers of bark.

PRUNING THE VINE.

The manner or style of pruning and training the vine will depend upon the object sought in pruning, whether we wish to cover a trellis or train to stakes.

The first thing to do is to plant the young vine in the vineyard, the soil having been properly prepared to receive it. The first season it will produce one or more shoots. We then prune the vine so that every leaf and every bud shall do its full duty. The duties of the leaves are to evaporate and assimilate the juices of the vine. In other words, the leaves effect the evaporation needed to aid the circulation and assimilation and form the buds.

Now what are the duties of the buds? They are, as it were, centers of vitality, and by retroaction form the wood fibers and the roots, and establish their own individual existence.

How can we best secure these results? We remark in the first place, we should train the vine upright. If there are too many shoots, pinch out some of them, and check others at the proper time, only do not extend the pruning into the summer, except it be to concentrate the forces of the vine by very moderate pinching. In the fall or winter the growth of the vine, one year set, is cut back to two or three eyes, and if at the end of the second year the growth has not been such as to warrant fruiting, it is again cut back to two or three eyes. When the vine has attained sufficient strength and maturity for fruiting the vines should be trained on stakes or trellises, in a way to secure the best results—that is, in a way to expose them as much as possible to the light and air. The amount or shortness of the trimming should be in proportion to the strength of the vine.

We fruit on canes, or on spurred canes. A cane is, as we have explained, the matured shoot, or one year old wood. The spurred canes are canes cut back.

In training or pruning a vine much is left to the judgment of the operator. He looks at the arrangement of the wood and judges from the strength of the vine what amount shall be left. The general rule is to leave to each cane six, eight or ten buds. The length of the cane is determined not by the number of inches but by the number of buds, for some canes have much longer internodes than others. You must be careful in cold weather not to cut too near the bud.

There are several different systems of pruning, which we will now describe. We will first proceed and prune for the trellis. [The lecturer here drew his diagrams on the blackboard.] First, he pruned with horizontal arms. These horizontal arms may remain the same for years. From these permanent arms shoots are trained upward, six, eight or ten in number, to the height of fifteen or eighteen inches, sometimes twenty inches. The danger always is in leaving too much wood and overbearing the vine. Almost any vine may be made to bear more than is good for it. Other modifications of the renewal system of pruning the vine were illustrated on the board. The Bon system, also spur pruning, the different systems being practiced according to the object sought in training the vine.

Summer pruning is not always properly done, for the reason that it is not understood as to what the object of summer pruning should be. Summer pruning means simply the pinching in of a portion of some of the shoots for the purpose of encouraging the even growth of all. It is sometimes done in midsummer in a most injurious manner. The operator goes to cutting and slashing with his knife, for the purpose, as he says, of letting in the sun and air to ripen the grapes! This is all wrong. Wrong as to time of pruning, and wrong as to manner of doing the work. Summer pruning is really spring pruning. The work should be done early, just when the shoots begin to start, and then discontinued in early summer, and no pruning should be done except with the thumb and finger. There is no occasion for the use of the knife in summer pruning. The objects to be accomplished in summer pruning are twofold, and for opposite purposes—to thin the wood and to thin the fruit—to strengthen the wood and to enlarge the fruit—to check and encourage—to air and to shade.

In fruiting on laterals it is usual and well to pinch back the lateral to within one leaf of the last bunch of grapes. Pinch also those shoots that are running ahead of others; this will equalize the growth of all. When these lateral shoots push again they may be again pinched, and so on as long as desired.

The buds on a cane that has made large growth are not always sure to break. They are called blind buds. The smaller canes are much surer, and are the canes sought by the vine dresser for his bearing canes.

I wish, in conclusion, to impress upon your minds the importance of early summer pruning. I have mentioned this subject, and here repeat, let this work be done at the earliest possible period, and let it be repeated and finished early in June. Early pinching causes the leaves to grow larger, and I am safe in saying that the four or five large leaves, in the position they occupy, are of more service in ripening the grapes than the fourteen or fifteen smaller leaves without the pinching.

DISCUSSION.

The discussion on this subject was very brief, and was as follows:

Mr. M. L. DUNLAP—The Doctor has told you much about pruning the grape vine. Now I do not believe in the necessity of so much pruning. I would like to hear Dr. Hull tell us something about the spiral mode of training the vine, practiced at Alton. I understand that this system of twisting the vine gives a check to the growth of the vine in favor of the production of fruit, and, further, that this system is simple and requires very little pruning in the spring.

The spiral method gives the best exposure to sunlight and air, and I would not take a leaf off in the way of further pruning. I think the great difficulty experienced at Cincinnati is too severe pruning, and I propose to demonstrate on my own grounds this season the superiority of the spiral mode of training. It is simple and economical.

There are a great many different systems of training the vine, but that which we want in this country is that which will produce the greatest amount of fruit with the least amount of labor.

Dr. WARDER—The spiral system of training is good where it can be done without danger of breaking the vine.

Mr. M. L. DUNLAP—There is no danger in that.

SWINE.

BY HON. ELMER BALDWIN.

My subject is the hog—a subject less poetic than that of the classic vine—less dignified than the story of the horse—the noble charger that bore the chivalrous knight to the combat—less inviting than Flora's fragrant breath, or Ceres or Pomona's bountiful stores. And it is very doubtful if the use of the product of the hog as human food is not decidedly deleterious to physical, mental and moral health and vigor. Yet the time is doubtless far in the future when mankind generally will appreciate that fact, and cease to go the whole hog—and the hog is not without its classic fame, it has its legends both in song and story. The victor in combat with the wild boar was in the olden time a hero among his comrades, and he was rewarded with the smiles of his lady love. And there is no animal that has furnished the same amount of human food during the historic period. The hog belongs to the class mamalia, order Pachydermata, genus Suidæ or Sus.

The fossil bone of the hog is found in the Miocene and Pliocene deposits of the tertiary strata, associated with those of the Mastodon and Dinotherium, that seems to have been the age of Pachyderm or thick-skinned animals, only two of which order, the elephant and hog, have ever been domesticated. The fossil hog was shorter than the domestic hog of modern times, but was evidently his progenitor. The wild boar, from which our domestic hog has doubtless descended, with its closely allied species, are disseminated over near the entire habitable globe, and have been the companion of man from the earliest antiquity. The hog is a perfect cosmopolitan, adapting itself to all climates. Omniverous in its diet, eating herb, seeds, grain, fruit, insects or flesh. More prolific than any domesticated animal except the rabbit, easily susceptible of improvement, and quickly attaining to maturity, it furnishes a cheaper and larger return of food for the outlay than any other animal reared for food. Consequently, in an economical point of view, the hog occupies a prominent place, and as a source of income to the farmer, for ready sale and certainty of remunerative return, is not surpassed by any other branch of his varied pursuits. Particularly is this the case in the Northwestern States, where varied and cheap food and rich pastures make it the paradise of swine.

The census of 1860 shows that there were then in the United States thirty-three and a-half millions of swine, of which the State of Illinois contained two and a-half millions, or about one-thirteenth of the whole. The census shows that the rearing of hogs is influenced by the price of their food and transportation, the pork costing much less for transportation than the bulky food of which it is made.

In 1860 the New England States had 10 hogs to each 100 inhabitants; the Middle States, 31 ; the Western States, 149 ; the Southern States, 175 ; the Pacific States, 101, and an average of the United States, 106. During the year ending March, 1868, there was received in Chicago 1,883,873 hogs, estimated to be worth about $30,000,000 ; and during the year ending January 1, 1869, there was received 1,706,000, the gross weight of which averaged about 230 pounds, and worth over $28,000,000.

The amount of this trade may very justly stimulate our farmers to inquire as to the best system of breeding, feeding and fattening, and the best breeds on which to expend their efforts in the production of this important staple.

BREEDS AND BREEDING.

There are several good breeds which lay claim to public favor—none of which are free from defects, or which embody all the points of a good hog. The Berkshire has retained the good opinion of the public longer than any other breed, and the improved Berkshire is probably our best breed. The Berkshire was first obtained by crossing the Neapolitan with one of the large English breeds. The Neapolitan is a descendant of the improved Roman hog, probably from their best, a proof of the skill of that ancient people in that direction.

Most of the improved English breeds were obtained by a cross of the large and rather coarse English hog with the fine and delicate Chinese. The Suffolk is the result of one of these crosses, and is esteemed the best breed in England. It is of fair size, and retains in a remarkable degree the fine fattening qualities of its China parent.

The pure Suffolk is almost destitute of hair, a very serious defect under our scorching sun and dry and hot climate; it is rather tender for our western treatment, but in fattening gives a good return for all the food consumed.

There are several American breeds that have attracted attention, as the Magee hog in Ohio, and the Chester White from Pennsylvania, both good hogs, but as yet hardly entitled to be called distinct breeds. It requires a long continued breeding in one direction, with careful and judicious selection, to form a distinct breed, so that all the pigs will be of uniform character, size and form. Till fully established, there is a tendency to breed back generally to the most defective progenitor, and till that tendency is overcome the certainty of reproduction in its perfection cannot be relied on.

The Chester White, when distinctly established, will be as most of the breeds are now, valuable hogs; the square and deep form, stout and erect legs, broad and short head, quiet disposition, good fattening qualities, and heavy weight, form a combination of good qualities that can hardly be surpassed.

Although our best breeds of hogs were obtained by judicious crossing, and our future successful efforts will be perfected in the same way, yet the indiscriminate crossing practiced by our farmers cannot be too strongly condemned. There seems to be a mania for mixing all breeds, while the aim should be to preserve each breed distinct and pure. We often see litters of pigs with no two alike, but each a representation of some one of the eight or ten breeds whose blood is mingled in the genealogical compound. I once made a cross of the Irish Grazier, a large, slow maturing hog, with the Berkshire, and then crossed that sow with the Suffolk, and the produce was three distinct breeds from the same litter—first, a fine delicate pig, that would fatten at any age; second, a medium sized hog, that would fatten at twelve to eighteen months, and third, a Grazier hog, that would weigh from five to seven hundred, but must be two or two and a-half years old before they would lay on fat. Preserve the breed pure and distinct, should be the rule.

Both parents should be at least one year old before being allowed to breed, and if the female should be kept till five or six years old for that purpose, it would materially improve the size and vigor of the pigs, while breeding from young sows deteriorates both size and vigor. The period of gestation with the sow is about sixteen weeks, or 112 days. During this period the sow should never be closely confined, but should have ample room for exercise, with free access to water. The food should be generous but not too heavy and heating—such as will insure the most perfect health.

The best season for sows to farrow is April, or early in May. An April pig is worth one-third more than a July pig, and more than double a September pig. Some breeds can be fattened at any age, but none will fatten as well at one year, or as much, as at fifteen or eighteen months. Any hog must arrive fully at maturity before it can be easily fattened. And an April pig can be kept till a year from the following January at less expense and trouble than a September pig. While suckling the sows should have free access to grass, and should have a generous supply of tolerably rich slop, and if fed in a trough easy of access, the young porkers will soon learn to feed with her, with decided benefit to themselves and the mother. At eight weeks old they should be weaned, and if they have learned to eat with the mother, and are fed milk or dairy slop, with a generous supply of fine bran or coarse meal, they will not fall off, but will continue growing without interruption.

A growing pig should never be fed corn to any amount; it contains too much oil, and does not contain elements of growth. Light grain, bran and shorts, with a good supply of grass and succulent vegetables, should constitute their food. After weaning, a pig should never be made extremely fat, it checks the growth and injures their thrift afterwards. Nor should they be permitted to become poor, a poor pig can never be made to attain the size or form it would have done had it never been stopped in its growth; like a hill of corn, if it once becomes feeble and sickly, no after culture can atone for the injury done. A mangy pig is worthless, and should be consigned to the golgotha where the dead animals of the farm are deposited.

Neat, cleanly and well sheltered accommodation should be provided for swine, especially during the season of growth. The hog has been much slandered in relation to his uncleanly habits. In some respects the hog is more cleanly than the cow or the horse, or most domestic animals. It is true, like the Elephant and other Pachyderms, he is fond of bathing, a cleanly habit, and it is more the fault of his keeper than his own that he wallows in mud when better accommodations are not accessible. But if young pigs have to lie in a damp and dirty bed, their skin soon becomes encrusted with scurf, the ears and tail frequently drop off, and the growth is at once arrested. During the entire rearing, to the time of fattening, the animal should be kept in a sleek, healthy and growing condition.

The natural instincts of every animal must be consulted and followed to produce the best results when domesticated.

The hog is impatient of both heat and cold; any unusual exertion during the heat of summer, especially if in full flesh, will frequently cost him his life. Comfortable shade should always be provided, easy of access, such as will protect them from the noonday heat of the summer sun. Neglect of this is inexcusable cruelty, and will be a serious drawback from the credit side of the pork account.

Equally important is ample protection from the opposite extreme of the winter cold. Pigs dropped in the fall are unfit, with all the care that can or will be given by our common farm accommodations, to pass uninjured the severity of the winter season. Early spring pigs will do much better, but a well covered, well protected, and well littered sty, where the pigs will not lie more than one deep, and where their owner will not have the nightmare from listening to their unearthly screams from suffering from the biting cold, is essential to successful pork raising. I do not believe that any good christian can say his prayers and sleep easily and quietly while the whole neighborhood is made vocal by the cries of his freezing pigs.

During the cold season a proportion of corn as food is not objectionable. It is well calculated to keep up the animal heat, and from the ease and convenience of feeding, it is now and doubtless will continue to be the principal food at that season. Yet the best results will follow when most of the coarser grains, with bran made into slop, and refuse apples, potatoes, or other roots or green food, constitute the diet.

Dry grain of any kind is not the best feed, and for this reason the hogs that follow beef cattle highly fed with corn do better than when they receive the corn directly from the crib·

During the summer, before fattening, a clover or timothy pasture is indispensable to successful fattening and to economical production of pork, and the next best course is soiling with clover, timothy, or other succulent grasses or vegetables. Confinement in small pens and heavy feeding with corn, is the most expensive, as well as the least successful preparation for fattening in the fall that can well be adopted. If fed through the hot weather exclusively on corn, the teeth become sore and the animal is generally diseased. At killing time the livers will generally be found diseased, and it will be found impracticable to make them put on fat.

One autumn, when corn was worth twenty cents, a neighbor inquired of me if I could tell why his hogs would not fatten, and also saying that his neighbors made the like complaint. I replied that the reason was obvious, cheap corn was the trouble; not that ten cent corn is less nutritious than when the price is one dollar, but it is fed too liberally, and neither a hog or any other animal can stand full feeding with corn alone but a few months and continue in health. The proper course is to so feed during the summer as to preserve the animals in the most perfect health, keep them thriftily growing and slightly gaining in flesh, so as to prepare them best for the fattening process, which is always more or less a health destroying process. With good clover or timothy pasture, a little corn or other grain is not objectionable, but they will do well on the pasture alone—they will grow but not fatten—and if kept through the summer on grass alone, will be in admirable condition to take on flesh; they will account promptly for every kernel of corn judiciously given them.

Their teeth and digestive organs are all fresh and in good condition, and with strong appetites and vigorous health, their advance to the condition of respectable porkers is easy and rapid. Sudden changes from solid to succulent food should be carefully avoided, and vice versa, the change from grass to heavy feeding with corn should be very gradual, especially as the fattening season commences.

There is one primary rule in fattening that should never be violated: the change of feed should always be from lighter to heavier, and never from heavier to lighter. Consequently, when taken from grass and vegetables, a little soft corn or meal should be gradually introduced. Corn cut while the kernel is in the milk is good food to follow the grass. The gradual hardening of the grain will be a proper increase of the nutrient quality of the food. When fairly established on a diet of sound corn, it should be fed on a clean floor, and in amount about what will be eaten, but not so as to have a kernel eft. The practice of leaving a quantity of corn more than will be eaten on he feeding floor is a very wasteful and bad practice. The nice point to as- ertain is to find, by measurement, the amount that will be consumed without ny waste, and then to always measure the feed by that standard, varying the mount as their appetites require. There are no animals that will retain their ppetites and thrive as well when fed to a surfeit, with the unused food, lown and dirty, constantly before them, as they will with just enough to ive healthy and full action to the digestive organs, and to preserve the ap- etite unimpaired. To effect this the last of each feed should be consumed rith avidity. Thus the old adage, that the lazy farmer who leaned upon the ence while his hogs finished their meal, always had the leanest pork, has uch significance.

Plenty of water, with occasionally a little salt, coal and ashes to correct he acidity of the stomach of the gourmand porkers, completes the required ietary. This system of feeding is adapted to corn fattening as practiced at ie West.

Our eastern friends have a somewhat different system. First, having se- ured the necessary buildings, kettles, troughs, etc., they commence the fat- ening process by boiling vegetables, such as apples, potatoes, pumpkins, or ny other that hogs will eat, and, when thoroughly cooked, these constitute he food for the first few days. They then commence adding a very little ieal, mixing it with the hot, boiled or steamed vegetables, so as to cook it ioroughly. When the mess has undergone a slight fermentation it is ready or use. The amount of meal is very gradually increased till toward the close f the fattening season, when meal alone is given. The meal is of corn, oats, uckwheat and barley, ground, and fed either mixed or separately. This sys- m resembles the English practice, and, aside from the labor required, is uch more economical than the practice at the West of feeding on corn lone. Hogs are made equally fat in much less time.

When our grain can be made into meal as cheaply here as in New England, nd labor shall be as plenty and cheap, the eastern system will deserve a fair ial here.

As to the value of corn when fed to hogs, farmers differ very widely. In- ances are given where, by actual weight, hogs have put on from 12 to 18 ounds by consuming one bushel of corn. My opinion is, that ten pounds ain for each bushel of corn consumed is a fair estimate. At that estsmate, ork at $10 per cwt. is equal to corn at one dollar per bushel; or at $5 per vt. it is equal to corn at 50 cents; but to secure even that result, the man- gement must be judicious throughout. Hogs kept in a close pen and fed rn through the whole period of their existence, will figure up the profits the wrong side of the balance sheet, and much depends on the breed; iere will be a wide difference between results from a good and an inferior eed, with the same keeping. There is much point in the reply of the man hen his neighbor wanted to get some of his breed of hogs, that "he would ant his swill tub too." Yes, both a good breed and a well filled trough are sential to successful pork raising.

I will only briefly notice some of the diseases of swine and their remedies, and will then relieve your patience. I have but little faith in specific medi cine as a cure for hog cholera, or any other disease to which swine are sub ject, and I have very little faith in a sick hog.

My practice is to turn them loose where there is water and leave them t(nature and their own instincts. A larger per centage thus treated recover o any disease than when treated by any prescribed form of medicine. But ɛ sick hog is poor property, and may be regarded, generally, as belonging t(the debit side of the account of profit and loss.

The wild animals in their native haunts are seldom diseased. The wil(boar in the forests of Europe or Asia, I presume, never had the cholera, bu when domesticated his natural instincts are thwarted, his food is changed, h chafes under confinement; sometimes starved, then fed to a surfeit; witl filthy pens, exposed to cold and heat, it is not surprising that he becomes dis eased.

The laws which govern the nicely balanced organism even of the hog can not be violated with impunity. Every species of animal has its natural food habits, condition and natural requirements, and the nearer those can be sup plied the more certain the immunity from disease. Any cause that weaken the vitality of any animal tends to invite disease. The practice of *in and i* breeding has a most injurious effect upon swine, rapidly weakening the vitali ty, and in two or three generations rendering them worthless, if not extinct When thus weakened, any exciting cause will induce cholera or some kindre(disease.

Sudden changes of food, especially from high to low feed, or the opposite exposure to excessive heat or cold, and an insufficient supply of water, ar among the causes of disease to be avoided.

If all the requirements of comfort, good beds and shelter, appropriate foo(judiciously given, plenty of water for drinking and bathing, and all the natu ral instincts are supplied as far as practicable, even in a domesticated stat there will be little danger of disease. The old superstition that disease is th decree of fate or of unpropitious stars, has long since been exploded, o should have been, and like every other effect is regarded as the result of tang ble cause. Avoid the cause and the effect will never be developed. Preven tion is better than cure.

Like other domestic animals, the hog is frequently the victim of a cruelt which disgraces humanity. He is but a hog, and his stubborn dispositior which often is more than reflected by his master, is made the pretext fo abuse and cruelty, but especially is he the objective point of all the worth less curs within his range; minus ears and tail, he frequently presents a liv ing monument of his wrongs. A man frequently harbors a grudge agains his neighbor, but is too cowardly to attack the man, but will dog his hog instead. Such a man abuses his superiors.

Every animal we rear is entitled to our kindness and protection. Nor i the hog undeserving our regard. Instances have occurred where they hav shown much intelligence and even affection. They have been trained t(hunt, and the " learned pig " has often "astonished the natives" with his sa gacious performances. The acute instinct which directs the pig straight to his home, as the bee flies, miles distant, when he was conveyed in a tight box from home, round a circuitous and crooked road, is a performance that man, with all his faculties, can never imitate.

There is no animal so low in the scale but has characteristics that excite our admiration and wonder. They are all the handiwork of the Great Architect of Nature. If we would rear them successfully we must know their natures, their instincts and their wants, and we shall learn that the treatment which kindness and humanity dictates will bring the greatest pecuniary profit. As the path of duty is the path of happiness, so kindness to the most inferior animals we rear, is the best guarantee of success.

DISCUSSION.

Mr. M. L. Dunlap—We have a gentleman here who makes a speciality of breeding hogs for the purpose of selling. Perhaps no party has sent out a larger number or a better style of pigs. I refer to Mr. Floyd. He can no doubt tell us something that will be instructive upon this subject.

Mr. Floyd—The speaker, in the excellent lecture given us, has said all that is necessary to be said. I have nothing further to add that I think would be either instructive or interesting.

A voice—At what time would you advise the commencing of feeding grain?

Mr. Baldwin—Early feeding is always better than late feeding, and having commenced to feed early we would increase the feed until hot weather is past.

Mr. Robinson—I would ask what stock of hogs is best for our State? What class of hogs is usually made most valuable in our country?

Mr. Baldwin—I think perhaps the Berkshire is as good as any.

Mr. M. L. Dunlap—I will mention a very important use that is made of the hog. In passing through this State I find that many fruit growers are using the hog to pick up the fallen fruit, that contains the codling moth and the curculio. Large orchards are supposed by this means to be kept free from these enemies. Now if this is the case, we have here a hint to fence in our orchards, so we can turn in our hogs and save our fruit. I have no doubt we shall have, before long, to adopt this plan. It is also economical. A small amount of feed will do the hogs, aside from what they get in the orchard.

The only large peach orchard that paid anything last year was Winter and Brothers', at DuQuoin, who kept hogs all the time in their orchard. They believe hogs a perfect immunity against the insect enemies of the peach. They also adopt the practice in their peach orchards of mounding up the earth around the trees. It may be a question whether the mounds or the hogs deserve the credit of saving the orchard. At any rate, we believe that if we will fence in our orchards and turn in our hogs we shall make a good use of them.

