EDUCATION AND RESEARCH IN AGRICULTURE IN THE UNITED STATES.

By A. C. True, Ph. D.,

Director of the Office of Experiment Stations, U. S. Department of Agriculture.

More than a century has elapsed since the movement began in this country to advance the interests of agriculture by widening the information of the farmer regarding the rational practice of his art. Near the end of the eighteenth century there was unusual activity in agricultural affairs, both at home and abroad. New crops and breeds of animals were being introduced. The attention of practical men was drawn to the discoveries of science, and great hopes were excited that immediate benefits of inestimable value would accrue to agriculture as well as to the other arts, especially from the application of the principles of chemistry to the various industries. The newly awakened interest in the oldest of human occupations was marked by the formation of agricultural societies. In Great Britain, for example, the Bath and West of England Society and the Highland Society were established. The British Government also recognized the importance of the movement by organizing a board of agriculture. The same influences were soon felt in the New World.

ORIGIN AND DEVELOPMENT OF AGRICULTURAL INSTITUTIONS IN THE UNITED STATES.

As far as is now known, the first society for promoting agriculture in the United States was established at Philadelphia, then the seat of the General Government, March 1, 1785, by men who were for the most part engaged in pursuits having no immediate connection with agriculture. On the 4th of July, 1785, General Washington was elected an honorary member of this society and ever afterwards showed a deep interest in its proceedings. Benjamin Franklin's name is also found on the list of its honorary members. In the same year a similar society was formed in South Carolina, which had among its objects the establishment of an experimental farm. This society was incorporated December 19, 1795. The present State Agricultural Society of South Carolina still holds the original charter. The New York Society for the Promotion of Agriculture, Arts, and Manufactures was organized February 26, 1791, and about the same time a society was formed at Kennebec, Mass. (now Maine). In 1792 the New York society published a small quarto volume of its transactions. The Massachusetts
Society for Promoting Agriculture was incorporated March 7, 1792, and in 1794 the Western Society of Middlesex Husbandmen was formed in Massachusetts, though not incorporated until 1803. "The Society for Promoting Agriculture in the State of Connecticut was organized August 12, 1794, and published its first volume of transactions, a small quarto pamphlet, in 1802." This society still exists as the county society of New Haven.

THE FIRST PLANS FOR AGRICULTURAL EDUCATION.

In 1792 Samuel L. Mitchill, M. D., LL. D., was appointed professor of natural history, chemistry, agriculture, and the other arts depending thereon, in Columbia College, in the city of New York. The college records do not show whether he ever gave any instruction in agricultural subjects, but it is almost certain that he was active in early efforts to advance agriculture through education, and that men afterwards prominent in urging the establishment of agricultural colleges were among his students. Lavoisier, who was probably the first scientist to give systematic attention to the application of chemistry to agriculture, was then the great chemist. Dr. Mitchill is credited with introducing his theories in this country, and undoubtedly referred in his lectures to the agricultural features of this science. We know that he was active in the New York Society for the Promotion of Agriculture, Arts, and Manufactures, and that he wrote essays on the chemistry of manures. He was retired in 1801, having been elected a member of the House of Representatives.

On the 21st of January, 1794, a committee was appointed by the Philadelphia society "to prepare outlines of a plan for establishing a State society for the promotion of agriculture, connecting with it the education of youth in the knowledge of that most important art, while they are acquiring other useful knowledge suitable for the agricultural citizens of the State." The committee made a report in which several alternatives for promoting agricultural education are presented to the legislature:

Whether by endowing professorships, to be annexed to the University of Pennsylvania and the College of Carlisle, and other seminaries of learning, for the purpose of teaching the chemical, philosophical, and elementary parts of the theory of agriculture; or, by adding to the funds of the society, increase their ability to propagate a knowledge of the subject, and stimulate, by premiums and other incentives, the exertions of the agricultural citizens; or whether, by a combination of these means, the welfare of the State may be more effectually promoted.

It was also a part of the plan to make the common-school system of the State contributory to the technical education of the farmer.

The country schoolmasters may be secretaries of the county societies, and the schoolhouses the places of meeting and the repositories of their transactions, models, etc. The legislature may enjoin on these schoolmasters the combination of the subject of agriculture with the other parts of education. This may be easily effected by introducing, as school books, those on this subject, and thereby making it familiar
to their pupils. These will be gaining a knowledge of the business they are destined to follow, while they are taught the elementary parts of their education. Books thus profitable to them in the common affairs of life may be substituted for some of those now used, and they can easily be obtained. Selections from the best writers in husbandry may be made by the society. The essays of our own experimentalists or theorists and the proceedings of the society will also afford information.

This report seems to have been the first formal attempt made in the United States to urge the claims of agricultural education and experimentation upon the attention of a lawmaking body.

WASHINGTON'S MESSAGE TO CONGRESS.

Two years later, on December 7, 1796, in his annual message to the second session of the Fourth Congress, Washington showed his interest in agriculture by the following recommendation:

It will not be doubted that, with reference either to individual or national welfare, agriculture is of primary importance. In proportion as nations advance in population and other circumstances of maturity this truth becomes more apparent and renders the cultivation of the soil more and more an object of public patronage. Institutions for promoting it grow up supported by the public purse, and to what object can it be dedicated with greater propriety? Among the means which have been employed to this end none have been attended with greater success than the establishment of boards composed of public characters, charged with collecting and diffusing information, and enabled, by premiums and small pecuniary aid, to encourage and assist a spirit of discovery and improvement. This species of establishment contributes doubly to the increase of improvements, by stimulating to enterprise and experiment, and by drawing to a common center the results everywhere of individual skill and observation, and spreading them thence over the whole nation. Experience accordingly has shown that they are very cheap instruments of immense national importance.

I have heretofore proposed to the consideration of Congress the expediency of establishing a national university, and also a military academy.

Congress soon established the academy to promote the science and art of war, but paid no attention to the words of the great general in favor of institutions to benefit the sciences and arts of peace.

In 1797 the trustees of the Massachusetts society began the publication of pamphlets, or, as we should now say, bulletins, on agricultural topics, which afterwards were developed into a regularly issued journal. A voluntary agricultural association was formed at Stockbridge, Mass., in 1799, and probably a few other societies were organized before the close of the last century.

Near the opening of the new century (1801) a suggestion was made to the Massachusetts society that fairs should be regularly held in May and October on Cambridge Common and bounties given for certain articles. This plan included not only the exhibition of agricultural products, but also stated open markets for their sale. No action was taken by the society regarding this suggestion. In the same year this society discussed a proposition for the permanent endowment of a professorship of natural history and a botanic garden at Harvard
College. The society took a lively interest in this matter and was enabled to carry out the suggestion in 1804, when William D. Peck was elected to fill the new chair.

AGRICULTURAL FAIRS AT WASHINGTON.

In the Report of the United States Commissioner of Agriculture for 1866, in an article on the History of the Agriculture of the United States, by Ben: Perley Poore, may be found the following statements regarding the first attempt made at the newly established seat of the National Government to promote the interests of American agriculture:

In 1804 it was suggested by Dr. Thornton, the first Commissioner of Patents, then residing in Washington, which was literally a "city in the woods," that the ready sale of cattle and of domestic products could be promoted by the holding of fairs on market days, as in England, his native land. The idea met with the warm approval of the citizens, and the municipal authorities passed an act establishing semiannual fairs. An editorial article in the National Intelligencer of October 17 spoke of the coming fair as offering advantages to purchasers and to settlers, "while at the same time it can but prove equally beneficial to the agricultural interests of our country." The fair was held on Wednesday, Thursday, and Friday, in "the mall at the south side of the Tiber, extending from the bridge at the Center Market to the Potomac."

It was a decided success, and before the next one was held an attempt was made by additional legislation on the part of the city government to increase its usefulness by appropriating $50 toward a fund for premiums. The citizens raised by subscription an equal sum, so that at the fair, which began on the 26th of April, 1805, premiums to the amount of $100 were awarded to the best lamb, sheep, steer, milch cow, yoke of oxen, and horse actually sold. A third fair was held in November, 1805, after which they were discontinued.

Early in the year 1806 Joel Barlow, then residing at Kalorama, in the vicinity of Washington, published the prospectus of a "National Academy," in which he enumerated, among the foreign institutions to be copied in forming an American organization, the agricultural societies of England and the veterinary school of France.

Meanwhile an institution had been organized by "members of Congress, officers of the Federal Government, and others, devoted to objects connected with public economy." Meetings were held at Mr. Hervey's, on Pennsylvania avenue, every Saturday evening, from 5 until 8 o'clock, and among the subjects considered were:

Our mechanical economy, or the means of abridging labor by useful inventions, implements, and apparatus; our agricultural economy, or the means of producing the most abundant and most reciprocal crops, under any given circumstances, without doing things by guess; the economy of our forests, or the best management of our latent resources there.

CATTLE SHOWS IN MASSACHUSETTS.

In the autumn of 1807 Elkanah Watson, a native of Plymouth, Mass., and a direct descendant of Governor Edward Winslow, who, in 1624, had brought to Plymouth, in the ship Charity, three heifers and a bull, "the first neat cattle that came into New England," procured the first pair of Merino sheep which had been introduced into Berkshire County, and gave notice of an exhibition of his two sheep on the public square at Pittsfield. He wrote that "many farmers and even females were attracted to this first novel and humble exhibition." The interest
excited by this exhibit led Mr. Watson to undertake a larger enterprise, and on the 1st of August, 1810, an appeal drawn by himself and signed by twenty-six persons was published, appointing an exhibition of stock at the same place on the 1st of October. This “cattle show” was quite successful, and before many years the annual exhibit became a permanent and popular institution in Massachusetts. Mr. Watson’s report of the exhibition of September, 1811, shows the picturesque elements which were thus early introduced into these rural festivals. There was “a procession of sixty-nine oxen drawing a plow held by the oldest man in the county; a band of music; the society, bearing appropriate ensigns, each member decorated with a badge of two heads of wheat in his hat, and the officers three heads secured by a green ribbon.” Meanwhile, in 1809, a number of gentlemen interested in agriculture, residing in Maryland, Virginia, and the District of Columbia, had formed the Columbian Agricultural Society, which may properly be considered as the germ of a national organization. This society actively engaged in the work of educating the farmer through the agency of exhibitions.

