general courses, and serve as an introduction to the more advanced work of those who wish to make a special study of zoology. Such students can then continue their study of insects or of vertebrates at this university or can take up the special study of marine forms at some of the seaside laboratories.

The summer of 1878 Assistant Professor Comstock spent in the Southern States, as a special agent of the U. S. Department of Agriculture, making a study of the insects injurious to cotton. The results of these studies formed the basis of an exhaustive report published by the government in 1880.

In the spring of 1879 Mr. Comstock was called to the position of entomologist of the U. S. Department of Agriculture. Appreciating the value of the experience to be gained in this position, and at the same time being unwilling to sever permanently his connection with Cornell University, he requested and obtained a leave of absence from the university for two years.

During his absence the work of this department was carried on by Assistant Professor William Stebbins Barnard. Dr. Barnard was a graduate of Cornell of the class of 1871 and had taken the degree of Ph. D. at Jena in 1873. He had served as lecturer on Protozoa at the Anderson school at Penikeese in 1874, and had resigned the position of professor of natural science at Oskaloosa College, in order to accept the position at Cornell.

During Dr. Barnard's administration of the department he made important contributions to our knowledge of the habits of certain insects. The most notable of these was his account of the habits of the pear psylla, which was published in the proceedings of the American Association for the Advancement of Science for 1879. In this paper he pointed out the serious nature of this pest, which ten years later destroyed many of the pear orchards of this State, and was the subject of an exhaustive investigation, conducted by this department in 1891 and 1892.

Immediately after the return of Mr. Comstock, at the expiration of his leave of absence in 1881, the laboratory was moved from its limited quarters in McGraw Hall to its present home in White Hall.

During the year 1881–2, much time was given to the completion of certain investigations begun in Washington but still incomplete. Financial aid was furnished by the government, including the salary of an assistant, Mr. Henry Ward Turner. The results of these investiga-

tions were published, partly in the Annual Report of the U. S. Department of Agriculture for 1881, and partly by the university in the Second Report of the Cornell University Experiment Station (1883).

At the close of the year 1881–2, Mr. Comstock's connection with the government work ceased; and early in the following year he was promoted to a full professorship. This promotion placed the Department of Entomology on a footing co-ordinate with the other departments of the university.

On the completion, at the close of the preceding year, of the investigations for the U. S. Government, Professor Comstock began a task which he had long had in mind, the preparation of a text book of entomology. The need of a suitable text-book had greatly hampered the work of instruction; and it seemed clear that the most important thing to be done for the advancement of the department was the preparation of such a work. As American entomology is still in its infancy, it is impossible to compile a satisfactory text book; its preparation must necessarily be to a great extent original work, based on the study of specimens.

Although the entomological collection had become of considerable size, it was still inadequate for the purpose. Fortunately the financial condition of the university at this time was such that appropriations could be made for the purchase of specimens; and there began a systematic filling up of the more important gaps in the collection, which has been continued to the present time; so that now, with the exception of the great collections of insects at Cambridge, Philadelphia and Washington, ours is one of the most important in the United States.

At the same time that the increase of the entomological collection by purchase began, important additions were made to the illustrative material in other departments of invertebrate zoology. Among these additions was a complete set of the glass models of invertebrates made by Blaschka.

During the growth of the entomological collections, much thought has been given to the methods of arranging and displaying specimens in the museum. This has resulted in the development of a new method of arranging them, which is known as the block system. This method allows the rearrangement of a collection with great facility, and the interpolation of new material at any desired point.

The rapid growth of the collection rendered necessary the employment of help in the laboratory, and in the fall of 1883 Mr. J. M. Sted-

man was appointed laboratory assistant. In 1888 Mr. Stedman was succeeded by Mr. A. D. McGillivray, who still holds this position.

On April 30, 1888, the Cornell University Agricultural Experiment Station was established under the provisions of a national law known as the Hatch Act. At the organization of this station it was decided to give considerable attention to entomological investigations, and there resulted in consequence a considerable enlargement of the scope of the work of the entomological department of the university.

In order that the new duties of the department might be carried on with the greatest facility, a building especially designed for the purpose of experimental entomology was planned and erected. This building, the first of its kind, was named the Insectary, and has served as a model for similar buildings at several of the experiment stations in other States, and at the Department of Agriculture in Washington.

The new duties connected with the establishment of the experimental work at the Insectary necessitated an interruption in the preparation of the text book of entomology, upon which Professor Comstock had been engaged for six years. This work was about one-half written, and as its completion seemed indefinitely postponed by these new duties, that part which was ready for the printer was published under the title, An Introduction to Entomology, Part First.

The more striking features of this text book are the use of analytical keys, similar to those used in botany, by which a student can readily determine to what family any insect of which he has a specimen belongs, and a large number of original wood engravings of insects, engraved by Mrs. Comstock.

Work on the concluding part of this text book was not entirely suspended, but for about three years, the greater part of the time that could be devoted to research was absorbed by the new duties at the Insectary. At the end of this period, the assistant entomologist, Mr. M. V. Slingerland, had acquired so much skill in investigations in applied entomology, that it was no longer necessary for Professor Comstock to do more than to exercise a general supervision of the work at the Insectary, and he was able to devote the greater part of his time, not required for teaching, to work on the text book.

The carrying out of the plan upon which the Introduction to Entomology is based has proved a much greater undertaking than was expected. And as the need of a completed text book is very pressing, work on the Introduction to Entomology was suspended in the spring

of 1891, and a more elementary work, entitled First Lessons in the Study of Insects, has been prepared. This is now in press and as soon as it is published, work on the Introduction to Entomology will be resumed.

The present is a period of great activity and rapid growth in this department. The laboratory is well filled with students, many of whom are graduate students conducting original investigations. Professor Comstock has just finished a revision of the order *lepidoptera* on the lines indicated in his essay on Evolution and Taxonomy, published in the Wilder Quarter-Century Book. Mr. McGillivray is publishing a series of papers on the classification of the thysanura, and Mr. Slingerland is publishing results of the highest practical importance in the bulletins of the experiment station.

THE TECHNICAL DEPARTMENTS.

XVI.

THE DEPARTMENT OF AGRICULTURE.

The demand for scientific education in agriculture was the occasion of the establishment of these national schools of science. The vast wealth of this country is founded upon agriculture and the products of the soil. With the rise of great cities, the need of the more skillful culture of the land in their vicinity was felt. The development of horticulture, and scientific market gardening became essential for the supply of the needs of the great centers of manufacturing and commercial life. A second need, which was more widely felt throughout the Eastern and Central Middle States, was the decline in the value of farm lands and products, caused by the gradual removal of large numbers of the farming population to the broad and fertile prairies of the West, where land was cheap and abundant harvests were obtained with less labor. Unscientific farming had been the rule throughout the early history of the country. Thrift, energy and industry always existed, but as there was no science of chemistry, and botany was but an empirical recreation, the scientific cultivation of the soil was impossible. To restore prosperity to the great agricultural domains of the East, which

had supported for two hundred years the population of the State, and to repair the need which the soil, once fertile, could no longer supply, to attract and retain the citizens of the East in their old homes and thus prevent the transfer of agricultural prosperity from its center to the West, was the subject of earnest thought of many of the wisest men of the time.

Such considerations as these had profoundly impressed the author of the National Land Grant Act. Prosperity was dependent not merely upon industry but upon intelligent industry, and for thirty years the demand for agricultural education found expression in the discussions in village lyceums, in conferences of farmers, in resolutions and memorials of agricultural societies, and in reports of legislative committees. The Legislature of Illinois as early as 1854 passed resolutions calling upon Congress to establish an Industrial University. One of the earliest duties of the governing board of this university was to make provision to fulfill the obligations of the National Land Grant. Conferences were held with the leading educators of the State and with the officers of the State Agricultural Society. One of the two professors first chosen was a professor of agricultural chemistry, but no professor of scientific and practical agriculture was appointed. There was a farm consisting of the land presented by Mr. Cornell, not reserved for a campus, upon which stood a small farm house, situated near the eastern extension of Sibley College, and several blackened barns. At ths meeting of the trustees of February 13, 1868, Joseph Harris, a gentleman widely known as the editor of a popular agricultural paper, who had some personal acquaintance with foreign agriculture, was appointed to the professorship of agriculture. He never entered, however, upon the duties of his position. Soon after the opening of the second term on February 18, 1869, Lewis Spaulding was appointed assistant-professor of agriculture and farm director. It was evident, that the entire organization of this department was inchoate, and the first specific instruction was elementary in character, and confined to the observation of farm work. Two prominent agriculturists were early appointed as lecturers in the university, Mr. John Stanton Gould, on June 30, 1869, who had been president of the State Agricultural Society and was actively interested in promoting the agricultural welfare of the State. This noble Friend was a man of great practical wisdom, and of large influence in the denomination with which he was connected, whose life had been devoted to the amelioration of the con-

dition of the suffering and criminal classes in the community. He delivered for several years two courses of lectures, one upon general agriculture and another upon mechanics as applied to agriculture. All who knew this man, so grand in every quality of his being, will rejoice in the memory of his association in those early years. Governor Frederick Holbrook, of Vermont, had been appointed a lecturer on one portion of the field covered by Mr. Gould, that of mechanics as applied to agriculture, but had never performed any duties. The trustees at this time interpreted the law of Congress as requiring all students in the university to receive certain instruction in agriculture. It was even provided that no students should receive a diploma, who had not attended lectures upon general agriculture. This compulsory baptism of unwilling literary recipients with agricultural knowledge, afforded a subject of humorous and earnest protest during those early years. The law imposed no obligation that agriculture should be a part of the course of instruction of all students in these national schools, but only that provision should be made for instruction in agriculture and the mechanic arts. Both Mr. Cornell and President White were disappointed at the failure of their efforts to secure an able scientist and teacher as professor of agriculture, during the first three years of the history of the university. The department had been equipped with professorships of agricultural chemistry, of veterinary medicine and surgery, of botany, horticulture and arboriculture. Three courses of study were, however, arranged, a thorough and systematic course of four years leading to the degree of bachelor of science, and two abridged courses, one of three and the other of two years comprising most of the instruction immediately relating to agriculture. These courses were designed to meet the need of students who were unable to complete a full course of study, and who desired to avail themselves of a certain amount of agricultural knowledge before returning to their profession as farmers. The requisites for admission to these courses were low, as they were to all courses in the university. For admission to the freshman class in the full course, a good sound English education, including algebra to quadratics was required; but for admission to the abridged, courses an examination in elementary English was alone demanded. Facility was offered to special students to follow certain lines of work in the laboratories and gardens under the direction of the respective professors. On February 10, 1870, the Honorable George Geddes was elected professor of agriculture. He, too, had been promi-

nent in the promotion of the agricultural interests in the State, but did not accept the position. There were, however, in various colleges scientific professors of agriculture, who had won distinction for their success in developing instruction in this field, but who were not available. Those who had been nominated here were men rather of general interest in agriculture, than of special scientific attainments.

Mr. Louis Spaulding remained in connection with the agricultural department but one year. At the end of that time a practical farmer was made director of the university farm, and the professorship of agriculture remained vacant for a year, when, on June 28, 1871, Henry H. McCandless was appointed professor of agriculture. Mr. McCandless had been connected with an agricultural school at Glasnevin in Ireland. Mr. McCandless had directed the farm, or been foreman or superintendent of some portion of the agricultural interests of that institution, but was unfamiliar with the demands of American agriculture. During his period of service the south barn was erected, whose architecture has been the subject of amusing comment ever since. In 1873, Professor Isaac P. Roberts of the Iowa Agricultural College was appointed assistant-professor of agriculture. From this time, the proper development of the department and the scientific direction of the farm date. The farm was no longer cultivated simply for the production of crops, but to test certain important principles. Soon after his appointment an appropriation of one thousand dollars was made to fit up the agricultural museum. Certain illustrative material had previously been ordered by President White, among them the Rau models, a series of one hundred and eighty-seven models of plows illustrating the history, development and varied use of the plow in different ages, also a collection of cereal grains, a duplicate of the royal collection in Edinburgh which had been presented by the British government.

The subjects for which provision was made in the early history of the department were, first, the chemistry of agriculture, including the constituents and chemical agencies of the atmosphere and water, and the composition of manures.

The lectures and exercises now embraced in this course comprise the following subjects: 1. The chemistry of agriculture, including the constituents and chemical agencies of the atmosphere and of water, and the composition of manures. 2. The geology of agriculture, including the formation of soils, their chemical, physical, and economic character; their suitability to different kinds of crops, and the princi-

pal geological features of the various portions of the United States as affecting the soils and productions. 3. The physics of agriculture, including meteorology, or the laws of climate, and of light and heat, as influencing plant life. 4. The mechanics of agriculture, and their application to the various descriptions of implements and labor required on the farm. 5. The botany of agriculture, including structural botany, vegetable physiology, vegetable pathology, and a knowledge of crops cultivated for food and for technical purposes. 6. The zoology of agriculture, including the habits, diseases and treatment of live stock; the anatomy of the horse, the cow, the sheep, and other farm animals, and all branches of veterinary surgery and medicine, as well as a special consideration of insects injurious to vegetation. 7. The economics of agriculture, including the sequence of agricultural operations, the economical division of labor, rearing, feeding and handling of domestic animals, the rotation of crops, the improvement of the soil by manuring, draining and liming, farm engineering and construction, general agricultural policy, and the management of landed property.

The graduates from the department of agriculture have taken a prominent part in like work in other institutions, notably the following:

Wm. Arnon Henry, professor of agriculture in the University of Wisconsin, and director of the agricultural experiment station.

Wm. R. Lazenby, professor of horticulture in the Ohio State University.

Joseph A. Holmes, State Geologist of North Carolina.

Fred. L. Kilborne, director of the experiment stations for animal diseases in the United States department of agriculture.

Clinton De Witt Smith, professor of agriculture in the Michigan Agricultural College.

Geo. C. Watson, assistant agriculturist in the Cornell University agricultural experiment station.

Thos. L. Brunk, late professor of horticulture in the Maryland Agricultural College.

Loren P. Smith, late professor of agriculture in the Iowa Agricultural College.

Henry H. Wing, professor of animal industry and dairy husbandry in Cornell University.

Joseph R. Chamberlain, late professor of agriculture in the Agricultural College of North Carolina.

In February, 1879, the Cornell University Experiment Station was organized for the purpose of promoting agriculture by scientific experimentation and investigation. A board of control was appointed, consisting of the Faculty of Agriculture of the University, with one representative each from the State Agricultural Society, the State Grange, the State Dairymen's Association, the Western New York Farmer's Club, the Central New York Farmer's Club, the American Institute Farmer's Club, and the Ithaca Farmer's Club. Professor I. P. Roberts was elected president, and Professor C. C. Caldwell director. This experiment station seems to have been a voluntary association of the professors, who invited the co-operation of the representatives of various agricultural societies. It marks the beginning of a series of investigations whose value to the economic and scientific side of agriculture can scarcely be overestimated. It would be difficult to summarize the numerous publications of this organization. There have been investigations in the chemistry of milk, in the manufacture of dairy products, in the value of fertilizers with various crops, in the diseases of cattle, in the results of feeding, in experiments with self-sown seeds, field experiments with various crops and the various varieties of grains and grasses; experiments in the feeding of cattle, with reference to the production of milk, and also of flesh; valuable experiments in entomology, in insects injurious to vegetation; in the analysis of commercial foods and fertilizers, etc., etc. A special appropriation was made by the trustees for the use of the station for the year 1881–2, and Dr. S. B. Newbury was appointed chemist, and a second appropriation, somewhat larger, made for the following year. Upon the resignation of Dr. Newbury, Mr. F. E. Furry was appointed in his place. About this time Congress took action, which added, indirectly, to the original endowment for the support of these national schools. To meet the cost of investigation, in addition to instruction, a special appropriation was made "In order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established under direction of the college or colleges, or agricultural departments of colleges in each State or Territory, in accordance with 'the Congressional Land Grant,' a department to be known and designated as an Agricultural Experiment Station." The act of Congress provided, "That it

shall be the object and duty of said experiment stations to conduct original researches, or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping, as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States, as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories."

To meet the necessary expenses of conducting investigations and experiments, and printing and distributing the results, the sum of $15,000 per annum was appropriated to each State to be paid out of any money in the treasury proceeding from sales of public lands. It was provided that the results of investigations or experiments should be submitted annually to the governor of the State in which the college was situated, and the bulletins or reports of progress of these stations should be sent to every newspaper in the State in which the experiment station was located, and also to individuals actually engaged in farming who might request the same, so far as the means of the station permitted.