In regard to breeds, we think the Suffolk a good hog to turn into the shade of the orchard trees. I have fenced in three or four acres of my own orchard, and I am satisfied that the hogs have benefitted that part of the orchard. Nearly all the sound apples are in this hog lot, and I propose to extend this hog lot. Although I have mentioned the Suffolk as among the best for this purpose, any good hog will answer the purpose.

M. Baldwin—If you turn your hogs into an orchard where there is no green feed they will bark the trees. Hogs prefer grass, but if that is not present they will take to the trees. There is another use made of the hog. We are in some places very much troubled with the wild morning glory. It is very difficult to get rid of it in the ordinary way, but if you will turn in your hogs, they will very soon root it out. I went out one morning to find my hogs. They were no where to be seen. Presently I saw the tail of one of them sticking out of the ground. The fellow was down there after the roots of the morning glory. [Laughter.]

Mr. N. J. Colman—We in Missouri depend very much upon the nuts of the forest to furnish food for our hogs. We can raise hogs there cheaper than you can here in Illinois. I have seen trees where twenty bushels of acorns could be gathered from them. They are excellent food for hogs. I know it is said that mast-fed pork is not as good as grain-fed. Be this as it may, this is the way much of the pork counted good is made.

In feeding grain we have the lazy man's practice, we use portable fences, and let the hogs feed themselves. These fences will inclose five or six acres, and when it becomes necessary the fence is removed to another place. I am not sure that this is not the best way to fatten hogs. It is certainly better than the practice of some, who, having but one small field for the hogs, let them "root or die."

Some one inquired if a clover and timothy pasture was a good hog pasture.

Mr. Baldwin—Timothy pasture for hogs is to me a new idea, besides, I could not recommend it. I find that hogs will destroy the timothy by rooting it out. Clover is most excellent for hog pasture. They will keep fat upon it if they have plenty of water.

Question—At what time would you turn the hogs upon the clover?

Mr. Baldwin—In the spring season, after the clover has made a good start.

Question—What about the hog tamer?

Mr. Baldwin—I think the hog tamer a good thing. I have used it. That is one thing that all farmers having hogs must look after.

Mr. H. J. Dunlap—Would it not be a good plan to get up a breed that cannot root? [Laughter.]

Mr. Colman—Yes, sir; I don't know but you here in Champaign could get up such a breed. [Laughter.]

It is very essential to let the hogs have plenty of stone coal or charcoal. Give them also ashes. In regard to breeds, I may say I have been clean through the mill. I once had a great fancy for the Essex, but I found I could not propagate them. I could not keep the Essex in a condition to breed, they would put on fat. The Suffolk is a good hog. I have lost a few with the quinsy. I have tried the Berkshire and like them, but, like Mr. Baldwin, I like the Chester White best. We had, last year, a breed that came from Illinois to our State Fair, which carried off the premiums. They were, I believe, owned by a Mr. Moore, of Canton, Illinois. They were the Poland and Big Boned China hog, sometimes called the Magee hog. I think favorably of this breed. I do not know, however, that it can be called a breed, it is a cross. After all, there is a great deal in the swill tub in regard to breed. I do not think hogs can be raised profitably and feed upon grain. A clover pasture is indispensable. I agree with Mr. Baldwin in his faith, or want of faith, in pork as being a good article of diet. I would much prefer for my use a piece of mutton or beef. But the people will have pork, and it is the business of farmers to grow it for the profit there is in it.

Mr. Periam—In regard to feeding coal to hogs, I think this is essential, especially where three or four hundred are kept together.

Without it the hogs are very liable to disease and death. Coal acts as a preventive of disease. A hog will eat three or four pounds per week, and he seems to relish it.

Mr. Jewett—I should dislike to see this discussion close without further mention of this spotted hog mentioned by Mr. Colman. It is a hog worthy of your attention. I have grown these hogs, and would advise farmers to look at them, and if any one here wishes to look at them he can do so by crossing the street here. They are a cross it is true, but they are so carefully crossed that they will always produce the same breed or style of hogs, so that any one will be satisfied with them. I know one man that fed 430 of these hogs.

Mr. Colman—Where does he live?

Mr. Jewett—In Warren county, Ohio. It was there called the Magee hog. They are very fine hogs, and will measure more than any hogs that I am acquainted with. He has heavy hams, and they will fatten at any age.

Mr. Ennis—Do you breed more than once in the year?

Mr. Baldwin—No, sir; that is enough.

Mr. Jewett—I wish to ask Mr. Dunlap if he *knows* that sheep will feed upon the trees of the orchard?

Mr. M. L. Dunlap—I have seen orchards where sheep were kept, and where the ground was cultivated, and all the sprouts and weeds and grass kept down, the sheep would bark the trees. They should be turned out when the green feed becomes short. They are of great service, however, in eating up the fallen apples that contain the codling moth.

Mr. Jewett—In regard to sheep barking trees, I have a little experience. I turned my sheep into my orchard in Michigan and had 100 trees barked, and I watched the sheep, too.

Dr. Hull—I am fully prepared to indorse the value of hogs in an orchard. They are almost the only protection we have against the codling moth. But we wish to protest against the idea that seems to be gaining ground that the hog is a protection against the curculio in the plum. If the gentleman will come to Alton, I will take him into an orchard where hogs have been kept all the year, and yet not a single specimen of perfect fruit remains on the tree at the close of the season. Gentlemen having no experience with the curculio know not the difficulties with which we have to contend.

He gave an acconnt of his visit at DuQuoin and Centralia some years ago, when he foretold the coming of the curculio, or rather showed them the marks upon their fruit indicating the presence of this dreaded enemy, from whose ravages they had boasted that they were free. He then told them that they must do something more than simply to turn in their hogs. This would not exterminate the "little Turk." Another fact. The curculio is not an imported insect. It is an insect of our own. It has not yet reached England. It may yet reach it, and woe to that orchard wherever the curculio is allowed to come and remain in peace!

Mr. PARKS—I wish to inquire whether the disease of hog cholera is disappearing?

Mr. BALDWIN—I have never had a case of hog cholera, and do not know whether it is on the increase or decrease. I am confident, however, that, with proper care in keeping hogs, there need be no fear from this disease.

SHEEP.

BY A. M. GARLAND, PRESIDENT OF THE ILLINOIS STATE WOOL GROWERS' ASSOCIATION.

As in the past, of all the domestic animals, none have occupied so prominent a place in the history and economy of civilized nations as the sheep, so at the present time no animal bears so intimate a relation to the comfort and necessities of the human family.

Among the many wise and bountiful gifts of nature for the welfare of the human family, none are so indispensable as this animal, furnishing, as it does, at the same time a food so wholesome and nutritious and the most comfortable and healthy of our clothing materials. And we find that man was not slow in availing himself of so generous a gift.

"Abel was a keeper of sheep," and the firstlings of his flock, offered as a sacrifice, were acceptable to the Lord; and the frequent allusions to the sheep all through the Holy Writings and Prophecies, it seems, were intended to have the double office of furnishing appropriate illustrations of the purity and usefulness necessary to the perfect man, and to fix ineffaceably upon the minds of the people of the then and coming ages the prominence of this most indispensable animal.

The shepherds upon the plains of Bethlehem were the first of men favored with a look upon the brightness of the star that marked the birth-place of the Savior of the world.

Nor is this prominence peculiar to sacred history. We find frequent allusions to the sheep in the oldest writings of China, Persia and India, and representations of them are found carved upon the monuments of ancient Egypt.

More than two hundred and fifty years ago (in 1613), John May wrote, concerning the famous "wool sack" upon which the Lord Chancellor of England has sat for ages, as President of the House of Lords: "The antiquitie of wool within this Kingdom hath been, beyond the memorie of man, so highly respected for those many Benefits therein, that a customable use has always been observed to make it the seat of our wise, learned judges, in the sight of our noble Peers (in the Parliament House), to imprint the memorie of this worthy commoditie within the minds of those firm supporters and chief rulers of the land." *

Mr. John L. Hayes, in an admirable paper, read at Philadelphia in 1865, says of the sheep: "This species is endowed with a plasticity, so to speak, so very remarkable that it is more susceptible of modification than any other animal except the dog; so that 'the breeder,' as Lord Somerville says, 'may chalk out upon a wall a form perfect in itself, and then give it existence.' Hence peculiarities are developed in the coverings of different races produced by man, which make the distinctness and variety of fabric which characterize the wool manufacture; and thus we have the coarse Cordova and Donskoi wool for our carpets; the noble electoral wools of Saxony and Silesia for our broadcloths; the strong middle wools of the Southdown and our native sheep for blankets; the soft, long and finer merino wools of France, Vermont and Michigan for thibets, delaines and shawls; the longer and coarser wools of the Cotswold and Leicester races for worsteds in their thousand applications; the very long and bright haired lustre wools of Lincolnshire for alapaca fabrics, and, lastly, the precious, silky Mauchamp wool, the recent triumph of French agronomic skill, rivaling even the Cashmere, for shawls, and the Angora for Utrecht velvets."

The docility, hardiness, easiness of keep and prolificacy of the sheep—strong arguments in its favor in semi-barbarous countries like Australia, South America, Africa, and some parts of Asia, are found to increase in force when mixed with the agriculture of more civilized nations.

SHEEP AS FERTILIZERS.

There is an old Spanish proverb to the effect that "gold springs up where the foot of the sheep has trod." This is literally true as applied to the wealth that lies hidden and undeveloped in the soil. It is certainly not necessary here to dwell unon the expediency, not to say absolute necessity, of maintaining the fertility of our soil. As fertilizers, sheep are unrivaled among the domestic animals. Beneath their "golden hoofs" we see the fields of Great Britain, after centuries of cultivation, rivaling in productions of wheat, and excelling in their yield of grasses, the fertile prairie lands of our own and other Western States. The preponderating, the undisputed, testimony of many of the most successful farmers of Great Britain is, that farming, though now profitable, could not remain so, in many localities, without sheep.

Blest as we are with a virgin soil of unsurpassed fertility, we should constantly keep in mind the fact that it is not inexhaustible; and the sooner we

See Smith's Memoirs, Vol. I.

give heed to this fact, and learn to diversify our industry, so as to preserve in our soil its original fertility, the better for the most of this generation and all of the unborn millions that, after it, are to find homes and a livelihood upon the bosom of our vast prairies, and along the margins of our beautiful streams.

Sheep should be handled upon every farm in connection with the raising of grain crops. They occupy a place in the economy of the farm that no other animal can fill so well, in consuming the straw and cornstalks and other refuse fodder.

The facility with which the product of the flock is transported is a strong argument in their favor. The greatest drawback in the raising of the great staple of the Northwest, Indian corn, is the expense of getting it to market. We daily see the price of corn quoted, in our lake shore and Eastern markets, at a pretty high figure, but the rejoicing of the farmer is pretty thoroughly alloyed when he reflects that from one-half to two-thirds of this round price has to be paid to railroads for transportation. As sheep are usually fed in Illinois, it requires a bushel of corn to make a pound and a quarter of wool. How much better then to transform our corn into wool, which can be sent to the same Eastern markets for one-tenth to one-twentieth its selling price. The only better way than this would be, after having transformed our corn and grass and straw into wool, to bring the manufacturer to our doors, and let him and his operatives furnish a home market for the other products of the farm, while saving the transportation of the wool one way, and the cloth back again.

LEGISLATIVE PROTECTION NECESSARY.

Notwithstanding these incentives to a generally diffused sheep husbandry, the history of the "flock" in the United States is an eventful one. The instability that has characterized our national legislation, with its bearing upon wools, both in their raw and manufactured states, has shrouded the business of both the grower and manufacturer of this staple with a cloud of uncertainty, alike detrimental to the interests of both; so that the past history of sheep with us can not be written, nor their future conjectured, without touching upon that principle of political economy affecting this and all other branches of industry—the protection of the American against the competitive labor of persons living on lands without cost, in a climate without winter, under a government that imposes, if any, but a nominal tax, and in a state of society which requires but little for its support.

The grower of wool here needs to have the protecting arm of his government thrown around him, in so far that the necessities of his situation, such as high taxes for the support of the government, schools, churches, and the other adjuncts of an advanced civilization, place him at disadvantage when brought in contact with the producers of wool who are exempt from these burdens. Without here attempting an argument in favor of a protective policy in our national legislation, let me say in passing, that, in my humble opinion, such a protective or defensive policy leads to the only road through which the American producer can ever reach that firm basis from which he can defy the competition of the world. France pursued such a policy until the justly celebrated Rambouillet wools were relieved, by their own excellence, from all competition, when even the producers themselves consented to the abolition of all duties.

The culture and increase of flocks of sheep are, with us, a national necessity. The United States, dependent upon Australia or South America for her raw clothing material, in the event of a foreign war is at the mercy of any power that can man and float half a dozen war vessels. This insignificant force, by depriving us of the means to clothe our army and our people, could freeze us into terms that, under more favorable circumstances, could not be extorted by the combined navies of the world. I have no envy for the foresight of the statesman, or the patriotism of the journalist, who would place his country in a position exposed to such danger. We must defend both the agriculturist and the mechanic, the manufacturer and the laborer, against the cheap labor of Europe and the semi-barbarous countries, even though it costs something to do it. This was the policy of every manufacturing nation of continental Europe after Peace had spread her wings over the desolated war path of the First Napoleon, and the result we see to-day in the thousands of workshops and factories that make Europe one vast beehive.

At that time the policy of England was to keep the other nations dependent upon her for their manufactures, not only of clothing but all other artificial necessaries; and one of her statesmen, Lord Brougham, while urging the great advantage to accrue from such a condition, said: "England can well afford to incur some loss in the export of English goods for the purpose of destroying foreign manufactures in their cradle!"

GENERAL SUGGESTIONS.

The period of gestation with the sheep is five months, though exceptions to the rule, in a variation of two or three days, and sometimes even a week, are not uncommon. The great fundamental law of nature that "like begets like" finds no more exceptions with the sheep than with other domestic animals. In breeding use none but the best animals, and be careful that lambs do not come in the spring before you have grass for the mother. Attention to these points will relieve the farmer of much labor and loss, and go very far towards insuring a healthy and vigorous offspring.

WOOL PRODUCTS OF THE WORLD.

In the United States, with an annual clip of about 100,000,000 pounds, the home demand for wool exceeds the supply by nearly one-third. It may be of interest here for us to inquire for a moment where the wool is raised that clothes the world. The latest estimates available are German.* These place the production of the wools of the globe at 1,610,000,000 pounds, or one and one-quarter pounds to each inhabitant, calculated upon an estimated population of 1,285,000,000 people.

* U. S. Economist, June 10, 1865, also address of John L. Hayes.

The amount set down to each country is as follows:

England	260,000,000	pounds.
Germany	200,000,000	"
France	183,000,000	"
Spain, Italy and Portugal	119,000,000	"
Australia, South America and South Africa	157,000,000	"
Russia in Europe	125,000,000	"
United States	95,000,000	"
British North America	12,000,000	"
North Africa	49,000,000	"
Asia, at a very general estimate	470,000,000	"

In the manufacture of carded or clothing wool, from statistics collected at the recent Paris Exposition, the leading countries of the world stand relatively thus:

Rhenish Prussia, first for men's wear; France, first for women's wear; Austria, second for women's wear; France, second for men's wear; Belgium, third for men and women's wear; Prussia, fourth for men and women's wear; England, fifth for men and women's wear; the United States, sixth for men and women's wear, and Russia seventh for men and women's wear.

In combing wool fabrics, France stands first and England second; the other European nations showing nothing to particularly distinguish them from each other.*

The largest flocks of sheep of which we have any knowledge are in Russia. †

Mr. Michael Bernstein, of Odessa, describes his production as follows: "The flock of Falz Feim consists of 400,000 animals. The last shearing produced 30,000 poods, washed, and sold for 870,000 rubles, or 2,974,500 francs," or, in plain English, 1,250,000 pounds, selling for $595,000. Another flock is mentioned, as the property of Mr. Tilibert, consisting of 70,000 merino sheep.

We have in the United States not far from 35,000,000 sheep of all breeds. By far the greater part of this number are of the merino family and its crosses. "The merino breeds are distinguished amongst the various types of the ovine species by the fineness of their wool and the abundance of their fleeces." The product of these, with occasional combinations of foreign wool, and, I am sorry to say, sometimes shoddy, are made into the characteristic woolen fabrics of our country, such as plain and fancy cassimeres, sackings, repellants, tricots, beavers, cloakings, woolen shawls, and the different varieties of flannels. With proper encouragement the American grower will soon be enabled to furnish all the card wool or fine wool clothing needed by our population.

* Report of E. R. Mudge, U. S. Commissioner of Paris Exposition.

† Ibid.

AMERICAN MERINOS.

It is cause for just pride to know that to such a high state of perfection has fine wool sheep husbandry been brought in Vermont and some other localities, that the American merino, now recognized as a distinct type, stands unrivaled in the ovine species for symmetry of form, strength of constitution, and in compactness of its fleece. These excellencies are the more gratifying in view of the fact that they have been attained without the sacrifice of that hardness and capacity for enduring long journeys, and aggregating in large flocks, that were such prominent characteristics of their trans-Atlantic ancestors.

Many prudent and successful feeders pronounce this the most profitable sheep for the stall, and they furnish a quality of mutton admitted by many good judges to nearly equal the famed Southdown. It is the generally accepted opinion of those best informed, that this class will furnish a greater return in wool and mutton, for an equal amount of feed and attention, than any other. The exceptions to this rule, if any exist, are to be found in close proximity to large markets, and upon very high priced lands. The weight of fleece from some of these animals is enormous, and shows, in an eminent degree, the success that has attended the efforts of the American breeders in improving upon the original stock as imported from Spain in the early part of the present century. Single fleeces, weighing from eighteen to twenty-five pounds, are frequently taken from choice rams, while in a few exceptional cases as high as thirty pounds has been clipped from a single year's growth. From ewes fleeces have weighed from nine to sixteen pounds. This is of wool in an unwashed state, and quite often is made up of gum or grease.

HOUSING AND PAMPERING.

The custom of housing, feeding too highly, and in every manner unduly developing and retaining in the wool the oily secretions of the animal, has been carried to an extreme no honest practical breeder will justify, and has undoubtedly operated to the disadvantage of all parties—affording, as it has, the opportunity for the impostor to palm off upon the inexperienced purchaser animals either entirely worthless, or at best of very inferior merits. This practice has tended largely to bring "full blood" and "show sheep" into disrepute. Many who have been thus imposed upon now stand ready to denounce the "sheep business" as an unremunerative humbug, and those engaged in breeding choice animals as cheats and impostors. With the cynical statesman of Roanoke, they are ready to "walk half a mile any day to kick a sheep." The housing, and otherwise pampering, of sheep is not necessarily a fraud. If parties resorting to such a custom would inform the purchasers of their animals of the manner in which they had been handled, probably no wrong would be done. I say probably, for any one having experience in such matters will appreciate the difficulty in arriving accurately at the real merits of an animal that has been thus highly pampered. At best it is a useless expenditure of time and money, and unless much intelligence and care

are exercised will redound to the detriment of the constitution of animals and their offspring. Animals possessing real merit do not require any artificial adornments to recommend them to the breeder of judgment and experience, and the sooner the practice is abandoned the better for all parties.

The very severe tests by scouring, to which many fleeces have been subjected lately, demonstrate, however, a marked improvement in the weight of cleansed wool. The tests conducted by the Board of Agriculture of our own State, in 1866 and 1867, developed fleeces averaging from five to seven pounds when thoroughly scoured; while in some Eastern States fleeces have been found to average as high as six, seven and eight pounds—and at least in one instance reached over nine pounds—nine pounds three ounces. This considerably exceeds the weight of the unwashed fleeces of the best Spanish rams at the beginning of the present century, which Youatt places at eight pounds, and Livingston at eight and a-half pounds. It may be of interest to note here that American merino rams are now being transported to Australia—sent there to give "quality and body to the degenerated wools of that locality."

TYPES OF THE MERINO FAMILY.

Of the merino family we have the different types of Spanish (which is the foundation of all the others), the French, the Saxon, the Silesian and the American.

THE MAUCHAMP MERINO.

This part of our subject would not be complete without reference to a new and now perfectly established race, remarkable for its soft and silky fleece, called the Mauchamp Merino. About forty years ago (1828), there was accidentally produced upon the farm of Mauchamp, department of Aisne, in France, cultivated by M. Graux, a ram lamb, badly, even monstrously, formed, with a wool remarkable for its softness, and more especially so for its lustre, which resembled that of silk. Mons. Graux carefully raised this animal and used it for reproduction, obtaining some lambs similar to the sire and others similar to the dams. He then took the animals resembling the sire, and by a careful and tedious course of in-and-in breeding succeeded in forming a small flock, whose wool was perfectly silky. After this he applied himself to the somewhat easier task of modifying their size and form, both of which were objectionable, and has so far succeeded that his flock is said now to compare favorably in these respects with the French Merinos, of which they are an offshoot. A commission of Savans who reported upon the qualities of this new race to the Imperial Society of Acclimatation, say: "The silky wool is destined to replace completely in our own industry the Cashmere which comes from Thibet. It is fully as brilliant as Cashmere, fully as soft; and while it costs less as a raw material, it requires less manipulation to be transformed into yarn, since it does not contain the hair, which must be removed from the Cashmere."

It is greatly hoped that the utility of crossing the Mauchamp with the American Merino will soon be tested by some breeder of the requisite capital and enterprise.

Since writing the above paragraph I have seen the remarks of Hon. John P. Reynolds upon the Mauchamp Merino, in his able report upon the Paris Universal Exposition, and wish here to call attention to them as the opinions of a gentleman of enlarged and liberal views, and the result of a long study, having for its object the good of the agricultural interests of our whole country. Mr. Reynolds seems to entertain no doubt that the cross alluded to could be made profitable in this country, in view of the greatly increasing demand for fine combing wools, and cites the result of experiments in crossing them upon the Rambouillet sheep of France, in proof of the correctness of his conclusions.*

LONG WOOLS.

The long wool breeds are generally distinguished by great precocity, and in raising them the item of mutton is the prime consideration, and that of wool secondary; and in England, where are to be found the most perfect types of this variety, a remarkable success has been achieved in the development of those particular parts of the body giving the best meat, and in producing animals capable of being fattened with the greatest economy and at an early age.

This branch of sheep husbandry, presenting as it does so inviting a field to the farmer, has been too long neglected. Of the long combing wools we consume annually some 6,000,000 pounds,† for a large proportion of which we are dependent upon the British Provinces, from whence we also draw largely for our supply of mutton. Since the abrogation of the Reciprocity Treaty with Canada this interest has received quite an impetus, and if properly fostered and protected will soon take its proper rank in the industrial economy of the country.