HINDRANCES TO AGRICULTURAL EDUCATION, 1810-1840.

Various causes seem to have contributed to retard the progress of agricultural education during the next three decades. The war with England, from 1812 to 1815, undoubtedly turned the attention of our people away from the consideration of measures for the improvement of agriculture. The obstruction to commerce growing out of the wars of Napoleon, and the quarrel between England and the United States, caused the manufactures of this country to develop with wonderful rapidity. The enterprising youth were drawn in large numbers from the farms to factories, and the public mind was occupied with schemes for increasing the wealth of the country in this direction. However, in 1817, the Berkshire Agricultural Society of Massachusetts, under the enthusiastic leadership of Elkanah Watson, presented a memorial to Congress praying for the establishment of a national board of agriculture, in accordance with the original suggestion by President Washington. A bill for this purpose was actually reported in the House of Representatives, but was defeated by an overwhelming vote. Some members opposed the bill because there was in their judgment no warrant in the Constitution for such an institution; others based their opposition on questions of expediency, or on the general indifference of the agricultural public. It was also well known that President Madison was not in favor of the measure. The decade closed with the establishment of the New York Horticultural Society, the first horticultural society in the United States, in 1818, and the publication of the first distinctively agricultural periodical in this country, the American Farmer, in Baltimore, Md., in 1819. This was followed by the New England Farmer, published in 1822. “During this decade, also, the
wool interest made much stir. The breaking up of the flocks in Spain, the importation of Merino sheep into this country, and the speculation which followed, influenced agricultural fairs and societies."

There were comparatively few events of striking interest to mark the progress of agriculture in the United States during the next twenty years. During this period the boundaries of the Republic were greatly enlarged; the introduction of steam as a motive power was already contributing largely to the movement of population from worn-out lands in the East to fertile districts further west; the demoralization of enterprise resulting from the employment of slaves was beginning to be felt in the South; questions relating to the extension of slavery, to methods of transportation, to the establishment of new States and Territories, to public systems of free elementary education, were absorbing public attention. There was little heed paid to the claims of scientific agriculture or thought about the necessity for technical education. About 1820, however, there was considerable popular interest in a scheme for the culture and manufacture of silk in the United States, a matter which had had its cycles of agitation somewhere in this country in every decade since 1750. Congress responded to the demand for information by ordering the publication of a well-digested manual prepared by Richard Rust, Secretary of the Treasury, containing the best practical information that could be collected on the growth and manufacture of silk. In 1828 an edition of a Treatise on the Rearing of Silkworms, by Count Von Haggie, of Munich, was printed as a Congressional document, and several valuable reports on silk culture were made and published, until the bursting of the "Morus multicaulis bubble" checked for a time this branch of agricultural industry.

REVIVAL OF INTEREST IN AGRICULTURE.

Ten years later public attention was rudely awakened to the necessity of doing something to prevent the rapid exhaustion of the soil, which was becoming a matter of serious concern in all States along the Atlantic seaboard. The failure of the crops in 1837-38 turned the balance of trade heavily against us and caused the importation of millions of dollars' worth of breadstuffs. From this time may be dated the beginning of active interest in agriculture on the part of the National Government. At the prompting of Hon. Henry L. Ellsworth, Commissioner of Patents, Congress, in 1839, made an appropriation of $1,000 for the "collection of agricultural statistics, investigations for promoting agricultural and rural economy, and the procurement of cuttings and seeds for gratuitous distribution among the farmers." In the two succeeding years Congress failed to make any further appropriation, but the Commissioner of Patents did not flag in his efforts to secure recognition of the claims of the farmers by the National Legislature, and in 1842 the appropriation for agriculture was renewed and has ever since been regularly made, except in 1846. The first attempt
to organize a national agricultural society was made at Washington in 1841 by a convention of persons desiring "to elevate the character and standing of the cultivation of the American soil." It was hoped that the fund left by Hugh Smithson might be made available for the maintenance of such an organization, but the establishment of the Smithsonian Institution frustrated these expectations, and the "national society remained dormant until 1852."

PLANS FOR AGRICULTURAL EDUCATION IN NEW YORK AND OTHER STATES.

The history of the early agitation in favor of agricultural education in the State of New York is very interesting and instructive. Prof. W. H. Brewer, of Yale University, who was closely identified with agricultural schools established in that State prior to 1860, has collected much information on this subject, and the author of this article is indebted to him for many of the facts here stated. As early as 1819, Simeon De Witt, surveyor-general of New York, to whom we are indebted for the classical names given to many towns in that State, in a pamphlet published anonymously at Albany, under the title "Considerations on the necessity of establishing an agricultural college," urged the foundation, under State authority, of an institution which he proposed to call "The Agricultural College of the State of New York." This matter was thereafter never allowed to drop wholly out of sight. Allusions to an attempt to found an agricultural college in 1822 are found in the Transactions of the New York Agricultural Society and elsewhere.

In 1826 mention is made of a lyceum in Maine devoted to agricultural studies, of schools in Connecticut having agricultural courses, and of efforts in Massachusetts to establish an agricultural college. The Farmers' School Book, by Prof. J. Orvill Taylor, was published at Ithaca, N. Y., in 1837. It was a little elementary work on science, particularly chemistry, on the use of manures and on general farming, and was soon introduced in many of the district schools. About the same time the establishment of an agricultural college, probably a private speculation, was undertaken in Columbia County. Between 1830 and 1840 there was much talk about "manual labor schools," a term variously applied to schools in which the students were to pay for their education in whole or part by their labor, and a number of schools were started on that basis. The Oneida Institute was one of the earliest of these schools, and for a time enjoyed considerable popularity. So general had the agitation for agricultural education become in New York by 1838 that petitions asking for State aid in behalf of this cause, with nearly 6,000 signatures, were presented to the legislature and turned over to a committee, who made a report deploiring in strong language "that there is no school, no seminary, no subdivision of any school in which the science of agriculture is taught," and recom-
mending the establishment of a school for this science. This matter came up in the legislature in different forms in succeeding years, and the movement seems to have steadily grown in strength and importance. It was greatly aided by the State Agricultural Society, which was reorganized in 1841, and immediately began the publication of the series of volumes of Transactions, which was continued annually for over thirty years, and less frequently since. One project of these times was that the State should maintain a lecturer who should inform the people of different localities on scientific and practical agriculture. Lectures on agricultural chemistry were delivered about this time to popular assemblies or schools in western New York, and this seems to have been done elsewhere, perhaps as far south as Georgia.

At the annual meeting of the New York State Agricultural Society in January, 1844, a committee of seven, consisting of Hon. John Greig, Governor Seward, Lieutenant-Governor Dickinson, Col. John A. King, James S. Wadsworth, Judge Savage, and Henry O'Reilly, was appointed to promote "the introduction of agricultural books and studies in the schools and libraries throughout the State, and also for the purpose of selecting such prize essays from among the transactions of the society as may be most appropriately published in volumes of suitable size for the family and school district libraries;" and the society further resolved "That this society regards the establishment of an agricultural institute and pattern farm in this State, where shall be taught thoroughly and alike the science, the practice, and the profits of good husbandry, as an object of great importance to the productive agriculture of New York."

This committee entered into correspondence with school superintendents and influential friends of agriculture in several States and presented an elaborate report the following year, in which are quoted the resolutions passed by the State convention of common-school superintendents held in June, 1844. The chairman of the committee which submitted these resolutions was Professor Potter, of Union College, and the committee stated that in their opinion "the time has arrived when the elements and scientific principles of agriculture should be taught in all our schools, especially to the older class of pupils."

Between 1845 and 1850 agricultural schools were established by private enterprise in various places in the State. Among the peculiar features of these earlier schools were courses of lectures on agricultural chemistry and other topics, similar to the short or winter courses recently organized in a number of our agricultural colleges. For example, the Genesee Farmer for March, 1846, speaks of the Cortland County Agricultural School and of Mr. Woolworth's "unexpected success" in delivering lectures once a week to twenty-five or thirty farmers.

The agricultural school at Cream Hill, Connecticut, was established in May, 1845, by Dr. S. W. Gold and his son, T. S. Gold, and continued in successful operation until 1869. The number of pupils was limited to 20, and the object of the school was "to unite with classical and scientific education, theoretical and practical instruction in agriculture."
A course of lectures on agricultural chemistry was delivered in New Orleans on invitation of citizens during the winter of 1845-46, by B. W. Jones, afterwards a professor in Yale College.

Sufficient interest was awakened in this and other plans for the promotion of agriculture to make it seem to the United States Commissioner of Patents worth while to send a special agent to Europe to investigate the movements there in the same direction. In the report of this agent, published in 1847, is contained an account of the European agricultural schools.

In 1846 John P. Norton was appointed professor of agricultural chemistry and vegetable and animal physiology at Yale College, New Haven, Conn. B. Silliman, jr., was appointed professor of chemistry applied to the arts. This was the beginning of Sheffield Scientific School. The Lawrence Scientific School at Harvard was begun about the same time. Professor Norton began his lectures in 1847, and during the next five years also wrote extensively for agricultural journals, edited an American edition of Stevens on the Farm, and published a work of his own on the Elements of Agriculture. So great was the demand for teachers in agricultural chemistry that a regular course with a view to their preparation was established at Yale in 1848. Prof. W. H. Brewer was among the first students to take this course, and Prof. S. W. Johnson joined him in 1849.