This is the important "Hatch law," under the action of which the work of the experiment station, previously established, has been continued with enlarged facilities. The department as organized did not consist simply of the special scientists who were attached to it, but all professors in the university, whose chairs were allied, have constituted the staff of investigation, and every year has seen special reports in chemistry, general botany, cryptogamic botany, entomology, agriculture, horticulture and veterinary science. The splendid equipment of the university has been thus utilized to contribute to the efficiency of the experiment station. The mere utilitarian value of these investigations has been such as to contribute to national wealth and elevate the entire work of the farm. It has been found that by using scientifically the familiar material which has always been available, the annual

value of the products of the farm may be increased, and the danger to growing fruits and grains from insects harmful to plant life, mitigated, if not overcome. The introduction of new varieties of fruits and grains and breeds of cattle and fowls has added enormously to the materials of wealth at the disposal of the farmer. Single investigations, patiently conducted in the laboratory, have resulted in discoveries, whose annual contribution to the national wealth reaches many millions. The diseases of cattle, which are more serious from the possibility of communication to human beings, have been investigated. The relation of climate, soil and locality to the profitable production of grain has received elucidation, and the use of proper plant foods has been determined by scientific analysis. Production has not been merely improved, but doubled. In the year 1892, Governor Flower called the attention of the Legislature to the advantages offered by Cornell University for conducting successfully the various State agencies for the promotion of agriculture, which had been heretofore divided and which, in his view, should be concentrated under the direction of one bureau. He said: "I think it will be conceded that more effective scientific work of this nature can be done in connection with a great educational institution, and the grouping of these now scattered departments of agriculture at one place and under one general supervision, will also be a considerable saving of expense and maintenance. Cornell University furnishes an excellent nucleus for carrying on this work, and its facilities and instructors might be utilized by the State to great advantage to agricultual interests. The State Meteorological Bureau is already located there. There is also an Agricultural Experiment Station already established and doing effective work. Moreover, the institution has established practical courses of instruction in agriculture, botany, horticulture, dairy husbandry, animal industry, poultry keeping and veterinary science. It offers free of charge and without examination to all persons who are sixteen years of age competent instruction in these subjects for one or more terms." The Governor proceeds: "All this is exactly in line with what the State is now trying to accomplish through miscellaneous agencies for the encouragement of modern methods of agriculture. The question presented is whether official efforts can be combined with these private efforts in the interests of both economy and efficiency. . . . It is entirely, however, with a view to such advantage that I would urge the concentration at Cornell University of the various agencies for

promoting scientific agriculture. To carry out this suggestion would not only enable the State to do more effective work immediately and at less expense, but would permit the State from time to time to extend its field of usefulness in this direction without the creation of new boards and new officers. The proper diffusion of knowledge with reference to the preservation law of our forests is of vital interest to the future welfare of the State and could be obtained through such an agency. The same is true of the spread of veterinary science. Public attention has only lately been called to the vast importance of this subject, not merely as it affects the value of our live stock, but because of its intimate relation to the question of public health. Modern science has demonstrated that a large proportion of human diseases is directly traceable to diseases of animals. . . . And proper regard for the health of the community will eventually demand scientific protection against dangers of this kind. . . . Our State is too thoroughly committed to the encouragement of agriculture to abandon it. State energy and public money, however, should not be frittered away by misappropriation and misdirection. The time is ripe for the adoption of some comprehensive, systematic and intelligent policy which shall assure the best results at the least expenditure." Acting in accordance with these suggestions the Legislature appropriated fifty thousand dollars for a building and its equipment for dairy husbandry. This fine and skillfully designed edifice of Ohio sandstone was erected in 1893 upon the east side of the north quadrangle of the university. It contains lecture rooms, a reading room, laboratory for general agricultural analysis, and a smaller laboratory for special investigations, and the office of the professor of dairy husbandry; also rooms for the manufacture of butter and cheese and also storage rooms, together with a steam engine for furnishing the requisite power to be employed.

The university has recognized fully its duty to the State. It received 990,000 acres of land, the value of which did not exceed sixty cents per acre, or a total endowment of $594,000. The annual proceeds of this sum at five per cent. interest would amount to $29,700; yet the average expenditure by Cornell University during the last ten years for purposes of agricultural instruction alone has much exceeded this amount. The expenditures in the five departments of agriculture, horticulture, botany, entomology, and veterinary science have averaged $36,762 per year for a decade. This does not include instruction in chemistry, which is a part of the Agricultural College, nor any of the expenditures

for the great Department of Mechanic Arts, which, with agriculture is a twin child of the Land Grant. Professor Bailey has outlined the future form of agricultural education. He says that the university must be taken to the people. "For the teaching of agriculture, then, we must make a new species of curriculum and some of the instruction must be given away from the university, where special needs or special equipments exist. This instruction for best results should be given partly in class room work, partly in actual laboratory practice upon a sufficient scale to demonstrate the value of the methods as farm operations, and partly upon farms and gardens in various parts of the State. Instruction by the teachers and instructors in charge must be liberally supplemented by lectures upon special topics from men who have made signal success in those directions." After citing the several proposed courses as they exist in this university, he says: "In addition to all this there should be definite instruction by means of correspondence and extension lectures, and any mature student, who desires special instruction in a particular topic, should be allowed to come and go at any time." Acting upon views like these, which expressed the judgment of the College of Agriculture, a special course of instruction extending through the winter term was introduced. Lectures presenting a rapid survey of agricultural processes with a discussion of the best materials for the farmer's profession were given. This course attracted wide attention. Young men came from the farms, practical farmers came even from without the State to listen to the most advanced scientific discussion of the raising of grain, the preparation of the soil; the subject of dairy farming; breeding; and the various questions connected with farm economy. During the first winter of 1893, in which this special course in agriculture was given, it was attended by forty-eight students. In the winter of 1893, the attendance reached sixty-five, thus vindicating at once the success of the plan, which became the means of diffusing the freshest intelligence in agricultural communities throughout the State. Attention has been called also to the importance of new departments of study such as forestry, floriculture, including in its practice twenty thousand people with an annual value of over twenty-six million of dollars, etc.

The Department of Horticulture was reorganized upon its present basis in 1888, upon the establishment of the National Experiment Station. At that time Professor L. H. Bailey, who held the chair of horticulture and landscape gardening in the Michigan Agricultural

College, was selected to inaugurate the new department. This horticultural department is dual in its character, its energies being divided systematically between experiment and teaching. The title of the chair in the university is General and Experimental Horticulture, and it was probably the first full professorship devoted solely to horticulture in any American university, and probably the first in any academic institution in the country. Ordinarily, landscape gardening, botany or entomology are associated with the subject. Practically, however, the chair now includes landscape gardening, which is taught to students in architecture and agriculture.

The horticultural department is organized upon an entirely different basis from any like department in the country. In teaching, its object is to place horticulture upon much the same basis as those sciences which are generally recognized as elements in a liberal education, rather than to make it a purely technical course or an academic apprenticeship to a profession. In experimentation, the object is also rather to monograph certain subjects than to attempt any general tests of varieties of plants, or to raise a general and miscellaneous collection. Cultivated plants, because of their immense variations and great numbers of species, afford one of the readiest means of studying and understanding the fundamental problems of the evolution of the organic world; and this phase of the subject, which elsewhere in America is practically untouched, is here extended into a special course of study. Facilities, are, of course, fully given for the acquirement of the immediately practical arts of horticulture; and greenhouses, gardens and orchards are maintained for this purpose. The forcing-houses comprise about 9,000 square feet of glass, and the grounds about twenty acres, of various soils and exposures.

Although the department of horticulture was formally established in 1888, instruction did not begin until the opening of 1889, owing to the absence of Professor Bailey in Europe. There was then no horticultural equipment of any kind at the university, not even a growing orchard. Results up to this time, therefore, have not been great. There has been an earnest body of students from the first, however, largely due to the fact that all the horticultural courses are elective. Amongst the students from the department who have already assumed prominent responsibilities, are the following: W M. Munson, professor of horticulture in the Agricultural College of Maine; C. W. Mathews, professor of horticulture and botany in the University of Kentucky;

F. W. Rane, professor of horticulture and agriculture in the University of West Virginia; L. C. Corbett, professor of horticulture and forestry in the Agricultural College of South Dakota; F. W. Card, professor of horticulture in the University of Nebraska; H. L. Hutt, professor of horticulture in the Agricultural College of Ontario; F. H. Burnette, horticulturist to the Experiment Station, Baton Rouge, Louisiana; W. E. Britton, assistant in the Experiment Station, New Haven, Connecticut; and E. G. Lodeman, instructor in horticulture and assistant-horticulturist to the Experiment Station, Cornell University.

Twenty-six separate bulletins have been issued from the Experiment Station by the horticultural department, beside thirty-nine articles in general bulletins. The most important of these bulletins are monographs on certain groups of plants, as the native plums and cherries, Japanese plums, dewberries, mulberries, egg-plants, etc. The experiments upon the influence of the electric light upon vegetation, which have been farther extended here than elsewhere in the world, have also been prominent contributions.

VETERINARY SCIENCE.

The Veterinary Department of Cornell University was organized in 1868 as a division of agricultural education, which was imperatively prescribed in the Land Grant Act. This early recognition of veterinary science was doubtless largely due to the personal interest taken in the subject by the founder, who appreciated the culture of the soil as the foundation of all solid national prosperity, and the multiplication and improvement of farm animals as the basis of a permanent fertility of the land. He had already shown his faith by his works by gathering at his farm a valuable herd of imported short-horn cattle, a flock of Southdown sheep and an Arabian stallion—a representative of that race from which all that is excellent in the equine family has been derived.

For the first year the work of the veterinary professor was confined to the delivery of a course of lectures on anatomy, physiology and hygiene, dietetics, breeding, veterinary medicine and surgery. Attention was also given to such clinical instruction as was afforded by the presentation of animals for treatment. President White, however, early expressed his intention of securing a fully equipped veterinary college, and in the second academic year (1869-70), at the urgent re-

quest of several students, special classes in veterinary anatomy, physiology and hygiene were begun, supplemented later by others in the science of pathology, the practice of medicine and surgery and the various cognate subjects that go to make up a professional education.

Of the students that pursued these special courses, a number entered veterinary schools elsewhere, where they could secure a degree at an earlier date; others entered medical schools and some devoted themselves to other departments of science. Representatives of these special classes are found to-day teaching in veterinary, medical and other colleges. Four only secured the Cornell degree in veterinary medicine, and of these, three are now employed in the Bureau of Animal Industry at Washington; one, for a period of ten years, as chief, and the other two as valued co-workers in the field of veterinary sanitary science. The work of these students, as published in the yearly reports of the bureau, reflect the highest credit on their alma mater, and on their own scientific devotion and acumen. Dr. Salmon, chief of the bureau, has served four years as alumni trustee in Cornell University.

As time passed without any material addition to the equipment, it became only too plain that to maintain the semblance of a veterinary school with existing means, and to grant degrees, was unfair to all concerned, institution, teacher and students, and in the absence of any immediate prospect of an adequate equipment, it was judged better to refuse all students who came with the object of obtaining a veterinary degree. For a number of years, therefore, the veterinary department has been remanded to the position which it occupied in the first year of the university, as a simple chair in the College of Agriculture.

In connection with the failure of the department to develop into a veterinary college, it should be stated that the executive committee twice appropriated the sum of $10,000 to construct a veterinary building, but as no suitable site could be agreed upon, the appropriation lapsed, and veterinary instruction is still given in connection with a small room for a museum and the use of a lecture room devoted, in the main, to another science.

But if we have failed in the first twenty-five years of the institution to furnish a veterinary college, the chair has not been without influence upon the State and Nation apart from the instruction furnished to students. Since 1869 the veterinary professor has been consulting veterinarian to the New York State Agricultural Society, and, besides attendance at the State fairs and examination of animals on exhibition,

he has contributed at intervals to the Transactions of the Society, some of which contributions have been translated and republished in Europe. In 1878 he was appointed by Governor Robinson as veterinary counsel in dealing with the lung plague of cattle in the State of New York. In 1881 he was appointed chairman of the United States Treasury Cattle Commission, and prepared three yearly reports on the restriction and suppression of epizootics, together with a number of lesser reports on particular outbreaks of contagious and other animal diseases. As a member of this commission he superintended the location, erection and starting of the cattle quarantine stations at the ports of Portland, Boston, New York and Baltimore, which have been conducted by the Department of Agriculture since the formation of the Bureau of Animal Industry in 1884. In 1883 he represented the United States Department of Agriculture at the International Veterinary Congress at Brussels, Belgium, and embodied in a paper the deliberations and resolutions of that body for the report of the Department of Agriculture of that year. To this was appended a report on the veterinary colleges of Europe. In 1885 he was appointed by the governor as State veterinarian and served in that capacity until called in 1887 by the United States Department of Agriculture to direct the work for the extinction of the lung plague in cattle in Illinois. Having accomplished this object, and having been granted a year's leave of absence by the university, he went successively to Baltimore, Philadelphia and New York to assist in the organization of the work for the extinction of this plague in Maryland, Pennsylvania, New Jersey and New York. In this latter State, he remained in charge of the work, in the double capacity of agent of the governor and veterinary superintendent for the United States Department of Agriculture, until the fall of 1888, when he resigned to resume his university duties. The sanitary work was, however, continued on the same lines, and in three years the continent was rid of the lung plague in cattle, which it had harbored for forty years, at a loss in its exports alone of $2,000,000 per annum.

Beside these official services the incumbent of the veterinary chair has contributed largely to educate the public on veterinary medicine and surgery, and veterinary sanitary matters. His Farmer's Veterinary Adviser, which has been used as a text book in many agricultural colleges, has reached its 10th edition and has been republished in Canada and England. For years he was a constant contributer to the New York Tribune, The Live Stock Journal, The Breeders' Gazette,

and others papers, and a number of his public lectures have been published in the transactions of different societies. As contributions to standard works may be named: Articles on Anthrax and Glanders in Ziemssen's "Cyclopedia of Medicine;" on Veterinary Science in the American edition of the "Encyclopedia Britannica;" on Rabies, Anthrax and Glanders in Pepper's "System of Medicine by American Authors;" on Horse Training in Appleton's "Cyclopedia;" and on Rabies, Anthrax, Actinomycosis and Glanders in the "American System of Medicine."

This work has not been without its influence in preparing the public mind for the appreciation and fostering of veterinary science and especially of veterinary sanitary science. The extinction of one animal plague has demontrated the possibility and economy of stamping out other animal plagues dependent like that on a pure parasitic infection. The work of Pasteur and his followers in producing germs of diminished potency, capable of producing non-fatal forms of a given plague, giving immunity from the more destructive forms, has shown how science may abolish the mortality of diseases which still continue to exist. The still more important fact, to which the Cornell veterinary professor has contributed by his experiments with swine plague, anthrax and rabies, that the sterilized chemical poisons, produced by the microbes of a self-limiting disease, can be used on the susceptible animal to produce immunity from that disease, opens a way to do away with the mortality of a disease, though the germs still exist in the locality. The use of antitoxins, produced in the system of an immunized animal, of protective serums, and of protective extracts of different organs to cure an infected subject or immunize a susceptible one, though less familiar to the general public, is becoming so with the advanced members of the medical fraternity, and through them tends to reach the people at large. The use of the chemical products of the germs as a means of diagnosis of occult forms of disease (tuberculosis, glanders) opens a way for the discovery and extinction of cases of disease which would heretofore have escaped the most skillful inspection. The source of tuberculosis in our herds may be completely removed, by the aid of such means of diagnosis, and the production of a safe and efficient product for such diagnosis is the duty of a veterinary institution. So, too, with the production of other sterilized disease poisons, of protective and curative antitoxins, serums, and animal extracts. Further, the investigation of the composition of such disease-poisons and

of their appropriate antidotes is the natural work of such institutions. The more this field is studied, the wider its possibilities appear, and to those who already know something of the subject, the demand for investigation becomes more and more imperative. At the present moment the all but universal interest in the tuberculosis of cattle and its conveyance to man through meat and milk, creates a demand for veterinary supervision of our herds, and of veterinarians sufficiently well educated in bacteriology, epidemiology and sanitation to be entrusted with the extinction of the disease in animals. Hence the latest movement in reference to our veterinary department has been the appropriation by the Legislature of fifty thousand dollars as the first instalment toward the building and equipment of a Veterinary College in connection with Cornell University. If this is followed up in a manner becoming to the great State of New York, we may hope for a center of education and investigation which will furnish this and other States with accomplished men, equipped not only to deal with animal plagues, but with every other disease and injury of domestic animals, and with the whole subject of their improvement and hygiene. To do justice to the subject will demand a liberal outlay, first for veterinary education and second for veterinary sanitary work throughout the State, and the aroused public sentiment may be trusted to carry this out. What was impossible twenty-five years ago, though no less necessary and no less imperative in the estimation of those of us who know the field, has become not only possible but a public demand, which must be supplied at no distant date. The province of this work is admirably expressed in a review of Professor Law's bulletin on tuberculosis: "Two enormous tasks are naturally presented to the State and to economists for solution One is that of exterminating all tuberculosis by means of test examinations of the animals; the other is the thorough inspection at the abattoirs of every animal slaughtered for food, and the rejection of all animals that are in the slightest degree infected.