RECIPROCITY TREATY WITH BRITISH PROVINCES.

And here let me remind you that a movement is on foot to re-establish the Reciprocity Treaty, which, if successful, will be a death blow to the long wool interest in the United States, and, by sympathy, will greatly injure the fine wool interest. The committee on Ways and Means, at the last session of Congress, reported in favor of referring the question of re-establishing the treaty to the Secretary of State, who is thought to be in favor of granting "free tickets" to such part of the world as he cannot *buy*. This reference, if agreed to by the House, is but one way of voting for the treaty, by dodging a direct vote against it, as Mr. Seward will of course recommend it to the Senate for ratification. The treaty as it formerly existed meant only free use of the New Foundland fisheries for the fishing States, and free lumber for New York, and so far as the agricultural interests of the country may be

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* Report of John P. Reynolds to Governor of Illinois, 1868.

† Mudge's Report.

concerned had no reciprocity in it. The true policy for us stands opposed to letting any people have the free use of our markets who do not help us pay the expenses of this government. If Canada, or any other country, wishes to enjoy our commercial privileges, let her throw aside the soiled and ill-fitting garments of royalty, and enter into the fold at the open door, for whoso "climbeth up some other way, the same is a thief and a robber."

VARIETIES OF LONG WOOL SHEEP.

Of the long wool varieties, those most generally introduced into the United States are the Leicesters, the Cotswolds and the Southdowns—though some others are finding their way among us.

The *Leicester*, (probably more generally diffused through England than any other variety) is the result of the remarkably successful efforts of Robert Bakewell, (for whom they are sometimes called,) to produce a profitable mutton sheep. His experiments commenced more than a century ago, and, to use the language of another, "was a successful effort to form a sheep suited to low land and rich pasturage, that would produce the greatest amount of salable mutton from the least food in the shortest time." Their peculiar propensity for fattening may be inferred when it is stated that animals with a coating of fat six inches thick around the entire body are not uncommon.

The *Cotswolds* are a hardier variety, generally exceed in weight, and mature as early as the Leicesters. After these we have the family of "Downs," at the head of which stands the justly celebrated *Southdown*, furnishing the most popular mutton, both in this country and England, from whence they were imported. They more nearly approach the Merino than any of the longer wooled varieties, in their ability to subsist on scanty pasturage and to endure severe exposure.

The *Hampshiredown* is the offspring of a Hampshire and Wiltshire ewe coupled with a Southdown ram, and exceeds the latter in size of carcass and weight of fleece.

The *Shropshiredown* is the result of several crosses between the "Clun Forest," the Ryland, the Hampshire and the Southdown. Their chief characteristics are their fecundity and freeness from liability to disease.

The *Oxforddowns* were produced by coupling Cotswold rams with Hampshire ewes, with an occasional dash of Southdown to perfect the cross.

Of the Lincolns, the Herefords, the Cheriots, the Romney Marsh, and other varieties not yet introduced in this country in any numbers, I will not take time now to speak.

GENERAL REMARKS.

The late civil war gave a wonderful impulse to sheep growing in the United States, as evinced by an increase of ten millions in the number of animals, and a heavy per cent. in the amount of wool. The very general desire to embark in the "sheep business" is fresh in the minds of all. Men of every capacity and avocation made haste to get rich by becoming the owners of sheep. The reaction from this excitement, owing to a number of causes, readily understood by the business man, has been so severe that under its pressure many have become discouraged, and are turning their attention to other branches of business. Flocks have been sold for less than the value of a single year's clip, or have been slaughtered for their pelts and tallow. Like Bunyan's Pilgrim, we have long walked in the "Valley of Humiliation;" but I firmly believe the darkest hour has passed, and that the immediate future for the wool grower has in it much of encouragement. The stock of raw wools is so low that already we have complaints from purchasers that they have a limited opportunity for making selections. The past year has seen a holocaust among the flocks of the country without a parallel. Nearly forty thousand sheep per week, for the last three months of 1868, were slaughtered in the city of New York alone; while Boston, Philadelphia, and other cities have absorbed more than their usual average. The city of Chicago consumed during the entire year some four thousand per week. We did not raise as much wool in 1868 as we did in 1867, and the clip of 1869 will show a still further decline. So, reasoning from the well recognized laws of supply and demand, both wool and mutton must bring a fair price for sometime to come.

The relative position of wool in our markets for the past two years has been an anomalous one. The average price of wool in Boston market for 35 years preceding the war, was, according to the report of the Revenue Commissioners, 42.8 cents, and that it will soon find its level with the other products of the country there can be no doubt, *except the stability of the present tariff*, which is just now beginning to show something of its legitimate effect. Let the tariff upon foreign wools be repealed, or materially modified, and the days of prosperity, almost of hope, for this great interest are over, until such time as the wisdom or necessities of our people shall demand its re-enactment.

In proof of the correctness of the foregoing views, let me call attention to some speculations upon the future of wools in the New York Economist, a paper whose unremitting devotion to the importing and free trade interests ought certainly to relieve it of all suspicion of an intention to excite the market in behalf of the domestic wool growing interests; it says:

"The heavy importations of wool of 1866 are about all worked off, with very little wool in the country to fall back upon. We do not see why wool at present prices is not the best property at the present time for an investment, and we think those parties who are now laying in stocks are acting wisely, for we cannot see what is to prevent an advance of wool. We do not think the plea that manufacturers are well stocked is a valid one. Nor do we think those farmers are acting wisely who are selling their sheep at a monstrous low price, or slaughtering them for their pelts and tallow. We think it would be well for them to remember the old adage of 'waste not, want not.' * * * * * If farmers will be reckless, and sow the wind, simply because things do not exactly suit them, they must not be surprised if they do have occasionally to reap the whirlwind. They may depend upon it that for the next ten years sheep husbandry will be the best investment that can be made in agriculture."

In view of the fact that the United States has but one sheep to 57 acres of er domain, and as we produce but little more than two-thirds of the wool re manufacture, and a much smaller fraction of the amount we wear, sheep usbandry certainly does present the most inviting field now open to the merican farmer; and why the prosperity vouchsafed to those who embark n it by the eleventh-hour prophet of the Economist should be limited to ten ears I can see no good reason. Our people are rapidly learning that mutton s the healthiest of all meats; and that they are promptly acting in the light f this new knowledge the reports of the live stock markets at the great ommercial centers abundantly prove. Why, then, should the wool grower e discouraged? That, with an over-stocked market, a general financial de-angement, and an unsettling of values, incident to the transition from a ime of war to a time of peace, the result has been very unsatisfactory foot-ngs upon their balance sheets for two years past, no one can gainsay. But hat branch of business is exempt from vicissitudes? The fact is that wool as shown, for a series of years, fewer and less extreme fluctuations than any ther commodity the farmer has to sell. A review of the market quotations n Chicago for ten years show that the highest price wool has sold for is $1 er pound, and the lowest 27 cents; the highest corn has sold for is $1 12, nd the lowest 38 cents; the highest wheat has sold for is $3, and the lowest 8 cents; the highest hogs have sold for is $13 per hundred, and the lowest 3; the highest hops have sold for is 60 cents per pound, and the lowest 4 ents—showing for wool a fluctuation of 369 per cent., against 300 per cent. or corn, 500 per cent. for wheat, 430 per cent. for hogs, 1,500 per cent. for ops, or 369 per cent. on wool, against an average of 683 per cent. on all ther products.

CONCLUSION.

Though days of adversity may occasionally overtake the wool grower, let im stand firm, hold fast, take good care of his sheep, and in the end they vill take good care of him. The sheep never dies entirely insolvent. Even vhen starved to death, he leaves his pelt as a legacy to the cruel master who lenied him food.

No business is exempt from vicissitudes, as can be read in the melancholy istory of the wheat grower. Winter killing, blight, rust, the chinch bug nd the midge, have made his fortune a checkered one. The grower of five nd ten cent corn has had his share of misfortune in years past. The hog holera has plowed its deep furrow through the fortunes of the pork grower; nd to-day the Texas or Spanish fever hangs, as a sword of Damocles, over he millions of cattle that constitute the present wealth, and upon which are uilt the high hopes for the future, of so many farmers.

Though the prospect may not be dazzling, no surer avenue to an indepen-lent prosperity is open to the people of this country than the one presented hrough an increase of the growers and manufacturers of wools. Nature has placed within our grasp all the elements that go to make a people great. Millions of acres of grass annually wave a welcome to flocks and herds that come not, and, in their turn, go down before the destroying fires of autum to mingle their ashes with the accumulated fertility of the centuries befo them. Unnumbered streams unceasingly ply the water-powers that can b had if we will but take them. Inexhaustible coal beds wait for the develo ing hand of the miner, as the bride waits for the coming of the bridegroon and, when assisted by fair and judicious legislation, state and national, v learn to utilize all these gifts so lavishly bestowed; then, and not till the will this mighty, undeveloped valley of the Mississippi be what God intende it should be, not alone the garden, but the granary, the factory, and the wor shop of the world!

FRENCH BREEDS OF SHEEP, AND THEIR IMPROVEMENT BY CROSSES WITH TH SPANISH RACES.

The breeds of sheep in the north of Spain form three groups, perfect distinct, and characterized; first, by ther form; secondly, and principall by their fleeces. These three types are designated in their native count under the names of Merino, Churra and Lacha.

First, of the Merinos, or fine wools. The Merino race, in Navarre, reser bles somewhat the type which is usually found in France and other countri of Europe, under the same name. Small in size, rather pot-bellied, and alt gether presenting a sorry appearance, the only valuable feature about the is their wool. This is short, frizzled, fine and knotty. This race has of la years lost much of its relative value, even in Spain. Raised principally Estramadura, New Castile and Soria, it forms the major part of the migr tory flocks; nevertheless, this race is now less appreciated in the north tha in the west of the Peninsula. Increasing slowly, yielding only a mediu quality of mutton, they are not even profitable for their wool, which, thoug exceedingly fine, is too little in quantity to make up for the other inferi qualities. Consequently, this race is very little noticed in the fairs and oth agricultural exhibitions, the highest prizes being given to the other rac which are usually much better represented.

Second, the Churra race, or curly wools. They are much more numero in Navarre, and infinitely more esteemed than the preceding race. They a much stronger and taller, wide in the shoulders, and closely built in the hi quarters. The wool is of medium length, curly and rather coarse. They a held in high estimation for the fine quality of their mutton.

Third, the Lacha breed, or long wool. The distinguishing marks of th breed are medium height, larger in the hind quarters than preceding race, fine head, black sometimes, small horns, and frequently without any. Th race is particularly remarkable for the great length of its wool, which som times measures 30, 35, and even 40 centimetres (12, 14 and 16 inches), han ing frequently to the ground, and giving to the animal a very singular aspe very much resembling the lama.

This curious race lives upon the southern slope of the Pyrennes, to th north of Navarre, and principally in the districts of Irun and Valcarlos.

ves constantly out of doors, night as well as day, either in sunshine or ıade, remaining, without inconvenience, exposed for weeks at a time, to ›nstant rain, which slips off from their thick fleeces without hurting them . the least.

They are never fed except when the snow covers the ground, and then only little straw and dried leaves, which serves to sustain them till the snow isappears. Some shepherds, during the lambing season only, place their ɔcks under shelter.

Their mutton is reckoned a little less valuable than that of the Churra ıce, but is nevertheless of good quality. With a little extra feed they fatten ıpidly.

Their fine fleeces are very valuable, and they supply the greater part used ı the fabrication of the famous Valentian cloaks. It is remarkable that this ıce, to which its long wool gives such a characteristic aspect, although living ı the same manner as other races, is not subject to so many diseases, and es- ɜcially those which so often decimate the other Spanish races.—*Le Journal 'Agriculture Pratique.*

DISCUSSION.

Mr. Rice—I will give my experience in the sheep business. ʾhe speaker here gave a minute account of the manner in which ıe was led into the keeping of sheep. He formerly lived in the ıorthern part of the State. Commenced keeping sheep in 1856. ʾaid for the first bought $1 per head; afterward bought Vermont ·heep, at $2 50 per head. He bought of a farmer who had be- ·ome disgusted with the sheep business. This farmer paid $22 ·ach for what he sold at $2 50. The amount of wool taken, and he price received for it, was very satisfactory. He purchased a Merino buck, and the cross brought him fleeces of wool of seven ›ounds each. Besides the wool was fine. The people came to ;et it for stockings. He increased his flock to 200, and with it ıis profits increased. Finally, he sold his farm, and his sheep with it, except 62, none over three years old. The conclusion of ;he whole matter was that he would rather keep sheep than any ›ther stock. "I think," he said, "it is very foolish now, when ;he price of sheep and wool is down to a low figure, to turn atten- ;ion away from sheep. I do not believe there will ever be a time when sheep will be as low as now.

But I do not wish to occupy the time. I will say, however, that I think we can cross the fine buck with the coarse ewe, with good results.

Mr. Scott—I have some experience in raising sheep, though not with the fine-wooled variety. I breed some of the Southdowns and Cotswold, and sent to Kentucky to get them. My experience is that the Cotswold is not adapted to this cold climate, and in some seasons the wool is inferior. But my Southdowns continue to improve. I consider them the best for our small farms and cold climate. They do not yield as much wool or mutton, but it is better mutton, and commands a better price. I recently sold two car loads of these sheep in Chicago for six and three-quarter cents, when common sheep were selling at four cents. I have on several occasions sold these sheep at an advance of one and a-half cents over common sheep. I wish to say in regard to the dog question that I fear our farmers will have to abandon sheep raising on account of the dogs. Very recently the dogs got into my flock and killed from forty to fifty lambs. I consider that they injured the flock one-half.

Mr. Rice—I ask whether dogs are considered property in the State of Illinois?

Mr. A. J. Dunlap—Perhaps the gentleman will find out if he kills somebody's dog!

Mr. Rice—I have tried it.

Voice—They are taxed, or should be.

Mr. Scott—I would be willing to pay a tax of five dollars on any dog that I was willing to keep. I cannot see why any man wants to keep anything about him that is not worth enough to be taxed. It is only the worthless dogs that run about the country that give us this trouble and loss.

Mr. H. J. Dunlap—Many act upon the principle "you kick my dog, you kick me."

Mr. Robinson—I would recommend for the dogs a piece of mutton with strychnine on it. I would not hesitate to give it to them.

Mr. Scott—If I put out poison on the highway and kill the dog, I think the way the law stands I am liable for the value of the dog.

Mr. Baldwin—I think if the farmers of the State would petition the Legislature they could secure the passage of a law providing that no man shall keep a dog without a license and the payment of five dollars. This would dispose of worthless dogs, for no one would pay five dollars for a dog good for nothing. I know no better way. I think the Legislature would pass such a law. This is the law in Massachusetts.

Mr. Scott—I would ask permission here to introduce a resolution:

Resolved, That we respectfully request the Legislature to pass a dog law in this State similar to that of Massachusetts.

Mr. M. L. Dunlap—Perhaps we had better examine this question a little. To-morrow we expect to have this Legislature with us. At least we have notice of the coming of about fifty of them. Let us consider well what action it is best to take in this matter. In New York they have a dog law fund. Every man that has sheep killed comes and makes complaint, and if he can prove that the dogs, or dog, killed the sheep, he can get the full value of the animals from this fund.

The difficulty is in the proof. You cannot convict any man's dog of sheep killing. You may know that a dog killed the sheep, but you cannot know, perhaps, that any particular dog did the killing. Now if we had such a general fund from which we could reimburse the farmer, it would be encouraging to those engaged in raising sheep. Now let us ask the Legislature to pass such a law. It is the great hindrance in the way of sheep husbandry, that we have not such a law. Great flock masters, like Mr. Garland, can afford to keep a man with them. Give us this law, and in two years we will double the number of sheep in this State. I prefer to send the pork off and eat the sheep. It is more healthy. When we dispose of the dogs we can have mutton.

Mr. Garland—Let me call your attention to the dog law in the state of Ohio. It provides that each man shall return the number of his dogs and the value, and upon which valuation he pays tax. If, by accident or otherwise, his dog is killed, the man killing the dog pays the value placed thereon, and that is the end of it. We had a law in New York which placed a tax upon dogs of one dollar. We found that it did not work well, for the man who had the least of anything else had the most dogs, and when the tax gatherer came round he could get nothing, and that was the end of it. The law of Ohio we found most practicable.

Mr. Scott—I still like the Massachusetts law best. I do not think the one dollar tax is the thing, for we know, as stated by Mr. Garland, that the man who has the most dogs has the least of anything else. But this putting a mark upon the dog is a different thing. It reduces the nnmber of dogs. We want to get rid of three-fourths of the dogs in the State.

Mr. M. L. Dunlap—I think we can soon settle this question. I therefore move that Messrs. Garland, Scott and Baldwin be appointed a committee to draw up a law to be presented to our Legislature.

Dr. Warder—I keep two dogs. One I value at fifty dollars; the other is a plaything, valued at five dollars. I would not keep a dog that was not worth the taxes. But there are too many worthless dogs in the country for the good of those who keep sheep. I know the difficulty in collecting the dog tax, and know it is not successful. I will tell you what I do. I prepare strychnine and salt my sheep with it. The dogs get it. [Laughter.] I make a great many enemies by it. I could not be elected a constable in my district, because they say they will not vote for a man that will kill a poor man's dog. Still these same men will sit at my table and eat my mutton. They forget this when they come to vote.

The resolution of Mr. Dunlap passed.

Question—Can sheep be cured of the scab?

Mr. Garland—I think they can. I cured a flock of 1,000 by dipping them in a strong decoction of tobacco water. The difficulty is in dipping only once. Two applications are necessary. I have on two different occasions cured sheep of this disease in that way. There are a number of nostrums through the country, but they are worthless.

Question—Would it not be best to remove them from the flock?

Mr. Garland—Yes.

Mr. Garland, in answer to a question of Mr. Rice, said: When the wool is long it requires three or four times as much liquid. I raise a platform, and the juice runs back in the tub. I send to St. Louis and get the sweepings that are bought cheap.

Mr. Robinson—Are stems used?

Mr. Garland—Yes; but I do not think they are any cheaper than the leaves, had in the way I have suggested.

A voice—I will state that a neighbor of mine tried this remedy without success.

Mr. Garland—I think the only difficulty must have been in the thoroughness, that is in the want of thoroughness.

Question—How would you treat foot rot?

Mr. Garland—I have never been very successful with this disease. It is most difficult to cure. I had rather have scab in my flock three or four times where I would have this once.

Mr. Rice—I will give a receipt which I have tried in a small flock—butter of antimony and corrosive sublimate.

Mr. Garland—I have used butter of antimony, and the objection to it is it is too expensive in large flocks. We have also used common blue vitriol, at an expense of fifty cents for 500 sheep; but none of these things are very successful.

Mr. Miner—Suppose mutton to be the object, what variety or cross would you recommend?

Mr. Garland—If you have the Southdown you are at the top of the ladder. You do not need anything better for mutton.

The Merino sheep accumulates fat rapidly on the outside, but not on the inside; but the Southdown does not take on fat in this way. I would say all the time that the Southdown is at the head for mutton.

Mr. Scott thought, on farms well sheltered, the Cotswold most profitable for wool and mutton.

Mr. M. L. Dunlap—Our Canadian neighbors grow Cotswold, and prefer it. Now there is this difference in the mutton of the two. The Southdown makes mutton steak, the Canadian boils his and eats it cold. As to the fat, you can pick out that and use it as lard. And this is the best mode of cooking.

AGRICULTURAL BOTANY.

A LECTURE BY ASSISTANT PROFESSOR THOMAS J. BURRILL.

As we look abroad over the land we see upon every side, in infinite variety and endless forms, evidences of vegetable growth. The stately century-clad trees of the forests, the fragrant flowers of spring and summer, the nutritious grasses weaving their carpets of green, and yielding their riches in almost every quarter of the inhabitable world, the mosses and lichens that cover the bark of trees and wreathe themselves in curious forms even upon the tombstones of our cemeteries, the green scum of stagnant pools, the moulds that cover as with hoary age the damp walls of our cellars, and infuse themselves into the neglected preparations of our food, and other forms still more minute, that irreverently plant themselves in the very tissues of our own bodies, causing eruptions, ringworm, and possibly scores of diseases yet to be ascertained—these, and such as these, in the countless hosts of their number, their myriad forms, their untold value and their seldom ever appreciated importance, are the rich legacies which the vegetable kingdom, in the accumulated ages, has left and is still leaving as the munificent inheritance of man. We cannot fix the price of their value. Mathematics may extend its line to the sun and weigh with poised balance the innumerable worlds of the heavens, but its widest reach and greatest bearing forms but the alphabet of an expression for the worth to us of plant life. Let us bargain away the atmosphere we breathe, and pass to the auctioneer, to be sold without reserve to the highest bidder, the water we drink; let the solid earth itself tremble and pass away in thin air, and our lives will be quite as hopeful as when vegetation forgets its office and the plants of the forests and the fields cease to minister to our necessities. They furnish us, directly or indirectly, with all our food, our clothing, our fuel, the greater part of our building material, the white sheets upon which we write; they extract the poisons from the air and render it fit for our use, and they pump up the water from the earth and send it down the valleys in cooling streams to give drink to the thirsty. "Were I a heathen, not knowing the true God, I would not worship the sun, as did the Peruvians, nor the stars, as did the nations of the East, but would bow in adoration to the trees and herbs of the field." Why not, in the absence of the knowledge of a higher power, worship that which provides my wants and pours out its many luxuries to meet my desires—by which or through which we may almost say we live and move and have our being.

But in the beginning man was given dominion over the sea and over the land, and all things contained therein. "God said, behold, I have given you every herb bearing seed which is upon the face of all the earth, and every tree in the which is the fruit of a tree yielding seed; to you it shall be for meat." Like every other gift of the Creator, however, they are ours to improve. He always gives us elements from which we must develop their possibilities. He furnishes the materials; we, by patient study and consummate skill, must learn how to use them. He gives us organs of speech, but long and careful training alone renders the human voice vocal with song and stirring with eloquence. He bids the wild lightning exhibit its terrible speed and power in the sky, but the labors of a Franklin and a Morse were needed to make it tamely and obediently comply with the dictates of man. So the original potato was planted in the soils of Peru, a somewhat bitter, scarcely edible product, from which the world-renowned vegetable has been propagated through the agency of man. The diminutive original of the cabbage, growing wild upon the shores of old England, without a sign to hazard a prediction of its after value, has gathered up its juicy leaves under the fostering influences of culture, and now yields, far and wide over the surface of the earth, its highly prized substance. As it were but yesterday, was developed a more wonderful product from the trees of tropical America and Asia. For ages the trees from which India Rubber and Gutta Percha are obtained grew and flourished, yielded their products and perished; thus generation after generation of them passing away before they became in the least serviceable to man. In 1770 Dr. Priestly refers to the rubber as a substance which had just been brought to his notice as admirably suited for rubbing out pencil marks, and as selling at three shillings sterling—just about a dollar in our currency—for a cubical bit of half an inch, and the record of this first simple use we still have in the name—rubber from India, or India rubber. But it was not till 1839, only thirty years ago, that Mr. Goodyear, of New York, gave it to the world in its present protean form. To-day, to what myriads of uses it is put! Varnishes, paints, tubes, hose and pipes, shoes and clothing, railroad carriage springs, flexible joints, dishes, toys, combs, furniture, beds, tents, traveling bags, covering for submarine telegraph wires, etc., an array of uses such as never fell to the lot of any vegetable product, woody fiber alone excepted. It was a Goodyear in more than one sense that gave to us a new substance of such rare value. The world can well afford to remember the name found stamped upon all these goods, and the time well known as the good-year in invention.