In January, 1849, Governor Hamilton Fish, of New York, in his annual message to the legislature of the State, strongly recommended the establishment of a State agricultural college. The same year the New York Agricultural Society established at Albany a chemical laboratory for the analysis of soils, manures, etc., and an elaborate but very inaccurate chemical examination of maize was made there by Dr. Salisbury. During the session of the legislature that year Professor Johnston, of Edinburgh, the celebrated Scotch agricultural chemist, came to Albany and delivered a course of lectures under the auspices of the society.

In an address before the Norfolk Agricultural Society, delivered in 1849, Hon. Marshall P. Wilder urged the advisability of establishing an agricultural college in Massachusetts. The idea speedily took hold of the friends of agriculture in that State to such an extent that in 1850 the State senate of Massachusetts passed a bill to found such an institution, but it was defeated in the house. As a compromise measure a board of commissioners was appointed to investigate the matter. The commissioners sent Professor Hitchcock to Europe to visit the agricultural schools already in operation there, and his report was transmitted to the legislature in the following year. The only immediate outcome of this movement was the establishment of the Massachusetts Board of Agriculture in 1852.

The United States Commissioner of Patents had meanwhile begun to urge upon Congress the desirability of giving national aid to agricultural education. In his report for the year 1850 he deprecates the lack of
qualified men to fill professorships in agricultural colleges, and says that "if a young farmer engaged in stock growing wishes to study the digestive organs, the muscles, nerves, or blood vessels of the horse, cow, sheep, or hog, there is not a museum in all America where this can be done." And in the two succeeding years the same official publishes in his reports letters from prominent agriculturists urging the establishment of a national school for the training of teachers for agricultural and other industrial schools.

Professor Brewer thus writes concerning the first industrial college established in New York:

In 1850 Mr. John Delafield, a retired banker of New York City, a graduate of Columbia College, where he may have received instruction from Professor Mitchill, was living on one of the best farms in the State, "Oaklands," near Geneva, in the town of Fayette, Seneca County. He was enthusiastic in all matters relating to agricultural progress, and was a near neighbor of John Johnston, the famous Scotch farmer, the pioneer of tile drainage in the United States. Mr. Delafield imported the first tile-making machine in 1852. He was also at one time president of the New York State Agricultural Society, and originated and carried out an agricultural and topographical survey of Seneca County. He took a deep interest in the cause of agricultural education, and, owing to his action and energy, on April 15, 1853, the State passed an act establishing a State agricultural college. This act created a board of ten trustees, of which Mr. Delafield was president, but appropriated no money. The college was to be located on Mr. Delafield's farm, in the town of Fayette, but as he died October 22 of the same year, nothing more was done about building a college there.

At this time the Ovid Academy, located some 15 miles south of Fayette, was in successful operation; agricultural chemistry was there taught, and public lectures were given upon the same subject. Rev. Amos Brown, the principal of that academy, conceived the idea of having the college charter transferred to Ovid. The agitation for this was begun in 1855, and in 1856 an act was passed providing for the loan by the State of $40,000 for twenty-one years without interest, and the citizens of the vicinity subscribed nearly $50,000 more for the carrying out of the plan. In that year the board of trustees was reorganized, and soon after a farm was purchased at Ovid and Judge Cheever was made president. Buildings were built and the college was formally opened as the New York State Agricultural College in the fall of 1860, under the presidency of Maj. M. R. Patrick. By this time the institution was heavily in debt, the civil war soon broke out, Major Patrick was called to the army, and the college was closed, never again to be opened as a school. The land and buildings reverted to the State and are now used for an insane asylum.

Contemporaneous with this was the starting of another institution, known as "The People's College," to be located near Havana, N. Y. It, too, was to be an industrial institution, but of wider scope. Its act of incorporation was passed April 12, 1853, or three days before that of the agricultural college just mentioned. Amos Brown later became the president of this institution, and as such took an active part in the
discussion of the Morrill bill, and was largely instrumental in securing its passage. In a letter dated December 1, 1862 (only five months after the passage of the bill), Mr. Morrill writes as follows:

The Reverend Amos Brown took such active part in securing the passage of the bill referred to whenever it was before Congress, both by his earnest and intelligent advocacy of the measure through personal interviews and by sufficient urging the attendance of members on all questions of any test votes, his services continuing for months, that it is due to him and the institution of which he is the head, whenever an official disposition of the funds shall be made, that his merit shall not go unacknowledged by the State of New York. From an early moment after the first bill was introduced he has been unflagging in his efforts to promote the success of this great measure in behalf of agriculture, and it is a pleasure to me to acknowledge the value of his aid and cooperation.

It is interesting to note in this connection that even before the first introduction of the Morrill bill, in 1857, and when Mr. Brown probably had no knowledge of Mr. Morrill's intention to frame such a bill, Mr. Brown was earnestly urging that an agricultural college should be a broad institution of high grade, in which the sciences and technology should be taught along with the old studies. In talking of this matter he often expressed the sentiment, if not the very language, afterwards adopted for the seal of Cornell University.

After the passage of the Morrill act of 1862 the legislature of New York voted to give the whole of New York's share of the land grant to the "People's College," but afterwards, when that institution failed to comply with the conditions of the law, the grant was given to Cornell University.

THE FIRST AGRICULTURAL COLLEGE.

The constitution of the State of Michigan, adopted in 1850, requires that "the legislature shall provide for the establishment of an agricultural school for agriculture and the natural sciences connected therewith." In obedience to this provision an act for the establishment of a State agricultural college was adopted by the legislature of Michigan in 1855, and approved February 12 of that year, and the organization of the institution given into the charge of the State board of education. A farm, then in the woods, of 676 acres, lying 3½ miles east of the city of Lansing, was purchased and buildings erected, and on May 13, 1857, the college was formally opened for the reception of students. The institution began with 61 students and 5 professors. To Michigan, therefore, belongs the honor of having been the first of the States to put in actual operation an educational institution for the direct promotion of technical training in agriculture.

The Farmers' High School of Pennsylvania (now the Pennsylvania State College) was incorporated in 1854 and opened for students in February, 1859. Donations of land as a site for the institution were offered in several parts of the State. Funds for the erection and equipment of buildings were provided by the legislature, the State
Agricultural Society, and private subscription. The first president, Dr. Evan Pugh, had not only studied in Germany at a time when very few American students went abroad, but had also spent several months at Rothamsted, England, working under Lawes and Gilbert.

In 1856 the legislature of Maryland incorporated Maryland Agricultural College.

Under this law nearly 500 philanthropic and patriotic citizens of Maryland, with a few in other States and in the District of Columbia, subscribed the minimum amount of stock provided by the act and organized the institution. The stockholders met, elected the first board of trustees, and this body, after much deliberation, purchased for the college, from the late Charles B. Calvert, the estate known as Rossboro, containing 428 acres and situated in Prince George County, 8 miles from the city of Washington, and upon the Baltimore and Ohio Railroad. There the cornerstone of the main college building was laid on August 24, 1858, and the institution was opened for students in September, 1859. The opening of the college was quite an imposing event. Bishop Pinkney was chaplain and Professor Henry, of the Smithsonian Institution, was the orator of the day.

Meanwhile, in 1856, Mr. Wilder, of Massachusetts, had succeeded in obtaining from the legislature of his State a charter of "The Trustees of the Massachusetts School of Agriculture," and from Congress a charter of the United States Agricultural Society, which had been formed in 1852. It is perhaps worth while to notice that the latter was opposed in the Senate by Jefferson Davis on the ground that "Congress had no power to create corporations."

The First Morrill Act.

The activity of the friends of agricultural education now began to extend itself beyond the limits of State legislation, and numerous petitions were presented to Congress asking for national aid for the establishment of agricultural colleges. The relation of this movement to that wider development of the American system of higher education due to the progress of the natural sciences and their application to the arts is thus briefly discussed by Professor Brewer, whose intimate personal acquaintance with many of the leaders of industrial, scientific, and educational progress in this period eminently qualifies him to speak of the causes which led to the passage of the Morrill act of 1862.

The Events leading up to the Morrill Act.

The Morrill act of 1862 was the outcome of a long series of events which seem either to have been imperfectly understood by many writers or to have been deemed of an importance far below what they really had. The causes which led up to this grant of land for the purpose of aiding schools of science were numerous and not so simple as they seem now. Educational demands were doubtless the greater, but others, which need not be discussed in detail here, were important and, indeed, essential factors in promoting the passage of this act. Considered even as an educational movement, it was only a part of a wide movement, of which instruction in the sciences of immediate and special application in agriculture was but one phase.

It is true that there was a widespread and often-heard demand for agricultural
colleges during the twenty years preceding the passage of that act, but this was but one feature of a general educational movement.

The period between 1840 and 1860 was a peculiar one in the history of the world's intellectual activity and material progress. At its beginning some of the physical sciences, more particularly chemistry and geology, were scarcely 50 years old, but they had already revolutionized some of the arts and produced great changes in agriculture. All this had taken place within the lifetime of the older workers then in the field.

Popular works on science were widely read, and had prepared the public mind to cherish hopes, perhaps exaggerated, of the benefits to come by the applications of science, and had greatly stimulated intellectual activity in this new field of knowledge. Liebig's familiar Letters on Chemistry incited hopes for agriculture which will probably never be realized. Dick's works made the moon hoax not only possible but such a great success as it never could have been before or since, and the discoveries actually taking place at that time awakened the most widespread desire to know more.