"The difficulty and expense attending such work will be at first very great, but it seems to us that the course to be pursued is a plain one. Tuberculosis kills one-twelfth of the population and maims many more. The most potent and serious source of danger is in the animals that supply us with milk and meat. We do not hesitate to spend millions on a navy and army that are to be used only against possible future enemies. Why should we hesitate to spend still more on an enemy which is real and which is constantly assailing us?"

These are truly "enormous tasks," but they are only the beginning of the work that looms up before the veterinary college of the future. The State that will furnish a college equal to the demands of the present day and of the new era now dawning, will deserve well of the nation and of humanity. Colleges that have been conducted as private corporations, have in some cases striven nobly and have accomplished much, but their day is past and the eve of the twentieth century demands an institution in keeping with the rapidly growing knowledge of the day, and with the uses to which such knowledge must now be applied.

XVII.

THE DEPARTMENT OF ARCHITECTURE.

Among the professorships proposed by Mr. White in the organization of the university, was a professorship of architecture. Attention had already been called to the great need in this country of scientific instruction in this important branch. Professor William B. Rogers, to whom, we may perhaps say, the Institute of Technology in Boston primarily owes its existence, in an address on the "Objects and plan of an Institute of Technology proposed to be established in Boston," published in 1860, had presented an eloquent plea for the organization of a Society of Arts and an Industrial Museum, and also for a School of Industrial Science and Art. He embodied in the plan of the Massachusetts Institute of Technology a course in architecture. Seldom have the beginnings of an institution been guided by a higher scientific wisdom and experience than in this case. Its foundation enlisted many of the most intelligent and progressive scholars in Boston, and all the discussions connected with the establishment of this school show an admirable mastery of the history of industrial education abroad, as well as a clear grasp of the demands of such an institution in America. This department of instruction went into operation in the Institute in 1865. President Barnard, that sagacious educator and noble man, whose services as an investigator rank with his great merit in advancing the interests of Columbia College, of which he had become president two years before, said in his annual report presented

June 4, 1866: "There is no country in the world in which building in a style of costly magnificence is more constantly going on than this; and yet, in the whole country there does not exist a school of scientific architecture." President White, in his lectures upon the history of culture, had naturally become interested in the fine arts as illustrating intellectual development and typifying national character. He admired the English colleges with their picturesque quadrangles and cloister-like appearance; their halls and chapels as miracles in the history of English art; and it was with something of the feeling derived from the contemplation of these buildings, having their origin in the ecclesiastical foundations of English culture, that he sought to transplant their form to this country, to a new atmosphere, but with a suggestion of the external glory and traditions of their home. This accounts for the attempted arrangement of the university buildings in the form of quadrangles. There seems to have been a suggestion at first, that the department of architecture should be linked with that of civil engineering, for we find it so grouped in the original announcements of the courses of study. It was, however, impossible to realize at once President White's broad conception of the university as a center of all departments of industrial science, and it was not until September 18, 1871, that the Reverend Charles Babcock was elected professor of architecture. Professor Babcock was a graduate of Union College, and had been associated with that brilliant architect, Richard Upjohn, in architectural work in New York. To a mind loving art in every form he added practical skill as a designer and draftsman. Ecclesiastical architecture he studied with especial fondness. Upon entering upon his duties, there was little equipment available for specific instruction in his department. Models, plans and designs, which are indispensable for training in drawing, and as an illustration of styles and historical periods in art, were lacking. One valuable feature, however, for his work was available in a collection of splendid works upon the history of architecture which had constituted a part of President White's private library, and which he offered to present to the university in consideration of the acquisition of a mathematical library, were at the disposal of the department of architecture. Technical instruction in physics, in chemistry, in mechanics and mathematics, and to a limited extent in drawing, was supplied by associated departments of instruction; but the entire work of teaching architecture devolved at the beginning upon one professor. Not only was it necessary for him

to give courses of lectures upon the history of classical, Byzantine, Romanesque, Gothic, Renaissance and later architecture, and the history of its development in various countries, but to discuss the question of the materials of construction, and the designing of public and private buildings, and to give instruction in drawing in all the forms essential to the architect. No department, whose full equipment demands large appropriations for architectural models, has so grown, with limited support, as the department of architecture. It now ranks as one of the three great technical schools of the university. It was not until 1876 that the department was enlarged by the appointment of a single instructor in architectural drawing. In 1880 Charles Francis Osborne was made instructor in architecture, and in the following year assistant, and later associate professor of architecture. The first accommodations for the architectural department were found in a single room on the second floor of the west division of Sibley College. Later it occupied two rooms in McGraw Hall; it was then transferred to Morrill Hall, north end, where it occupied the second and third floors. It was finally removed to Lincoln Hall, to accommodations that seemed ample when the building was erected, but the great increase in numbers has caused instruction to be given the present year to nearly one hundred students in rooms originally planned for fifty. With ample museum accommodations, the collections in this department would soon become among the most valuable in the university.

XVIII

THE DEPARTMENT OF CIVIL ENGINEERING.

The first professor chosen to this chair was William Charles Cleveland. Professor Cleveland was a graduate of the Lawrence Scientific School, a scholar accomplished in several departments of science, an excellent botanist and geologist, gifted in his own profession and an enthusiastic and inspiring teacher. He left his impress upon the students whom he taught during the first four years of the history of the university. The Era of that day pays a beautiful and pathetic tribute to his memory. It says: "How shall we adequately describe him, claiming as he did to a degree rare as it was beautiful, veneration as a

professor, esteem and profound respect as a friend? Of his scholastic acquirements we need not speak. The extent of his studies was only equaled by his thoroughness. An erudite mathematician, an ardent geologist, thoroughly conversant with literature, language and science in almost every department and proficient in sculpture and music, he was indeed a rare example of thoroughness and widely diversified scholarship. He aimed to make his department at Cornell the best of its kind in the country, and he succeeded to a wonderful degree." President White said of him: "He was a builder, and his ambition was nothing less than to build a great college of engineering which should be known for good throughout the United States, and be a tower of strength for the university. In all this he planned most sagaciously and labored most devotedly. Against all persuasion to lower the standard of scholarship in his department, he insisted on holding it high, maintaining that this was the only policy which would give it permanent success. The originality of his methods and the extent of his knowledge was a constant surprise to his associates. On the practical side of his department he was admirable. In the construction of models for illustration he showed very great skill, nor was his skill entirely mechanical or mathematical; he showed a capacity for work in art, which, if carried out, would have certainly brought him high reputation. The sketching of a landscape that pleased him, the modeling of the bust of a brother professor whom he loved, these were pastimes with him." Upon the death of Professor Cleveland, Professor E. A. Fuertes, a graduate of the Troy Polytechnic Institute in this country, but who had studied with distinction in several foreign schools, was called to be his successor. Professor Fuertes was a scholar of thorough literary as well as scientific training. He had been the engineer in charge of the Nicaragua survey, and had had wide experience as a consulting engineer in the erection of important municipal works in New York. The College of Civil Engineering began with the establishment of a department of engineering, which originally bore the name of engineering and architecture. Like every other branch of the university at that time, the engineering work was still in a primordial or chaotic condition. A vast amount of well directed effort had outlined the work in certain directions, which waited to assume useful shape, when Professor Cleveland was cut down, before he could fully organize his evident intentions with reference to the development of this school. The quarters of the department were in a single room

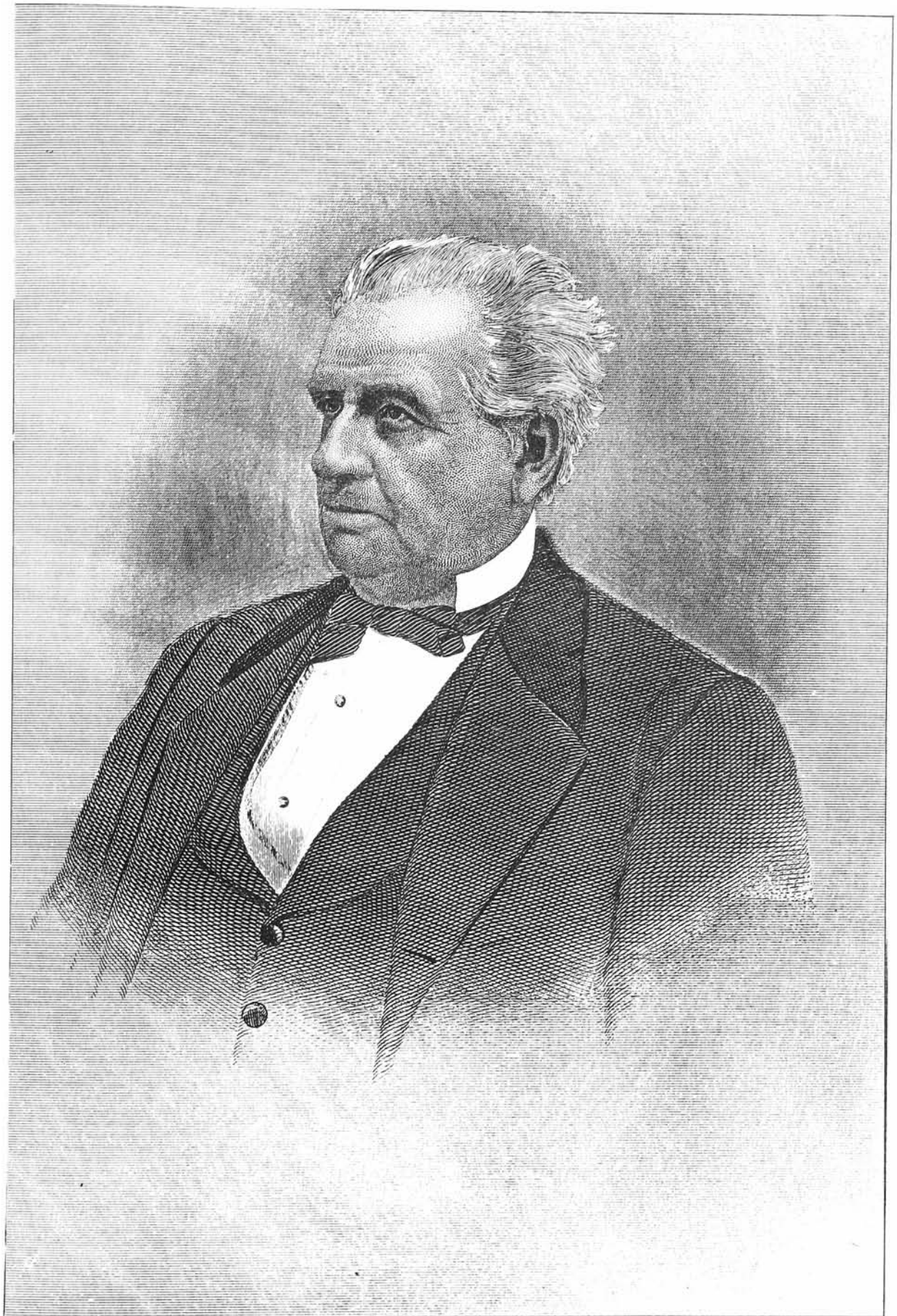
about thirty feet long by fifteen feet wide, and all its equipment found ample space under the stairs, in a corner of the same room, leading to a garret. The organization of the present college is the outgrowth of what has been considered the duty of raising both the social and professional standing of the engineers of this country. Progress was at first slow, owing to lack of resources and the absence, at the time, in the university of the proper atmosphere, in which alone technical and professional studies can be prosecuted. The difficulty of engrafting upon our curriculum certain needed studies was greatly enhanced by the lack of that ready sympathy, which is not less influential than the lack of material resources. In the course of time, as the university broadened in every direction, it has been possible to carry out the evident purposes of the organizer of the school, viz., that catholicity of sympathy and appreciation of intellectual activity in every field must be an all-prevading purpose in any institution of learning. The plain wooden building bearing the name of the Chemical Laboratory, which, soon after the opening of the second term, furnished scant accommodation for the departments of chemistry, physics, civil and mechanical engineering, botany and veterinary science, and even general store rooms for the university, was in process of time, vacated, as better accommodations were opened to them elsewhere, and the entire building was devoted to civil engineering. The growth of the department was maintained in the depressing years which followed the financial crisis of 1873. The trustees suddenly changed the cautious policy which they had pursued as regards appropriations. The need of a vigorous development and of wise and enthusiastic leadership was felt throughout the university. The trustees felt that to inspire new life into all departments, additional appropriations must be made, even if the capital of the university was temporarily impaired. At a single meeting, December 18, 1880, one hundred thousand dollars were appropriated to equip certain departments in the university. In the summer of 1880, the dean of the department purchased in Europe the nucleus of the present equipment, which has been steadily increased until it has no equal in this country, and, considering the mutual relations of the entire equipment in the university, it can be safely said that it has no equal in the world. The single teacher in 1873, upon whom devolved all the professional and other work of the college, has been supplanted to-day by fifteen men who dedicate their entire lives to the subdivided labor submitted to their charge, while the advance

in other departments of the university, supplements, in extra-professional studies, the distinctive work of the College of Civil Engineering. Many graduates have become eminent as authors, investigators or engineers, not only in the material industrialism of the country, but also in the development of transcendental engineering and cognate sciences. The proportion of graduates of this department who have charge of important works in the field of engineering, exceeds possibly that of any other institution. The striking feature of the educational aims of the college has been to impress upon its graduates the habit of well-controlled self-reliance, to which in no small degree is due the orderly and industrious qualities which they manifest, and without which success would be impossible. The theory has been to regulate instruction by the needs of the country, which are entirely different and, in some cases, even incompatible with those of older societies. To this is due the progress in professional preferment characteristic of our graduates. They are educated for the purposes for which they are needed. The effort to render useful our educational theories has given rise to novelties in method for which Cornell can claim priority of inception. Prominent among these is a feature now universally adopted, not only in the schools of this country, but in Canada, and is gaining favor in Europe, viz., that of teaching engineering in laboratories, a method which appeared for the first time some eighteen years since in the announcement of this work.

XIX.

THE DEPARTMENT OF MECHANIC ARTS.

Provision was made upon the opening of the university for a department of mechanic arts as required by the charter and by the Land Grant Act, by the election of Professor John L. Morris, a graduate of Union College as professor of practical mechanics and director of the shops. Professor Morris, in addition to special training under Professor William L. Gillespie, a graduate of West Point, and one of the first professors of civil engineering in this country, and Professor Isaac W. Jackson whose reputation in the departments of mathematics and of natural philosophy made him one of the most prominent of the



Engd by H.B. Hall & Sons, New York.

Hiram Sibley

earlier scholars in that department, had had a valuable experience in practical engineering. One of the earliest chairs of civil engineering in this country had been established in Union College. Although this department was one of the twin departments which gave rise to the Land Grant, no preparation had been made for its equipment until after the opening of the university. There were no shops, laboratories, drafting rooms, or models of machinery, to prepare this important department for successful work. For the first two terms, so little provision was afforded for instruction, that the attention of the professor was devoted entirely to instruction in mathematics, and, for a time, in physics. A single room in Morrill Hall was shared in company with other professors. In the late winter of 1869, when the chemical laboratory was finished, it became the temporary home of the department of mechanic arts, in connection with other departments, but it was not until the last term of the first year that initial instruction in drafting and designing was given.

THE SIBLEY COLLEGE OF MECHANICAL ENGINEERING.