But let us look further. The hundreds of the varieties of wheat, both winter and spring, have, through man's agency, all sprung from one species. See the differences. There is the white chaff and red chaff, the bearded and bald, the early and late, the strong wiry stems and the soft and flexible, the large grain and the small, the dense compact head and the long loose one, the varieties liable to rust and others subject to the attack of insects—yet all were created alike. It is said that all the varieties of the rose came from fourteen species, every one of which had single flowers and very little fragrance. Behold again the dominion of man in the petals of the rose. The apple, of which there are estimated 1,000 varieties cultivated in the United States, are all from one plant—the apparently worthless European crab. The 200 varieties of peaches likewise originated from one species in Persia, their differences wholly due to causes exterior to themselves.

All these illustrations, taken at random from the innumerable number that present themselves upon every hand, are a kind of bird's eye view of the undisputed dominion of man over the forms of the vegetable world. They clearly show us that long culture and well directed care completely and radically changes, so far as their value is concerned, the elementary vegetable forms which the Creator in the beginning planted upon the earth.

The particular methods of producing desirable changes must be in the main passed by in this paper, having been so fully and ably discussed in other parts of this lecture course. Some of them are brought about by simply making the conditions under which growth takes place, more favorable, and is only a change in degree, not in kind; while others consist in interrupting the natural functions and producing vegetable monstrosities. The primary end and aim of all plants is the production of seed by which its species may be perpetuated. It is for this the vine, by spiral coils, lifts itself above the damp earth into the life-giving sunlight; it is for this the oak strikes its roots deep into the earth, and spreads out its ponderous branches bearing their immense load of leaves. Now if the seed is the valuable product, as it is in wheat, corn and beans, we must strive to increase the natural development of the plant, to furnish it an abundance of proper food, to assist it in every way in its natural career. But to develop extraordinarily any other part of the plant, we must resort to checks, to local stimulations, crosses, modified influences in the circulation of sap and assimilation of food.

Nearly all of our orchard and garden fruits belong to this class, hence the necessity of pruning, grafting, hybridizing, etiolating, and the like, all processes well known to our practical fruit growers and gardeners. It is the juicy pulp of the apple, the melon, and the gooseberry, that we value so highly, but this is never produced to a great extent by the plant in its natural state, and it is here that man has achieved some of his greatest triumphs over the vital forms which it has been given him to control. He has given the tints and fragrance to the rose, the nectarine juices to the fruits, the starchy fatness to the roots and subterranean stems, has made the barren fruitful, and the waste tissues to lean with the fullness and richness of their products.

It must not be supposed, however, that man's dominion over nature is not limited, and that because he is made a ruler he is therefore an absolute monarch over his passive vegetable subjects, for in his authority he is, and must eternally be, governed by a constitution and by-laws written out by the finger of the common author of both. Some plants utterly refuse to give up to the will of man any of their time-honored characteristics. The wheat seems perfectly willing, when properly appealed to, to dispense with the awns or beards which tassel its head; but the rye, equally ancient in origin, persistently holds to them. The potato gives up its bitter, somewhat poisonous, properties, and humbly but richly ministers to our needs. The cabbage forgets its ancient worthlessness, but the dog-fennel persists in being simply and senselessly, it seems, dog-fennel still. Indeed, this is the case with most of our noxious weeds.

The technical name given to this disposition to change, under culture, is *sporting*, and plants that may be thus modified are said to sport; but there seems to be no sport about the thorn and thistle, which sprang up under the curse of the Almighty.

But even with those most obedient to man there is a limit beyond which they never go. Some eternal proclamation had been issued to them long before man had an existence, saying, " thus far shalt thou go, and no further," and the command, written in the secrets of their internal structure, has come down with them through the ages, and must go with them to the end of time. The rose, though bearing its thorn, never becomes a thistle, the apple never gives up its individuality and assumes that of the peach or the pear, and, though hundreds of voices and pages of testimony to the contrary notwithstanding, wheat never becomes chess, or cheat, as it is sometimes called. Not that experiment has alone proved this fact, but that the fundamental law of its existence forbids it.

Different varieties, species, and even genera, may be grown together in such a manner that the new plant, called a hybrid, shall partake of the characteristics of both. Many flowers, hot-house and garden plants, are thus originated, and seemingly new species established, but all such plants are unstable in nature, and exhibit a constant tendency to revert back to the primary forms. But the principle has its uses. From flowers of different colors is produced one having both tints, becoming what we call variegated. In the same way fruits and the other vegetable products are modified. A knowledge of the fact will also teach us to avoid such results as are not desirable.

Plants of the same nature must be grown so far apart that the pollen grains, that fine dust from the center of the flower, from the one shall not reach the other. All must have observed how corn of different varieties, planted side by side, mixes upon the ear. The powdery dust from the tassel of one variety falls upon or is carried by the winds to the silk of the other. This latter consists of hollow tubes, each one of which connects a rudimentary kernel with the outer world. The pollen grain falling upon this outward end bursts its spherical covering, and stretching out its inner integument to accommodate itself to its task, descends the long silken channel, and by its union with the embryo grain prepares the way for the fully developed kernel, having the color, size, etc., of one or the other of the varieties. But without this union nothing is formed but the worthless watery sac, which we sometimes find upon the cob. In some plants, when useful products are thus obtained, the varieties are perpetuated by cuttings and grafts, but the seed, if any are produced, which is not always the case, soon give plants possessing the characteristics of one or the other original kinds.

Another element in plant growth, already spoken of in this course of lectures, which, contrary to the prevailing opinion, undoubtedly baffles the power of man. It seems to be a common belief that plants coming from warmer regions may, by continued growth, become adapted to our more vigorous climate. Instances are cited of plants which were grown only in hot-houses at first, and afterward found to succeed in the open air, but it should be remembered that, though coming from a warmer latitude, they may not require more heat, and that had they been tried first, would have succeeded just as well. Plants growing under a tropical sun may still be alpine in character from the altitude they occupy. A plant from Southern Africa was introduced into England some years ago and found to succeed only under cover of the hot-house, but a specimen was accidentally thrown into a garden pond and continued to thrive very vigorously. The result did not, as was thought, prove that the plant had become acclimated, but simply that its roots had penetrated deep into the water, which was fed by springs. From the testimony of many close observers, it appears that each kind of plant bears a certain range of temperature, the limits of which cannot be extended by man. Varieties certainly may be secured better suited to the climate, but always at the hazard of losing the valuable properties of the original, for which alone we care for its permanence.

But with all the changes man has wrought in the vegetable world, he has still an infinite task before him in the same direction. The number of plants which now directly furnish us with food or clothing are but a few hundred, while the total number of known species of plants, to say nothing of varieties, amount in all to more than 120,000. Who believes we have found out all their useful properties, or have realized all of their highest possible development? What has been done, and especially in the last few years, forbids such a belief. Something like a century and a half ago, a man by the name of Herd found a peculiar kind of grass growing in the swampy lands of New Hampshire. He procured the seed and began cultivating it for hay, for which, we were told last week, the grass stands eminently foremost in the order of plants first in value to man. Out in the valleys of the Rocky Mountains grows wild a kindred species of the same grass, softer in texture, not tending so strongly to the formation of woody fiber, and apparently better adapted by its thick growth of base leaves for pasturage. Who knows but our valuable timothy or Herd's grass is to be surpassed by this rival brother? Growing along with it is a species of flax, having apparently all the valuable properties of our field product, and of nearly double the size. Who, again, shall predict what shall be the future of this plant, and of the tens of thousands yet to be brought into use? Who shall teach us to more successfully manage those we already have, in improving their fruits, in avoiding or curing their diseases, in discovering new economical and medical uses? This is the final application of the knowledge received in the study of botany. This is the goal to be reached toward which the science is continually pointing. Like the diamond, it is treasuring up the light gathered from the pointed spires of leaves and shining through irradiated cell structures, and is pouring it in burning lustre upon the pathway of our investigations.

Professor Chadbourne says, to accomplish all we wish and all we expect in bringing the vegetable world to render its riches more abundantly, we must undoubtedly call to our aid the kindred science of chemistry. But here is the great storehouse of materials. * * * * All animals, man included, are so constituted that they cannot subsist upon inorganic elements. We may analyse our food, determine its exact composition, but it will not enable us to feed on minerals. We may prove with all the science of a Liebeg that charcoal and air and water contain all we need, but we know they would form poor fare for our tables. We may call in the aid of chemistry, with all its power, to produce transformations—give it a magazine of the pure elements, and it cannot furnish us with a single grain of starch nor crystal of sugar, nor anything to be a substitute for them. The plants are the only chemists that can take up these inorganic materials and in the wonderful laboratory of their living tissues mould them into forms to support animal life. * * * * We can hardly over estimate the importance to our country if all our young men who travel were so vested in science that they should be able at once to detect the valuable properties of plants and their habits, that all capable of introduction might be secured at once. A single plant might repay for all the time and labor of every American student in this department. But if men are never trained they do not observe, and if a strange plant is forced upon their attention they know so little that they can determine nothing of the prospect of improving its qualities by cultivation, if ever of cultivating at all. If all those who labor among plants, and have opportunities of introducing new, were well versed in botany as it is now understood, this source of wealth would be vastly increased in a single year. The progress would be rapid, the quality would be improved and the number would be increased. Useful plants would take the place of those useless or noxious. Our forests would be better preserved, and new forests would be springing up. Millions of acres, barren and dreary, might be gradually supplying our waste trees if men would learn that forests can be planted, and were imbued with that spirit of improvement, and care for coming generations, which science has ever had a tendency to produce.

It may be said, with truth, that much of the work already done has been done by those ignorant of science. These results have been the slow accumulation of the ages; we wish now more rapid progress; the times demand it. The same is true of every department of human industry and source of wealth. Discoveries in olden time were accidental. The alchemists in the dark ages, with their alembics and crucibles and chemicals of mystic names, worked by chance, and by chance, from time to time, made some valuable discoveries. But how different is the work of a modern chemist. A thing is to be done, and he is able as once to bring to bear upon the problem all the principles of that wonderful science. Every experiment is performed for a definite purpose, and accidental discovery is the exception, not the rule. So in mechanics, a result is to be reached, and the problem is attempted by well established principles. Those wonderful looms that ply their iron fingers to weave our carpets, were not a chance discovery by Bigelow, they were an invention, reached only by long continued systematic study. So of the discoveries and the improvements in the vegetable kingdom in our day. They must not be left to chance, but be sought under the guidance of science, where alone the course is direct, the progress sure and rapid.

We have attempted thus far to indicate the importance to us all, and especially to the agriculturist and horticulturist, of the study for which we are contending. Let the attention now be turned to some of the special lessons which it teaches. Like every other science, its first great work is to classify and give names. History shows that this has been the chief work in the past; and, it may be added, in no department has there been greater problems to solve, or greater triumphs achieved. What wonder that, with 120,000 species, in their multiplied forms, the task has been long in its accomplishment and herculean in its requirements. From the days of Solomon to the present time, earnest men have been contributing their industry, their investigations and their talents, to this one end. System after system has been advanced, zealously advocated, thoroughly tested, and abandoned, to be superseded by another, destined to share a similar fate. Thus the work went on, groping in the darkness, but struggling for the light. At last, about the year 1682, a luminous *Ray*—a man by that name—came to the aid of the investigators, and the foundation of our present classification was laid. Let us not imagine, however, that this preliminary work was done in vain. To form any valuable classification, a very extensive knowledge of the kinds, structure and habits of plants was absolutely essential. This knowledge, obtained by the rivalries of original and diverse plans, became the building materials from which the goodly structure has now been reared. But man has found that it is not his business to invent schemes of classification, the work having been done in the beginning of time. He is but to read in reverence the handwriting of the Almighty. The seals of the book of nature have been broken, and the broad glittering page, with its exquisite touches of beauty and wonderful revelations, spreads out everywhere to those who will read the story of the creation. It is true that we do not yet always interpret correctly, neither can we expect to till our knowledge of the vegetable world is complete and perfect; but enough is already known to make our progress in this direction sure, and to give us a clear insight into the mysterious works of their infinite author.

The differences which we observe in plants have been caused in one or two ways. Either all forms were created alike, and have by insensible shadings, due to kinds of food and other external influence, gradually changed in character, so that in one instance we have an oak, and in another a pine; or they were created different, and have, by constant reproduction of themselves, remained true, except in slight variations, to their original types. Common observation always points to the latter, but is it not strange that scientific men are divided upon the question, and are to-day waging war upon each other in hot debate and severe criticism. But let the matter be settled as it may, the lasting value of our classification depends upon the idea that species are permanent vital forms, absolutely unchanging in time beyond a certain limit, and recognized everywhere as belonging to the same family of individuals.

A species may be defined as the entire collection of plants of one kind that have descended from the same parent stock. They will therefore agree in all essential particulars. The properties of one are the properties of the whole. And so we find it in nature. A single plant is found to be poisonous, and immediately we conclude that every other plant of the same essential character is also poison. If one is found to have strong fibrous bark, its kind may be examined everywhere, though continents intervene, and find the same peculiarity. Species, then, are the true subjects of classifications, but the work does not end with them. While they are separated from each other by clear and definite distinctions, several of them are found to exhibit striking resemblances to each other, as if originally modeled upon the same plan. Thus we arrive at the idea of a genus, which is a collection of allied species. Again, upon still broader natural characteristics, genera are grouped into orders, these in turn into classes, the classes into sub-kingdoms, or the primary divisions of the kingdom of plants.

The work of making out a classification has, however, in the main been accomplished. We can hope for but little more in this direction. It now remains for us, as students of nature, to use it to assign upon examination the various plants about us to their proper places in the system. To do this will require an intimate knowledge of the structure, forms and habits of every specimen we examine. We are not only led but compelled to observe closely. We must watch the tiny seedling just bursting from the earth, and follow it carefully in its processes of flowering and fruiting; we must dissect its parts, and, with microscopic vision, note its structure; we must, by the taste, or chemical tests, find out its properties, and seek to pry into the mysteries of its life.

The system of classification, therefore, not only hangs out, as it were, a label upon each plant, as a true guide to the knowledge of its whole species, but stimulates thorough investigation into the structure and life of plants. This brings us to the province of Physiological Botany, in which the great work of our day is to be done. Here are mighty problems yet to be solved, respecting the conditions of growth, the direct food of plants, the influence of sunlight and heat, the means of securing more bountiful harvests, the modes of increasing new varieties, the finding out of new uses for those we have, and the general influence of vegetation upon the economy of nature. But so much has already been said upon these topics, and to be said under special heads hereafter, that they are in this paper omitted, save one statement from Dr. Sewall, in regard to the influence of vegetation upon climate. He says:

"Tell us how much water the leaves pump up. Let me say here, I do not mean the water that evaporates from the leaf, as it would from a wet shaving, but how much it actually pumps up. It has been demonstrated that every square inch of leaf lifts three five-hundredths of an ounce every twenty-four hours. Now a large forest tree has about five acres of foliage, or 6,272,640 square inches! This being multiplied by three five-hundredths, (the amount pumped up by every inch,) gives as a result 2,352 ounces, or 1,176 quarts, or 294 gallons, or 8 barrels; a medium sized forest tree about 5 barrels; the trees on an acre 800 barrels in twenty-four hours. An acre of grass or clover, or grain, would yield about the same result."

I have made a calculation of the amount of water lifted from the great Amazon valley. * * * * Here is the result of my arithmetic—974,328,-972,628 barrels, 23 gallons, 3 quarts, 1 pint and a fraction. I suppose a professor of mathematics would have told us the exact fraction, but this is near enough, perhaps.

The great treeless plains are rainless, except when a foreign shower visits them. On the plateau of Bolivia it never rains except when the great Amazon valley sends up its surplus waters over the eastern Andes. The vast desert plains of the West afford another illustration of this fact. Regions cleared of forests are always drier, the streams smaller, the rains less frequent. Not only does the leaf pump up water, but all the inorganic matter. The mineral matter of the earth, dissolved by and in the water, is lifted into the tree, and the water is lifted into the tree, and the water evaporating leaves the mineral or ash in the wood. Now the ash in the oak tree amounts to three per cent. of the entire weight. A large tree weighs seven or eight tons, an ordinary, medium sized forest tree weighs five tons; in such a tree the leaf has lifted three hundred pounds of solid earth. Surely the leaf has an elevating influence; it brings earth nearer heaven!

A new field of labor is also opening before the student of botany, that of the vegetable diseases. Perhaps nothing pertaining to plants is so little understood; but the importance of the study and the increased facilities of late years for microscopic observations, will undoubtedly call more attention to the subject. Cold, damp soils, sudden changes in temperature, excessive heat and drought, the attacks of insects and parasitic plants, are among the fruitful sources of disease. So far as observation has gone, it is pretty generally believed that the parasitic fungi are not in the first instance a predisposing cause of disease or decay; but it is known that they materially influence both, after causing great loss and alarming destruction. The spores or germinating particles of these plants are so minute that they readily float invisible to the eye in the air, and being very tenacious of life, await with perfect composure a favorable opportunity to germinate and grow, which they do with astonishing rapidity. Doubtless all have observed, upon wet days, a jelly-like formation on old leaves, decaying wood, and other substances. In some cases this forms so fast that it is popularly believed to have fallen from the clouds. A gentleman in Australia was, when descending a hill, overtaken by a sudden shower, and upon his return found the hill-side so slippery, by this fungus or algoid growth, as to render his descent in safety quite hazardous. We are often astonished at the rapidity with which fields of wheat are attacked by rust, the value of the crop being sometimes totally destroyed. This is caused by a fungus called *Uredo Rubigo.* It forms yellow and brown oval spots and blotches upon the stem-leaf and chaff. The spores burst through the epidermis and are dispersed as very minute grains. Henslow has shown by experiment that if the diseased seeds of wheat be steeped in a solution of sulphate of copper, they will not produce diseased grain, and that the sulphate of copper does no injury to their germination. The solution used is one ounce of the sulphate of copper .to a gallon of water, for every bushel of wheat. It is believed that the spores are contained in the seed from the disease of the previous year, and that should the plant meet with nothing to prevent its vigorous growth they would never be developed, but are ready at any time to seize upon their victims if a favorable opportunity presents itself.

As a rule, fungi are never found upon perfectly healthy surfaces. Mildew is a disease caused by a fungus denominated *Puccinia graminis.* The ripe spore-cases of this plant are small dark brown club-shaped bodies, their thicker ends being divided into two chambers, each filled with minute spores, and their lower ends tapering into fine stalks. The clusters of spore-cases sometimes burst through the epidermis, or skin of the plant, in vast numbers. The minute spores seem to enter the plant by the stomata, or air openings in the leaf. In the vine a kind of mildew is traced by Berkely to the attack of a fungus called *Oidium Tuckeri.* For this disease sulphur and the pentasulphide of calcium have been recommended as remedies. Smut spurred rye, the potato disease, the rotting of fruits, and the decay of wood, are all, with many other vegetable diseases, believed to be the result of fungus plants. Ring-worm in our bodies, according to Dr. Fox, is produced by the spore of the fungus which causes the disease getting into the hair follicle, reaching the root and being carried up into the body of the hair. Intermittent and miasmatic fevers are now believed to be due to the same forms of vitalized beings.

But there is still another element in this study of botany, of direct bearing upon our agricultural and other rural pursuits. We are all ready to admit the importance of these avocations. We hear them lauded in sounding terms in public addresses. Their praises are upon the lips of many at our agricultural fairs, and in theory we all agree with the wise man, known to all, who said "Agriculture is the noblest pursuit of man." But, much as we believe in all this, and much as we desire to cherish such a feeling among men, knowing that the nation's wealth depends upon it, what do we really find in practical life to-day right here in the shadow of our University. Go yonder in the towns and country round about, and inquire of the young men what they propose to make the business of their lives, and listen to their replies. Hear them talk of law, and medicine, of trades, of civil engineering, or getting an education with a vague idea of being able to do something afterward, while a few out of the many choose the farmer's life. With parents it is not quite so one-sided, but after all, how many among those who labor themselves are there that would not rather have their son become an eminent lawyer, or a wealthy merchant? Now this should not and need not be.

It is not because these occupations are not healthful, for the testimony of all time is to the contrary. It is not because they are not honorable, for among all the pursuits of man they are the most legitimate. It is not because they do not pay, for, with proper culture, nothing offers greater inducements in this respect than our rich prairies. It is not because the labor is greater, for men are every day leaving them for more laborious and harrassing pursuits. It is and must be because the brain is not called into action as well as the muscles of the arm. Let a man have the opportunity of engaging in a pursuit which obliges him to think, and he will not dig potatoes for you with a hoe for the same price. The engineer will clear the way and mark the route, with excessive toil, for a railroad, but will scorn the offer of more money, if such should be the case, for shoveling sand, though his hands are equally soiled and his cheek equally bronzed. The pickax becomes a very different instrument in the hand of a geologist from what it is in the hand of the common stone quarrier. We do not say that farming and orcharding do not require thought, far from it, for they do require and are receiving the closest thought of many of our ablest minds, and in our day more than ever before; but the curse of the employments is that the large mass of those now engaged in them, who are thus searching after other means of making a living, are never trained to think. Things grow up around them in obedience to some unknown law, over which, they imagine, if it even occurs to them at all, they have no control. They do not and cannot see the need, nor the opportunity, of exercising so much brain power, and, to them, mysterious learning. But let the light of that learning shine in upon them, that they may see there is a reason, within their comprehension, for almost every change that takes place about them, from the growing and pointing of a leaf to the prolonged drouths of summer—not a mere matter of guess work, founded upon speculation, but resting upon the broad foundation of undeniable truth; and we shall find these pursuits in practice where, as they ought to be, we now know them in theory, and as they are represented in our high-toned, public-spirited addresses.