In a thousand and one ways, more in the other lines than in agriculture, discovery, invention, and the application of scientific laws to the arts and industries were playing a part in the development of the material resources of the civilized world and modifying the industries and occupations of men. There was then an absorbing interest in the growing steam transportation; railroads and ocean steamships then came into use and were made practicable; iron working, dyeing, and many other arts were being revolutionized by chemistry; commercial fertilizers were coming to be used; the electric telegraph, just invented, first came into use during this period; other events, some of them political, were profoundly affecting the current of human activity; prices, which had been falling from the decline of the production of silver in Mexico, began to rise with the discovery and production of gold in California. This was the beginning of an era in the rise of prices and of material prosperity unexampled in the history of civilization. The vine disease in the south of Europe, the potato disease in Ireland, the revolution in Germany, all occurring just as steamships began to carry immigrants, stimulated the immigration of working people as never before.

All these influences produced a deep and lasting effect on the theories and practice of education. The "old education," as it was called, did not supply the new wants. There was a loud and discordant demand for something else. The many agreed only in this, that less Latin and Greek (which had before been considered the corner stone and substance of a liberal education) be taught and in their place more science; or at least that, whatever place the old college curriculum might have in the future, new systems of education were required in this new development of civilization.

For example, great railroads were being surveyed and built; yet, aside from the national military school at West Point and personal instruction at places scattered here and there, there was but one engineering school in the United States previous to 1840. So it is not wonderful that the matter of training in the sciences, pure and applied, was discussed when engineers were wanted and our factories, iron works, and other industries were asking for chemists. The old education was not sufficient for the new uses, but what the new education was to be and what were to be its schools no one seemed to know.

This discussion, along with that of elective studies instead of a rigid curriculum, went on in all the colleges and universities in the land. The University of Virginia

1[A fabulous account of telescopic information regarding the moon, published in the New York Sun, in which the writer went so far as to predict that we should soon be able to study the entomology of that satellite. Many persons believed this marvelous story.—Ed.]

2Rensselaer Polytechnic Institute at Troy, N. Y.
already had elective courses. All tried in some way to expand in the direction of the physical sciences.

The agitation for education in sciences began earlier, but the profoundest movement in the colleges took place between 1840 and 1850. Yale College then established its scientific and agricultural department, more agricultural than elsewhere because of the personal bent of Prof. John P. Norton, who was really the father of that department in Yale. Harvard started its scientific department at the same time—the Lawrence Scientific School—but the Lawrences, who gave the endowment of $40,000 to start it with, being prominently engaged in manufacturing, chemistry applied in the direction of the arts rather than in agriculture became there more prominent. While these old and reputable universities added scientific departments, others modified the curriculum in their literary courses to embrace more science. So profound was this movement that some very respectable institutions whose endowment did not permit of extensive expansion seriously considered the advisability of changing their plans and becoming essentially schools of science rather than of literature.

Prominent among those educators who agitated this question was Francis Wayland, then president of Brown University. Liberally educated, first at Union College, under the administration of the eminent Dr. Nott, then studying and graduating doctor of medicine, later a Baptist clergyman, he became eminent as a Baptist theologian, as a teacher, as a professor of moral science, but more so as a teacher and writer on educational matters. He was president of Brown University from 1827 to 1855, and between 1840 and 1855, the period I am more especially discussing, he took a more prominent part in the discussion of the new needs in education than any other college president of the country.

As early as 1842 he published a little book entitled Thought on the Present Collegiate System of the United States, in which he argues earnestly in favor of the introduction of new subjects into the college curriculum, much more attention to the sciences, and the adoption of a system of elective studies.

In A Sketch of the History and the Present Organization of Brown University, published by the executive board, Providence, 1861, we find that Wayland had come in as president in the college in the year 1826–27; that "his presidency was marked by greater changes and more numerous improvements than had been effected by either of his predecessors;" that a science hall and a museum of geology had been added in 1840; that the college was poor and not self-supporting, and that, "despairing of improvement so long as the existing system was perpetuated, Dr. Wayland in 1849 resigned his presidency;" that he, however, consented to reconsider his purpose, and the corporation falling in with him, "it was resolved to attempt to raise a fund for the purpose of realizing his theory of education; $125,000 was subscribed and what was called the new system was commenced." Its main features were a provision "for such new courses in science as the practical spirit of the age demanded, etc." The four-years' course was abolished, a three-years' course established, and several kinds of degrees conferred. This ran from 1850 to 1855; then Dr. Wayland, "having inaugurated his cherished plan," resigned, and Dr. Sears was put in his place. Dr. Sears already had fame as a theologian, and soon under him the four-years' course was reestablished, leading to the degree of A.B.

Going along with these changes in collegiate instruction there was much clamor for purely technical schools of special kinds. In no direction was this more marked than in agriculture. This became the field of work for enthusiasts of various grades and a bewildering number of schemes was proposed. A few private schools were started, but the loudest clamor was for State agricultural colleges. Many were planned, a few were chartered, and three or four actually opened before 1862.

These early agricultural colleges were certainly not at first a success. Some were total failures (as in New York), others hardly a success (as in Michigan and Pennsylvania). Why this was so was a matter of dispute. It is certain that they were poor in means, and to this cause many attributed the poverty of their results.
We ought here to say that previous to 1850 numerous private agricultural schools of a grade lower than colleges had been established in the United States and many were for a time reasonably successful. Such, for instance, was Dr. Gold's, in West Cornwall, Conn.

Not only were a few agricultural schools started, but also other schools in which the sciences were to be a leading feature.

Many prominent educators, however, came to think that their failure was because their aim was too narrow; that it was too early in this country for a narrow institution, supplying but a single want, to be successful; that scientific and practical institutions should be wider and with wider aims, inciting to higher culture and laying a more solid foundation; in short, that schools of science rather than trade schools were needed. Of colleges of the old-fashioned sort there were already enough and more than enough. The direction of their studies and system of instruction had been developed by centuries of experience which must not be rudely thrown aside. On the other hand, schools of science were too new and too few to show what was the best curriculum and what should be the details; consequently there was a wide difference of opinion as to how they might be best conducted. It was therefore but natural that practical success should come slowly and total failures be common.

Such was the condition of educational affairs when the Morrill act was discussed and passed. This wisely left the details to be developed in the respective schools. With a sagacity greater than that of most "educators" before and since, Mr. Morrill saw that schools grow rather than are made, and he therefore only indicated the general direction in which they should grow; that is, they were to be schools of science rather than schools of literature—cities where the sciences and their application in agriculture and the arts were to be studied and cherished as the leading objects.

On December 14, 1857, Justin S. Morrill, then a member of the House of Representatives, and now a venerable Senator, from the State of Vermont, introduced a bill into the lower House authorizing the establishment of industrial colleges in every State, and granting for their maintenance 20,000 acres of the public land for each member of Congress. This bill was referred to the Committee on Public Lands, who brought in an adverse report April 15, 1858. Nevertheless, in the following session of Congress the bill passed both Houses, but was vetoed by President Buchanan.

In December, 1861, Mr. Morrill introduced in the House of Representatives his amended bill, which bestowed 30,000 acres of land for each member of Congress upon the several States for the establishment of colleges "to teach such branches of learning as are related to agriculture and the mechanic arts, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life," and May 2, 1862, Benjamin Wade, of Ohio, introduced a similar bill in the Senate. On May 29 the bill was reported adversely in the House by the Committee on Public Lands, but was passed by the Senate June 10, and nine days later by the House. President Lincoln made the bill a law by affixing his signature July 2, 1862, the very day when McClellan's army began its retreat from the Peninsula after the bloody battle of Malvern Hill. Amid the national

---

1The amount of land actually allotted the several States was partly determined by the value of the land selected.
gloom which succeeded the failure of the Union’s greatest army to take the capital of the Confederacy, few paid any attention to the gift of over 11,000,000 acres to promote the arts and industries of peace. It is a significant fact that in the amended bill it was provided that every institution receiving the benefits of the land grant should provide for the military training of its students.

As it was anticipated that the land grant would furnish a fund only sufficient for the partial support of such colleges as the several States ought to maintain for the benefit of the "industrial classes," the act provides that "no portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, to the purchase, erection, preservation, or repair of any building or buildings." Ten per cent of the fund might, however, be expended "for the purchase of lands for sites or experimental farms." "The Federal Government," says Dr. Blackmar, in his History of Federal and State Aid to Higher Education, "intended the grant should form a nucleus in each of the several States around which buildings, libraries, laboratories, workshops, gymnasiums, military halls, and other educational appliances should be grouped by means of public munificence and State bounty. It was to prove a stimulus to the generosity of the people and the liberality of the States. To this test the people, through private gifts and municipal and State governments, have responded, with few exceptions, in a liberal way."