Sibley College, so named in honor of its founder, the Hon. Hiram Sibley, of Rochester, N. Y., since deceased, is the school of mechanical engineering and of the mechanic arts, founded as a department of Cornell University in compliance with the law of Congress and the charter to carry into effect the requirements of the law establishing the university. The college dates from the year 1870, in which year Mr. Sibley began a series of contributions to the treasury of the university which have culminated in this great institution. The first building was begun in the summer of that year, a stone structure 100 feet in length, forty feet in width and three stories high, in which not only the college of engineering was established, but other departments of the university, including the printing establishment and the department of botany. This building was lengthened in 1884–5, and an extensive line of shops added, making the main building 165 feet in length. The workshops, which were one story in height, embraced a similar floor area. Attached to the latter, was a janitor's house and suitable store rooms and toilet rooms. After the death of the founder, his son, Mr. Hiram W. Sibley, succeeded to the trusteeship vacated by the father, and to the guardianship of the college. The last addition made by the founder to the buildings of the college was an extension of the line of workshops

erected in 1888, consisting of a two-story structure, fifty feet in length, in which were placed, for the time, the equipments and apparatus of the laboratory of experimental engineering and research. The son continued his father's work, by the erection, in 1893–4, of a second main building, 165 feet long, 50 feet in width and three stories high, with a lofty and well-lighted basement; following a plan which had been prepared by the architect, for the founder, as a guide in further extensions, and which he approved only a brief period before his death.

The plan thus provided embraces the two large buildings described, each of which constitutes a wing of the contemplated structure; the space between being occupied by a central mass surmounted by a dome, and containing a large auditorium and the offices of administration. At either end of the front thus constructed, it was also proposed to erect, when needed, flanking structures, making, with the front and the shop line in the rear, a quadrangle of something like 500 feet in total length on the front, with a depth of from one hundred to one hundred and fifty feet. The plan is exceedingly imposing, and was prepared on the assumption that it would accommodate 1,000 students, receiving professional instruction in engineering to the extent and in the manner now practiced. As now arranged, the first of the two main buildings is occupied by the departments of electrical engineering, and of art and industrial drawing; the former using the lower floor, the latter the upper floors. The eastern wing affords drawing rooms for the Graduate School of Marine Engineering, and for various other drawing classes, and the needed lecture and class rooms. Its lower floor is occupied principally by the museums of the college, which cover a space of about 7,000 square feet. The basement is assigned to the lubricant-testing and hydraulic work of the department of experimental engineering.

The accounts of Mr. Sibley show a total of disbursements in behalf of the Sibley College of Cornell University amounting to above $150,000. These include the cost of the building erected in 1870–71, the first in the Sibley College group, $36,160; a complete set of the models of kinematic combinations and mechanical movements by Dr. Reuleaux, $8,000, in 1882; an endowment fund for the professorship of mechanic arts, in 1885, of $50,000; buildings added in 1885–88, $63,367.44; total, $157,528.38; and the sum of $20,000 given to the university in 1873, and later devoted to the establishment of scholarships and fellowships, thus making a total of $177,528.38. The cost of the

second main building was $54,000, and the total expenditures to 1894, inclusive, were thus $231,528. The university has expended, besides, about $25,000 on the buildings and accessories, $50,000 in additions to the equipment which, through the generosity of Mr. Sibley and other friends of the institution, has risen to a total value of about $150,000, making the total inventory of the college and its outfit in all departments, in 1894, about $350,000.

HIRAM SIBLEY, the founder of Sibley College, was a man of marked individuality and power of thought. His whole life abounded in incidents illustrating his originality and purposeful energy. He was, in the truest sense, a "self-made man." He was born at North Adams, Mass., February 6, 1807. He had very little opportunity for early education and left school before he was sixteen years of age. He sought to support himself in various ways, and once earned a livelihood by sawing wood for his neighbors. A shower coming up he took refuge in the shop of a shoemaker, close at hand, and while sharpening and setting his saw, watched the workmen until he was confident that he could himself make a shoe. His proposition to try was met in the same spirit by the proprietor of the shop, and his success led to his taking up the trade. Soon after this, however, he found cotton and woolen manufactures more attractive, and, when of age, had learned these various kinds of business, and had also conducted a machine shop. In 1823 he removed to Monroe county, N. Y., and settled near Rochester, where he became, in 1843, the sheriff of the county. He had previously made the acquaintance of Professor Morse and Ezra Cornell, and had assisted them in their efforts, at Washington, to secure the aid of Congress in the promotion of their plans for the introduction of the telegraph, the result of their effort being the erection of the line between Washington and Baltimore at a cost of $40,000, which sum was appropriated by Congress.

The success of the first line of telegraph led to the establishment of numerous isolated companies, which were formed with the purpose of connecting certain cities in various parts of the country. None were very successful, and Mr. Sibley saw that, to insure thoroughly satisfactory operation and financial returns, complete consolidation and the formation of a single organization covering the whole territory of the United States was essential. He had accumulated by this time a considerable property, and, securing the aid of other large capitalists, he organized the Western Union Telegraph Company, at Chicago, which

absorbed all the lines in that part of the country, and those connecting that city with New York, and, later, substantially, all the working telegraph systems of the United States. He was the first president of the consolidated organization, and, under his administration, it attained extraordinary success. His services were retained by the company for sixteen years, and the number of its offices increased in that time from 132 to about 4,000, and its capital from an original $220,000 to $40,000,000. He made himself and all his companions enormously wealthy by the enterprise. Among the large stockholders in various lines was Ezra Cornell. The assent of the latter to the consolidation of the small companies in which he was interested was only secured by Mr. Sibley with difficulty; but the participation thus obtained was very advantageous to Mr. Cornell, and resulted in the fortune which made possible the foundation of Cornell University; and Sibley College, one of its most important departments, was founded by Mr. Sibley with a part of the wealth which he had similarly acquired by this and other no less bold and far-seeing undertakings.

The whole system of telegraphy for the Eastern, Middle and Southern States having been arranged, the next step was the construction of a line crossing the continent to San Francisco. This was quickly and successfully accomplished by Mr. Sibley, without the aid or countenance of his colleagues in the directory of the Western Union; and the Pacific coast was soon covered with a network of wires, which were connected with the East by the transcontinental line. But Mr. Sibley was not yet satisfied, and proposed to carry his lines across the ocean, and to unite the Western with the Eastern Continent by a line across Alaska and Siberia, including a submarine cable across Behring Straits. The completion of the first line of cable across the Atlantic made this unnecessary; but not before Mr. Sibley had secured the privileges which he sought from the Russian government, and expended a large sum of money in beginning the work. To secure the needed concessions, Mr. Sibley went to Europe and was received with great distinction by the Czar and the imperial court. He spent some time in traveling over Europe, and returned to the United States satisfied with the success of his greatest undertaking, which now seemed assured. His loss in this enterprise was estimated at about three million dollars. Mr. Sibley retired from active participation in 1869, and became interested in farming and seed-raising on a large scale. He bought the Sullivant farm of forty thousand acres in Illinois, which he divided

into a hundred and fifty or more small farms and rented them to selected tenants, after having supplied each with good buildings and a complete system of underdrainage.

Mr. Sibley died at Rochester, July 12, 1888, at the age of eighty-one, after a short illness which terminated in apoplexy. His health had been failing for some years. He had, however, attended to business without interruption, and only laid aside the management of his vast interests at the very last. Throughout his whole later life, he was intensely interested in the promotion of the prosperity of Cornell University and of Sibley College. He attended every meeting of the Board of Trustees, of which he was a charter member, and he never hesitated to give time, thought, and pecuniary assistance when needed. At one time, when the university was greatly embarrassed by a debt of $155,000, it was relieved by a generous gift of the entire sum by Messrs. Cornell, McGraw, Sage, Sibley, and White. The money thus contributed was afterward set aside by the university as a fund for scholarship and fellowships, which bear the names of these noble benefactors.

Mr. Hiram W. Sibley, son of the founder of Sibley College, has, since his father's death, taken his place on the Board of Trustees, and in various ways has shown an affectionate pride in his father's work, and a warm interest in the welfare of the university and of the college. His effective aid rescued the college in a most critical time from serious difficulties.

The growth of the instructing corps in the department of mechanic arts, as stated in the report of Mr. James Frazer Gluck, alumni trustee in 1884, was at first very slow, corresponding to the limited means which were placed at its disposal. At its opening in 1868–69, one professor was assigned to the subject of "practical mechanics," industrial mechanics constituting a part of the title of the professor of physics. In 1872–73 an assistant professor of mechanical drawing was appointed; in 1874–75 an instructor was appointed to take charge of the machine shops. From 1869 to 1873 Mr. John Stanton Gould lectured annually on mechanics as applied to agriculture. From that time the staff remained substantially the same in number, as did also the distribution of work, fluctuating slightly, as numbers varied from year to year. It was not until 1885 that a complete reorganization of the institution, so as to constitute a complete college of mechanical engineering and the mechanic arts, was made, with a single supervising head, and a defin-

itely planned schedule of work and distinctly assigned duties for its officers.

The reorganization of Sibley College in its present form, which occurred in 1885, began with the appointment of a director whose duties and responsibilities were thus established:[1]

It is proposed to appoint a "director" who shall be the official head of that department, who shall direct the workings of the whole department, shall nominate the assistants and be held responsible for their efficiency, shall be custodian of the buildings, tools, models and apparatus of the department, and shall be held responsible for their proper use and preservation, and for the efficiency of the motive power, as well as the machinery generally; who shall make requisitions on the treasurer for funds appropriated by the trustees, whenever needed, in that college, and shall be held responsible for their expenditure, and who shall assign to all who may take part in the work of instruction of the schools included in that college, such parts of the work as he may find best for the interests and prosperity of the college and of the university, all to be subject to the approval of the president and trustees, so far as affected by, or affecting, the general policy and the controlling regulations of the university.

The director will be expected to assume the professorship of mechanical engineering, to plan and to direct that course, as above provided, and also to take such part in instruction as he may find practicable and desirable, nominating such additional assistants as may be found to be needed to make the course as complete, as creditable, and as fruitful of result as possible.

The director will be held responsible for results, and will be allowed to take such course, in the organization and administration of the internal affairs of the college, as may seem to him best calculated to secure the results aimed at by the authorities from whom he receives his powers.

The president and trustees may be relied upon to give all proper support to the director, in the administration of the college, of its schools of trade-instruction, and of mechanical engineering, and may be trusted to supply all essential material, up to the limit of financial ability consistent with the welfare of the university as a whole.

The authorities will expect the director to make proper suggestions and recommendations for the extension of the department, as opportunity may offer, and for the institution of advanced schools of special branches of mechanical engineering, as they may be called for, and as the progress of the general course of university instruction may permit.

The results of the reorganization of 1885 and its work as reconstituted were immediately seen in the increased numbers of students and in a no less rapid growth and improvement of the courses taught and the quality of the student-body. The director lectured during his first year of service, 1885-6, to a senior class numbering five men; in the second year, to fifteen; in the third, to about twenty; in the fourth, to

[1] Sibley College Reports; 1885.

thirty; in the fifth, to fifty; in the sixth, to seventy-five; in the seventh to one hundred, and growth has not yet ceased. The number of graduate students, at first an unknown feature in engineering schools, became soon an important element in the college, and in a few years forty such students were enrolled in the graduate departments as candidates for second degrees, and many in the regular undergraduate classes.

The number of regular undergraduate students enrolled as given in the university "register," for each year, has been as follows:

	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94
Enrolled	63	106	168	220	283	369	428	501	546	556
Graduated		5[1]	18	22	32	54	52	90	107	—

The number of graduate students has also gradually risen to about forty and the number of "special" students, formerly comparatively numerous, has fallen to an insignificant number. The total enrollment for the year 1893-4 has thus been over 600 for Sibley College alone, and about 1800 for the university as a whole; Sibley College having registered about one-third.

Mr. Cornell's ambition was declared in the now famous saying, "I would found an institution where any person may find instruction in any study;" he hoped that the time would come, as he sometimes said to his friends, when a great university would cover his homestead farm with its buildings, and thousands of students flock to its halls. His personal interest was mainly directed to the technical side of the university, though no part escaped his watchful care. He was especially interested in the establishment of workshops, in which young men should be given instruction in the use of tools, and acquire trades, and, if possible, at the same time enjoy the opportunity of supporting themselves while attending the university. The last plan did not succeed, and Cornell's manual training and trade schools have risen far above the level then assigned them, and have become schools of engineering. Whether this elevation of grade is an advantage to the State or to the nation may be an open question; but the facts above stated constitute the history of the inauguration and growth of the technical schools of Cornell University. The rate and the extent of that growth during the first dozen years of the work of the university are presented in the

[1] Until 1886, no students in electrical engineering were formally registered in Sibley College.

next table, which shows that the "leading purposes" of the institution were not at first accomplished; while the older education, which the Land Grant Act was founded to supplement, became, for a time, the principal work of the institution. During the last decade, however, the growth of the departments "related to Agriculture and the Mechanic Arts" has been rapid, and the purposes of the National Grant, and of the charter of Cornell University have been correspondingly promoted. Since 1880, the whole country has witnessed the advance in the education of the "industrial classes," which has presented the most encouraging results. Cornell University and Sibley College have done their full part in this great work, and the extension of their various departments of engineering and architecture, and of applied science has been more than commensurate with the development of the technical side of general education in the United States. This development has been quickened by the new demands of applied science, and the progress in the schools of engineering, of both public and private endowment. This progress has been especially remarkable in the profession of mechanical engineering.

The extent to which mechanical engineering has advanced as a profession, and as a learned profession, since its first establishment, distinct from civil engineering, only twenty-five years ago, will be seen on examining the following table, which table was compiled for the year 1892.[1]

GRADUATES OF PROFESSIONAL M. E. SCHOOLS, JUNE, 1892.

1 school (Sibley Coll., Cornell) had		79 graduates.[2]	
1 " (Mass. Inst. Tech.) had		61 "	
1 " (Yale, Sheffield S. S.) had		49 "	
1 " (Stevens Inst. Tech.) had		39 "	
1 " (Rose Polyt. Inst.) had		23 "	
1 " (Worc. Polyt. Inst.) had		22 "	
Total of 6 schools (average 45½ each)		273 "	
2 had 20 graduates each			40
1 had 19 graduates			19
1 had 17 graduates			17
Total of 10 largest schools			349

[1] By Mr. A. M. Wellington.

[2] The reported number is less than the actual, which was 90 in 1892, and, including students taking second degrees, 107 in 1893.

The magnitude of the outfit required by the technical school of higher grade is not always realized, even by the educator engaged in this department of education. The following is collated from the reports and inventories of the schools of applied science of Cornell University, and shows that over $300,000 have been expended by the university or given by its friends for its apparatus of instruction; and it is desirable that it should be increased to meet the needs of the increasing number of students. It is, of course, true that this equipment is useful in the university instruction of the students in the "general courses;" but the students in the engineering schools are those who mainly crowd the laboratories of pure, as well as of applied, science, and compel the collection of such immense aggregations of machinery and apparatus. The figures here given are growing at the rate of from $25,000 to $50,000 annually.

Technical library, drawings, etc	$19,000
Collections, models, etc	61,000
Surveying instruments	30,000
Chemical laboratory appliances	17,000
Physical " "	43,000
Mechanical " "	54,000
Steam-power plant	31,000
Electrical plant	31,000
Workshop appliances	29,000
Astronomical appliances	13,000
	$328,000

Should the proposed new graduate and undergraduate schools of mining, of railway work, of textiles, and of other branches of engineering be founded, not less than an average of $25,000 each will be demanded for a beginning of their collections, and the amount here given will rise to $400,000, or possibly to even $500,000, if buildings of even an inexpensive character are included. In the above instance, as in most others in the United States, the collections are made mainly by private contributions, not by purchase by either State or college.

The character of the equipment, as well as its extent, in a large technical college of the first rank, may be exhibited, perhaps, by the following inventory of the outfit of the mechanical engineering departments alone:

"The two main buildings are each one hundred and sixty feet long, fifty feet in width, and three stories in height. The workshops consist of a machine shop, a foundry, a blacksmith shop, and a wood-working shop. The forge and the foundry are in a single detached building.

Besides these, there is a building one hundred and fifty feet by forty, and two stories in height, occupied by the laboratories of experimental engineering. At the bottom of an adjacent gorge are the turbines which supply the power required for driving the machinery of the college, and the electric apparatus for lighting the campus and the buildings. The large engine and dynamo room, containing all the engines and dynamos employed in lighting the university, is adjacent to the shops, and beside the boiler-room in which are placed the boilers.