Now the teachings and problems of Botany, in its broadest sense, embracing every possible scientific inquiry about plants, whether of the forests, the grasses, the fruits, or the microscopic forms which infest the earth, the air and the water, will furnish him who lives among and by the products of the vegetable world an exhaustless source of pleasurable and profitable investigation, of close inquiry and of deeply-penetrating, far-reaching, wide-comprehending power of thought.

May the time speedily come when this University—not by teaching one science alone, but all the departments of learning pertaining to the industrial pursuits of man—shall infuse into the very life blood of these callings this inspiring, manhood-developing power. Then shall the best interests of agriculture, horticulture and the mechanic arts be most enhanced, but not theso only, for man himself will rise as man and be crowned with power and dominion above them all.

DOCTOR WARDER'S LECTURE ON PROPAGATION BY CUTTINGS.

In a cutting the buds are the important parts. The cutting has a number of buds, and is about twelve or fifteen inches long. We cut some distance from the upper bud, while the cut below is close up to the bud. The wood above sometimes dies back to the bud. In this instance (showing a cutting) we have five buds. The reason we cut near the lower bud is this. The bud is the point of vitality, and the nearer we can approach that the better for the development of the cells. Cut with a sharp knife or shears. Mr. Henderson, who has written that capital book "Gardening for Profit," finds that it makes no difference where you cut, and you may cut in the internode with success, especially in green cuttings. The callus will take place and the roots strike at the end of the cutting.

Many of these green cuttings may be grown out of doors, if put in a shady place, on the north side of a fence. The green wood cutting, used out of doors, requires to be a little further advanced than when used in the green house. In the green house we control the bottom heat. Hot water pipes are used for this purpose. The boiling process keeps up the circulation.

In striking cuttings it is important to keep the sand in which the cutting is placed at a more elevated temperature than the air. This encourages the formation of roots. If the top buds shoot before the formation of roots the cutting will die. You cannot put them out of doors until the soil is warm. It must always be recollected that at the base of these buds there are undeveloped buds, and that the preference is given to what are called "Hammer cuttings." We used to get one dollar per thousand more for those thus selected. It is not necessary to cut them twelve or fifteen inches; often we cut six inches, and we even cut to one eye with success. The single eye is found sufficient. In cutting to a single eye we use artificial heat, as a general thing. The radicals are not confined to the base of the cutting, but will be thrown out at every bud below the surface of the ground. [The lecturer illustrated on the board the different methods of propagating cuttings.] Now these remarks refer to the propagation of grapes more particularly. Some plants are difficult of propagation, and some not so difficult are easier reached by planting the seed.

The apple tree will grow cuttings, but it is not usual to grow the apple from cuttings, because we can get the tree easier by planting the seed and grafting. The current is easily propagated from cuttings. The gooseberry is propagated in the same way. It is only when we want a new variety that we plant the seed.

The French method of growing cuttings is to bring both ends in contact with the earth. But there is no advantage in this.

PLANTING THE CUTTING.

For this the ground must be put in fine condition. Plow and trench-plow, and thoroughly pulverize. Now suppose your cutting ten inches long—perhaps the usual length. Cut a trench, and place it so that the top of the cutting will just come to the top of the soil, in a standing position. Now introduce fine soil, and tramp down at the base of the cutting. Set two, three, or four inches apart, and give clean culture, or, as is the practice of some, mulch. [The Doctor explained the method adopted by a Mr. Griffith, and upon which he has a patent.] He waits until the ground is warm, and then puts in his cuttings, and mulches with sawdust or other material. The object was to warm up the soil below, keeping the surface cool, in order to give the plant a chance to strike its roots before the bursting of the bud below. Mr. Griffith, in this way, is very successful in growing plants from single eyes, getting, sometimes, two plants from one eye. When asked how many plants he expected from a setting of ten thousand, he said, "eleven thousand!" so great was his success. It should be always remembered that it is not the precise degree of heat or temperature that is needed for the successful development of the cutting, but the comparative degree of temperature between the roots and the top buds.

ANATOMY, PHYSIOLOGY AND ECONOMY OF PLANTS.

BY JOHN H. TICE, RECORDING SECRETARY OF THE MISSOURI STATE BOARD OF AGRICULTURE.

The subject selected is vast in proportions and comprehensive in extent. So vast and comprehensive, indeed, as almost to preclude the possibility of giving, in a single lecture, an intelligible statement of even one of its three subdivisions, much less of its whole. You must not, therefore, feel disappointed if many of the points that will loom up in the discussion are not presented in all their minute details. Time and the occasion necessarily restrict us to the discussion only of general principles.

Plants, in the order of creation, preceded animals; and, in the order of habitation and settlement of the earth's surface, always precede or accompany them. The limits of inhabitation, for either man or animals, are, therefore, inexorably fixed by the limits of vegetable growth. Why are the deserts of Central Asia, and the Great Sahara of Africa, uninhabited by animals? Because no vegetation is there to sustain animal life. And, if ever they will be inhabited, or inhabitable, it will be when man, in the progression of the arts and sciences, will acquire the knowledge and skill to make vegetation grow and flourish there. Plants are the connecting link between the animal and the mineral world. Animals cannot live on inorganic matter. Exposed where only surrounded by minerals, they must perish, because they have no power to assimilate them, and therefore no ability of being nourished by them. But plants, fixed by their roots to the earth, decompose, by galvanic action, mineral substances found there, and absorb what is their proper food, which, under the influence of light and air, is converted into different vegetable compounds, serving for the food of animals. Then come animals, and feed upon the organized matter that plants have elaborated from the soil and air.

But, if animal life depended solely for subsistence on the vegetation spontaneously produced, the earth would not nourish and sustain one-millionth part of the animals it is capable of sustaining. Hence human skill and science are necessary to take control of vegetable life, and to so direct it as to contribute to the utmost extent to the multiplication and sustenance of animal life.

Man has availed himself largely of the forces of nature, and after subjecting them under his control, has directed them mechanically to subserve the purposes of life. In the great future he will avail himself to a still greater extent of them, and by them will effect purposes not now even dreamed of. But how has he availed himself of cosmical forces to carry on his mechanical operations? By studying their nature, and ascertaining the laws that operate through and by them.

What was true in the employment of wind, water, steam, electricity, magnetism, or any other force used by man as a motive power, is true, and must be complied with, to avail himself of any other forces laid up in the great magazine of nature for his use whenever he has demands for them. And since the primary dependence of all animal life, either for multiplication, extension or sustention, is on an abundant supply of vegetable productions, the study of the anatomy, physiology and economy of plants, is one of primary importance. For man cannot control and direct to the attainment of the highest results, vegetable life, unless he knows the laws by which, and the conditions under which, it operates. I shall, therefore, treat as briefly as is compatible with intelligibility, the subject, under the following three heads:

Firstly. Vegetable anatomy, by which I mean the analysis of the body of plants, so as to determine their organs and general structure.

Secondly. Vegetable physiology, or a description of the functions of the different parts or organs of a plant, and the offices they perform in its individual economy.

Thirdly. Vegetable economy, or the regular operations of nature in the generation, nutrition and preservation of plants.

I. VEGETABLE ANATOMY.

Every plant, or animal, originates from a single primary cell. Anatomically, a cell means a little sack or bladder, filled with fluid. As organic cells are so extremely minute as generally to be invisible to the natural eye, that you may comprehend what is meant by the term cell, I will state that the compartments of a honey-comb are called cells. Similar are the cells in organic tissue, only they are closed on all sides. If a minute particle of wood is shaved off and placed under a powerful microscope, it is found to be honeycombed with cells. They are so small that in a cubic inch of wood there are often one and a half millions of cells. Whatever the form or size of an animal or tree, it is all evolved by gemmation from a single cell. Each cell, though not differing externally in size or form from thousands of others, yet is so governed in its budding by a *sui generis* law, that it always evolves and reproduces the form and symmetry of its parental type. Men have sought grandeur, the beautiful, wonderful and sublime, in scenes where nature operated on a grand scale, producing an Andes or a Niagara; yet what are the Andes but an amorphous pile of matter, passively upheaved by a subterranean force? And what is Niagara but a passive mass of liquid matter obeying the cosmical force of gravity, and tumbling over a precipice? How does either compare, in the wonderful, with a little cell, filled with a vital fluid, which buds in regular order into other cells, in such places, and in such numbers, as in time to evolve, in all its beauty and loveliness, the original parental type?

The substance constituting the cell walls is called *Cellulose.* It is composed of the same elements, and in the same proportions, as starch. Starch, indeed, seems to be the primary substance out of which all the cellulose group are formed. Starch, Cellulose, Inulin, Dextrine, Bassorine, vegetable mucilage, and Metarabic acid, are isomeric bodies; that is, they are identical in composition, though different in properties. Their composition is expressed by the chemical formula, C 12, H 20, O 10. In starch we have carbon, hydrogen and oxygen, the three most important elements, as far as quantity is concerned, out of which plants are constructed.

All the ternary compounds, such as gum, jelly, cane and grape sugar, oil, resin, wax, tannin, etc., are compounds of various proportions of these three elements. The fourth element is nitrogen. It forms quaternary compounds, in which the four elements are combined in various proportions. Later analyses have shown that most of these bodies are not purely quaternary, but quinary compounds. The fifth element is sulphur. Albumen, which is transmuted starch, seems to be the basis of these quinary compounds, as starch is immediately of the cellulose group. The white of an egg is the familiar form of albumen. From it spring the albuminoids, such as fibrin, casein, gluten, gliadin, mucedin, etc. The albuminoids are sometimes called protein compounds; the term protein, in Greek, signifies to take the first place, or the highest rank, and was adopted to show their physiological importance in the structure of bodies. It must, however, be borne in mind that all these bodies are merely advanced stages towards growth and nutrition of starch, transformed by the action of plant life.

But protein, when found in the cells, has received the name of protoplasm, meaning first formed. It lines the inner walls of the cell, but does not fill it, and apparently is the active agent of transforming the other contents of the cell into organizable matter.

Protoplasm, or the formative substance, is a granular, gummy, azotised fluid, found gathered around the nucleus, or cytoblast, of the cell and its walls. It does not mingle with the other fluid contents of the cell, but possesses a visible stream-like motion, flowing upwards and downwards through them within the cell. The fluids proper of the cell apparently remain passive, while the protoplasm, in transposing the elements present in the cell, is constantly undergoing changes. If the motion were not life itself, or rather the evidences of life, we might conclude that it originated and depended upon the reciprocal action of the chemical elements of the fluid. It unquestionably is vital action, and may be sustained by the chemical, or perhaps galvanic, action, reciprocally of the nucleus (that is cytoblast) and the cellular integument, since the spiral current is always from the cytoblast to the cell wall, and returning from the latter to the former; the nucleus, in other words, is the centre of the motion.

THE CYTOBLAST.

The nucleus, or cytoblast, is a round, but sometimes also oblong, and generally flat, small body, with a sharp edged circumference, occupying the center of the cell. Mostly it is as transparent as water, filled with a very minutely granulated substance. In time, within the cytoblast may appear one or more nucleoli, or minute cytoblasts. New cytoblasts, for future cells, are formed either independently or by division. When formed independently, it seems to proceed from the protoplasm manifesting itself as a nucleolus, around which an integument soon forms. When the multiplication is by division, the original round cytoblast elongates, and soon a segmentation takes place, and instead of one two nucleoli appear. In the division of the mother cytoblast, the protoplasm plays an important part.

FORMATION OF CELLULOSE.

We now know what an organized cell is, and how it multiplies the nuclei for the formation of new cells. We have already seen that the integument of a cell is cellulose; and cellulose, by chemical analysis, is found to be identical in composition with starch. In the point of appearance, the albuminoids and all the protein compounds, stand between it and starch. It therefore has passed through all the intervening metamorphoses.

Cellulose is now generally supposed to arise from the outer hardening of the protoplasm. Its subsequent thickening is formed by alternate layers of hardening protoplasm; and its alteration is supposed to be due to the chemical, perhaps galvanic, action of the protoplasm and elements present in the cell.

The formation of new cells always proceeds from the interior of an already existing one. The cell in which a new one is formed is called the mother cell, and the new ones, in relation to each other, are called sisters, but in relation to the mother cell are called daughters. When but a portion of the contents of a mother cell is consumed in producing new ones, it is called free cell formation; but, on the other hand, when the whole contents of the mother cell divides into many parts, and a cell springs from each subdivision, it is called cell production by division. In both cases the cytoblast is formed first, and a new cell then incloses it. By free cell formation the mother cell endures as a permanent part of the structure; but when cell formation proceeds from division the mother cell vanishes, its integument sooner or later dissolves, and is consumed in forming cell membranes for the daughters. This latter species of cell formation is universal as to grains of pollen and the sporangia of the cryptogamia.

GROWTH AND NOURISHMENT OF CELL MEMBRANES.

The original form of a young cell is subject to many transformations by the mode of its nourishment; for, naturally, with the growth of the contents the cell membrane grows also. When the cell extends itself equally in all directions, it acquires size without changing its original form. On the contrary, when it extends itself more in one direction than others, or if certain points on its periphery extend themselves predominantly, with its increasing size, it also changes its primitive form; and the diversified forms in which cells exist accord with the manner in which the cell membranes extended themselves. The growth of a cell is, however, often restricted in its freedom by neighboring cells. Its form then more or less subordinates itself to the existing cells. This is the case in all those tissues where the cells are compactly placed. The thickening of the walls, and the finally closing up of the cells is effected by the continual deposition of cellulose layers upon the inside of the membrane. The inmost layer, is therefore, always the youngest.

COMBINATION OF CELLS.

In only a comparatively few cases does a plant exist of a single cell—only in some fungi and algæ. On the contrary, in the higher plants the structure is a combination of several varieties of cells.

Cells can be classified into like and unlike. When like cells are united, we call the combination cellular tissue. But when unlike cells are united, we call the combination vascular tissue. Cellular tissue can be subdivided into wood tissue, bark tissue, bast, pith, foliage, etc.

The compound known under the general name parenchyma, is understood to apply only to the cellular tissue, as developed in the bark, pith, leaves, etc. By the vascular tissue is meant the combination of cells that are much, and sometimes indefinitely, elongated, and should properly be called ducts, such as convey the lactex or milky juice in the milkworts, the resins in coniferæ, etc. They are of varied structure, annular, spiral, cylindrical, etc. The cellular and vascular tissues are each united together by an intercellular substance, which is a transmuted product of the mother cell, and is the same as that which, on the surface of plants, is called cuticle or epidermis.

INTERCELLULAR SPACES.

Where the cells lie side by side, without being in contact at all points, there is a free space which is called an intercellular space. The more globular the cells, the smaller will be the superficial points of contact, and the larger the intercellular spaces, and also the more will the form of one cell be subordinated to another; and the more the walls mutually flatten each other, and the closer they lie side by side, the larger become the superficial points of contact and the smaller the intercellular spaces. The tissue formed of stellar shaped cells, therefore, has the greater intercellular spaces. These spaces generally are filled with air, and form in this wise a regular tissue of a more or less coherent system of intercellular passages, which discharge in larger air-filled spaces under the stomata or small orifices, also called breathing pores, in the leaves, or on the green bark of the stem.

In all tissue, while the cell-forming process continues, air is not found in the intercellular spaces; and in wood tissue the spaces are generally filled with the intercellular substance. But in those plants containing gum, resin, lactex, etc., the intercellular spaces are large and serve as ducts for these substances.

KINDS OF CELLS.

Cells can be divided into several distinct classes, according to their origin, the time of their appearance in the structure, as well as to their physical and physiological nature. The first general division is into free, and the second into combined cells.

To free cells belong the spores of the cryptogamia, and the pollen cells of the phænogamia.

To the combined or linked cells belong those named as constituting the different kinds of tissue already described. All cells that constitute an integral part of any structure, either of entire plants, as fungi, lichens, algæ, or parts of structure, as wood, cambium, bark, bast, etc., are combined cells. In the building of vegetable structure, the leagued, combined or linked cells play the most conspicuous part. Of these, the most widely distributed are the cells of the parenchyma.

PARENCHYMA.

The term parenchyma is applied to the substance constituting the cells of the pith, leaves, bark, medullary rays, etc. Parenchyma, like cellulose, is a mere transmuted production of starch. The cone or apex of any bud, whether of the seed, root, stem or axis, is always composed of it. Upon its presence depends the vitality of the bud, and consequently the life of the plant. Growth of a plant, in whatever direction, upward, downward or laterally, is an extension of parenchyma. The vitality of the parenchyma, or its power of extension, depends upon the presence of vibrionic particles in the extending cell. Viewed under a microscope, these vibrios have the appearance of bees swarming, moving rapidly in all directions on the apex of the fluid contents of the cell.

Both in the longitudinal extension of either the extending or descending axis, the structure is parenchyma, known under the familiar name of pith. The lateral extension, originating in, and radiating from, the pith, is known as the medullary rays. The extension of the parenchyma thus produces the skeleton of the plant, on which all the other tissues form and build up its body. On the ascending axis nodes are formed, at which leaves develop, and generally a bud. The cells of the pith prepare the parenchyma for the development of the leaves, like those of the general structure do the cellulose for the cellular tissue. On the roots there is an analogous development, but no nodes or buds for new roots, and none to correspond with the leaves on the stem, unless it be the rootlets. These sometimes have been called spongioles, but the term is now discarded by physiological botanists.

The cells of the medullary rays, and those of the epidermis and bark, belong to the parenchymatous group. The medullary rays are seen in the radiating lines from the pith, through a cross section of wood, especially of oak. The rays are formed of compressed and often closed cells, that keep up communication between the interior of the stem and the bark, from the pith outward.

The cambium occupies the intermediate space between the wood proper and the bark. It is the last year's deposit of woody fiber, filled with starch, and endures only until the next annual layer is forming. The primary cells of the cambium layer spring from the secretions of the medullary rays, which seem to act chemically on the elaborated elements in the descending sap, transforming and fixing them as cambium. The cambium and the inner bark are main storehouses of starch and the azotized compounds, etc.

There is a distinction made between the cambium proper, which is a compact cellular and vascular tissue, and the cambium ring (*annulus cambialis*), which is a more open structure. The cambium ring is formed early in the season, as soon as vegetation commences. When the parenchyma in the cone of the stem, or of the radicle, begins to extend itself by growth in spring, the medullary rays similarly extend themselves laterally, pushing out, as it were, the bark, and forming new cells of mucilaginous matter on the outer surface of last year's cambium. It is on account of the delicacy of this structure that the bark so easily separates from the wood in spring and early summer.

The bark structure is not necessary to be analysed at present. I will, however, mention that portion of the outer bark which has a green envelop. The green matter that gives it this color is chlorophyl, and is the same that gives color to the leaves. The meaning of chlorophyl is leaf-green. In the leaf, however, it is not the leaf proper that has this color, but is the coating of minute starch granules, fixed to the interior of the cells, or floating in their sap, that gives the leaf apparently this color. The cuticle or epidermis has breathing pores (stomata), both on the stem and on the under side of the leaves, which bring the interior structure of the plant into communication with the atmosphere.

LEAVES.

The complete leaf consists of the blade and its petiole or leaf-stalk. The leaf might almost be said to be a thin layer of green bark, expanded horizontally. Like the stem, it consists of two distinct tissues, the cellular and the woody. The cellular is the soft pulpy portion, the parenchyma, and only appearing green because of the immense number of starch granules in it, covered with chlorophyl. The woody portion are the ribs or veins of the leaf, which, like the woody portion of the stem, give firmness to the structure. The subdivision of these veins is carried beyond the limits of unassisted vision, so as to distribute to and receive sap from the minutest organs of the leaf.

The cells of the epidermis, both on the upper and lower side of the leaf, are placed horizontally and are very minute, sometimes small parallelograms, and consist but of a single layer. The cells under the upper epidermis are compactly arranged, and have their vertical diameter from three to five times greater than the horizontal. This layer consists of from two to four tiers of cells. Under and between these and the lower epidermis is a network of amorphous cells, arranged horizontally with large intercellular spaces.

I have now enumerated some, not all, but the most prominent, of the vegetable cells and organs, have described generally their development, and partly have indicated their function. The anatomy of the organic structure is now sufficient for our purpose. The organized plant is before us. It consists of two parts, the root and the stem. One forms nodes, out of which side branches may spring, and buds for continuing organic growth. The other forms no nodes, but new roots and rootlets spring from a peculiar development of the outer terminal cells of the medullary rays. The buds on the stem consist, however, of two kinds, the leaf or wood bud, and the flower fruit bud. From this I pass to the second division of the subject.

II. PHYSIOLOGY OF PLANTS.

The embryo of the future plant is nestled in the seed. The mother plant has stored in the seed lobes sufficient aliment, ready prepared, to sustain the plantlet in early life until it has acquired organs and vigor enough to take care of itself. Starch is the principal ingredient of the seed. But the embryo cannot digest starch until it is organized. "Strong meat for men, but milk for babes," holds good also in the vegetable world. The mother plant has therefore digested a part of the starch in degree, and a part completely, which latter is placed around the embryo, so that when the plantlet wakes up the food is within its reach. This is an introgeneous milk-like substance, called aleurone. Next to the aleurone stands the alluminoids; and between the latter and starch stands the albumin. They are all starch in different stages or degrees of digestion. If the seed has one seed-leaf only, it is said to belong to the monocotyledonous order of plants; if it has two lobes, to the diocotyledonous order. The function of the seed leaf is to act as digester of the starch until the store is exhausted and the plant organized. The embryo has two buds, and buds, we have already seen, consist of parenchymatous cells. The incipient development of these buds has received the name of germination. Warmth and moisture are necessary to germination. As a general thing, fresh seeds germinate sooner and more freely than old.

The seeds of many plants, if kept long, will soon pass the limits of germination. Coffee, for instance. Some seeds, like those of the maple, germinate as soon as favorable conditions supervene; others, on the contrary, lie some time in the earth, and generally do not germinate until the succeeding year. They seem to require time to become fully matured.

Germination is the commencement of cell formation at the apex of each bud of the embryo. One bud proceeds by pushing the ascending axis, the plumule, upward, to put it in communication with the light and air; the other, by thrusting the descending axis, the radicle, downward, to put it in communication with the water and alkaline salts of the earth. The plumule soon expands its leaves in the air, draws in life and vigor from the vivifying rays of the sun, rejoicing in its new being. It is now ready to be weaned, and be self-supporting. What are its means to effect this end? It has exhausted its store of food laid up in the seed lobes; it must, therefore, draw it from other sources, or perish. Whence and how does it supply itself? These questions will be answered when we treat of vegetable economy. All we can do now is to give the functions of its different organs, and the offices each performs in its individual economy.

ROOTS.