The shares of the several States under the land-grant act of 1862 ranged from 24,000 acres for Alabama to 990,000 acres for New York. The fund arising from the sale of the lands was not, however, proportionate in all cases to the number of acres received by the State. Many States sought to establish colleges very soon after the passage of the act, and in other States where the land grant was given to existing institutions the boards of management foolishly endeavored to convert the gift into cash at once. At the same time the homestead act, by enabling thousands of settlers to obtain land free of cost, and the extensive gifts of land to aid railroads, tended to depress the price of public lands offered for sale. The general result was that many States received small advantages from the land grant, the income from which in some cases was not sufficient to properly maintain even a single department of a college. In a few States, like New York and Michigan, where the number of acres received was large and the sale of the land was skillfully made, large funds were obtained and strong institutions were established. The total fund received from this land grant amounts to about $9,500,000, and about 1,200,000 acres still remain to be sold. The twenty-five years succeeding the passage of the act was necessarily a period of organization and of discussion regarding the character of the institutions which would fulfill the objects of the act and meet the needs of the industrial classes in the respective communities. The language of the act is broad and easily admits of widely diverse interpretation. It was not the intention to establish
agricultural colleges only, but rather institutions for "the liberal and practical education of the industrial classes in the several pursuits and professions in life." Whether a farmer's or mechanic's boy wished to become a doctor, machinist, or farmer, he was to have such instruction as he needed in the land-grant college. At the same time, in the agitation which preceded the introduction of the bill, in the speeches made in its favor, as well as in the act itself, special emphasis was laid upon agricultural education. The colleges to be founded under this act were in the minds of many to be to the profession of agriculture what West Point is to the profession of war. Unfortunately, the designation "agricultural colleges" was inserted in the title of the bill by the engrossing clerk and quickly passed into current use. In this way the real import of the act was obscured in the minds of the people, and the difficulties attending the proper administration of the fund were greatly increased.

It is also very important to remember in this connection that the definitions of the terms "liberal education," "practical education," "professions," as employed in the United States in 1862, were very different from those given to the same expressions to-day. A "liberal education" was then, in the popular mind, a medieval classical education; a "practical education" was one which fitted a man to earn his livelihood in any honest calling, and the "professions" were medicine, theology, and law. Reading, writing, and arithmetic were "practical" studies; Latin and Greek were "liberal" studies. Technical and scientific schools as we now know them were comparatively few and weak, and the period had not yet come when the ordinary education of the schools was not a passport to remunerative employment. It may be safely said that in 1862 an industrious boy of average common sense was sure of good wages if he could only get a common-school education. There is little wonder, then, that in carrying out the provisions of this act many of the States did little more than graft certain industrial features on new or old institutions which in general were like all the other institutions for higher education existing in the United States. Moreover, it could be fairly claimed that all institutions which made it easier for members of the industrial classes to obtain an education of any sort acted within the provisions of the Morrill act. But the land-grant colleges did far more than this. Almost all of them made more or less earnest efforts to secure agricultural students, and to provide at least a small amount of training in agricultural science. The farmers were not prepared to respond to these efforts. Many did not think there was or could be any science of agriculture worth learning. In the newer States the lands were so fertile and so cheap that farmers were highly prosperous under the most careless methods of agriculture. Moreover, when the immense volume of foreign immigration and the wonderful development of thousands of manufacturing and other industries in the United States since the civil war are considered, it
will not seem strange that the American farmer's boy of the period between 1862 and 1887 was not willing to stay on the farm, but sought the avenues leading to more rapid accumulation of wealth. It is easy to say now that the land-grant colleges ought to have resisted this tendency and held out larger inducements to pursue technical courses in agriculture; but when institutions deriving a large part of their support from the public purse were beset by the very class for which they were established with demands for a general education, and when there was no consensus among professional educators as to what should be included in agricultural courses, it could hardly be expected that the schools would refuse compliance with such requests. On the other hand, these colleges did much to inculcate a broader view of what constitutes a liberal education, and undertook much pioneer and experimental work in the development of technical courses suited to the needs of American farmers and mechanics. Even those which may seem to have done very little to directly benefit agriculture did in some cases the most valuable kind of work in preparing teachers and scientists who are now in the front ranks of those engaged in the work of technical instruction and in scientific and practical investigations in the agricultural schools and experiment stations throughout the country.

During this period clearer conceptions of what is desirable in courses of instruction in the sciences and arts, including agriculture, were being formed in the minds of educators and the public. Great changes and developments were taking place in all institutions of learning. The system of elective studies was steadily making its way and opening up wider opportunities for satisfying the demands of individuality in teacher and learner. Original research, which was all the while growing in importance and securing more brilliant and useful results in the Old World, began to assert its claims in the United States. Private benevolence was beginning to provide funds for the maintenance of such research in this country, and the people were gradually awakening to the necessity of promoting the interests of great industries by extending governmental aid to inquiries carried on in their behalf. Agriculture began to feel the influence of this movement. Experimental inquiries in field and laboratory were begun here and there, and very soon the regularly organized experiment station, after the German pattern, made its appearance in this country. Before proceeding to give a brief sketch of the history of the experiment stations let us consider for a moment the general status of the land-grant colleges just prior to the establishment of experiment stations under the act of Congress of March 2, 1887. The report of the United States Bureau of Education for 1886–87 contains the following general statements regarding these institutions:

The number of institutions in the United States sharing in the benefit of the land grant of 1862 is forty-eight.

In thirteen States the grant was made over to universities or colleges already exist-
ing, and has served to establish or augment the funds of courses, departments, or schools of applied science in the same. In the twenty-five remaining States the fund has served as the chief source of endowment for new institutions, or as the nucleus around which have collected additional funds, in several cases far exceeding the amount derived from the national grant. In six States the grant has been divided. In Georgia it has been applied to the endowment of six colleges of agriculture, affiliated to the State University; in Massachusetts separate colleges, one of agriculture, the other of the mechanic arts, have been the recipients; in Missouri a portion of the grant has been applied to the endowment of an "agricultural and mechanical college," and the rest to the endowment of a "school of mines and metallurgy," both under the auspices of the University of Missouri; in Mississippi, South Carolina, and Virginia the fund has been divided between institutions for white and colored students, respectively.

Certain of the schools have developed particularly in the direction of the mechanical arts; others are agricultural colleges, pure and simple; a few combine both departments, with large provision for theoretic instruction, while some differ in no essential particular from the ordinary classical college.

ORIGIN AND DEVELOPMENT OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.

While the States had been active in establishing agencies for aiding the farmer in acquiring a better knowledge of his art and in improving its practice, the National Government had not neglected to provide a central bureau for doing its part in similar work.

The establishment of a national board of agriculture was one of the measures which President Washington strongly urged upon the attention of Congress. The propriety of giving national aid to agriculture was early considered by committees of both Houses of Congress, but the indifference of the farmers and constitutional objections prevented any legislative action. During the Administration of John Quincy Adams the consuls in various parts of the world were instructed to send to the Department of State rare seeds and plants for distribution, and about the same time a botanical garden was established at Washington. These measures proved to be the germs from which has grown the United States Department of Agriculture. When our Government was first organized, after the adoption of the Federal Constitution, the principal charge of the issuing of patents was given to the Department of State, and when seeds and plants were received from consuls they were distributed through the Patent Office. Thus it came to pass that when, on the 4th of July, 1836, the Patent Office was made a separate bureau, and Hon. Henry L. Ellsworth, of Connecticut, was appointed as Commissioner of Patents, he considered it within the proper scope of his office to help the farmers of the country by distributing seeds and plants. Mr. Ellsworth had been a practical farmer in Connecticut, and, having traveled far to the West as Indian Commissioner, had been greatly impressed by the fertility of the vast prairies and was deeply interested in projects for the opening of these lands to settlement. He also realized the importance of the invention of improved agricultural implements, which were then beginning to attract
public attention, and believed that great benefit might result from the establishment of a regular system for the selection and distribution of grains and seeds of the choicest varieties for agricultural purposes. So earnest was he in this matter that, without legal authorization and outside of office hours, he secured free gifts of seeds and plants, which he afterwards distributed to farmers in various sections of the country, with the help of friendly members of Congress, who lent their franks for this purpose. Beginning with his first annual report, dated January 1, 1838, he strongly urged an appropriation to continue and enlarge this work, and in the closing hours of the Twenty-fifth Congress secured the passage of an act (March 3, 1839) appropriating $1,000, “to be taken from the Patent Office fund, for the purpose of collecting and distributing seeds, prosecuting agricultural investigations, and procuring agricultural statistics.” From that time up to 1854 seeds were distributed and agricultural statistics were compiled with the aid of small appropriations from the Patent Office fund, except in 1840, 1841, and 1846, when Congress failed to make any appropriation for this purpose. In 1854 the policy of appropriating money from the Patent Office fund was abandoned, and in the following year the whole amount ($39,000) drawn from that fund in the interest of agriculture was reimbursed, and thereafter the appropriations for agriculture were drawn directly from the Treasury. The same year the annual appropriation for agriculture was increased to $35,000, and has never since been less than that sum. A special agent was now employed “to investigate and report upon the habits of insects injurious and beneficial to vegetation, especially those infesting the cotton plant.” In 1855 an arrangement was made with the Smithsonian Institution for procuring and publishing meteorological statistics. A chemist and botanist were also employed, and a propagating garden was begun. The first annual report of Commissioner David P. Holloway, of Indiana, is worthy of notice as the last and most complete agricultural manual issued by the Patent Office, and as containing a bold and able plea for the creation “of a Department of the Productive Arts, to care for all the industrial interests of the country, but especially for agriculture.” Congress adopted a portion of the Commissioner’s plan, and passed a bill establishing a Department of Agriculture. This act became a law by the approval of President Lincoln on the 15th of May, 1862, and on the 1st of July of the same year the new Department was formally organized in the rooms of the Patent Office previously occupied by the agricultural division of that Office. Though by the terms of the act an independent department of the Government was established, its chief officer was styled Commissioner of Agriculture and was not a member of the President’s Cabinet. The duties of the Department as defined in this act are, “To acquire and diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word, and
to procure, propagate, and distribute among the people new and valuable seeds and plants." Hon. Isaac Newton, of Pennsylvania, who had been, since early in 1861, the superintendent of the agricultural division of the Patent Office, was appointed the first Commissioner of Agriculture. Mr. Newton had been a practical and progressive farmer, was one of the first and most active members of the State Agricultural Society of Pennsylvania, and had for years urged upon Congress the importance of establishing such a department as that over which he was now called to preside.