"The two principal rooms on the first floor of the main building are devoted to the purposes of a museum of illustrative apparatus, machinery, products of manufacturing, and collections exhibiting processes and methods, new inventions, forms of motors, and other collections of value in the courses of technical instruction. Here are placed a full Reuleaux collection of models of kinematic movements. Beside these are the Schroeder and other models, exhibiting parts of machinery, the construction of steam engines and other machines. In the museum are placed a large number of samples of machines constructed to illustrate special forms and methods of manufacture. Many machines and tools have been made in the shops. The lecture rooms are each supplied with a collection of materials, drawings, models and machines, especially adapted to the wants of the lecturer. The course of instruction is illustrated by a collection of steam-engines, gas and vapor engines, water-wheels and other motors, models and drawings of every standard or historical form of prime mover, of parts of machines, and of completed machinery.

"The collections of the department of drawing also include a large variety of studies of natural and conventional forms, shaded and in outline, geometrical models, casts and illustrations of historical ornament.

"The workshops are supplied with machine-tools, including lathes, and hand and bench tools sufficient to meet the wants of two hundred students of the first year, in wood-working; in the foundry and forge, all needed tools for a class of one hundred and fifty in the second year; in the machine shop, machine tools from the best builders, and a great variety of special and hand tools, which are sufficient for a class of one hundred and fifty in the third year, and a hundred and twenty-five seniors and graduate students.

"The department of experimental engineering possesses experimental engines and boilers, and other heat motors, such as air and gas engines,

and is well supplied with testing machines in great number and variety, as well as the apparatus required, as indicators, dynamometers, etc., for determining the efficiency of engines.

"The mechanical laboratories constitute the department of demonstration and experimental research, in which not only instruction but investigation is conducted. They are principally located in an annex to the college main building, and occupy its entire space. They are supplied with the apparatus for experimental work in the determination of power and efficiency of motors, and of the turbines driving the machinery of the establishment; with the boiler-testing plant and instruments; and with many machines, of the various standard types, for testing the strength of metals, including one each of the common type, of 50,100, and 150 tons capacity, and one Emery testing machine; all of great accuracy and delicacy. Numerous steam engines and boilers, air and gas engines, several kinds of dynamometers, lubricant-testing machines, standard pressure-gauges and a large collection of steam-engine indicators and other apparatus and instruments of precision employed by the engineer in such researches as he is called upon to make, are collected here.

"Apparatus is provided for delicate testing, for the exact study and determination of alternate current energy, for conductivity and insulation tests, and for the determination of the properties of the magnetic materials. Means for making quantitative measurements are supplied through a well-equipped photometer room for the photometry of arc and incandescent lamps; several Brackett 'cradle' dynamometers for efficiency tests of dynamos and motors; a rheostat of German silver wire, for a working resistance, with a capacity ranging from twenty-two hundred ohms and four ampères, to four-tenths of an ohm and three hundred ampères."

The mechanical laboratory, the department of research of the modern American engineering school, has come to be so important and essential a division of the most successful schools and colleges of engineering that an article should be specially devoted to this subject. Although not recent in origin or absolutely modern in form and purpose, it is only within a comparatively short time, that it has taken its proper place in the organization of these schools and commenced that work which has come, to-day, to be recognized by engineers and educators alike to be the most fruitful of result, the most beneficial to the student, and the most productive of both knowledge and discipline, of all the

methods of instruction and of study and practice forming parts of the contemporary scheme of professional engineering instruction.

The Sibley College laboratory of mechanical engineering was organized by Dr. Thurston in 1885, on first assuming the duties of director of Sibley College. Improvements in the plant were made from time to time, and in 1890 the laboratory was organized as one of the departments of the college. The time devoted by the students to laboratory work was then very much increased, and a large sum of money was devoted to the improvement of the equipment.

In this laboratory are included special laboratories for the investigation of the following subjects: Strength of materials; hydraulics and hydraulic motors; friction and lubrification; transmission of power, dynamometers; steam engines, hot-air and gas engines; air-compressing machinery, rock drills; heating and ventilating machinery; elevators and mining machinery.

While these laboratories are largely devoted to investigation and research, they are also of great value educationally, as they afford the best possible opportunity of illustrating and applying the principles advanced in the class room. They thus tend to fix in mind and show the application of what would otherwise be regarded by the student as abstract and without practical value. The laboratories also give valuable instruction regarding methods of testing, and serve to train skilled observers for accurate investigation later. Incidentally they afford students an opportunity, and about the only opportunity they can obtain, for practically handling and directing the operations of various machines or engines, and such knowledge is of great service in after-life. The investigations which can be carried on in such a laboratory may be as varied in character as the scope of the course or extent of the equipment will permit, and are not likely to be limited by any consideration of the course of instruction laid down in the catalogue.

The laboratory is equipped for commercial testing as well as for educational purposes. While commercial testing is primarily of value only to the persons for whom the test is made, incidentally it is found of great value educationally, as giving variety to the laboratory investigation, and showing the practical nature and the usefulness of experimental work. Such income as may be obtained from that work is largely or entirely devoted to extending the laboratory plant, or in scientific research.

The laboratory for strength of materials has in its equipment one Emery testing machine of 200,000 pounds capacity, of especially fine workmanship, and one of 60,000 pounds from the Yale & Towne Co., especially constructed for the purpose of standardizing Emery machines.

The hydraulic laboratory is equipped with stationary and portable weirs, nozzles, and Venturi tubes, by means of which the flow of water can be measured. The hydraulic machines to which the students have access for experimental purposes consist of several small water motors, centrifugal and rotary pumps, and hydraulic ram, in rooms of the laboratory, and in addition they have access to the hydraulic machinery used for power purposes and for the water works.

The laboratory for the measurement of friction is equipped with four of Thurston's machines for the determination of the coefficient of friction, and one of Bouldt's oil-testing machines for cylinder oils, and apparatus for the measurements of the viscosity, chilling points, and flashing points of various oils.

The laboratory for the measurement of transmitted power is supplied with several dynamometers, having a capacity ranging from one-half to 160 horse power each.

For experiments with compressed air the laboratory is supplied with two air compressors, a Westinghouse air brake outfit, and a rock drill. With heating and ventilating apparatus a number of experiments have been made, but no systematic course has been laid out.

The laboratory of steam engineering is the most important in principal use, from its relation to the motive power. This is located in two rooms remote from the principal laboratory building, but adjacent to the boiler plant which supplies the university with both heat and power.

The "experimental engine" is a triple-expansion engine with Corliss valve gear. The engine will give about 200 horse power and is so arranged that it can be run as a simple engine, as triple-expansion or compound, condensing or non-condensing, with or without steam jackets as required. The engine occupies with its accessories a floor space of 36 by 40 feet.

It is this latest field of engineering work which is to be occupied by the graduates of Sibley College and its rivals throughout the world. The course of instruction commences where the high school instruction in the higher mathematics and in the physical sciences ends, and college work in those subjects begins. It includes so much of the most advanced mathematics, and of physics and chemistry, as are required

for application in professional practice, and adds to these the purely professional instruction which constitutes the formal part of the work of training the young engineer for entrance upon the duties of his chosen vocation. Meantime, also, the several mechanic arts are taught to the young engineer as systematically and completely as is possible in the small amount of time available in the midst of his studies. He learns the art of woodworking by a series of graded and carefully planned exercises, each leading from a simpler and easier to a more intricate and difficult problem in the use of the tools of his trade, and, in a marvelously short time, becomes, if he has the genius for it (without which he should never enter an engineering school), a good carpenter and patternmaker. He enters the foundry or the blacksmith shop in his second year, and learns there the best methods of molding, or of blacksmithing and toolmaking, and leaves with two additional trades more or less completely at his command. In many cases, very admirable, often beautiful, work is performed by these novices after a wonderfully short period of practice. Leaving the blacksmith shop and the foundry, the student concludes his course of trade instruction in the machine shop, where he is given, first, as in the other trades, a series of graded exercises, which gradually lead up to the most difficult and exacting tests of skill known to the skilled mechanic, and, once conquered, the young man is able to use any tool, and with it do any appropriate work. He is then allowed to test his powers in the construction of steam engines, lathes, and other machine tools, and on important work of construction of all kinds. Meantime, and throughout the whole four years of his college course, he receives an uninterrupted line of instruction and practice in the draughting room, and learns there to employ freehand drawing in making the sketches from which he is taught to make later finished drawings. He is also, at the same time, and in parallel courses of lectures and text-book work, instructed in the principles of the resistance of materials, and their application in the proportioning of parts and of completed machines, in such a manner that he can, if he makes the most of his opportunities, easily and correctly plan any form of machine, the purpose of which is prescribed. The student in Sibley College is thus made competent to earn a living at any one of five different trades, and is given a professional, scientific, and practical education. At the same time he is prepared to enter upon the practice of one of the most lucrative of professions, and to direct intelligently every operation which is involved in the carrying out of his plans.

Sibley College has for its main purpose the education of young men in the scientific branches, upon which the constructive professions, and especially that of mechanical engineering in all its many departments, are based. Engineering, as a profession, has for its field of action the construction of all forms of structures and machinery, and is divided, as it becomes more and more specialized, into many departments. A century ago, engineers like Smeaton, Telford, and their contemporaries, were expected to be prepared to give advice in all engineering lines, to make designs, to supervise the construction of docks and canals, of steam engines and factories alike, and to have perfect familiarity with all their details.

In the early part of the century the builder of public works, of the recently instituted railways, and of roads and bridges, found it impossible to keep himself informed of the progress of the mechanic arts which had then, through the genius of Watt and others, commenced a wonderful development, and the civil engineer surrendered all the work of the construction of machinery to the mechanical engineer, retaining only stationary structures not architectural. In these later days the mechanical engineer finds the same process of specialization and of differentiation going on which divide his work into marine, railway, locomotive, electrical and mill engineering, the construction of textile machinery, and possibly still others; all of which are simply subdivisions of the larger half of the profession of engineering.

Specialization is to some extent practicable, even in the regular course; and the student proposing to enter upon the work of electrical distribution of light or of power, if well prepared in the earlier portion of the work in Sibley College, may, in the latter part of the four years' course, give special attention to this attractive subject. Fully one-half of all the students who enter the college make this division in their final work. The student may also, if fully prepared, study marine engineering and naval architecture. A graduate school in this department was established in Sibley College, by authority of the trustees, in 1890, and it has accomplished excellent work. Those who desire special instruction in locomotive construction, find the department of industrial drawing prepared to give instruction in this line of design. Other departments of engineering are expected to be opened as opportunity offers, and capital—the primary essential of all progress in the schools as well as in business—can be secured. In all special, as well as in regular instruction, the student comes to his work well

prepared in mathematics, in applied mechanics, and in the physical sciences, which have been investigated with the aid of higher mathematics. Extended instruction is given in the principles of machine designing, and in proportioning the parts of machinery; in the principles and practice of metallurgy, and in the study of the nature, the characteristics, and the uses of the various materials of engineering construction; in kinematics, the science of motion in machines, and in the study of the history, the present standard forms and the principles of economical design, construction, and operation of the most important representative classes of machinery. The student who graduates with five trades at his command, and his scientific education, with such extended practical applications, if he has the right spirit and even but moderate talent in his chosen field, is evidently fairly independent of the world.

Hundreds of young men have graduated from Sibley College in the few years of its work in this highest field, doubly and triply armored against the vicissitudes of life, and prepared to conquer the highest success in their chosen vocation. They have already taken possession of their full share of the most desirable positions in the engineering profession, and of the great work in progress throughout the country. They fill professor's chairs in almost all the most important engineering schools and colleges of the country, and are introducing everywhere methods of practical instruction which first received form in Sibley College. The professors of engineering of other institutions also come to Sibley College, in considerable numbers, to learn there, by practice, the best laboratory methods and the best methods of fitting up their own departments for similar work. Sibley College is thus doing its work within its own walls and outside them, in the instruction of large bodies of students of all departments of engineering, in training teachers of engineering, and in its gift to the world of the results of its own experience. Its departments of research are training numerous talented men in the methods of experimental investigation, and its professors and their pupils in the graduate department—sometimes even in the undergraduate—are continually giving to the profession and to the world new and valuable contributions to existing knowledge in the fields of pure and applied science, and in the as yet unconquered fields of the inventor, the mechanic, and the engineer. These contributions are published in the Sibley Journal of Engineering, a monthly magazine of high character, conducted by a board of editors elected

by the student-body from among themselves, with an advisory board selected from the faculty. These are also issued, often in elaborate form, in the transactions of learned societies, of which many of the faculty are members, and to whose proceedings they are frequent contributors, as well as to scientific and technical journals on both sides the Atlantic. Sibley College has thus become the largest department of the Cornell University, and aims to fulfill its prescribed mission so as to promote the best interests of the engineering profession, and contribute to the advance of science throughout the world.

The officers of Sibley College are: Dr. R. H. Thurston, director; Professor W. R. Durand, principal of the graduate school of marine engineering; Professor J. L. Morris, head of the department of mechanic arts; Professor R. C. Carpenter, head of the department of experimental engineering; Professor H. J. Ryan, head of the department of electrical engineering; Professor E. C. Cleaves, head of the department of drawing; and Professor J. H. Barr, head of the department of machine design, and associated with the director, who is also professor of mechanical engineering, also a large body of assistants and instructors of various grades.

XX

PROFESSIONAL SCHOOLS.

EARLY in the history of the university, propositions were made for the establishment of professional schools. At the fourth meeting of the Board of Trustees, held in Ithaca, October 21, 1866, a communication was presented from certain prominent physicians in New York proposing the organization of a medical department of the university, to be located in that city. This application was referred to a committee of the trustees to examine and report. This report was presented on the 13th of February, 1867. The committee decided that the establishment of a medical department in Ithaca was not at that time desirable, on account of the impossibility of combining theoretical and clinical instruction successfully. The committee were, however, of the opinion that a medical school should be established in connection with the university, and that its location should be in the city of New York. As

the gentlemen who presented this application were members of the homeopathic school, the question of the recognition of a body differing in theory from the regular school of medical science had to be considered. It was recognized that in the essential features, the science of medicine as taught in the two schools was alike, viz., in anatomy, physiology, chemistry, surgery, toxicology and materia medica, but that in the department of therapeutics there was an essential difference. In view of the fact that schools of medicine representing the established practice were attached to several existing colleges, the committee felt that the science of medicine as represented by the homeopathic school should receive favorable consideration. It was proposed, therefore, that the board should accept the proposition of the physicians who had presented the memorial, and that details of the arrangement of the proposed school should be referred to a committee, who should be empowered to confer with the applicants upon the following basis: First, that the professors of the medical school should be appointed by the trustees on the recommendation and nomination of the New York State Homeopathic Medical Society, it being understood that the trustees would not withhold their assent from any nomination upon any other grounds than want of high professional standing, or of personal character in the nominee. The university reserved the right, in order to avoid any charge of partiality to either school, to appoint in the proposed school professors of allopathic and eclectic therapeutics, whenever they should think proper to do so, who should enjoy all privileges of the regular professor of therapeutics, or to establish a department under the charge of allopathic professors. Students graduating should receive their degree without any reference to the school in which they desired to practice. The university reserved the right to impart instruction in medicine at Ithaca to any degree, and in any manner thought advisable, and the university was not to be responsible for the financial support of the proposed school.