The roots, we have seen, put the plant in communication with the earth. They may be divided into two classes—first, the primary or tap root, which springs from the germinal cell of the embryo; and second, the secondary or side roots, springing from the sides of the tap root. As there are no nodes in the root, consequently it does not develop, like the stem, its branches from buds at the nodes. Branch roots, side roots, and rootlets, can spring from the sides of any main root at any point whatever. Nodes in the roots would be an impediment to the economy of the plant, for then only branches and rootlets could spring from buds at the nodes. The plant requires an organ at all points where the soil comes in contact with the roots, to gather food, which could not be the case if rootlets had to spring from nodes. This peculiar development of rootlets, therefore, enables the plant to put forth any number of them desirable, which it often does so as to cover the main root until it has a hairy appearance. The presence of parenchymatous cells is necessary for the development of branches, either on the stem or root. On the stem, the branches are formed only at nodes, where there is a ready organized bud; but the node itself is only a compact lateral development of parenchyma from the pith outward. The medullary rays, we have seen, are also a lateral development of parenchyma, permeating at all points and binding together the various tissues between the internodes of the stem. In the roots, these rays also bind the various tissues together, and form a connecting link between the bark and the pith. Instead of a root branching out from a regularly formed bud, as at a node on the stem, it springs from gemmation of the cell of a medullary ray. Something similar occurs on the stem when side limbs, known as water sprouts, develop.

The medullary rays of roots, besides multiplying roots and rootlets by gemmation, may develop new stems; as is the case in the root sprouting of the locust, cherry, plum, and some roses.

Roots, as a general thing, shun the light, and burying themselves in the earth, they seek there such food as the plant requires from the soil. The main roots fix the plant firmly to the earth, and their extensive ramifications lay a considerable area of the surface tributary to the nourishment of the plant. The younger portions only of the roots perform the functions of nutrition, and mainly by the innumerable fibrous rootlets they send out. These rootlets, seldom if ever branched, perish after performing their functions, but are constantly renewed.

CELLS.

The functions of the cells have already been partially indicated while describing their structure. First, cells may be regarded as digesters of the sap, transforming it into cellulose and parenchyma, for building up the skeleton of the organism, and for thickening and filling up the older cells, to give stability and firmness to the structure. Secondly, they are general digesters of the reserve elements in the plant, and of the crude elements taken up by the roots. Though cells are closed sacs, filled with fluid contents, yet there is a constant interchange of elements between them. In a state of rest, the contents of the cells may be, and probably are, homogeneous; but when vital action ensues, the transformation of the protoplasm into living organism, at such points where organic structure takes place, destroys the homogenity. This disturbs the equilibrium, and hence an interchange of elements ensues, to replace those consumed in building new structure.

DUCTS.

The structure known as vascular tissue should properly be called ducts. It consists of indefinitely elongated cells, of which the function is to conduct the fluid and gaseous elements taken up by the roots to every active cell in any portion of the organism. Hence they are of unequal length. Between them and the cell there is a similar interchange of elements as between the cells themselves. They also furnish the water with whatever it holds in solution to the cells, and from the latter receive the digested sap. Crude elements and digested sap seem each to have their appropriate ducts in the vascular tissue.

SPACES.

Intercellular spaces, though devoid of air, while cell formation in their proximity is progressing, when the structure is completed form air passages throughout the organism. In the milkworts these passages are filled with the lactex.

MEDULLARY RAYS.

The medullary rays branch off horizontally from the medullary sheath surrounding the pith. They keep up a communication laterally between the pith and the bark, and perhaps also with the atmosphere. The annular or cambium ring is formed in spring by their action on the cellulose. In the latter part of the growing season, their action transforms the descending sap into starch, storing it up as formed in the cambium and alburnum.

BAST TISSUE.

The bast tissue is composed of the longest cells found in any tissue. Textile fibers, such as hemp and flax, belong to this tissue. The membranes are tougher, softer and more flexible than the cells of the woody tissue. Their toughness is proportioned to the length of the cells, but when short they are brittle. Where long, as in flax and hemp, they have great tenacity. They are the main channels of the descending sap, and elaborate from it various alkaloids, most likely with the concurrent action of the medullary rays.

LEAVES.

Leaves have been termed the lungs of the plant. If intended as a comparison of the functions performed, it is unfortunate, because it would lead to the inference that there was an analogy between the offices performed by the lungs of animals and the leaves of plants, while indeed there is very little. Lungs bring the blood, and leaves bring the sap, within the vitalizing influence of the atmosphere, and prepare them to build up vegetable and animal tissue. So far only the analogy holds good. But when we examine what takes place in the act of vitalization of each, we find it as opposite as the poles. In the lungs, the act of vitalization consists in the oxygenation of the blood; and the vital action in the animal organism ensuing therefrom decarbonizes organic matter to build up animal tissue. In the leaves, vitalization consists of deoxydating inorganic matter in the sap, and the vital action ensuing in the vegetable organism carbonizes the inorganic compounds before building up organic vegetable tissue. Moreover, the lungs of an animal draw not a particle of the nutriment from the air, while the leaves draw the greater portion of the nutriment for the plant from it. In the lungs, the mixture of veinous blood and chyle come in contact with the atmosphere, decomposing it, consuming the oxygen obtained, and exhaling the nitrogen and carbonic acid gas. In the leaves the digested sap decomposes the atmosphere, and the carbonic acid gas it holds in diffusion, consuming both the nitrogen and carbon obtained, and exhaling the oxygen. The leaf also decomposes water, to obtain hydrogen, which enters largely into the compound elaborated sap. The dynamical effect, in the correlating and conservation of force is also entirely different. The oxygenation and decarbonization effected by animals is the same as combustion; it liberates heat, while the deoxydation and carbonization effected by vegetation, imprisons heat. The analogy between the lungs and leaves, therefore, is very remote, and may be of use to assist us to understand the relative functions of each; but we must always bear in mind that it is by antithesis and not by harmony that the relation exists.

The inspissation of the sap also takes place in the leaves; first by exhalation of water, and secondly by its decomposition and the absorption of the obtained hydrogen. The elaborated sap, when it quits the leaves, is, therefore, changed in its fluidity as well as chemical composition, suited to deposit in its downward course cambium, starch, gluten, alkaloids, etc.

III. VEGETABLE ECONOMY.

We have already seen that at the end of every stem, and at every node on it, there is a bud formed. These buds, in the economy of the plant, are either intended to perpetuate its life, or its species. The former are leaf, the latter flower buds. Flower buds only appear when the plant has attained or is approaching maturity. Diminution of nourishment, or impaired vital action, is supposed to be favorable to the development of flower buds. In trees and shrubs the flower buds appear on spurs, or beside the leaf bud. In herbs perishing annually, they supercede the leaf bud, or rather the latter is converted into a flower bud. The flower bud, therefore, is merely a leaf bud changed in form and function; and the leaves of the flower are but ordinary leaves changed in form and color. And as insects perform an important work in vegetable economy, in distributing pollen, the leaves of the corolla are colored for the purpose of guiding and attracting them.

STAMENS.

The stamens are only flower leaves that have still deviated farther from the normal leaf. In fact, they have deviated so far as to have lost the character of phænogamous leaves, and have acquired that of cryptogamous, by bearing sporangia. Stamens produce pollen, and if a pollen grain were self-proliferous it would differ in nothing from the spore of a cryptogamia.

PISTIL.

The pistil is a peculiar columnar prolongation of the parenchyma in the center of the flower. The pistil and stamens are called the organs of fructification.

The pistil has three subdivisions; the ovary, containing the ovules or rudimentary seeds; the style or columnar prolongation, and the stigma, which caps the style. A stamen has also three subdivisions; the filament, a thread-like stalk; the anther, capping the filament, and the pollen, a powdery substance, contained in the anther.

POLLEN.

Under the microscope, pollen grains have the appearance of spores; very often covered with protuberances not unlike the burr of the common Datura. Dissection shows the pollen grain to have two membranes; the outer, called *extine*, has an inflexible integument, and the inner, called *intine*, has a highly elastic integument. The intine is filled with fluid vegetable albumin, in which float innumerable particles of vibrionic matter called the fovillæ, which have an incessant molecular motion, like swarming bees.

The stigma has a moist network of cells, not covered by any epidermis, which receives the pollen. The cells of the stigma are tubes leading down through the style into the ovary. The moisture of the stigma swells the pollen grain, bursting the inflexible extine and letting the intine escape. The latter then elongates down through the tubular cell of the style, and when it reaches the freer space of the ovary, swells out like a bladder, until it touches points where the ovules are attached to the embryonic sac. When the pollen cell touches this point a minute cell makes its appearance on the ovule, into which the fovillæ pass, and it has become a living cell.

GENERATION.

Vegetal generation is effected by the meeting of two cells of different origin; the pollen cell, containing the favillæ, and the embryonic sac, each filled with potentially vital matter. They coalesce, mingle their contents, and a new cell springs up, of actual vitality, out of which the individual plant is afterward developed. Endowed with vital force, and constituted an individuality, the embryonic cell commences its development. From its free end it elongates downward; minute granular matter appears in its interior, which before was perfectly clear and transparent. Soon transverse partitions appear, and the original cell is converted into a chain of cells, each having a distinct nucleus, the cytoblast. This first cell formation is by division of the original cell. After this chain of cells, as seen under the microscope, has obtained some length, the lower cell becomes globular, swells, its contents become turbid, and by gemmation develops a globular mass of cells. In the interior of this globular mass are first differentiated the plumule and radicle, as well as the parenchyma and cellulose.

After fertilization has taken place, the embryonic sac enlarges, and by secretion becomes filled with starch, gluten, oil, and the albuminoids. It is then called the seed.

After the maturity of the seed the vital force lays dormant until it is aroused by the intervention of heat and moisture, when it begins actual development into an organized, self-sustaining individuality of its parental type.

To enable it to develop, and to attain an organized structure, a supply of food was laid up for it by the mother plant, upon which it draws until the store is exhausted. These stores are generally starch, or compounds of identical composition and proportions, though there are some exceptions.

Plants of woody stems, such as trees and shrubs, come to rest after the exhaustion of the starch contained in the seed leaves and cotyledons, and make no further longitudinal growth that season. As far as I have observed, the peach is the only exception to this rule. It also comes to a rest and remains so, unless excited by cultivation and an abundant supply of air and nutriment. Under the latter favorable circumstances it will resume its longitudinal extension, and continue it until the close of the season.

In annuals and perennials whose herbaceous stems die annually, (unless the cotyledon leaves are converted into ærial leaves) the exhaustion of starch is also followed by a spell of languor or of more or less inactivity, when growth recommences with increased vigor.

ABSORPTION.

Every plant draws the elements of its nutrition either from the soil or fron the air. Cells, we have seen, are closed on all sides, and the ends of the roots are covered with thin membranes, in which microscopes of the highest power have failed to detect any openings. How does the nutriment from the soil enter through this poreless membrane, and how is it transmitted and diffused through the cells after it enters? But first, what does enter, and what is its condition when it does so? The substances entering are lime, potash, silica, soda, magnesia, water, ammonia, carbonic, nitric and sulphuric acid, etc. The condition of the alkalies is, they are dissolved in water, and so is ammonia Water, therefore, is the medium by which they are introduced within the organism. The acids are in the gaseous state. It is therefore evident that the plant cannot avail itself of any elements for nutrition, unless dissolved in water, or in a gaseous condition.

The transmission of matter dissolved in a liquid, or in a gaseous state through closed membranes, is properly absorption. But on account of the movements started within the organism after their entrance for distribution and redistribution, it has been called by the scientific name of diosmose which means impulsion through, from two Greek words, *dia*, through, and *mosos*, impulsion. Diosmose means impulsion through lengthwise; but there also are two impulsions sidewise. To that sidewise inwardly, the name endosmose has been given; and to that from the inward outwardly, exosmose All these terms are borrowed from chemical and physical science, and when employed to designate chemical or physical phenomena are appropriate, but when used to designate physiological facts of life, in the absorption, distribution and nutrition of plants or animals, are of doubtful propriety. In physics, they mean only the reciprocal action and reaction of dissimilar dead matter, in juxtaposition. But if the vital force is nothing more than chemical action and reaction, then life itself is but another name for mechanical action.

Of life itself we know nothing, and can learn nothing, except what we can discover in its manifestations. In the manifestations of the vital force we can detect the presence of the cosmical forces, heat, light, electricity, magnetism, and chemical affinity, as the modes of motion. It is well known that the cosmical forces are convertible, one into the other, and that through the whole cycle of changes one is always the equivalent of the other. Motion however, stands to them in the relation of genus, they being the species of motion. True, light, heat, electricity, magnetism and chemical affinity can all be converted into motion, and we know, also, that life is motion, but who has ever heard of converting heat, light, electricity, and so on, into life Cosmical motion, and vital motion, then, are not convertible terms. Though every one is conscious that life is motion, yet he recognizes it also as something more. While, therefore, it is allowable to use mechanical terms to illustrate and explain the facts and phenomena of life, yet we must be careful not to be led ourselves, nor lead others, into materialism.

As already stated, in the manifestations of life we detect the presence of the cosmical forces. For instance, there can be no life without a definite amount of heat. By the law of its being, each living organism is so constituted that it can only exist within the limits of certain degrees of temperature. Within these limits there is a point of the highest vigor of vital action. If the temperature varies, either by increasing or decreasing from this point, vital action suffers, and will be destroyed if the variation proceeds to extremes in either direction. Like gravity, heat is an inexhaustible property of matter. Always radiating from all points of space, it is yet incapable of exhausting its sources. The ulterior law controlling its radiation is not known. But when any body receives heat, either by radiation or conduction, it develops in it positive, and when it loses heat by radiation, negative, thermo-electricity.

In fact, heat seems to be the active agent for developing electricity, magnetism and chemical affinity. Chemical affinity only acts upon matter in juxtaposition, but electricity and magnetism, if a proper medium is furnished, can travel and act at indefinite distances.

But heat travels everywhere, with or without a medium. Life, like the other forces, requires heat for its development, but it would be an unpardonable blunder therefore to assert its identity with them. The cosmical forces operating on inorganic elements produce merely inorganic compounds, but when acting under the controlling influences of the vital force from inorganic elements they form organic compounds and build up organic structure. It is therefore evident that, within a living organism, they are the servants of the vital force. While from necessity we are unable to explain the phenomena of plant nutrition without the operation of the cosmical forces, we mnst always keep in mind that their action is subordinated to a controlling force, the vital force over them, and not a mere mechanical action as in inorganic matter.

How far, then, can these forces be made available to explain nutrition and the various phenomena of plant life? Heat, the omnipresent force inherent in matter, must, in degree and intensity, accumulate in and around the embryo to start it into life and accompany it throughout all its future developments. When heat fails, growth ceases. Heat, we have seen, also develops and brings into action the other cosmical forces. One of these is electricity, a species of which is galvanism. What evidence have we that either electric or galvanic action is taking place in vegetation? The leaves give out oxygen in the ozonic condition, the same as the electrodes of a galvanic battery. Whence comes this oxygen? The hydrocarbonates, of which the elaborated sap is composed, show that both water and carbonic acid have been decomposed to supply the hydrogen and carbon. There is no way of explaining these facts without admitting the presence of electric or galvanic action. Wherever there is electric action there are two opposite poles to the current. One of these poles is evidently in the leaves, for no chemical decomposition takes place in a galvanic current, except at the poles of the battery. Where, then, is the other pole? Unquestionably at the other extreme of the organism, at the points of the roots. Is there any evidence of galvanic action around and about the roots? We know that the alkalies are not free in the earth, but form many compounds; many of which are insoluble in water, but are easily resolved under the action of a battery. The plant, manages, somehow, at all seasons, to get a full supply of these, when we know there is not water enough in the soil to act as a solvent. Admit galvanic action, and the whole mystery is explained.

Again, the medullary rays elaborate starch from the descending sap, and fix it in the cambium and alburnum. Galvanic action again explains this. So also the formation of the alkaloid crystals, as developed in the bast cells by the joint action of the bark and medullary rays. The motion of the protoplasm within the cell being alternately mutually repelled and attracted by the cytoblast, and the evolution of cellulose from the clear fluid of the cell are all explainable upon the hypothesis of galvanic action. And so of many other phenomena in plant life.

It must also be borne in mind that, by the free interchange and transmission of the different elements of the cells, the alkalies and acidulous juices of the plant are constantly commingling; which alone, without any extraneous aid, would start a galvanic current.

The fact that the alkalies are not free in the soil, but bound up in various compounds, has already been stated. But supposing they were free, they are so distributed through the soil that it would be impossible to have rootlets enough to go out in search of them to collect them. Then, again, when collected, unless they were in juxtaposition with dissimilar elements with which they had affinity, they would be inert. But they are not inert. Here then is the difficulty. Since the roots are not numerous enough to search them out and collect them, then they must go to the roots. If the mountain will not go to Mahomet, then Mahomet must go to the mountain. How can this chemical inertia be broken up, so that each particle will move to the roots? If there is any known law by which this can be effected, then the whole difficulty vanishes.

Suppose we take a vessel filled with a diluted acid, holding some metal, gold for instance, in solution. We put in the vessel some metalic substance and operate upon it by a galvanic battery. The gold held in solution by the acid will move to and be precipitated upon the metal, in other words, gild it. Suppose again, instead of putting the metal to be gilded directly into the acid, we put it into a bladder or series of bladders, filled with water or any liquid dissimilar to the acid. We again subject it to a galvanic current, and it is gilded the same as before. The galvanic current then has not only broken up the inertia of the gold held in suspension, but it has given it mechanical transportation, not only through the acid but through the animal integuments and the water. Hence we find that if we admit galvanic action in the roots we solve at once two difficulties. It will not only give transportation of the alkalies to the roots, but also through the membranes of the roots.

The question has been discussed, what gives the impulsion that makes the sap flow upward, as we find to be the case when in early spring a maple tree is wounded, and more especially in the bleeding of the grapevine? It is not necessary here to present the explanations given to account for this fact, but merely to state that none are satisfactory.

There are many phenomena manifested in plant life to which science has not yet furnished adequate explanation. If any two of these phenomena can be satisfactorily explained by one and the same agency, the presumption is in favor of the explanation afforded by said agency. There is one phenomenon, that of a plant possessing, when the thermometer ranges low, a higher temperature than the surrounding atmosphere, or soil even, which has not been explained. Can any supposed agency be imagined that will effect both the upward flow of the sap and the excess of temperature?

Nitrogen is a chemical neutral, or rather negative. It enters directly into combination with no other element, but indirectly it forms the most powerful of all combinations. When other elements combine to form compounds, they, unless the compound occupies greater space than the constituent elements did, liberate heat. But when nitrogen enters into combinations it reverses this rule, it imprisons an enormous amount of heat, as is attested in gunpowder. The universal characteristic of nitrogenous compounds is their instability and easiness of dissolution by the least disturbing agent, often exploding with great violence—of which gunpower, guncotton, nitro-glycerine and dynamite are examples. Nitrogen, in the form of ammonia, is absorbed by the roots. Within the tissue starch is converted into the various forms of the albuminoid compounds, of which nitrogen is a component part. These again are transformed into the organic compounds cellulose and parenchyma, of which nitrogen is not a component part. In the breaking up of these nitrogenous compounds, may not the nitrogen, by explosion, or at least by expansion when it returns to the gaseous form, give this upward impulsion, while at the same time it liberates the heat it fixed in combining?

For every season the plant has its appropriate work. In the spring, when it wakes up after its long winter nap, it repeats the identical operation its embryo did when it woke up in the seed: it nourishes itself by assimilating the starch into cellulose and parenchyma, sending its roots downward and its branches upward, and adorning them with leaves and flowers. It then neither grows laterally, unless the cells of the cambium ring be called lateral growth, nor does it elaborate and store up starch for the next year. Its work then is, by the ascending sap, to assimilate the stores of starch deposited the previous year into cellulose and parenchyma. But the ascending sap builds no structure excepting the pith, the medullary sheath that surrounds it, the medullary rays, the cuticle and leaves. In old plants it also fills up the old cells with cellulose, converting the alburnum into duramen, that is, heart wood. On the contrary, the descending sap commences its work when the stores of starch are exhausted. It builds the cambium layer and new bast tissue, and from it, as already stated, the medullary rays elaborate starch and other isomeric compounds, storing them up in the cambium and sap wood, the richest stores of which, however, are in the roots. Crystals of the alkaloids, possessing the medicinal properties of the plant, and sometimes highly poisonous, are elaborated likewise by the liber in the bast cells.

The movement and function of the descending sap is so evident as to leave no room for doubt. If a branch of a tree is girdled in spring by removing the bark for an inch or so, that portion above the girdle will receive an abnormally large development of the cambium layer, a large store of starch and albuminoids, while below the girdle no cambium is deposited, and no starch elaborated and stored away. Moreover, the downward flow of the sap will push the cambium downward over the ring, and, if the latter is not too wide will re-establish communication below it.

The building of cellular and vascular tissue by the ascending sap ceases about the summer solstice. The starch is then exhausted, and longitudinal growth comes to rest for the season. The plant is then organized, and it commences the work of enlargement laterally, and laying in provision for perpetuating its life. To this work, and to the ripening of its fruit and seed, it devotes the remainder of the season.

These are important facts in the economy of plants, which furnish many useful suggestions to the cultivator. When the starch is exhausted timber should be cut, for then it will afford but little food for borers. Starch, while it exists in the wood, is constantly being converted into albumen, which is a nitrogeneous compound, and unstable, like all such compounds. Albumen in wood, like the albumen in fresh meat, is the cause of rapid decay and decomposition. Timber cut when the starch, and consequently also the albumen, is exhausted, will have greater durability than when cut in winter, when full of starch. Again, starch is the provision stored up to develop new stems, roots and leaves the next season.

There is that foul troublesome weed, the horse nettle (*Solanum carolinensis*) which sends its perennial root down too deep for eradication. Exhaust it by continual hoeing down, so that it will have no supply of starch to start growth with the next year, and it will never appear again. In July is the best time for sprouting, because then no reserve of starch has been deposited to develop organisms in the future. You may smother the grass in your pastures the same way, by letting your stock crop it too closely when it is about replenishing its roots for the work of next year. Above all, you may ruin your timothy meadow by mowing before the leaves and stems have performed their functions in replenishing the roots, so that no new shoots will start either the same or the following year. That insensate summer pruning of the grapevine, which goes slashing in the vineyard in July and August, and which has very aptly been styled "summer slaughtering," is in violation of the laws of vegetable economy, and consequently followed with such direful results. I have seen a fine vineyard of Norton's Virginia completely exterminated by it in a single season. A knowledge of the laws of vegetable economy would have been worth thousands to its proprietor. A knowledge of the laws of vegetable economy may also be made available to increase the health, vigor and productiveness of plants, as well as their destruction. As we said at the beginning, the highest results of vegetable productiveness is not attained in a state of nature, either in quantity or in quality, but is brought about by the intelligent control of man. Man cannot control the laws of nature, and any attempt to do so must end in failure and destruction

All he can do is to bring his operations to harmonize with, and to aid these laws. Sometimes his object may be destructive, as in the case of sprouts and weeds; but it is oftener to assist nature in attaining the highest results. In either case, to act intelligently, he must know what these laws are, and the mode of their operation.