Upon assuming the duties of his office he at once proceeded to organize the Department in accordance with the liberal spirit of the act creating it. * * * The clerical force of the former agricultural division was increased; a chemist was engaged and a laboratory established; a skilled horticulturist was placed in charge of the propagating or experimental garden; greater activity in the collection and dissemination of current agricultural facts was inaugurated, and a larger quantity of seeds and cuttings was distributed. * * * A statistical branch was organized early in 1863, and to it was committed the collection and analysis of all statistics. Lewis Bollman, of Indiana, was appointed statistician. To ascertain, at the earliest practical period, the condition of the crops, their yield, the prices obtained for them, and other facts connected with current agricultural operations, the Commissioner issued during 1863 periodical circulars to farmers in every county of the loyal States. The results thus obtained were given to the public through the medium of monthly reports, which have been continued to the present time, with such modifications of their original features as time and experience have seemed to render necessary. The first monthly report was issued July 10, 1863. The publication in the monthly reports of monthly and bimonthly meteorological tables furnished by the Smithsonian Institution was commenced at the same time. These tables were reproduced in the ensuing annual report. Up to 1872 the same arrangement concerning these tables continued in force, when their further publication was suspended.

The employment of a skillful gardener was one of the most auspicious incidents of the first year of Mr. Newton's administration. He was fortunate in procuring the services of William Saunders, who has ever since given to the important duties assigned to him an intelligent and conscientious devotion.

In the second year of Mr. Newton's administration (1863) Townend Glover was appointed entomologist. In 1864 the Government reservation in the city of Washington lying between the Smithsonian Institution and the Washington Monument, and embracing 35 acres, was assigned to the Department of Agriculture. For several years this land was chiefly used as an experimental farm. The main building now occupied by the Department was erected on this farm, being completed in 1868. At that time the grounds were converted into a landscape garden, comprising a collection of hardy trees and shrubs arranged in their natural orders.

As the progress of agricultural science demanded new divisions of the work and the means at the disposal of the Department enabled it to widen the range of its efforts, one scientific branch after another was added. In 1884 the Bureau of Animal Industry was established to investigate and report upon the diseases of domestic animals, especially pleuropneumonia, and to devise measures for improving the animal industries of the country. The Bureau has since been charged with
the inspection of import and export animals and of live stock and their products slaughtered for food consumption. On the 11th of February, 1889, President Cleveland approved the act of Congress to make the Department of Agriculture an Executive Department, and nominated Norman J. Colman, of Missouri, the last Commissioner of Agriculture, to be the first Secretary of Agriculture. With the change of Administration, on March 4 of the same year, Jeremiah M. Rusk, of Wisconsin, was appointed Secretary of Agriculture by President Harrison, and Edwin Willits, president of the Michigan Agricultural College and director of the experiment station connected with that institution, was appointed Assistant Secretary. During their administration the Department was further developed by the addition of the Weather Bureau, which had been a branch of the Signal Service of the Army, and was, under act of Congress, transferred, on July 1, 1891, to this Department.

As at present reorganized by Secretaries Rusk and Morton, the Department of Agriculture has been divided into two grand divisions. One division embraces all branches of the Department which are more particularly charged with administrative and executive functions, and which, for that reason, are conducted under the personal supervision of the Secretary. The other division includes those branches which are chiefly engaged in investigations in agricultural science, and which are in immediate charge of the Assistant Secretary. Under the present organization, the Secretary supervises the Weather Bureau, Bureau of Animal Industry, Divisions of Statistics, Forestry, Records and Editing, Accounts, Seeds, Garden and Grounds, Road Inquiry, and the Library. The Assistant Secretary supervises the Office of Experiment Stations, the Divisions of Chemistry, Entomology, Ornithology and Mammalogy, Botany, Pomology, Vegetable Pathology, Microscopy, Agricultural Soils, Irrigation, Fiber Investigations, and the Museum. The duties of the several branches of the Department are briefly described in the Appendix. While the administrative and executive functions of the Department have been greatly enlarged by recent legislation, the scientific and practical investigations have been pursued with increasing activity, and the results of its work are more widely distributed and more highly appreciated than ever before. The growth of the Department is strikingly illustrated in the rapid increase in the amount of information which it has disseminated during the past five years. In 1889 the Department issued 78 publications, in editions aggregating 526,537 copies. During the fiscal year ending June 30, 1894, 205 publications passed through the Division of Records and Editing, all but 6 of which directly issued from this Department. The editions of these publications aggregated 3,169,310 copies.

That this Department has been a mighty factor in the education of the farmers of this country probably no one will deny. For our purpose,
however, it is only necessary to observe here that the Department has
developed very strongly in the direction of original research in behalf
of agriculture. In considering the history of the experiment stations
in the States it should never be forgotten that the Department has for
many years had within itself what is practically a great experiment
station, and that it is a very important feature in the great system of
experimental research in agriculture which has been established in this
country, very largely with the aid of funds drawn from the National
Treasury.

THE AGRICULTURAL EXPERIMENT STATIONS.

We have already seen how the idea that experiments with a view to
improving agricultural practice should be carried on, along with instruc-
tion in agriculture, had been more or less prominent in the minds of
leaders in agricultural progress in this country for many years. At
first it was thought that all that was necessary for this purpose was to
establish experimental farms on which new varieties of plants or new
processes of culture of crops could be tested, or practical experiments
in the feeding or breeding of animals could be conducted. Before the
middle of this century, however, the investigations of such chemists
as Liebig, in Germany, and Boussingault, in France, had shown that
science could be made useful to agriculture as well as to other arts.
Indeed, Liebig's theory of fertilizers aroused extravagant expectations
in the popular mind, and it was hoped that chemical analysis of soil
and plant would be an infallible guide to show what manuring of the
crop would produce the most abundant harvests. In the period between
1840 and 1850 Liebig's Familiar Letters on Chemistry were printed in
cheap form and widely read in this country. In 1843 Lawes and Gil-
bert began, at Rothamsted, England, that remarkable series of field
and laboratory experiments which has been continued under the same
management for half a century.

"The beginning of the experiment station proper, the organization
of scientific research with the aid of Government 'as a necessary and
permanent branch of agricultural business,'" came in 1851, when a
"company of Saxon farmers joined themselves together in the little
German village of Moeckern, near the city and under the influence of
the University of Leipsic, called a chemist to their aid, and with later
help from Government, organized the first agricultural experiment
station." As soon as agricultural colleges were established in this
country experimental investigations in field and laboratory were under-
taken, but for a number of years these were carried on with small means
and for the most part by the voluntary labor of professors outside of
their regular duties as instructors.

The act to establish and endow an agricultural college passed by the
legislature of Maryland in 1856 contains the following section:

Sec. 6. It shall be the duty of the said board of trustees to order and direct to be
made and instituted on said model farm, annually, a series of experiments upon the
cultivation of cereal and other plants adapted to the latitude and climate of the State of Maryland, and cause to be carefully noticed upon the records of said institution the character of said experiments, the kind of soil upon which they were undertaken, the system of cultivation adopted, the state of the atmosphere, and all other particulars which may be necessary to a fair and complete understanding of the result of said experiments.

The records of the college show that in 1858, immediately after the college was located, and before building began, field experiments with corn, oats, and potatoes, "to test the relative value of the different manures offered for sale in the cities of Baltimore and Washington," were commenced on the college farm. This work continued for two or three years, but was interrupted by the financial distress which soon affected the whole country and by the disturbed political condition of the State and nation.

In 1870 the president and fellows of Harvard College began to organize the school of agriculture and horticulture which had been provided for in the will of Mr. Benjamin Bussey, of Roxbury, Mass. This interesting document was signed July 30, 1835, and was proved soon after the death of the testator, in 1842. It bequeathed half of the income of about $300,000 and 200 acres of land in Roxbury to the president and fellows of Harvard College, on condition that they establish on the farm "a course of instruction in practical agriculture, in useful and ornamental gardening, in botany, and in such other branches of natural science as may tend to promote a knowledge of practical agriculture and the various arts subservient thereto." Owing to other provisions of the will, it was not deemed advisable to begin the formation of the Bussey Institution earlier than 1870. In the same year the trustees of the Massachusetts Society for Promoting Agriculture granted to the corporation of Harvard College a considerable sum "for the support of a laboratory and for experiments in agricultural chemistry, to be conducted on the Bussey estate." The laboratory of the new institution was not ready for occupation until the last week in 1871. As soon as it was completed, however, agricultural researches were begun by F. H. Storer, the professor of agricultural chemistry, and his assistants. The first report of this work was presented to a committee of the trustees of the Massachusetts Society for Promoting Agriculture, December 3, 1871. The experiments consisted of field tests of fertilizers upon the farm of the institution, and chemical analyses of commercial fertilizers. Other interesting and valuable work was done in the next few years, but the great fire in Boston in 1872 and the commercial crisis of 1873 combined to cripple the institution financially, and it has since been able to make comparatively few original investigations.

When the College of Agriculture of the University of California was organized it was understood that a part of its work would consist of experimental inquiries. In 1870 Prof. E. S. Carr, in an address at the State Fair, made the following specific allusion: "The University proposes to furnish the facilities for all needful experiments; to be the
station where tests can be made of whatever claims attention." A later report contains the following statements regarding the development of experimental inquiries in agriculture at the University:

Ex-President Gilman, in his report dated December 1, 1873, alludes to progress in this work, as follows:

"The University domain is being developed with a view to illustrate the capability of the State for special cultures, whether of forests, fruits, or field crops, and the most economical methods of production. It will be the station where new plants and processes will be tested and the results made known to the public. * * * A fine estate has been provided, well adapted to the establishment of an experiment station in agriculture, a botanic garden, an arboretum, etc."