At the same meeting, a memorial was presented from a committee of the Congregational State Association, consisting of the Rev. Drs. J. Douglas and Joseph Thompson, of New York, and W. A. Budington, of Brooklyn, acting in behalf of the association, which asked the board to approve a plan to endow certain professorships, which could not be deemed denominational. It was proposed to establish a theological seminary in connection with the university. Halls or colleges for theological study have been established in connection with the univer-

sity of Oxford, like Mansfield College and with Harvard University, which, in addition to the Harvard Divinity School, containing professorships filled by eminent scholars of various denominations, has, in its immediate vicinity, the Episcopal Theological School, to whose students certain privileges of attendance at lectures and in the use of the university library are extended. The attitude of the governing boards at Harvard has always been favorable to the establishment of such schools in its vicinity. These separate colleges constitute together one center of learning. President Eliot has sought with wise liberality to enlarge the Harvard Divinity School, so that it shall represent in its broadest sense the scientific study of Oriental languages, ecclesiastical history and theology. The report of the committee of the trustees of Cornell University, held that it would be inexpedient to furnish facilities for the use of lecture rooms, or dormitory accommodations for any such school. They were willing that such a seminary should be established in Ithaca, and would welcome similar institutions by other denominations. They placed on record the statement that, "we value any institution which will bring earnest men of scholarship and culture near to the university. They, therefore, recommend that university statutes be passed, admitting theological students to the lecture rooms and libraries on the same easy terms required of resident graduates of the university itself; and secondly, that every privilege of the university regarding lectures or library be extended to the faculty of any theological institution established in Ithaca, which is extended to the faculty of the university." Difficulties seem to have arisen in the execution of both these plans. In March, 1873, an additional effort was made by the physicians in New York to secure the establishment of a medical school in that city, constituting a part of this university. It was believed by those who presented the memorial, that a sufficient sum would be immediately available, to erect a building and supply its equipment, and also that a faculty of great eminence could be at once secured. This application, as presented, does not seem to have been considered favorably. The school, as proposed, was to contain lecturers representing various theories, or views of medical science. It was believed that, the inability of the university to provide certain important chairs of instruction, made it inexpedient to attempt to found a medical school at a distance, whose administration would necessarily present difficulties, and possibly complications. A third effort to establish a medical department in connection with the university was made in 1887, when

at the meeting of the trustees of June 6, a committee was appointed to consider the desirability of taking preliminary measures for the establishment of a medical department, either independently, or by arrangement with some existing institution. Certain propositions had been presented by those interested in the Graduate School of Medicine in New York, looking to its incorporation as a part of the university. The question of constituting Bellevue Medical College a part of the university was agitated, and a committee appointed to consider the subject, February 23, 1892. No final agreement was reached in the case of either of these applications. For many years there has existed in connection with this university, what has been termed a medical preparatory course, which, under the efficient direction of Dr. Wilder, imparted valuable instruction in comparative and human anatomy and physiology, also in microscopy and biology. Many graduates of this school have attained the highest eminence in their profession In a single year four pupils received the highest recognition of scholarship, upon graduating from as many different medical schools. The subject of establishing a medical school in connection with the university in Ithaca has appealed strongly to the trustees. They have recognized the necessity of securing in advance an adequate endowment for its support, as well as the establishment of hospitals or wards in the vicinity of the university, which should afford the necessary clinical and hospital practice. The establishment of such a school must be regarded as an event of a not remote future.

On the 7th of March, 1887, the trustees decided to establish a school of pharmacy, to be open for the admission of students at the beginning of the fall term of that year. It was proposed to found a course of study of equal rank in point of thoroughness and scientific character with the courses in the university, and that the training given should be adequate to prepare students for positions of responsibility as dispensing or manufacturing chemists. The law establishing a State Board of Pharmacy, which should license all druggists, was designed to advance the standing of that profession, and it was thought that students in large numbers would be induced to prepare themselves for pharmaceutical chemists, for which the existing courses in chemistry, botany and microscopical technology, offered special inducements. Mr. William Angell Viall was appointed instructor, and later assistant professor of practical pharmacy and lecturer on materia medica. The hopes of attracting large numbers of students to the school were not

realized, and the department was formally abolished on September 24, 1890,

LAW SCHOOL.

Attention was also early called to the expediency of establishing a law department in connection with the university. The courses in history and political science, in constitutional and international law, and in the history of institutions already furnished instruction in departments closely related to the curriculum of a law school. Many students who contemplated professional studies desired the facilities for pursuing them here. Articles appeared in the college press in favor of such an institution long before its realization seemed possible, President Adams, in his first report, recommended to the trustees for favorable consideration, the establishment of a law department to be opened in the autumn of 1887. At the meeting of the trustees, held November 20, 1885, a committee was appointed to consider and report on the practicability and expediency of the early establishment of a law department in this university, such report to include the whole subject of the plan of organization. This committee consisted of President Adams, Messrs. Boardman, Gluck, Williams and Woodford. This committee presented a careful report upon the questions involved in the establishment of such a school, at the meeting of the trustees held June 16, 1886, which report was accepted and its recommendation unanimously adopted. The importance of a thorough legal training was considered, and it was held that the provision for legal education already existing was not ample, and that in many cases, where schools existed, they were private enterprises without endowment, in which instruction was often not of that character which was demanded by the present state of legal science. It was held that the University was favorably situated for a law school, and that such a school might be established in accordance with the letter and spirit of the charter. The original Land Grant Act stated that its purpose was to promote "*the liberal and practical education*" of the industrial classes in the several pursuits and professions of life. The proper equipment, and the additional demands which would be made upon the university in founding a law school, were considered and its establishment was at once recommended. The plan of the proposed law school was issued and the beginning of the school was fixed for September 23, 1887. The Honorable Douglass Boardman, whose extended experience upon the bench made his counsel of great value,

was elected dean, and Professor Harry B. Hutchins of the Law School of Michigan University, secretary, upon whom the executive administration of the school has devolved. As a preliminary step in the equipment of the school, the university purchased the valuable law library of Mr. Merritt King, consisting of 4,061 volumes. The opening of the school justified at once the confident hopes of its founders. The first year there were fifty-five students; in two years the numbers reached 105, and at the present time there are about 200 students. An important addition to the library of the school was made by the gift of the Moak law library which was presented to the university for the use of the school, as a memorial of its first dean, Judge Douglass Boardman, by his widow, Mrs. A. M. Boardman, and his daughter, Mrs. Ellen D. Williams. In presenting this library to the university, the Honorable Francis M. Finch stated: "Even beyond the value of the gift, is the grace of it, for it came with the cheerful and happy freedom which waited for none to persuade, and sought only the assurance that the gift was worthy of the purpose from which it sprang. It is hardly possible to overestimate its value. I know of but one or two collections in the land which are as perfect and complete. Beginning back in the shadows of the early centuries when Bracton, whose true name is in dispute, and Fleta, by an author unknown, set growing in the bark and sap of the Saxon branches innumerable grafts from the older Roman law, and with the quaint and curious year-books couched in their barbarous Latin and primitive Norman French, the series of English reports comes down without a break to the present day. The State Trials beginning in 1163 with the arraignment of Becket, that Archbishop of Canterbury who ventured to question the religious supremacy of a not over-religious king, and passing on to their tragic and terrible stories of the blood through which liberty and justice waded to the shores of a higher civilization, the chancery volumes along the lines of which one can trace the growing strength and courage with which equity tempered the severities of the law, the colonial reports reflecting the thoughts of the motherland, but coloring all with the necessities of climate and situation, and changes born of Canadian snows, the Australian bush and the customs of many islands, all these are here in orderly rank and array and none are wanting at the call of the muster roll; and with them are massed the reports of that newer and younger life in our own land, gathered from every State in the Union omitting none, not one . . . And with all these which garner up the whole

legal knowledge and wisdom of the English speaking race, are commentaries and text books without number, discussing all phases of jurisprudence and all forms of adjudication, so that it may be truthfully said of the gift which these ladies make to you to-day, that no authority will ever be cited, no case will ever be referred to, no existing doctrine will ever be asserted, which cannot at once be verified in the library thus added to your treasures."

The Law School was first accommodated in the rooms on the fourth floor of Morrill Hall, but aside from the inconvenience and the difficulty of access to these rooms, they only partially met the needs of the school. In February, 1891, the trustees made a liberal appropriation for the erection of a special building for the school, which was completed in the summer of 1892. It is a large three-story structure of Cleveland stone, having the general architectural features of the Sage Library, and is practically fire-proof. On the first floor are three large lecture rooms and the necessary halls and cloak rooms. Seminary rooms and the offices of the several resident professors occupy the second floor, while the third is devoted to library purposes. Here are three large, well lighted and elegantly furnished library rooms, which have accommodations for thirty thousand volumes, and for three hundred readers. The building is heated by steam and lighted by electricity, and is thoroughly well ventilated. The erection and furnishing of the building, cost $110,000. At a meeting of the trustees held on September 14, 1892, it was resolved unanimously that, in view of the long and valuable services of the late Judge Douglass Boardman as a member of their body, and of his official connection with the School of Law, the home of the school should be designated as Boardman Hall. The library of the school contains 23,000 volumes. The building was first occupied for the purposes of a school at the opening of the fall term of 1892, and was formally dedicated and named on the 14th of February, 1893, with addresses by the Hon. Francis M. Finch, who presented the Moak Law Library in behalf of the donors, and President Schurman accepting the gift, and by the Hon. Chas. Andrews, chief judge of New York Court of Appeals. The able address by Judge Andrews traced the history of legal study in the formation of the Constitution of the United States and of the separate States, and described the increasing demands which the future would make in settling problems which affect the rights of the people, and social order.

The faculty of the Law School first appointed, consisted of the Hon. Douglass Boardman, dean. Judge Boardman had served on the Board of Trustees, first as alumni trustee from 1875–1885, and from that date as a regular trustee, elected by the board. He had served on the bench of the Supreme Court from 1866–1881, a portion of the time as a member of the General Term, when he voluntarily retired, bearing with him the respect of his colleagues on the bench and the members of the bar. He was an upright and industrious judge, who, while possessing positive views, was courteous and tolerant, while maintaining the dignity of his judicial office. The associate dean of the school, Professor Harry B. Hutchins, a graduate of the University of Michigan, and afterward Jay professor of law in that institution. He lectures on American constitutional law, the law of real property, common law pleading and practice, equity-jurisprudence and equity-pleading and procedure.

The Hon. Charles A. Collin graduated at Yale in 1866, and was later city attorney in Elmira. For several years Professor Collin has been one of the commissioners on statutory revision, where his work has been recognized as of the highest value to the State, and also legal adviser of the governor to report upon the constitutional and legal character of bills submitted for approval. He has also devoted much attention to sociology and to the amelioration of the condition of the dependent and criminal classes. He lectures in the Law School upon elementary law, criminal law and procedure, civil procedure under the codes, private and municipal corporations, and partnership.

Professor Francis M. Burdick, now of the Columbia Law School, came from Hamilton College, where he held a similar position. His instruction embraced elementary law, contracts including agency, evidence, bailments, mercantile law including bills, partnership, sales, suretyship, and Roman law. Upon Professor Burdick's resignation in 1891, his position was filled with brilliant ability by Professor Charles E. Hughes, who resigned after two years' service, and was succeeded by Professor Ernest Wilson Huffcut, a graduate of the university in the class of 1884, and at the Law School in 1888, who had filled the position of instructor in English, from 1885–88, and had later, after a period of practice at the bar, held a professorship of law in the University of Indiana, and in the Law School of the Northwestern University in Chicago. Professor Huffcut's instruction embraces the subjects formerly taught by Professor Burdick, with the exception of elementary law, bailments and partnership.

William A. Finch, esq., of the class of 1880, has been assistant-professor (1891–2) and later associate professor in the Law School. He lectures upon wills and administration, evidence, chattel mortgages, domestic relations, bailments and insurance. Professor Herbert Tuttle, L.H.D., lectures upon English constitutional history (1887-94), and Professor Moses Coit Tyler, LL.D., has lectured upon American constitutional history since the opening of the school.

Notable lectures before the school have been delivered by the Hon. Francis M. Finch, LL.D., of the Court of Appeals, on the Statute of Frauds and Fraudulent Conveyances; by the Hon. Daniel H. Chamberlain on Constitutional Law; by the Hon. Alfred C. Coxe of the United States District Court on Admirality; by the Hon. Orlow W. Chapman on the Law of Life Insurance; by the Hon. Goodwin Brown on the Law of Extradition, and others.

XXI.

THE QUARTER-CENTENNIAL.

At the meeting of the trustees of June 15, 1892, a committee was appointed to arrange for the appropriate observance of the twenty-fifth anniversary of the organization of Cornell Uuiversity. It was decided to arrange for the celebration of the opening of the university on October 6, 7 and 8, 1893. Such an occasion afforded an opportunity to review the history, and to estimate the influence of the university as an educational force in the nation, in the twenty-five years of its existence, and for a reunion of former students and friends, who were present in large numbers. The exercises began on Friday evening, October the sixth, with a reception in the University Library, at which delegates from other universities, and invited guests were present.

Among the attractions of the library many recent additions were exhibited, among them the Zarncke library, previously one of the finest collections for the study of German literature and philology among the private libraries of Germany, which had been recently presented to the university by Mr. William H. Sage; a rare Dante collection from Professor Willard Fiske; several richly illustrated volumes upon events in Russian history, from the Hon. Andrew D. White, minister to Russia; two portraits by the artist, Mr. J. Colin Forbes, one of the Hon. Ezra Cornell, painted in accordance with a resolution of the Legislature of

the State of New York, for the State Library in Albany, and a replica of a foot-length portrait of Mr. Gladstone, painted for the Liberal Club in London. The literary exercises in connection with this event were held on Saturday, October 7, in the lecture room of the library. The oration upon this occasion was delivered by the Honorable Chauncey M. Depew. The address which the eloquent orator delivered upon this occasion was perhaps one of the most notable of his life; it glowed with the emotion which such an academic occasion suggests, and with the spirit of a scholar who is permeated with the thought of the glory of the history of universities in the past, and of their place in the world's progress, and who, at the same time, is full of memories of academic life which are at once tender and ennobling. The occasion, aside from politics and the fever of political life, was worthy of a celebration commemorating a university which has been representative in the history of the new learning. At the same time it was a glorious prophecy of the future, and of the influence which the university should exert in the coming educational life of the nation. Seldom, possibly never, has the province of the university been portrayed with more eloquence and beauty than was done by Mr. Depew on this occasion. One of the noblest passages of the address was, as was proper, a tribute to the memory of the founder, with whom Mr. Depew has been personally associated:

The life of Ezra Cornell is a lesson and an inspiration. The study of his struggles and success is a liberal education. Our meeting would lose much of its significance if it failed to enforce the lesson of the career and commemorate the character of the founder, Sixty-five years ago young Cornell, who had just attained his majority and started out to seek his fortune, after a walk of forty miles rested upon one of the hills overlooking this beautiful lake. This reticent Quaker was passionately fond of nature, and he was entranced by the superb panorama spread out before him. Few places on earth possess so many scenic attractions. The only view I know which compares with this, is the view from the Acropolis, at Athens, with the plain in front, the Pentelic mountains behind, and the blue Ægean in the distance.

The young mechanic had neither friends nor acquaintances in the village which nestled at his feet, and his worldly possessions were all in a little bundle on the end of the stick which served for staff and baggage-wagon. He had no money, and only a spare suit of clothes; but with health, good habits, ambition, industry, and a perfect knowledge of what he intended to do, and an equal determination to do it, he entered Ithaca a conqueror. No delegation of citizens met him at the gates; no triumphal procession bore him in a chariot; no arches spanned the streets; but the man who was to make this then secluded hamlet known throughout the world had done for Ithaca the greatest service it could receive by deciding to become its citizen. Though poor, he was far removed from poverty. His situation illustrates one of the hopeful features of American conditions. Neither doubt nor despair was in his

mind. He had found his place and he knew he could improve it. He saw his ladder and began to climb it. It is the genius of our people to get on, and it is the pleasure of the community to help and applaud. Occasional failures test the metal of the aspirant, and hard knocks develop grip or gelatin. There are, unhappily, suffering and helplessness incident to the practical workings of the doctrine of the survival of the fittest, but vigor and manhood win their rewards.

Faith and works were the principles of Ezra Cornell, and the carpenter's bench a platform and preparation for larger efforts. . . . As a carpenter he improved the methods of his village master; as a mechanic he devised machines which overcame unexpected difficulties; as an unprejudiced, practical man, he became familiar with the uses of electricity while the professor was still lecturing upon its dangers.

. . . The inventor needed an undaunted and indomitable man of affairs to demonstrate to capitalists its possibilities and to the public its beneficence, and he found him in Ezra Cornell, who saw its future, and upon his judgment staked the accumulations of his life and the almost superhuman labors of a decade. He owned electric shares of the face value of millions and went hungry to bed because he had not the means to pay for a meal, and his family suffered because they could not be trusted for a barrel of flour. But neither want, nor debt, nor the sheriff, could wrest from him his telegraph stock. I know of no more dramatic scene in the lives of any of our successful men than the spectacle of this potential millionaire tramping through the highways and byways of penury, suffering, and sickness, upheld by his sublime faith in his work and the certainty of its recognition. Suddenly the darkness was dispelled and the day dawned. People woke up to the necessity of the telegraph for the government and for commerce, and Cornell's faith had coined for him a fortune.