As almost everybody is now planting grapevines, I will take the vine as an illustration.

The object of pruning it is to attain the highest degree of health and vigor, and at the same time the finest and largest quantity of fruit. How will the laws of vegetable economy aid him in his operations?

The vernal growth of all plants, we have seen, is effected by a mere assimilation of the starch stored up the previous year. The plant consumes, or rather transmutes, this, by extending its roots and branches, clothing the latter with bloom and foliage. When this is accomplished, its operations are all directed to provide for the future. Starch, we have seen, is laid up in the alburnum and roots, but more in the latter than in the former. Suppose that the vine demands one hundred square feet of leaf surface immersed in the air, to perform its vital functions healthfully. We give it no pruning; it expands a leaf surface to one hundred feet or more. The leaves are smaller and more crowded than if they had been intelligently distributed. Some of them are insufficiently aerated, and they sicken and die, in consequence of which the general constitutional vigor of the vine is affected. There are more bunches of fruit that can mature; they also suffer. When the fruit is matured the berries are small and the fruit is inferior. The vine also grows more and feebler canes than it can maintain in full vigor next year. This is the result that nature accomplishes unaided by the guiding, controlling hand of man. How can better results be attained both in healthfulness and fruitfulness? The intelligent vine dresser inspects the size and constitutional vigor of the vine. He estimates its capabilities for bearing fruit, and its wants for vigorous health, and prunes off whatever is redundant for either. The starch being in excess in the roots, what is cut off in pruning would not suffice for forming the new extension of leaf and branches on the excised canes. The pruned vine, finding itself curtailed in its dimensions, starts vigorously the buds on the remaining canes, putting out a branch and a bunch or more of bloom at each end. The vine dresser watches its operations, and, looking to the future, will not let the vine expend its energies in producing that which is superfluous, and which will have to be pruned off next year. For fruiting canes next year he wants a definite number, according to the vigor of the vine. If the vine starts more than he wants, he rubs off the surplus. On the fruiting canes of the present year he only wants healthy and adequate foliage enough to develop and perfect the fruit, and none to make surplus wood. Therefore, when a leaf or two has been developed beyond the last fruit bunch, he pinches off the extending cane. Thereby he husbands the resources of the vine. For, instead of exhausting itself in longitudinal extension and leaf building, it expends its vigor in developing the fruit and remaining leaves, both of which become abnormally large. The leaf becomes, perhaps, twice as large as it would have been had longitudinal growth not been checked.

From the axils of the leaves laterals may start, which, after developing a leaf or two, are again pinched off. The result is large, healthy leaves, and not a crowded mass, exhausting and smothering each other, are developed in the immediate vicinity of the fruit, bringing it to the highest degree of perfection, while the cane on which it grows, and which is to be pruned off the next season, makes but little growth.

But how is it with the canes for fruiting next year? They are left to take their own course, unchecked by pruning, and develop an abundant supply of healthy, vigorous wood for the next year.

For the want of time, this illustration of the application of the principles of vegetable economy must suffice. There is, however, a mooted question about the best time to cut timothy for hay, which deserves a passing notice. There seem to be many notions about this, and each one has his own; but no one has ever tried to settle it upon a scientific basis. This is a question that can be settled by experiments conducted upon laws of vegetable economy. If timothy can only yield the highest results to man at the expense of its own life, then it ought not to be exacted of it. If it yields the best results to man when time is given to provide, not only for the perpetuation of its own life, but also for that of its species, then it ought to be known, to govern the operations of man. But at present neither is known.

To determine this, let equal areas of land be cut at different periods; one when in bloom, another intermediate, between the bloom and the full maturity of the seed, and one when the seed is fully ripe. Let the quantity obtained from each be weighed, both in the green and dry state, and let equal weights of hay of each be analyzed to ascertain the relative amount of nutriment in each. This will settle the question as to immediate profit. But let also the effects of cutting at each period be noted on the health and vigor of the roots. These experiments and observations will elicit facts that will fix, beyond controversy, the particular time for cutting hay.

The example of the culture of the vine, employed to illustrate the application of the principles of vegetable economy, has furnished the fact that culture, by directing and controlling the nourishment, effects a deviation in the fruit, making it larger, finer, and more delicious than in the normal wild state. Culture, for an indefinite number of generations, not only fixes this deviation, but begets still greater. Deviation correlates to the care bestowed to effect healthy and more vigorous growth, by directing the energies into proper channels, and supplying more abundant nutrition. All our cultivated fruits were in this manner, by a long series of years and careful selection, developed from unpromising, acrid, wild specimens. The wild pear, an extremely acerb fruit, is yet found in Europe and Asia. How long a term of cultivation it required to make it palatable is not known. But if Columella is to be believed, in his day the Roman Emperors, at their feasts, boiled it in wine to make it palatable.

Change in the external normal condition and nourishment has converted single rayed into double flowers, by converting the stamens, and sometimes the disk flowers, into petals. The Dahlia and double Zinnia are recent examples of this law of vegetable economy. The tendency in all deviations is uniformly to increase by further propagation.

But deviations are not always improvements. The departure from the normal type may take an opposite direction, and may become a deterioration, and this deterioration may increase. The further propagation is carried on under the abnormal condition of cultivation. In Europe this is the case when some variation of nut trees are cultivated. Cultivation, sooner or later, induces not only deterioration but degeneration, which increases with the continuance of cultivation, while the wild trees never degenerate.

DISEASES.

Diseases of vegetation originate from disturbances or irregularities in the normal vital functions of the organs. They may be, like their causes, local or general; and may make their appearance in different ways, according to the nature of the disease or the plant it affects.

The primitive causes of all diseases are perhaps always found to be external. The changed circumstances, unfavorable to healthy growth, brought about by cultivation, is a fruitful source of plant disease. These and local causes may enfeeble the plant so that parasitic plants make their appearance on the vital tissue, as mildew and blight. Insects may select the succulent shoots and leaves for depositing their eggs, which develop galls and knots. But the most general diseases are sequences of violent meteorological changes, such as sudden, frequent and extreme changes of temperature, excessive moisture, or drouth, etc. Local causes of disease are less detrimental than those that are general. With the cessation of local causes, and the removal of the affected part, health returns. Sometimes these causes are within the control of man, but not always. The potato disease is caused by sudden and severe chilling and flooding while growing. The fungus that rots it is not the cause of the disease, but the consequences of it. It is the common *oidium lactis*, that merely seizes upon the dead matter of cells that have died, and decomposes it. The sweet exudation on the surface of leaves, known as honey dew, is supposed to be occasioned by the engorgement of the leaf cells during unfavorable conditions of the atmosphere for evaporation.

Many plants suffer if they have not sufficient light; others love the shade, and perish if exposed to the full glare of the sun. Some flourish even during long continued drouth, but soon perish in excessive moisture, and vice versa. One plant needs a high, another a low temperature. Some perish if the sap freezes, and others can withstand uninjured a temperature many degrees below zero. Though there is a great variation in the temperature that plants can bear, yet there is none that can endure the boiling point. One plant is indifferent to sudden and great variations of temperature, another perishes even in a little variation.

The cultivator of plants, it will be thus seen, must possess not only an intimate knowledge of the structure, function and economy of plants, but of their constitutional vigor, habits and power of endurance.

TIMBER GROWING.

A LECTURE BY O. B. GALUSHA.

The influence of forest trees upon the atmosphere, in purifying it by absorbing noxious gases, in equalizing its degrees of humidity, in softening the asperities of its temperature, in checking the force of its violent gales, so often destructive to growing crops and injurious to domestic animals, and thus securing a carpet of snow in winter to protect the roots of plants from the damaging effects of severe frost, are truths upon which nearly all men of science and observation are agreed; and certainly they are facts of so great importance that they should command the immediate attention of all dwellers upon the great western prairies. It does not come within the province of an essay upon "timber growing" to explain the principles in meteorology, electricity, chemistry and vegetable physiology, which operate to produce these important results. These subjects have been ably treated in other papers; yet we may and should consider the effects of these causes, inasmuch as they indicate to us the path of duty or economy in the direction of forest tree culture.

Foreign nations accuse the "Universal Yankee Nation" of being "slaves to the almighty dollar." That the American people are impatient of results, is a fact of every day's observation; and this, perhaps, justifies, in a measure at least, the opinion which the citizens of the old world entertain of us. The consideration of profit to ourselves, instead of benefit to posterity or ultimate good to the nation, has ever been too prominent among our incentives to action. But the time has come when we are called upon to prosecute enterprizes which look beyond the present generation for results. We must, for our own national salvation, look threatening disasters full in the face, and prepare to avert them. If we are to achieve and maintain our manifest destiny as the greatest and most prosperous people upon the globe, we must at once commence laying the foundations of this success. One of the important steps in this direction is the cultivation of trees for their climatic influences and for uses in the mechanic arts. The wide extent of our American prairies renders this work far more imperative upon us than it has formerly been upon the people of transatlantic countries; yet the history of many countries of the old world admonishes us of the folly of our present course of wholesale destruction of forests and neglect of planting new ones for the use of future generations.

The fact that our home groves are fast diminishing, without adequate efforts being put forth to make up for the loss, is apparent to all. But it is not generally realized to how great an extent the same is true of the pine regions of the North, from whence we now draw almost our entire supplies of timber and lumber for building purposes. Lumber is becoming dear each succeeding year, not, as has been generally supposed, from the high price of labor, so much as from the fact that the timber, at almost all points easy of access, is either thinned out or entirely used up, so that logs are now often drawn great distances to the rivers, and floated long journeys to reach those mills which, a few years since, were supplied from adjoining forests. The amount of timber in portions of these vast pine regions has been greatly overestimated. I have traveled over and looked over hundreds of thousands of acres of these lands, extending from the southern point of Green Bay to Lake Superior, and am fully persuaded that two acres out of three, in this great territory, are either destitute of trees or covered with such varieties as are almost worthless. The fires which sweep over these vast plains, and through the forests, destroy the young trees, except here and there an isolated tract, so that we here find little or no provision for a supply when the present crop of trees is exhausted.

While we cannot prevent the destruction of our forests for the use and benfit of the present generation, we can and should take measures to create forests upon our farms, which will be ample to supply the wants of those who are to come after us. Comparatively little has as yet been done in this direction, and this little has been confined mainly to the cultivation of those varieties which are of rapid growth, and which would consequently bring the quickest returns. While these varieties are, perhaps, more profitable for artificial groves than most of the slower growing ones, yet it is highly important that a sufficient number of kinds should be grown to subserve all the purposes of the mechanic arts, and these arts call largely for the close, firm texture of the slower growing varieties. I am inclined to the opinion that the rate of growth in trees is generally underestimated, and am quite sure that comparatively few landholders realize that large profits would ultimately accrue from cultivating groves, even of the more moderate growing varieties. To illustrate the rate of spontaneous growth of such sorts I will cite an instance which has come under my own observation.

A few miles from my residence are a few acres of ground which were cleared of timber sixteen or seventeen years since. There was then left upon the ground a growth of underbrush only, consisting of several varieties of oak, hickory, ash, and some other sorts. I have watched the growth of timber there from year to year, until the present time, and am myself surprised at the result.

The land was worth, when cleared, perhaps twelve dollars per acre, not more. There have been taken from it, during the last seven years, poles equal in value, probably, to ten dollars per acre; and one hundred and fifty dollars per acre would hardly buy the trees now standing upon it. So that if we estimate the value of the land (at the time mentioned) at twelve dollars per acre, and compute the interest upon this for sixteen years, at six per cent., compound interest, adding the amount of taxes accruing during the time, with interest upon this at same rates, we have one hundred dollars per acre as the net profit of the timber crop, while, of course, the land itself has partaken of the generally enhanced value of surrounding real estate, and would now probably sell for fifty dollars per acre, were the timber removed.

A German friend, for whose integrity I can safely vouch, tells me that when he was a lad, and in his native country, his father had a tract of eighty acres of poor land, upon which he had tried in vain to raise remunerating crops. It was finally prepared in the best manner and planted with seeds of Norway Spruce, which grow readily there in the open ground. These trees flou rished, and, after a few years' cultivation, were left to themselves, thinnin them out as they became crowded.

At ten to fifteen years' growth, immense numbers were sold, in thinnin out, for hop poles and grape stakes. This tract is now a well timbered fores from which fair sized saw-logs are cut, and every part of a house can be buil with its timber.

These seeds were sown only thirty-six years ago! What would such a lo be worth upon the prairies of Illinois? Who would estimate its value at les than one thousand dollars per acre? What farmer upon the prairies of Illi nois would wish to leave a better legacy to his sons? What has been don upon the poor hills of Germany, except starting the plants in open ground may be repeated, and with equal or greater results, here, where all the hard varieties of evergreen, as well as deciduous, trees grow luxuriantly.

The rates of growth in the more common varieties of trees may be ob served by any one, and the time required to bring them to a size suitable fo building purposes, and use in the various mechanic arts, easily calculated thus the actual cost of raising timber may be very nearly ascertained.

Let us estimate the expense of raising a grove of ten acres, planted witl white ash and black walnut—five acres with each. These varieties grow a about the same rate, and are about equally valuable for lumber.

The seeds of the ash, like all seeds of this class which ripen in the autumn should be gathered when ripe, and kept in the cellar through winter. Th walnuts, as other nuts, should be spread evenly upon the ground, where sur face water will not stand, not more than two nuts in depth, and covered witl two or three inches of mellow soil, that they may freeze during winter—tc be planted as soon in spring as they show signs of sprouting. The lanc should be deeply plowed, late in fall if practicable, and finely pulverized ir early spring, and marked both ways, as for corn, three feet eight inches apart. The tree seeds and nuts should be planted eleven feet apart, which will admit of two rows of corn or potatoes between each two rows of trees. By putting two or three seeds in a place—to be thinned out to one if both or all germinate—an even stand may be secured. A better way is to plant in rows, eleven feet apart, running north and south, and three feet eight inches (in the marks for corn.) This will secure straight trees—being closer—and they may be thinned out to eleven feet each way when large enough to use for grape stakes, bean or hop poles. This will give three hundred and sixty trees per acre, or three thousand trees in all, allowing for sixty vacancies, though in all cases of tree planting, whether in groves or screens, a supply of good plants, grown elsewhere, should always be in readiness to use in filling vacancies, which should be done at the end of the first year.

The preparation of the ten acres of ground, at five dollars per acre, would be fifty dollars. Average cost of seed, fifty cents per acre, five dollars. Planting, twenty-five dollars. The cultivation during the first five years will be paid for in the crops grown between rows. For cultivation from fifth to ninth years—four years—with horses only—thirty dollars per year, one hundred and twenty dollars. After this time no cultivation or care will be ieeded. This makes the entire cost, in seed and labor, of the ten acres of rees, two hundred dollars. These trees will, at twenty-five years of age, average sixteen inches in diameter at the ground, and about ten inches at the height of sixteen feet. This will give, deducting waste in sawing, one hundred and twenty feet of lumber per tree. Allowing one-sixth for damage by the elements and loss from other causes, we have in round numbers three hundred and sixty thousand feet of lumber, which, at fifty dollars per thousand, would amount to eighteen thousand dollars. The value of the tree tops for fuel would be equal to the cost of preparing the logs for the mill, and the expense in sawing would not exceed five dollars per thousand feet. This, added to the cost of producing the trees, and the amount deducted from the value of the lumber, leaves *sixteen thousand dollars for the use of ten acres of land for twenty-five years*, and the interest upon the amount expended in planting and cultivating the trees! This statement may be deemed incredible, perhaps, by those who have not previously turned their attention to the subject, but after much study and many years observation and measurements of growths of different varieties of trees, I am convinced that in all well conducted experiments in growing artificial groves upon our large prairies, the profits will not fall far, if at all, short of the rates above stated. It must be borne in mind that trees standing at regular and proper distances upon rich prairie soil, and receiving good cultivation, will grow much faster than the same varieties usually found growing in natural groves. For a list of varieties suitable for planting in artificial groves, I would refer all interested to the lists recommended by our State Horticultural Society, with the remark that the planter can hardly be in error in planting any tree which is indigenous in a soil and climate similar to his own; while many trees, whose native homes are found in latitude north or south, have thus far proved valuable, as the Osage Orange and Catalpa, from the South, and the Red Pine and White Spruce, and others, from the North.

Some foreign varieties are equal or superior to any of our natives; among which are European or Scotch Larch (best of all foreign deciduous trees), Austrian and Scotch Pines, Norway Spruce and White Willow.

I regard this last as probably combining more desirable qualities for cultivation in groves for lumber purposes than any other variety of the soft wood, rapid growing deciduous trees, and am decidedly of the opinion that this and the golden variety are the best deciduous trees within my knowledge for wind-breaks or screens, but wish to be distinctly understood as not recommending this tree as a "hedge plant," or the planting of this or any other one sort to the neglect of other desirable varieties. Strong cuttings of this tree seldom fail to strike root at once in mellow soil, and will make a growth of from two to six feet the first season. It thrives in all kinds of soil, making as much wood in a given number of years as any other known sort, not even excepting the cotton wood, growing into a large tree, sometimes four feet in diameter. The wood is of rather fine texture for a light wood, making a fair article of soft lumber, which bears a fine polish. It is also valuable for making wooden ware, bowls, trays, etc. It also splits freely, which is a desirable quality in making fence posts, rails, railroad ties, and fire-wood. I would here remark that it is more than probable that before five years are past the present mode of infusing the gasses of coal tar into the pores of timber will be so improved, or some other method, that soft and porous wood will be rendered almost indestructible, and at a trifling expense. If any Professor or student in this University would accomplish this achievement, he would confer a blessing upon the State which would repay an hundredfold all the expense of establishing and maintaining it.

The golden willow is similar in growth and texture to the white, but I think does not make so large a tree. I have measured about a dozen trees of this variety (golden) which were planted by the road side fifteen years ago last spring, and find the average circumference of the trunks, at three and a half feet from the ground, to be five feet and three inches. A white willow, standing near my house, which has grown from a small cutting put in thirteen years ago last spring, now measures six feet and two inches in circumference near the ground, forming a head or top thirty feet across. This variety, when planted in groves, grows tall and almost perfectly straight.

I have carefully computed the expenses of raising ten acres of trees of this variety, and converting them into lumber and find the entire cost not to exceed ten dollars per thousand feet.

This estimate is based upon actual measurement of the growth of trees. The land is valued at forty dollars per acre, with interest upon this amount, together with expenses, computed as before, at six per cent. compound interest.

I take ten acres in these estimates of growing artificial groves because it is desirable to have trees enough together, or in close proximity, that the cost of putting up and removing a saw mill would be but a trifle upon each thousand feet of lumber sawed.

TIMBER BELTS.

The actual profits which would accrue from a general and uniform system of cultivating trees in belts, or double rows, for protection, cannot as readily be estimated; yet no one who has carefully investigated this subject can doubt the utility and economy of such screens. To show the possible extent of their beneficial influence, I will call up an instance which, probably, very many of this audience will remember.

In the year 1862, at the time when spring wheat and oats, in the northern portion of the State were just past the bloom, and a portion of the grains in the milky state, we were visited by a storm from the northwest, which swept over this portion of the State, prostrating nearly all the grain not sheltered by timber.

I have selected this instance as an illustration, because of the extent of the storm, and also on account of the marked effects of protection by timber in this storm, which clearly showed that the entire loss might have been prevented by belts of trees. In one locality a single line of broad and tall willows, closely planted, proved a sufficient check to the wind, so that a field of wheat adjoining it upon the east stood erect, and was harvested with a machine, while in exposed situations, the shrunken grain, if saved at all, was often gathered by the slow and tedious process of hooking it up with scythes. Many thousands of acres were left to dry, and were burned upon the ground, which two or three weeks before harvest promised abundant crops. The extra expense of gathering the grain of that harvest could not have been less than fifty cents per acre on the whole amount harvested.

I traveled quite extensively over this portion of the State before and soon after the harvest of that year, and am convinced that one-half the value of the wheat and oats in the territory passed over by that storm was destroyed by it.

There were sown in that year, as per census reports, in the thirty counties lying north of the Burlington, Peoria and Logansport Railroad, about one million two hundred thousand acres of wheat, and at least one-fourth as many of oats. Allowing one-tenth of these crops to have been protected by timber, we find the loss to have been equal to five hundred and forty thousand acres of wheat, and one hundred and thirty thousand acres of oats.

Computing the wheat at fifteen bushels per acre, and the value at fifty cents per bushel; the oats at thirty bushels per acre, and price twenty cents per bushel, we have the sum of four millions eight hundred and sixty thousand dollars, as the cash value of property in these two crops alone, which was destroyed in a single storm in an area of a little more than one-third of our State.

Allowing one hundred and fifty thousand acres to have been burned, or not harvested, and adding to the amount of loss fifty cents per acre of the remainder of the nine-tenths (lodged grain), equal to six hundred thousand dollars, it swells the amount to the enormous sum of five million four hundred and sixty thousand dollars.

Let us see how much it would cost to plant and cultivate screens to prevent such losses. A double row of white or golden willows, with trees in the second row set opposite the spaces in the first, planted upon the west side of every eighty acre lot, would doubtless prove sufficient, as they would, at the age of twelve years, form a dense wall of foliage about forty feet high, and would of course increase in size for many years thereafter.

These would cost, per mile of screen, about as follows: Average value of two acres of land, forty dollars per acre, eighty dollars; preparation of the soil, and planting with strong cuttings, ten dollars; cultivating the first two years, twenty dollars; making a total cost, with purchase money of the land, one hundred and ten dollars. After two years no care will be needed, save a mulch of refuse straw, to be renewed once in two or three years, the cost of which will be more than repaid in the partial protection which the trees will render previous to the twelfth year.

There are, in the thirty counties referred to, about sixteen thousand six hundred and twenty-five sections of prairie land. This will require sixty-six thousand five hundred miles of screen, if planted as above proposed, making the entire cost seven million three hundred and fifteen thousand dollars. Thus we see that, without estimating the immense damage done to fruit and other crops, the wheat and oats destroyed in that storm would, if saved, have paid about three-fourths the entire expense of growing timber belts throughout that entire territory!

I think it may be safely estimated that an average of one-twelfth part of all our crops of grain and large fruits are destroyed by violent winds, which such a system of protection, or its equivalent in groves, would so far check as to prevent the destruction. If this is true, such protection would save to the husbandmen and orchardists its entire cost every two, or, at most, three years. Such protection, too, would, by causing the snow to remain spread evenly over the surface of the ground, as before hinted, enable the farmer to raise winter wheat in localities where it is now impossible to do so.

If we add to the benefits of tree culture already considered, those far-reaching and incalculably valuable climatic influences which would flow therefrom, we must all admit the necessity of commencing this great enterprise at once, and prosecuting it with vigor.