As is usual in the history of new undertakings, progress at first was slow and hesitating. The report for the years 1873-1875, by R. E. C. Stearns, at that time secretary of the board of regents, shows that 40 acres were prepared for planting with a view to agricultural experiments in 1874, and that during the winter following there were planted 584 named varieties of tree fruits, 73 of grapevines, and 95 of various small fruits. * * *

In 1874 buildings were erected on the grounds set apart for agricultural experiments, viz: A barn 36 by 44 feet; a tool house 64 by 12 feet; two propagating houses, one 64 by 15 feet, the other 30 by 24 feet; a house for hatching fish eggs; and in addition to these larger structures a complement of sheds and outbuildings, hot beds, and cold frames were provided. Propagation of shrubs and trees from seed obtained abroad, and especially from other arid regions of the world, was first undertaken.

In 1874 E. W. Hilgard was chosen professor of agriculture. [Prof. Hilgard had previously been engaged for a number of years in conducting an agricultural and geological survey in Mississippi, in connection with which chemical examinations of soils, field experiments, and other agricultural investigations had been incidentally carried on in accordance with a plan inaugurated as early as 1857 and afterwards made the basis for the highly successful work of the California Experiment Station under his direction.] In the winter of 1875-76 the first field experiments were undertaken to determine the effects of deep culture and of the application of various fertilizers.

In 1875 the laboratory branch of the experiment station work was inaugurated, the regents making provision for the expenses thereof for the first two years; and at the end of this time the legislature opened the way for the continuation and extension of the work by liberal special appropriations from year to year.

After the fund which had been established by the sale of the land scrip donated to Connecticut under the act of Congress of July 2, 1862, had been given to the Sheffield Scientific School of Yale College in 1863, a professor of agriculture was added to the working force of that institution. Samuel W. Johnson, M. A., the successor of Professor Norton as professor of theoretical and agricultural chemistry, and William H. Brewer, Ph. D., the professor of agriculture, have for many years taken an active interest in all work for the promotion of agricultural science in Connecticut and elsewhere in the United States. Under their direction experimental work for the benefit of agriculture was carried on to a limited extent at New Haven more than twenty-five years ago, and it is doubtless safe to say that "through the influence of the professors and pupils trained in this school, more than to any other single cause, is due the recognition of the importance of the
establishment of agricultural experiment stations, first in Connecticut and subsequently throughout the whole country." Prof. W. O. Atwater, the first director of the first regularly organized experiment station in this country, received a part of his training in this school.

The reports of the successful and beneficial work done in the European experiment stations excited more and more attention on this side of the Atlantic, and the more advanced leaders in agricultural progress in this country began to ask for the establishment of similar institutions in the United States. In 1872, at a convention of representatives of agricultural colleges held in Washington in response to a call issued by the United States Commissioner of Agriculture, the question of the establishment of experiment stations was discussed, and the report of a committee in favor of such institutions was adopted by the convention. On the 17th of December, 1873, at the winter meeting of the State board of agriculture, at Meriden, Conn., Professor Johnson, of the Sheffield Scientific School, and Professor Atwater, of Wesleyan University, urged the establishment of an agricultural experiment station in that State after the European pattern. A committee was appointed to consider the expediency of such a movement, and reported two days later that it was their "unanimous opinion that the State of Connecticut ought to have an experiment station as good as can be found anywhere, and that the legislature of the State ought to furnish the means for its establishment." A permanent committee was then appointed by the board to bring this matter to the attention of the public and the legislature. This committee held meetings in different parts of the State, and the following winter secured the introduction of a bill for an experiment station, which, however, was laid over until the next session of the legislature. Another year of agitation of the matter ensued. The project had many warm and enthusiastic friends, but, as might have been expected, the great mass of the farmers took little interest in the enterprise. When it had become apparent that it could not succeed, Mr. Orange Judd, the editor and proprietor of the American Agriculturist, offered on his own part $1,000 to begin the undertaking, and on the part of the trustees of Wesleyan University, at Middletown, the free use of the chemical laboratory in the Orange Judd Hall of Natural Science.

These offers were made on condition that the legislature should appropriate $2,800 per annum for two years for the work of the station. It was thought that if by these means the work of agricultural experimentation could actually be begun, the usefulness of the enterprise would be so clearly demonstrated that it would speedily receive more generous and permanent support. An act making the appropriation thus proposed was unanimously passed, and approved July 2, 1875. Early in October of the same year a chemist was on the ground, and as soon as practicable two assistants were secured. Professor Atwater was made director, and thus the first agricultural experiment station
in America was an accomplished fact. Notwithstanding the severe financial depression of 1877, which caused serious reduction in old appropriations and utter refusal of new ones by the legislature of that year, a bill prepared by the director of the station and making a permanent annual appropriation of $5,000 "to promote agriculture by scientific investigation and experiment" was passed unanimously. At the end of the two years provided for in the original bill the station was reorganized under the direct control of the State and permanently located in New Haven where it has since been in successful operation, until 1882 in the chemical laboratory of the Sheffield Scientific School, and thereafter in buildings and on grounds provided by the State in the suburbs of the city.

The success which attended this first attempt to establish an organized experiment station in the United States was sufficient to attract the attention of advanced agriculturists throughout the country, and the example set by Connecticut was soon followed in other States. March 12, 1877, the State of North Carolina established an agricultural experiment and fertilizer control station at Chapel Hill in connection with the State University in accordance with an act of the legislature creating a Department of Agriculture, Immigration, and Statistics. The Cornell University experiment station was organized in February, 1879, by the faculty of agriculture of the university, as a voluntary organization. From that time until the passage of the act of Congress of March 2, 1887, the work was carried on by the different professors in such time as could be spared from other studies. For a part of that time the trustees of the university appropriated money from the university funds to pay for the services of an analyst and for the purchase of supplies. All the other work was done without compensation.

The New Jersey State station at New Brunswick, N. J., was established March 18, 1880, by an act of the State legislature and connected with the scientific school of Rutgers College.

The movement grew in favor with the people with each succeeding year, and in 1886 the Committee on Agriculture in reporting the Hatch bill to the House was able to make the following statements:

Since 1881 the legislatures of several States have either recognized or reorganized the departments of agriculture in the land-grant colleges as "experiment stations," thus following substantially the course adopted by New Jersey. Such stations have been established in Maine, Massachusetts, Ohio, Tennessee, and Wisconsin. In three other States (possibly more), without legislative action, the college authorities have organized their agricultural work as experiment stations. This has been done in California, Missouri, and New York. But in addition to the twelve experiment stations specifically designated by that name a very large number of the colleges established under the act of 1862 are doing important work of a precisely similar kind. Many of them began such work immediately upon their establishment, and have since maintained it continuously; others have entered upon it more recently. The colleges in Colorado, Indiana, Kansas, Michigan, and Pennsylvania are carrying on what is strictly experiment-station work as a part of their ordinary duty.
The convention of delegates of agricultural colleges which met at Washington in 1883 discussed and indorsed the project for the establishment of stations in connection with the colleges by appropriations from the national Treasury, in accordance with the terms of a bill already introduced in the House of Representatives by C. C. Carpenter, of Iowa. Congress, however, was not yet quite ready to undertake so large a scientific enterprise in this direction, and the bill was not put upon its passage. Meanwhile the number of stations was steadily increasing, and the interest of practical farmers, as well as men of science, was more and more excited by the reports of the results of the experiments which the stations had completed. On July 8, 1885, a convention of agricultural colleges and experiment stations met at the Department of Agriculture at Washington, in response to a call issued by the Commissioner of Agriculture. Almost the first thing which this convention did was to pass a resolution "that the condition and progress of American agriculture require national aid for investigation and experimentation in the several States and Territories; and that therefore this convention approves the principle and general provisions of what is known as the Cullen bill of the last Congress, and urges upon the next Congress the passage of this or a similar act." (The Cullen bill was in its general provisions similar to the bill afterwards passed by Congress and now popularly known as the Hatch act.) So earnest was the convention in this matter that it appointed a committee on legislation, which was very efficient in securing the passage of the amended bill.

In a later session the convention passed resolutions urging the creation of a branch of the Department of Agriculture at Washington which should be a special medium of intercommunication and exchange between the colleges and stations, and which should publish a periodical bulletin of agricultural progress, containing in a popular form the latest results in the progress of agricultural education, investigation, and experimentation in this and in all other countries. Provision was also made for a permanent organization by the appointment of a committee to cooperate with the United States Commissioner of Agriculture in determining the time of meeting and the business of the next convention, and in forming a plan for a permanent organization.

At the next session of Congress the experiment-station enterprise was again called to the attention of the House of Representatives by the bill which was introduced by William H. Hatch, of Missouri, and referred to the Committee on Agriculture. This committee made a favorable report March 3, 1886, and nearly a year later the bill was passed by Congress, and was approved by President Cleveland March 2, 1887.

The Hatch act provides that $15,000 a year shall be given out of the funds proceeding from the sale of public lands to each State and Territory for the establishment of an agricultural experiment station,
which must be a department of the land-grant college, except in the case of those States which had established experiment stations as separate institutions prior to the passage of the act.

The duties of the stations are thus defined:

SEC. 2. 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.

In order that the funds from the national Treasury might be for the most part devoted to agricultural investigations, only $3,000 of the first year's appropriation for each station was to be expended for buildings, and thereafter only $750 a year could be so expended.