. . . A most noble and brilliant representative of this class was the founder of this university. Prosperity made him neither an idler nor a voluptuary. It added fresh vigor to his work, enlarged his vision and broadened his sympathies. No mawkish sentimentality nor theatrical surprises were in his character. He determined to devote a portion of his fortune to the welfare of his countrymen and countrywomen, and decided that the best way was to give them the education and training with which to help themselves. He had the self-made man's belief that a successful career is possible to every one who tries, but he knew from sore experience how difficult is progress for the poorly equipped in the sharp competition of life. He did not give up money-making. On the contrary, the more beneficent the purpose to which he found it could be applied, the harder he worked to gain more. His was the ideal of the divine injunction to be "diligent in business, serving the Lord."

. . . . . .

It was my privilege as a young man, and the youngest member of the Legislature, to sit beside Ezra Cornell. I learned to love and revere him. In those days, so full of the strife and passions of the civil war, it was a wonder and inspiration to listen to the peaceful plans of this practical philanthropist for the benefit of his fellow men. The times were big with gigantic schemes for the acquisition of sudden fortunes, and his colleagues could not understand this most earnest and unselfish worker. To most of them he was a schemer whose purposes they could not fathom, and to the rest of us he seemed a dreamer whose visions would never materialize. These doubters of a quarter of a century ago esteem it a high privilege to stand in this

presence, and an honor to have the opportunity to contribute a chaplet to the wreaths which crown the statue of Ezra Cornell.

Other addresses were delivered by the Hon. Stewart L. Woodford, LL.D., who, as lieutenant-governor, had responded on behalf of the State at the opening of the university; by Chancellor Upson of the University of the State of New York; by Professor G. C. Caldwell in behalf of the original faculty; and by the Hon. Joseph C. Hendrix, member of Congress from Brooklyn, one of the early students. An interesting feature of the occasion was the presentation to Dr. Burt G. Wildes, by Dr. Theobald Smith, of a *Festschrift*, a volume containing contributions in science from his former pupils, designed to express their gratitude for his instruction and services to the cause of science; also of a manuscript history of the university, prepared by Professor Ernest W. Huffcut.

General regret was felt that President Cleveland, who, as governor, and at other times, has always manifested his interest in the university, was unable to be present, owing to the demand of important legislation in Congress.

At the dinner which followed congratulations were received from ex-President White in St. Petersburg, to which a grateful response was sent, from General Meredith Read in Paris, the only survivor of the ten trustees named in the charter of the university; and a letter was read from Professor Goldwin Smith in Toronto, who regretted his inability to be present. Speeches were made in behalf of the trustees by the Hon. S. D. Halliday; the faculty, by Professor Crane; the Commonwealth, by the Hon. Chauncey M. Depew; sister institutions of the east, by President Seth Low of Columbia College; the earlier students, by Hon. Joseph C. Hendrix; theosophy and education, by General A. C. Barnes; practical education, by Andrew Carnegie; sister institutions of the west, by President Cyrus Northrup of the University of Minnesota; the university and the press, by St. Clair McKelway; the education of women, by President James M. Taylor of Vassar College; the college graduate and the men of affairs, by Hon. Oscar A. Straus, late United States minister to Turkey; the later alumni, by Seward A. Simons, A.B., '79.

On Sunday, the 8th of October, an impressive anniversary sermon was delivered in the Armory by the Right Reverend William Croswell Doane, D.D., bishop of Albany and vice-chancellor of the University of the State of New York, thus closing this academic festival.

For special co-operation in the foregoing work the author is indebted to the Hon. Andrew D. White, LL.D., Hon. Henry W. Sage, Hon. Alonzo B. Cornell, Hon. Justin S. Morrill, U. S. Senator from Vermont, Col. Charles H. Blair, Professor William H. Brewer, of Yale University, whose valuable contribution relating to the efforts for agricultural education in this State was received too late to be used in this volume; and among his colleagues, to Professors Caldwell, Wilder, Low, Prentiss, Crane, Corson, Oliver, Fuertes, Comstock, Williams, M. C. Tyler, Thurston, Wheeler, Nichols, Bailey, Hart, Jenks, Burr, Bennett, Gage and Harris, and to many others for minor suggestions. He is also indebted to the Hon. William T. Harris, United States Commissioner of Education, to the Hon. Melvil Dewey, Secretary of the Regents of the University of the State of New York, to Dr. Herbert B. Adams, whose monograph on the Study of History in American Colleges and Universities has been used; to President James B. Angell, LL.D., of the University of Michigan, Professor J. H. Gilmore, of the University of Rochester, Professor J. W. Chickering, of the National Deaf-Mute College, and to others whose aid he would not fail to acknowledge.

BIOGRAPHICAL

THE HONORABLE EZRA CORNELL.

"A stature somewhat above the average, a form slender and rigid, a thin face of the well-known Puritan type, with lips which expressed in their compression an unwonted firmness of character, the slow, steady, stiff gait, a demeanor of unusual gravity, but which was sometimes a little too brusque to be dignified, a sharp eye with a straightforward look in it, a voice tending a little to shrillness and harshness, but in its more quiet modulations not unpleasant, an utterance slow and precise as if every word was carefully if not painfully thought out, such was the founder of Cornell University as he walked among us during the first six years of the institution's history. In whatever community, or in the midst of whatever surroundings his lot had been cast, he would have been a man of mark. A stranger, meeting him in the crowded railway car, would strightway see that he was not a mere individual of the ordinary type, that he possessed strong characteristics which made him noticeably different from other men. He had a good memory and a quick eye, and was a close and careful observer of men and things. . . . His most predominant trait, overlooking all others, was his complete self-abnegation. He was an utterly intensely unselfish man; no human being, with similar qualificatons in other respects, could be more thoroughly uninfluenced by any considerations of his own comfort, of his own aggrandizement, or of his own fame. He was generous alike of his time his labor and his wealth, and no thought of his own interest ever limited the flow of this generosity."

In such words as these the death of Mr. Cornell was announced to the university world. They characterize his outward bearing and many of the predominant characteristics of a stern, silent, warm-hearted nature.

Mr. Ezra Cornell was of Puritan descent, his family having settled in Swansea, Massachusetts. His ancestors on both sides had been members of the Society of Friends. Like most of the early residents of New England, the family was of limited resources, and industry, simplicity and economy were prevailing traits in the family life of the time. Mr. Cornell's father learned the potter's trade, but he was besides, a mechanic both practical and skillful. He early removed to Westchester Landing, New York, and engaged for a time, in ship building. After a residence in Bergen county, New Jersey, near the site of the present beautiful village of Englewood, where he resumed his original craft as a potter, he removed to De Ruyter, New York. Here he established himself upon a farm, and, at the same time, carried on

EZRA CORNELL.

profitably the manufacture of earthenware. This was the early home of his son, Ezra Cornell, where, in a community of Friends, he grew up in the simple and healthy life which characterizes the members of this communion. Even as a boy, amid the restricted advantages of a new country, his education was limited; and once, when but sixteen years of age, in order to earn the privilege of attending a winter school, in company with a younger brother, he cut down and cleared the timber upon four acres of forest, transforming it into tillable land. A year or two later, he cut timber in a forest, and with the aid of the same brother erected a two-story dwelling house for his father, at that time the largest residence in the town. Having thus tested his capacity for work, he went forth, and was engaged for the next three years in the work of cutting timber for shipment to New York, and later as a machinist. Ithaca was at this time a village of two thousand inhabitants, and enjoyed the benefit of a thriving trade with the large territory which depended upon it for communication with the markets of the external world. "With a spare suit of clothes and a few dollars in his pocket, the earnings of his previous labors, Ezra Cornell entered Ithaca on foot, having walked from his father's house in De Ruyter, a distance of forty miles. He had chosen to make the journey thus, not only for the purpose of saving the expense of riding, but also for the pleasure he enjoyed in walking. He could travel forty miles per day with perfect ease. Without a single acquaintance in the village, and with no introduction or certificate of character in any form, except such as he could offer in his own behalf, he arrived in Ithaca with youth, courage and ambition as capital stock, determined by his own exertions to earn a living and establish himself on a permanent and prosperous basis." It was in April, 1828, soon after his arrival, that Mr. Cornell secured work as a carpenter, and erected at the corner of Geneva and Clinton streets a residence which is still standing, and which has for many years been the home of the Bloodgood family. Mr. Cornell's experience for a year as a mill-wright secured employment for him in certain flouring and plaster mills at Fall Creek, and for the next twelve years he was a manager of extensive interests, which often involved the disbursement of hundreds of thousands of dollars annually. Dr. Theodore L. Cuyler, in a letter written thirty years afterwards, said that he used to see sitting on the counter of his uncle's store (Mr. John James Speed) "a shrewd managing chap unfolding schemes for carrying the township for the Whig ticket. That obscure but keen-witted man is now the Ezra Cornell who has founded the most promising university in New York." Mr. Cornell's early interest in politics is manifest from this statement. His ability as a mechanic of a high order was shown still further, not merely in erecting mills, but also in devising and executing a feat of engineering of very great difficulty, viz., in cutting a tunnel above the falls, through several hundred feet of solid rock, thus securing an abundant supply of water for numerous manufactories below, which has remained in constant use up to the present time. This important work was finished in 1831. The tunnel was cut through a cliff and work was begun at both extremities. When the two galleries met in the center, a variation of less than two inches from an exact line was found.

During these years Mr. Cornell was active in local politics, advocating with great energy the principles of the Whig party. At the age of thirty-five, an interruption in the industrial prosperity of Ithaca threw Mr. Cornell out of employment, and his

life now began upon a wider sphere. He purchased the patent rights for an improved plow and journeyed to Maine mostly on foot to effect its sale, and later, he made a tour through the Southern States, going as far as Georgia. During this journey he walked a distance of one thousand five hundred miles. A second journey to Maine was undertaken in the year 1843. On his previous visit Mr. Cornell had met the Hon. Francis O. J. Smith, a Democratic congressman from Maine, the editor of the Maine Farmer. Mr. Smith was a politician of great ability, and though greatly defamed for his skill and adroitness by political enemies, a man of unusual ability. He had become interested in the electric telegraph. This enterprise in its initial steps was involved in great difficulty. Many important facts necessary for its practical use were as yet undiscovered, and it was only slowly that experience called attention to the necessity of essential improvements, before its inventor's dream of success could be realized, and the public share in the advantages of this brilliant invention. It was supposed that two wires were necessary in order to form a complete metallic circuit. No mode had then been devised for the treatment of India rubber to make it available for the purposes of insulation, and gutta-percha was wholly unknown as an article of use or commerce in this country. It was not yet determined how the wires could be extended between cities. It was thought at first that the wires should be enclosed in an underground tube. Upon the occasion of Mr. Cornell's second visit to Portland, he found Mr. Smith upon the floor of his office, with designs around him for the manufacture of a plow which should excavate the furrow for the underground telegraph pipe. It was proposed also to cover the pipe by means of a second machine. Mr. Smith had taken the contract to lay the pipe at one hundred dollars per mile, and it was necessary to invent some machine capable of executing his purpose successfully. He hailed the arrival of Mr. Cornell as the person to solve his difficulties. Mr. Cornell after examining the plan was convinced that a single machine would suffice for the purpose. He thus describes the event: "I, therefore, with my pencil sketched a rough diagram of a machine that seemed to me adapted to his necessities. It provided that the pipe with the wires enclosed therein was to be coiled around a drum or reel, from whence it was to pass over and through a hollow standard protected by shives directly in the rear of the coulter or cutter, which was so arranged as to cut a furrow two and one-half feet deep and one and one-fourth inches wide. Arranged something like a plow, it was to be drawn by a powerful team, and to deposit the pipe in the bottom of the furrow as it moved along; the furrow, being so narrow, would soon close itself and conceal the pipe from view." Overcoming his scepticism, Mr. Smith authorized Mr. Cornell to make the pattern for the necessary castings, who also, in the mean time, constructed the woodwork for the frame. On the 17th of August, 1843, a successful trial of Mr. Cornell's invention was made on Mr. Smith's farm in Westbrook, a few miles north of Portland. "The complete success of my machine, and the prompt manner of making the invention, the moment that circumstances demanded its use, inspired Mr. Smith with great confidence in my ability both as a mechanic and a practical man. He therefore urged me to go to Baltimore with the machine, and take charge of laying the pipe between that city and Washington. As this proposition involved the abandonment of the business which I came to Maine to look after, it was with some hesitation that I entertained it. A little reflection, however, convinced me that the telegraph was to become a grand enterprise, and this seemed a particularly advantageous opportunity

for me to identify myself with it. Finally, convinced that it would shortly lead me on the road of fortune, I acceded to Mr. Smith's earnest solicitation, and engaged to undertake the work on condition that I should first devote a little time to the settlement of my business in Maine." This was the beginning of Mr. Cornell's connection with the electric telegraph, which became the source of his fortune. It has been shown how incomplete the invention was as a practical achievement. Professor Morse says that up to the autumn of 1837, his telegraph apparatus existed in so crude a form that he felt a reluctance to have it seen; but on the 6th of January, 1838, he operated his system successfully over a wire three miles long, in the presence of a number of personal friends, at Morristown, N. J. Later, the leading scientists of New York and the faculty of the University, as well as the Franklin Institute of Philadelphia, recognized its pre-eminent merit. Mr. Morse removed his apparatus from Philadelphia to Washington, where he demonstrated its success in the presence of President Van Buren and his cabinet, foreign ministers, and members of Congress. Congress finally appropriated at the close of the session of 1843 thirty thousand dollars for the erection of an experimental line of telegraph between Washington and Baltimore. The original plan of placing the wires underground proved unsuccessful from the impossibility of effective insulation. Mr. Cornell then made a careful study of all the available scientific works which treated of electrical science, and finally urged the adoption of the method which had proved successful in England, in the hands of Cooke and Wheatstone—of placing the wires on poles. On May 1, 1844, the line was completed and in operation between Washington and Baltimore. Mr. Morse now offered to sell the patent to the United States government, to be used in connection with the postal service, for one hundred thousand dollars. The post-office department, to which this proposition was referred, reported that the operation of the telegraph between Washington and Baltimore had not satisfied the postmaster-general, and that at any possible rate of postage, could its revenues be made to cover its expenditures. Under the influence of this report, Congress declined to accept the offer of the patentees, and the telegraph was left to seek development by the aid of private capital. Mr. Cornell was now formally enlisted in the depelopment of this invention. He had short lines of telegraph erected across streets or between buildings in Boston and New York, with the purpose of interesting capitalists in the formation of a company to erect a line between New York, Philadelphia, Boston and Washington. Mr. Cornell constructed the section of the line between Fort Lee, opposite New York, and Philadelphia, in the summer of 1845. His compensation for superintendence was at this time one thousand dollars per annum. All the money that he could spare was now invested in the capital stock of the Magnetic Telegraph Company, the first incorporated organization to promote this new enterprise. It was not merely as a superintendent and constructor of telegraph that Mr. Cornell's admirable powers were displayed. He designed apparatus to facilitate the transmission of messages, among other things, a relay magnet which was used successfully for a considerable time. Mr. Cornell next erected a line between New York and Albany, under contract with the New York, Albany and Buffalo Telegraph Company, which was completed successfully in the autumn of 1846. From this enterprise Mr. Cornell realized a profit of six thousand dollars, his first substantial gain after three years of labor in connection with the telegraph. Later, he also erected lines from Troy to Montreal, and a portion of a line to Quebec. Mr. Cornell now assumed a larger

responsibility in establishing the telegraph system of this country. He organized the Erie and Michigan Telegraph Company to provide a line of telegraph between Buffalo and Milwaukee via Cleveland, Detroit and Chicago, and also the New York and Erie Telegraph Company to connect Dunkirk with the city of New York, passing throuth the southern counties of the State. In much of the territory west of Buffalo, telegraph lines were established before the railways, branch lines were erected to connect with the Erie and Michigan Company's lines, from Cleveland to Pittsburgh, from Cleveland to Zanesville and Wheeling, and from Cleveland to Columbus and Cincinnati. The rapid development of telegraphic communication created a rivalry between opposing lines, and competing offices were erected in various cities for the transaction of business. In 1855, the Western Union Telegraph Company was organized, by which these conflicting interests were consolidated. This company embraced at first the lines in the States of Ohio, Indiana, Michigan, Wisconsin, and a portion of Illinois. The success of this union of opposing interests was at once manifested. The profits of the enterprise increased rapidly, and the company employed its accumulating profits in extending its system over a wider field. Other lines were purchased, new lines were built, others leased in perpetuity, and thus the position of the new company was rendered complete and impregnable. Later, the Western Union Telegraph Company assumed the contract of Mr. Sibley, and extended its lines across the continent ten years in advance of the railroad.