I do not introduce this plan of planting straight belts of trees, a quarter of a mile apart, because it is the most desirable plan which can be adopted, for no man of taste would regard it as such. The eye would soon tire of such stiffness and monotony in the landscape. Tree planting may be so planned and conducted as to give beauty to the landscape, and at the same time secure nearly all the combined benefits of protection to crops, timber for uses in the mechanic arts, and those climatic influences which we all regard as so important. Of course no rules can be given for such tree planting. Generally, where the surface is somewhat undulating (for we have no hills), the planting should be done mainly upon the higher portions of the farms, and along the water courses. Where the surface is level, belts may be planted upon the north and west of the farms, with groves upon the least valuable portions. These last would intercept the straight lines and give diversity. But if each prairie farmer were to follow his own taste, or adapt his planting to secure the greatest profit in timber or protection to his own farm, planting about one-tenth of his land with trees, it is probable that all the desirable ends which we have been considering will be gained, and the landscape sufficiently diversified to be pleasing to the eye.

Here, then, brother farmers, and farmer students in this University, we have two pictures presented to us. In the one we look into the future and see wide spread desolation—an extended treeless country, visited by destructive storms, by severe drouths, with its streams dried up, and food for man and beast in such scarcity that the poor can scarcely obtain a supply. In the other we see a charming landscape, a rich, fertile country, a population enjoying all the blessings which flow from peace and plenty.

Which will you choose? Will we take warning in time, and arouse ourselves to action in an enterprise which promises such rich results?

DISCUSSION.

Mr. Miner—I have given some attention for nineteen years past .to growing timber. I plant the walnut. I differ with the speaker in regard to the time of planting. I gather them in the fall of the year and plant immediately. I strike off furrows with the plow, and plant them without taking the hull off, and the work is done. I do not see anything gained in laying the nuts away in the cellar and planting next spring.

Mr. GALUSHA—The only gain that I see is to have the ground in readiness to grow other crops between. We get a more even stand planted in the spring.

Mr. FREEMAN—It is well known that the nuts require frost and moisture in order to force them open. By the speaker's plan you can get a better stand, especially if you assort the nuts. By this means you get a more uniform stand in your plantation.

Mr. MINER—I still think my plan has some advantage. In the fall the ground is dry, and we have more leisure to do the work. In the spring the ground is wet, and is not in so good a condition as in the fall. I have no trouble to know when my walnut trees are in the row. Here in Illinois (take my own case) we have a great deal to do, and if this work is not done in the fall it will in all probability be neglected. If I were going to plant more trees, as I probably shall, I would plant in the fall. I now have planted and growing groves of cottonwood, walnut, sycamore, wild cherry, maple, the sugar tree, osage orange, and some crab apple. I am an advocate of tree planting.

Mr. ROBINSON—I wish to ask what is the value of the European Larch as to durability?

Mr. GALUSHA—So far as we know it we have everything in its favor as to its durability. This tree and the white willow stand at the head in this respect, and greater profits are realized from growing groves of the European Larch than any tree next to the white willow. I would ask if the gentleman has had any experience in growing the soft maple, and whether his trees are troubled with the borer?

Mr. MINER—I have never been troubled with the borer in my maples. I have the trees three years old. My black locusts are destroyed entirely.

Dr. WARDER—How soon are your locust trees attacked by the borer?

Mr. MINER—At two or three years old. I planted them fourteen years ago.

Mr. ROBINSON said that he planted locust trees, and the borer destroyed them.

Dr. WARDER—I see there are some very fine trees here in Champaign. Has any one seen the borer attack this tree in the first year?

Mr. ROBINSON—Not the first year, but I have seen them attack it the second year.

Mr. LUDLOW—I have made several efforts to grow this tree. The first year this tree grows thrifty, and the second year the borer attacks it.

Mr. H. DUNLAP—I have seen them working upon the sprouts of one year's growth.

Mr. MINER—Does Dr. Warder say that these trees in Champaign are free from the borer?

Dr. WARDER—I saw them only at a distance. They looked thrifty and well.

Mr. ROBINSON—It appears to me that as much can be done by preserving the young growth that is coming up as in planting. We know there are many places and large tracts of country where a judicious thinning of the thick undergrowth would be all that would be required in growing extensive and valuable forests. The expenses of thinning would be met in the amount of firewood obtained. The thinning out will induce stronger and more rapid growth, and consequently more durable timber. We know that timber that has made rapid growth—a strong burr oak for example—put in as a fence post, will last twice as long as timber that has become brash from slow growth. Timber grown in a crowded, damp place is nothing like as good as that which has room and light in which to develop strength.

Mr. STEWART introduced the subject of birds. They were pecking holes, and pecking to death his trees, and he wanted to know what the Institute was going to do about it, and wanted to know in particular if it was the sap sucker.

Mr. GALUSHA said that he would know the bird by the shape of its tongue; no other bird has such a tongue. They have a wedge-shaped tongue.

QUESTION—What is the remedy against the bird?

ANSWER—Shot.

Then said one, who supposed the bird was after the worms, and in particular the borer, what is the remedy for the borer?

Mr. H. J. Dunlap said he knew not how the gentleman would obtain the desired information, except by subscribing for the American Entomologist, published at St. Louis. [Laughter.]

Mr. Ludlow—I would like to ask Mr. Galusha if he has any knowledge of the mulberry tree, as to its durability for posts?

Mr. Galusha—I have never known the mulberry grown for posts. There is a tree that will be grown for posts, that is the osage orange. Also, another tree, the catalpa, will be grown for the same purpose. But the osage hedge will be best.

Mr. Miner—I have a few osage standing in my nursery. They are not likely to make posts.

Mr. Periam—They must have high dry land. They will not stand excessive wetness.

Mr. Robinson—All trees will branch out if left scattering. It is desirable that, for posts, they should have straight trunks. We have the coffee nut tree, which I think makes good posts. It is a free growing tree and splits well.

A voice—Is it not the same as the horse chestnut?

Mr. Robinson—It is altogether different. It has a property that no other wood has, that is, the property of not shrinking in a green state, and can be used for cog wheels.

Mr. Galusha—I would like to know the value of the chestnut tree. I find it does well on high rolling ground, not on wet.

Mr. Robinson—There are some large trees in Tazewell county. They make very rapid growth.

Mr. Parks asked if the silver leaf maples, growing upon the bottoms, furnished good seed. That is, are they the true silver leaf maple?

Mr. Galusha—They are. You get the true variety.

APPENDIX.

The following documents are the memorial to the Legislature alluded to on pages 48, 55, 58 and 59, and the appropriation bill as it finally became a law. Comparing the two, we find the following results:

App. for	Asked.	Granted.
Agricultural Dep't.	$38,000	$25,000
Horticultural "	22,000	20,000
Mechanical "	40,000	.....
Chemical "	30,000	5,000
Apparatus, etc.	25,000	10,000
Drill Hall	15,000	.....
Total	$170,000	$60,000

MEMORIAL

TO THE HONORABLE MEMBERS OF THE LEGISLATURE OF ILLINOIS, FOR THE SESSION OF 1869.

GENTLEMEN: The Trustees of the Illinois Industrial University, at their recent meeting, appointed a committee to address to you a memorial in regard to the condition and wants of this new State Institution.

It is not necessary to recount to you the prominent part taken by eminent citizens of this State, in securing the grant of public lands for industrial education; nor the almost unprecedented liberality of the citizens of the several sections of the State, in the bids made to secure the location of the University. Never have the people of a state exhibited a higher or broader interest in the foundation of an institution of learning, than the people of Illinois in this.

CONDITIONS OF THE GRANT.

The State, in accepting from Congress the immense gift of 480,000 acres of land scrip, deliberately assented to all the conditions of the grant, and assumed all the responsibilities it imposed. These conditions included the inviolability of the fund and its interest, its perpetual security against loss, the payment by the State of all expenses for its management and disbursement, and, by unavoidable implication, the support and maintenance forever, with its aid, of such an institution as the act describes.

Thus far the State has exhibited much wisdom in the management of this great trust. By wisely appealing to the public emulation of its several counties, it secured for the institution buildings, farms, and other property of great value, without expense to the State, and without diminution of the funds.

A NEW OBLIGATION.

But this generosity of its citizens has only added a fresh obligation to those which the acceptance of the grant imposed upon the State. The pledges made to Congress the State has now repeated to its own citizens. It was for no private or local institution that the several counties bid such princely sums. It was for a University belonging inalienably to the State, and for whose perpetuity and success the faith of the State was irrevocably pledged, that the tax-payers of the several counties were encouraged to vote upon themselves the burden of so gigantic a donation. The State cannot, in justice, and will not, if wise, attempt to thrust upon other hands a duty it voluntarily took upon itself.

ACTS OF THE TRUSTEES.

The Board of Trustees appointed by the State, obeying the mandate of the Legislature, located the University at Urbana, the county of Champaign having, in good faith, paid over its offered donation.

A full statement of the further doings of the Board will be laid before you in the annual report of the Corresponding Secretary. The Trustees have aimed steadily to carry into effect the laws of Congress and of the State Legislature. Acting, as they ought, for the whole State, they have sought to organize the University on a basis worthy the State itself, and of the great public interests involved. Large expenditures were found necessary to alter and fit up the University building for use, to grade and fence the grounds, and to purchase the additional lands, and the teams and tools needful for the present purposes of the institution. These expenditures have been carefully confined to the supply of immediate wants. It has been the policy to diminish as little as possible the permanent funds, in the hope that the University may ultimately be supported mainly, if not entirely, by the income of these funds.

PRESENT FUNDS AND INCOME.

The endowment fund of the University, derived from sale of scrip and from the unexpended balance of Champaign county bonds, is $309,000. The annual interest of this fund is $25,290. About 25,000 acres of lands have been located with the scrip, and 75,000 acres of scrip remain to be disposed of.

The expenditures during the first year, ending March 11, 1868, amounted to $35,076 90, of which $22,693 83 were for purchases of additional lands and for permanent improvements in buildings and grounds, and $2,951 80 for expenses of sale and location of scrip.

The expenditures for the current year will exceed $30,000. It is evident that the income, even when swelled to the utmost by the final sale of the scrip and lands, will be all required to meet the ordinary expenses of the University, and will be much less than that of many institutions with which it must come into competition for both teachers and students.

FUNDS NEEDED FOR OUTFIT.

It early became apparent to the Trustees and others, that a full outfit for the several departments could not be afforded from the ordinary income of the University. The peculiar character of its industrial departments, and its extensive scientific courses, entail upon it much larger expenditures than those of an ordinary college. Its farms, gardens, machinery, cabinets and apparatus will all cost heavily at the outset.

To leave these industrial departments to struggle forward without the necessary facilities for their work, is to doom them to certain failure, and to defeat the aims of Congress and the just hopes of the friends of Industrial Education.

It seems, therefore, the evident duty of the Trustees who have been appointed by the State to watch over this great interest, to lay its wants before you, the representatives of the authority of the State, and the guardians of its interests, and ask from you such action as the case demands.

APPROPRIATIONS REQUIRED.

Appropriations are needed as follows:

1. For the *Agricultural Department.* For barns and other farm buildings for the experimental and stock farms; for houses for farmer and farm laborers; for fences, drainage, wells, windmill, teams, tools, seeds, roads, bridges, shelter and fruit trees, and for stock of several breeds and varieties, $38,000.

2. For the *Horticultural Department.* For horticultural buildings and structures; for house for gardener; for barn and tool house; for teams and implements; for fences, underdraining and roads; for fruit and forest trees for the orchards, forest tree plantations and shelter belts, and for shrubs, plants and seeds of all sorts, $22,000.

3. For the *Mechanical Department.* Whatever may be done at branch institutions, the Trustees regard it as vitally important that some considerable

development shall be given to this department here at the central institution. Even the students of agriculture will need to know the theory of machines, and to understand especially the construction and management of that rapidly increasing array of machinery in use on the farms. For this department there is asked, for shops, tools, machinery, models and drawings, and for lecture rooms and drafting rooms, $40,000.

4. Apparatus of instruction for the several departments. For apparatus, philosophical, engineering, physiological, botanical, veterinary, etc., and for books, charts, cabinets, cabinet cases, models, plans, etc., $25,000.

The high importance of the chemical department, and its broad fundamental relations to agriculture and to all the industrial arts, demand that it shall be furnished not only with ample lecture rooms, but with working laboratories, in which large classes of students shall be accommodated with facilities for practical work in the several departments of analytical chemistry and mineralogy. There will be needed, for such purpose, about $30,000.

There is also greatly needed a drill hall, for the military and other exercises in inclement weather and in the winter season. The importance of such a building has been acknowledged everywhere, and most of the older institutions are now provided with gymnasiums. In our State, where the nature of the soil almost forbids outdoor exercise during so much of the winter and spring months, this is doubly important, and the military tactics required by Congress can scarcely be taught without it. It is estimated that it will cost $15,000.

A detailed statement of the several items of each appropriation has been carefully prepared, and will be presented to the appropriate committees.

REASONS.

The reasonableness of the amounts of these several appropriations will appear to any one who has even a slight acquaintance with the cost of institutions of higher learning. Their necessity is absolute. The University cannot go successfully forward without them. Our people will neither honor nor patronize an institution of mean proportions and cheap appointments.

No intelligent agriculturist or horticulturist will think too much is asked to furnish the gardens, orchards and farms on which the great problems in agriculture, in all its branches, and in horticulture, fruit growing and tree planting, are to be investigated and taught for the benefit of these gigantic interests in this great State. An interest which, in 1866, had already invested in cultivated farms and live stock over $400,000,000, and yielded, in its annual production of grass, grain and roots, $160,148,704, may certainly ask so small a sum as is here asked for the cultivation of the science and skill needed for its successful control.

And it should be remembered that the experimental farms and gardens are to be conducted quite as much for the promotion and diffusion of agricultural science throughout the State, as for the mere purposes of instruction inside the University. It would require but a very few acres to illustrate to the student the several processes of husbandry as already known, but to carry on a full series of experiments in field crops, fruit growing, tree planting and stock rearing, for the benefit of these great industries throughout Illinois, will amply occupy 600 acres, or even the 1,000 acres accepted by the State for this use from Champaign county.

The Hon. John P. Reynolds says, in his report on the Paris Exposition: "Almost all important efforts and experiments in Europe, the result of which has been to improve agricultural practice and increase production, have originated with the governments, or in special schools, maintained in whole or in part by government patronage, as necessary measures of political economy."

The sum asked for the mechanical department is moderate, when compared with the amount given by Massachusetts to her Institute of Technology, and with the immense value of this department to our great manufacturing interests still in their infancy, but already, in 1865, amounting in their annual products to $63,356,013. It is to their schools of this sort that France, Belgium and the German States owe their supremacy in manufactures. In the great Paris Exposition of 1866, England found herself beaten, at almost every point, by the French artisans, trained in the great Polytechnic schools of France. If Illinois shall ever compete successfully with New England in manufactures, we must do it by brain power, by minds trained to understand and direct machinery and manufacturing processes. Educated mechanics will do more than tariffs to introduce manufactures throughout our State.

The appropriation asked for the various apparatus of instruction amounts to only one-fourth of the sum lately expended by the Cornell University for these purposes, and there is no prominent college or university in the country that has not much larger sums than this invested in cabinets and libraries. Not one of the appropriations asked for is more vital to the real work and power of the University than this, and if the amount were $100,000 it would be a most wise expenditure. Apparatus teaches to the sight, and trains the student to use his own eyes, and to become a keen observer of the more magnificent apparatus with which God continually teaches those who can learn, in the great school of nature. Years of hard, and often fruitless, study can often be saved our youth by good instruments of instruction.

The entire amount asked for all purposes is but trifling when spread over the taxable property of the State. It is less than one-thirtieth of one per cent. The amount asked for the agricultural and horticultural departments is less than two mills for each acre of land in the State.

IT WILL PAY.

If the University shall lead to the discovery of new methods, or diffuse more widely those already known, and thus teach how to raise one bushel of corn more from each acre planted than was raised per acre in 1866, it would, at forty cents a bushel, add more than $1,000,000 to the annual harvest of the State.

If, by stimulating and directing the taste and skill of the farmers of the State to new cultures and better methods, it could add only *one per cent.* to the annual farm products, over those of 1866, it would increase the production $1,600,000.

It is asserted that noxious insects destroy, annually, over $20,000,000 in fruits, trees and grain. If the University shall teach how to avoid the ravages of a single species, it will save more than the entire cost of the institution.

If its experiments, widely published, shall save the farmers and fruit growers from useless experiments with worthless fruits, grains and trees, it will save annually to the State hundreds of thousands of dollars now wasted.

If its influence shall increase the tree planting throughout the state, it will give back in the wealth, and health and beauty of the State a hundred times all it now asks to carry out its plans.

If its mechanic shops shall stimulate the inventive genius of a single inventor of agricultural or other machinery, like the horse cultivator, rake or reaper, it will open a perpetual source of wealth.

If it shall help to develop our manufactures as such institutions have done, it will, like pumps sunk in deep wells, give out in perpetual streams what it asks now in quarts.

If it shall help to save the rich soil of our State from ultimate exhaustion by bad and wasteful husbandry, or shall teach how to bring under tillage lands now worthless or shall incite to a saving of the millions worth of manures now left to be wasted, how immense will be the returns it will yield for coming ages.

Nor are all these mere baseless suppositions. We are fully authorized by the past history of industrial schools to aver that this, if liberally fostered, will help to enrich the State a thousand fold more than all its costs.

While other appropriations are asked by charity or extorted by crimes, and are gifts from which no returns are asked, this is an *investment*, in the industrial fields and forces of the State, and will pay back every ten years all it asks. A million of dollars spent in this way would be wisely laid out, and would glorify and enrich the State beyond computation, and for ages to come.

ACTION OF OTHER STATES.

The liberality exhibited by other states, and by some of those of far less power and wealth than our own, encourages the Trustees to hope that a wise and liberal policy will be pursued towards the University. Pennsylvania appropriated to its Agricultural College $200,000. New York gives to Cornell University $18,000 a year, after having given it 900,000 acres of Agricultural College Land Scrip, to which Mr. Cornell has added about $800,000. That state also gives to the Renssalaer Polytechnic school $15,000 a year, and nearly $40,000 to other colleges. Massachusetts has given to the new Agricultural College of that state $91,000, to the School of Technology $262,444, and to the Museum of Zoology $180,708. It has also given to Harvard and to other colleges, within ten years, $128,500. The total gifts to Harvard amount to $215,797 73. Michigan has appropriated to its Agricultural College $198,398, besides large donations of state lands. It has also given to its State University $100,000, and now tenders it the income of a tax which will yield $15,000 a year, and this although its endowments already afford nearly $40,000 per annum. Wisconsin has given to the agricultural department of its State University $30,798 50, and to the University itself $27,594 84, and now gives it $7,303 76 annually.

The following tabular statement exhibits the sums paid to higher institutions of learning by the states whose statistics have come to hand:

States.	To Colleges and Universities.	To Agricultural and Polytechnic Schools.	To Normal Schools.
Maine........	$34,000 and lands.	....	....
Massachusetts.	$344,297 73.	$534,152.	$193,400 in 10 years.
Rhode Island..	....	....	$3,000 a year.
Connecticut...	$80,813 80.	....	....
New York....	large amounts. $40,000 yearly.	$33,000 yearly.	$106,000 yearly.
Pennsylvania..	....	$200,000.	$12,000.
New Jersey...	....	....	$11,000.
Maryland.....	$28,650 yearly.	$32,750, $6,000 annually.	....
Virginia......	$198,000, $15,060 yearly.	$15,000.	....
Alabama	$300,000.	....	....
Indiana.......	$8,000 yearly.	....	....
Michigan.....	$100,000, $15,000 yearly.	$168,320.	22,000 acres of land, $9,700 yearly.
Wisconsin.....	$7,303 76 yearly $27,594.	$30,798 50.	large land grants.
Kansas.......	$27,594 84.	$30,798 50.	14,400 acres of land, $35,637.
Minnesota	$15,000 for one year.	....	....

Thus far in her history, Illinois, as a state, has done very little for the promotion of this higher form of education. Her citizens have done generously, but as yet no statute graces her records, making a direct appropriation for the promotion of liberal and scientific education. Circumstances have heretofore prevented the founding of a distinct State University, and her liberality has found no channel tempting its exercise. But now the State has a University closely linked to its great industrial interests, and indissolubly bound to its own name and fame. The Industrial University belongs inalienably to the State. The world recognizes it as an institution of the State. Its prosperity will be both a blessing and an honor to the State; its failure would be both a curse and a shame.

With these considerations in view, the Trustees earnestly solicit, and confidently hope for, the favorable action of the Legislature. A failure to make the appropriations asked would be so disastrous that years could not repair the loss. The prompt development of the University will give early to the State the fruits of its work and afford its advantages to hundreds who will otherwise fail to receive them.

J. M. GREGORY,
Chairman of Committee.

AN ACT MAKING APPROPRIATIONS FOR THE BENEFIT AND COMPLETION OF THE ILLINOIS INDUSTRIAL UNIVERSITY.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly*, That the sum of sixty thousand dollars be and the same is hereby appropriated to the Illinois Industrial University, located at Urbana, Champaign county, Illinois, in amounts and for the purposes hereinafter set forth, viz:

To the agricultural department, including the erection of barns and other out-buildings for the experimental and stock farm, houses for farmer and farm laborers, fencing, drainage, wells, teams, tools, seeds, roads, bridges, fruit and forest trees, and stock of several breeds and varieties, twelve thousand five hundred dollars per annum, for two years.

To the horticultural department, including horticultural buildings and structures, house for gardener, barn and tool house, horticultural implements, fencing, underdrainage, roads, forest and fruit trees, shrubs, plants, etc., ten thousand dollars per annum, for two years.

To the chemical department, the sum of five thousand dollars. To be used for other apparatus and for books, by direction of trustees, ten thousand dollars.

§ 2. The Auditor of Public Accounts is hereby authorized and required to draw his warrant upon the Treasurer of the State of Illinois for the said sums of money, upon orders of the board of trustees of said University, signed by the regent and attested by the secretary of said board, with the seal of said institution affixed thereto. And it shall be the duty of said treasurer, and he is hereby authorized, to pay the same out of moneys in the treasury not otherwise appropriated: *Provided*, that said orders of said trustees shall not be given except as, in their judgment, the necessity arises for the expenditure of the moneys so appropriated for the specific purposes herein provided.

§ 3. This act shall be deemed a public act, and shall be in force from and after its passage.

§ 4. The board of trustees shall not create any indebtedness nor incur any liabilities beyond the provisions of this act.

APPROVED March 27, 1869.

INDEX.

NOTE.—It will be observed that the pages numbers 41-48 are duplicated. In indexing, we have referred to the second series of folios as 41 a, 42 a, etc.