In 1862 Mr. Cornell took his seat in the Legislature of the State. He served for two terms as representative, and for two terms as senator. His term of service fell, in part, within the years of the Civil War, when it was necessary to sustain the Federal Government with every influence emanating from its most powerful State. In all the questions to which the war gave rise, Mr. Cornell supported earnestly the national cause. During his residence in Albany he was chairman of the committee on agriculture in the Senate, and, also, chairman of the committee on finance. He was an uncompromising advocate of sustaining the credit of the State by payment of the principal and interest of the public debt in specie; in accordance with the true spirit under which the obligation was incurred. He also advocated the creation of sinking funds for the gradual extinction of the debts of the State. These wise measures have almost extinguished the entire indebtedness of the State. We find him active in the labor of the committees of which he was a member. Although not an orator, his remarks were terse and convincing. His name is associated with numerous measures for the benefit of agriculture, finance, and education. His services in the Legislature were recognized by his constituents by a unanimous renomination for senator. When he retired, it was at his personal wish, in order to devote himself to the interests of the university which he had founded. All Mr. Cornell's acts expressed his strong individuality. Definiteness characterized all his opinions, and views, once adopted, were sustained with tenacity in the face of all opposition. All idealists are perhaps visionary, and the erection of the university which bears his name was a noble ideal which Mr. Cornell set before him as the crown of his life. Visionary he may have been in other things, but a humane purpose underlay all. To promote its interests, he was led to withdraw his capital from the telegraph, in which it was rapidly increasing, and where its security seemed unassailable, in order to promote the erection of railways through his native city. Mr. Cornell's letter-books show the enormous labor to which he subjected himself, the minute and pa-

tient detail with which he answered inquiries and attended to every question of the administration of the university lands. He was unable to relinquish minor matters to others, and the new and untried responsibilities which he had assumed in connection with the railways were beyond his powers of immediate direction. In these vast undertakings to which he was impelled by a desire to benefit his native place, as well as to build up the university, his large fortune was impaired. Prosperous times could not probably have secured the success of his venture; but in the paralysis of all business in the crisis of 1873, it is not strange that his enterprises yielded to inevitable laws upon which all industrial prosperity depends. The blow of impending loss was met by Mr. Cornell silently, heroically, but with unfaltering resolution. The vigor and courage which had won his great fortune made his spirit still hopeful, almost triumphant, amid financial loss. In June, 1874, Mr. Cornell was suddenly incapacitated from attention to business by serious illness which he had contracted by unconscious exposure while traveling. From this illness he never recovered. Pneumonia passed into a settled affection of the lungs, and all hope was at an end. During his last months of weakness, mindful of the university which lay so near his heart, he transferred to it all his interests in the national lands which he had purchased, and thus secured its permanence. During his sickness he longed to recover; he could not bear the thought of defeat, and he wished to earn, as he said, a half million dollars more for the university. The enormous task of administering the estate of the university, which he had assumed, and the terrible burdens associated with the three railway enterprises in which he was engaged, added a crushing weight to the suffering of his last months. Even upon the morning of the 9th of December, 1874, he rose with the wonderful energy inherent in his nature, and was dressed, and devoted himself during the hours of the morning to business. At last, overcome by weakness, he sought his couch, and soon after noon, his work was over.

Although Mr. Cornell was by nature reserved, and there was an element of sternness in his exterior, only those who were intimate knew the warmth of personal affection which burned in his heart. His devotion to his family—his longing, when absent, for the sight of his little girls, and his remembrance of every member, found constant expression in his letters. His integrity and loyalty in the support of everything that he believed right, all knew; but the warmth of feeling in his nature was known only to his most intimate friends. The news of his death called out an expression of popular sorrow in the community in which he lived, such as is but rarely awakened; and neighboring cities held meetings to pass resolutions of respect for his memory. He rests in a Memorial Chapel erected in the center of the university, which will be his truest monument.

THE HONORABLE ANDREW DICKSON WHITE, LL.D.

The Honorable Andrew D. White, LL.D., the first president of the university was born in Homer, N. Y., November 7, 1832. After spending one year in Hobart, he entered Yale College, where he spent the last three years of his college course, graduating in the class of 1853. Mr. White won distinction in a class noted for its bril-

liant members. He received prizes in English essays, and was one of the editors of the Yale Literary Magazine. Upon graduation, he obtained the De Forest Gold Medal, one of the most coveted honors of an undergraduate course, for an oration upon The Diplomatic History of Modern Times.

Among his classmates were many who afterwards became distinguished, among them, E. C. Stedman, the poet; Henry C. Robinson, governor of Connecticut; Bishop Theodore F. Davis, of Michigan; Senator Gibson, of Louisiana; Wayne MacVeagh, United States attorney-general, and minister to Italy, and George Shiras, judge of the United States Supreme Court. After graduation he went abroad, where he spent three years in travel and study. He resided longest in Paris, where he heard lectures at the Sorbonne, pursuing with ardor the study of French history, in which sublect his lectures have always possessed an especial interest. He was a member for a few months of the official family of the Honorable Thomas H. Seymour, United States minister to St. Petersburg, during the exciting events associated with the Crimean war, where he obtained some glimpse of diplomatic affairs and of political and court life. He also traveled extensively through Europe. In intervals of other work, he inspected the archives of France and studied on the spot nearly every great event of the Revolution. He also made several journeys through various parts of France, including excursions on foot through Picardy, Normandy, Brittany, Touraine and the borders of La Vendée, during which he conversed with many who had an intimate knowledge of those great events. He says: "While thus satisfying my love for a study which has fascinated me, I have hoped to do something to counteract the influence of prejudiced English historians and the American dilutions of their works, and to give that view of the struggle which, so far from disheartening young men, will strengthen their faith and hope."

Upon Mr. White's return in 1856, he spent a year in advanced study at Yale. In the following year, he was elected professor of history and English literature in the University of Michigan, which position he held from 1857 to 1862. His large business interests recalled him to Syracuse where, after a second period of foreign travel, he resumed his residence. He was twice elected a State Senator from that district, serving from 1864 to 1868. His connection with the University of Michigan was, however, from this time merely nominal; after giving up the regular duties of his professorship he occasionally delivered a few lectures. His residence there was a most fruitful period in his educational experience. Michigan University was at that time under the intelligent direction of President Tappan, one of the wisest and most progressive administrators whom this country has produced. The independence of a State university, which had received enduring form under the moulding hand of the first superintendent of instruction, the Rev. John B. Pierce, although hampered at times by political interference, attracted Mr. White. President Tappan's views of the relation of the university to the school system of the State, as the crown of higher public education, were exemplified in the organization of the schools. President Tappan maintained that scientific learning had a right to compare, in modern education, with ancient learning. Views which Mr. White later incorporated into the constitution of Cornell University were seen here in practice, where their effects could be measured. President White himself said in an address in Ann Arbor that Cornell was the daughter of Michigan University. Mr. White, as chairman of the committee on literature in the Senate of New York, was an efficient agent in aiding his col-

league, Mr. Ezra Cornell, to secure the Land Grant for this university. Indeed, we may say that Mr. White made definite the plans of Mr. Cornell, and that the original purpose of the latter to found an industrial institution was expanded under Mr. White's advocacy, so as to include a university. Mr. White's strong faith, that the one great opportunity for the establishment of a university in the State of New York worthy of the name had come with the National Grant, and that, by preserving this gift in its integrity, the cause of higher education would be promoted and its success achieved, determined Mr. Cornell's views upon this important subject.

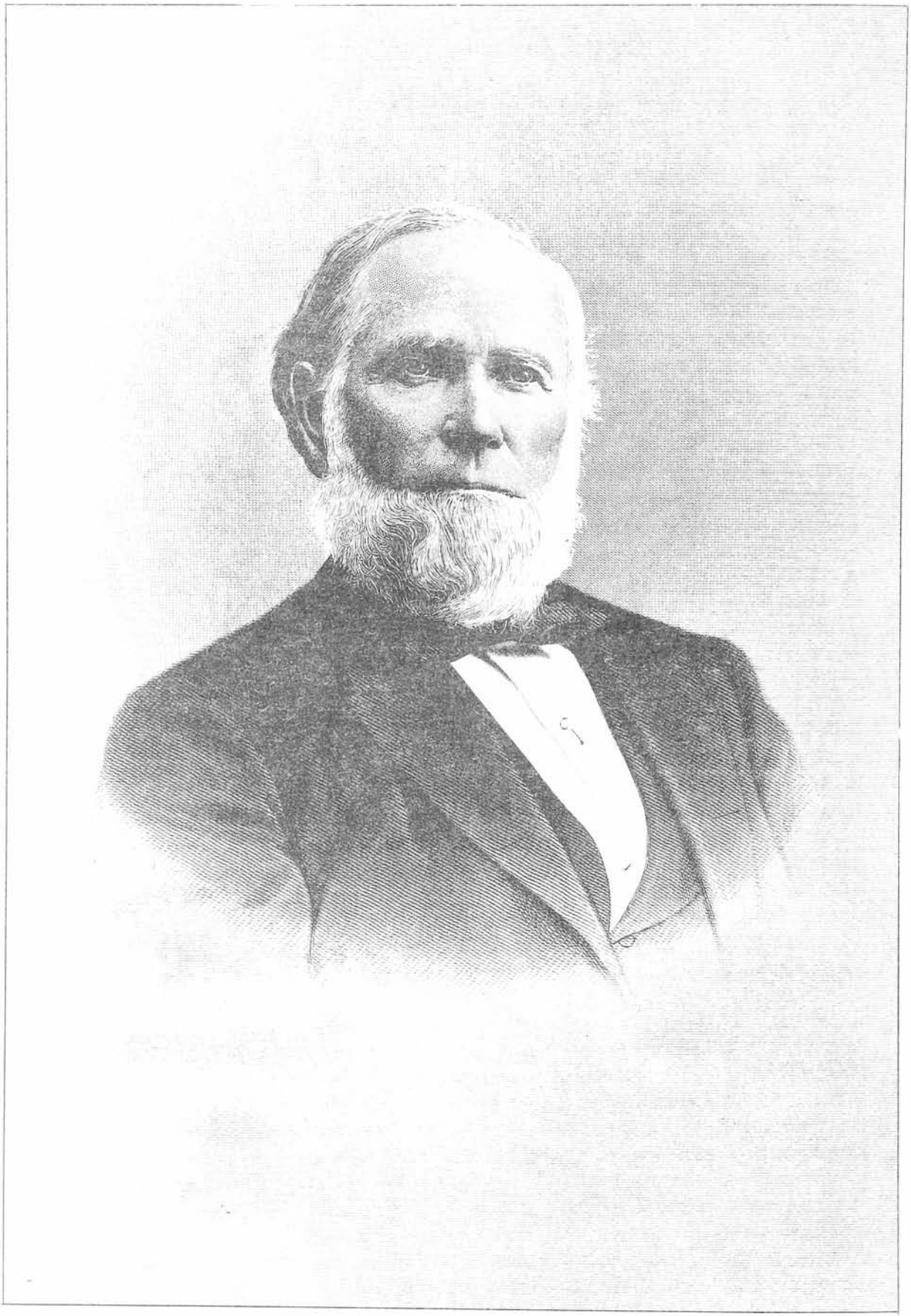
Mr. White was elected a trustee of the university at the first meeting of the Board of Trustees held April 28, 1865. At the request of Mr. Cornell he drew up a proposed plan of organization which was presented to the trustees on October 21, 1866, at the same meeting at which he was elected president of the new university. About this time, the directorship of the School of Fine Arts at Yale was offered to Mr. White but declined. Mr. White's influence during his term of senatorial service was of great value. He was independent, and brought a knowledge of the world, and a study of political institutions to bear, in the discharge of his duties, which was unusual in legislation. His influence in extending the system of normal schools throughout the State was felt, and one or two addresses which he delivered, in which he discussed national questions were vigorous defences of Republican principles. The address, in which he advocated withdrawing the National Grant from the People's College and bestowing it upon Cornell University, was an able defence of the proposed legislative action, and exerted a marked influence. After the close of his duties as State senator, in the summer of 1868, President White went abroad for a few months in order to execute numerous orders from the trustees for the purchase of scientific apparatus, books and maps for the university, and also to visit various schools of applied science. During this visit Professor Goldwin Smith decided to come to Ithaca to reside during his proposed visit to America, and Dr. James Law was secured as Professor of Veterinary Science. Mr. White retained his residence in Syracuse for the first four years after the opening of the university, until the completion of the president's mansion on the university grounds in the autumn of 1872. During this time, while residing in Ithaca, he occupied rooms in Cascadilla Place which was the center of official as well as of social life. His diversified interests often called him away from the university in those early years, and the immediate administration devolved in his absence upon the vice-president. In 1871 President White was appointed by President Grant one of the United States commissioners to San Domingo to report upon the expediency of the annexation of that island; in 1876 he received a leave of absence from the university for the purpose of visiting Europe and was absent until the autumn of 1878, during which year he was a commissioner to the Paris Exposition and, at its close, received the cross of Commander of the Legion of Honor. His return was welcomed by the entire student-world by processions and an address. President White remained in Ithaca until the spring of the following year, when, in April, he was appointed as envoy extraordinary and minister plenipotentiary to Germany. He sailed from New York May 7, 1879. Mr. White was well qualified to represent the United States at a foreign court. His acquaintance with European history and life, and his social gifts attracted to his house the most accomplished scholars and artists of the capital, and his broad and genial sympathy with literary men made his residence a center of charming social

intercourse and hospitality. In the autumn of 1881 President White again assumed the discharge of his duties as president of the university and resided continuously in Ithaca until the date of his resignation in June, 1885.

The early interest of President White in historical study, which was exhibited during his college life, has continued until the present time. His favorite department is the history of European culture since the dawn of the Renaissance. He has devoted most attention to French and German history, especially to the period of the Protestant Reformation and the French Revolution. He collected a rare and extensive library, possibly not surpassed in America upon these periods. The formative ideas which determined the early character of the university are largely due to President White. He was fertile in theories, and active in investigating different courses of study and systems of education both in this country and abroad. To him belongs undoubtedly the credit of advocating, even if he did not originate, many of the views which prevail in modern university education. Among these we may mention the importance of history, especially of American history, and of modern languages, both as a means of culture and for scientific investigation; he has advocated instruction in sociology, and in lectures upon free trade and protection he has urged that both sides shall be represented by their ablest advocates; the equal value for intellectual training of parallel courses of study, and the dignity and importance of industrial education to the nation. He has insisted upon the superior value of Latin for the general student above Greek. He has also been an earnest advocate of the improvements of the secondary schools throughout the State. Freedom in the choice of studies has been a prominent characteristic of the university from the beginning. The solution of the conflict in regard to classics he found in the establishment of definite parallel courses, such as have been adopted in this university.

If a certain native disinclination to the details of executive duties, an undue reliance in important questions upon the formulated and aggressive views of those in whom he had confidence, an impetuosity and personal element in the solution of vital questions, combined with a peculiar indecision, and adherence to theoretical views after they had been disproved in practice, were manifest in administration, so many beautiful and generous traits were revealed, so much personal thoughtfulness as to preserve the enduring affection of his colleagues. He loved to gather his friends in his home which was the centre of delightful literary and social intercourse; his large library was open to the use of the poorest students without hesitation, and there was no case of distress in the university world that did not appeal to him.

The position of dean of the School of History and Political Science was offered to President White upon its establishment in 1887, but he declined the honor. In 1892 he received again the honor of a foreign diplomatic position. President Harrison appointed him minister to the court of St. Petersburg, where he has since resided. Mr. White has presented to the university numerous works upon art, medallions, and manuscripts. Upon the completion of the Sage Library, Mr. White transferred to it his own valuable historical library consisting of 19,300 volumes. In order to secure the development of the studies of history and political science in which he was especially interested, he made as a condition of this gift the establishment and support by the university of a School of History and Political Science, and also that it should maintain fellowships in these subjects, defray the salary of a librarian in the White Library and the cost of the publication of a catalogue of the library.



H. W. Sage