That the farmers of the country may receive prompt information regarding the work of the stations, it is provided that in addition to "full and detailed" annual reports of their operations and expenditures, "bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same and as far as the means of the station will permit." The franking privilege is also given for the station publications. Financial and other reports of the stations are to be sent to the Secretaries of Agriculture and the Treasury, but no provision is made for auditing the accounts by officers of the United States or for any supervision of their work by the Federal authorities. It is, however, made the duty of the Secretary of Agriculture "to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate, from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purpose of this act." In the appropriation act for the Department of Agriculture for the present fiscal year it is provided that "the Secretary of Agriculture shall prescribe the form of the annual financial statement required by section 3 of the said act of March 2, 1887; shall ascertain whether the expenditures under the appropriation hereby made are in accordance with the provisions of the said act, and shall make report thereon to Congress."
Establishment of the Office of Experiment Stations.

On the 18th of October, 1887, the second convention of agricultural colleges and experiment stations convened at Washington. A permanent organization was effected, and the association was named "The Association of American Agricultural Colleges and Experiment Stations." George W. Atherton, LL. D., president of the Pennsylvania State College, was elected president of the association. This convention was deeply interested in securing the coordination of the work of the several stations, and indorsed the action of previous conventions in urging the establishment of a central bureau. As the result of the efforts of this association, an appropriation to enable the Commissioner of Agriculture to carry out the provisions of section 3 of the act establishing the stations was included in the annual appropriation bill for the Department of Agriculture for the fiscal year ending June 30, 1889, and the Commissioner of Agriculture instituted in October, 1888, an Office of Experiment Stations as a special branch of the Department of Agriculture.

Prof. W. O. Atwater was appointed director of the office, and continued in this position until July 1, 1891, when he was succeeded by Prof. A. W. Harris, who had been assistant director, and who resigned in 1893 to become president of Maine State College.

The Second Morrill Act.

As the organization of the land-grant colleges proceeded and the system of technical education in agriculture and other industries was elaborated it seemed to Mr. Morrill and other friends of industrial education that the income derived from the land-grant funds, even when supplemented by liberal contributions from the States and other sources, was inadequate to the demands of modern collegiate instruction in such lines. Mr. Morrill, therefore began to formulate plans to secure additional aid for these institutions from the national Treasury. Meanwhile the subject of Federal aid to the common schools throughout the Union was agitated, mainly through the debate which went on for years in Congress and in the country over the propositions of Mr. Blair, of New Hampshire, to extend such aid on the basis of the relative illiteracy in the several States. When it became evident that a general measure of this kind would not receive the sanction of Congress, Mr. Morrill introduced a bill to provide for the further endowment of the land-grant colleges, and this was passed and received the approval of President Harrison August 30, 1890. The second Morrill act provides that there shall be annually appropriated to each State and Territory, out of the funds arising from the sale of public lands, for the more complete endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts established under the act of 1862, the sum of $15,000 for the year ending June 30, 1890, and an annual
increase of the amount of such appropriation for ten years thereafter
by an additional sum of $1,000 over the preceding year; and that then
the amount shall continue at $25,000. This money can be applied "only
to instruction in agriculture, the mechanic arts, the English language,
and the various branches of mathematical, physical, natural, and
economic science, with special reference to their applications in the
industries of life, and to the facilities for such instruction." Provision
is made for separate institutions for white and colored students in such
States as may desire to make such an arrangement. The Secretary of
the Interior is charged with the administration of the law, and is given
authority to withhold the appropriation to any State or Territory for
cause, subject to an appeal to Congress.

PRESENT STATUS OF AGRICULTURAL EDUCATION AND INVESTIGATION IN THE UNITED STATES.

Having briefly described the origin of different agencies for the edu-
cation of the farmer and the improvement of his art, it remains to out-
line the system for agricultural education and research as it now exists
in this country. In doing this it will be necessary to exclude those
general educational agencies, such as newspapers, State and local
societies, farmers' institutes, and the State departments of agriculture,
which to a greater extent than ever before are disseminating valuable
information and stimulating or conducting inquiries for the benefit of
agriculture. No further reference seems to be needed here to the United
States Department of Agriculture except what is said below regarding
the Office of Experiment Stations in its relations to the agricultural
experiment stations in the different States.

COLLEGES HAVING COURSES IN AGRICULTURE.

Under the provisions of the acts of Congress of July 2, 1862, and
August 30, 1890, 65 institutions are in operation in the several States and
Territories. Of these, about 60 institutions maintain courses in agricul-
ture. In 14 States separate institutions are maintained for white and
colored students. The organization of these institutions is so varied that
an exact classification of them is impracticable. In a general way, how-
ever, they may be classified as follows: (1) Universities having colleges
or departments of agriculture; (2) colleges of agriculture and mechanic
arts; (3) colleges of agriculture; and (4) secondary schools of agricul-
ture. In these institutions the college course in agriculture leading to
a degree covers four or in some cases three years, and in a number
of institutions is supplemented by post-graduate courses. Shorter
courses of one or two years or of a few months are also provided in
many institutions. Special courses in dairying and in other agricultural
industries have been recently established at a few of the colleges.
Some institutions have preparatory classes in which instruction in agricultural subjects is given. An attempt is being made to establish courses of home readings for farmers under the direction of the colleges, the Pennsylvania State College being the first institution to introduce this feature. In a number of States courses of lectures in farmers' institutes held in different localities are given by members of college faculties during the winter months.

The total number of officers in the faculties of the colleges having courses in agriculture in 1894 is 1,643, and the total number of students is 21,195, of whom 3,847 are in the courses in agriculture. The graduates from the courses in agriculture in 1894 numbered 229, and the total number of graduates in those courses since the establishment of the colleges is 3,003.

The total revenue for the fiscal year ending June 30, 1894, was $4,458,014, from the following sources: United States—Income of land grant of 1862, $618,273; appropriation under act of Congress of 1890, $948,837; total, $1,562,110; State, $1,337,928; local communities and individuals, $195,914; fees, $357,759; farm produce, $114,167; miscellaneous, $687,067.

The value of additions to equipment in 1894 is estimated as follows: Buildings and land, $998,632; libraries, $72,874; apparatus, $229,499; farm implements, $26,346; live stock, $10,857; miscellaneous, $77,284; total, $1,145,495.

Owing to the complicated organization of many of these institutions and the fact that the students in agricultural courses are in many subjects in classes with students in other courses, and that much of the equipment is used in common by the students in all the courses, it is impracticable to show by statistics with exactness the means and facilities for strictly agricultural education.

The following general statements regarding these institutions are from the report of the director of the Office of Experiment Stations for 1893:

The reports received from the colleges during the past two years indicate that while the facilities for instruction in agricultural courses have been increased as the result of the act of Congress of 1890, the number of students in the regular college courses in agriculture still continues to be relatively small in many institutions. On the other hand, the short courses are increasingly popular, and wherever special courses, as in dairying, have been established they have been well attended. The success of the schools of agriculture having a curriculum of lower grade than that of the college, in Minnesota, Rhode Island, and Connecticut, is evidence that there is a demand for institutions which will receive students directly from the common schools and give them training in agricultural subjects along with those ordinarily taught in high schools. Experience in agricultural education in this country during the past thirty years shows that colleges of agriculture are mainly for those who have the means and the leisure to gain that liberal education which will fit them to be investigators, teachers, journalists, and managers of large agricultural enterprises. In a word, the colleges are principally useful in training the leaders in agricultural progress. This is a high duty, and its successful performance should entitle an institution to the gratitude and support of the people. But there is need
that the masses of our agricultural population should have more ample opportunities for education in agricultural lines.

The experiment stations, through their bulletins and reports, are doing much to educate the adult farmer. The colleges also are doing more each year in what may be called university-extension work through farmers' institutes. As the demand for instruction in agriculture increases the colleges will undoubtedly shape their courses to meet the needs of the farmers as far as this is practicable. We shall then have experiment stations, college courses in agriculture, schools of agriculture, special schools in dairying, animal production, etc., farmers' institutes, and home readings as the complete system of education for the farmer, carried on under the auspices of the university or college.

**AGRICULTURAL EXPERIMENT STATIONS.**

Agricultural experiment stations are now in operation under the act of Congress of March 2, 1887, in all the States and Territories. Alaska is the only section of the United States which has no experiment station. In each of the States of Alabama, Connecticut, Massachusetts, New Jersey, and New York a separate station is maintained wholly or in part by State funds, and in Louisiana a station for sugar experiments is maintained mainly by funds contributed by sugar planters. In several States substations have been established. Excluding the branch stations, the total number of stations in the United States is 55. Of these 51 receive the appropriation provided for in the act of Congress above mentioned. The total income of the stations during 1894 was $996,157, of which $719,830 was received from the National Government, the remainder coming from State governments, private individuals, fees for analyses of fertilizers, sales of farm products, and other sources. In addition to this, the Office of Experiment Stations has an appropriation of $25,000 for the current fiscal year. The value of additions to equipment in 1894 is estimated as follows: Buildings, $43,822; libraries, $9,286; apparatus, $22,711; farm implements, $15,824; live stock, $13,373; miscellaneous, $31,382; total, $136,901.

The stations employ 577 persons in the work of administration and inquiry. The number of officers engaged in the different lines of work is as follows: Directors, 67; secretaries and treasurers, 26; librarians, 8; clerks, 27; in charge of substations, 40; agriculturists, 55; biologists, 11; botanists, 36; chemists, 124; entomologists, 43; geologists, 5; horticulturists, 61; irrigation engineers, 7; meteorologists, 15; mycologists and bacteriologists, 7; physicists, 3; veterinarians, 24; dairymen, 11; farm foremen, 25. There are also 28 persons classified under the head of "miscellaneous," including superintendents of gardens, grounds, and buildings, apiarists, herdsmen, etc.

In 1894, 54 annual reports and 401 bulletins were issued. Besides regular reports and bulletins, a number of the stations issue press bulletins, which are widely reproduced in agricultural and county papers. The station bulletins are now regularly distributed to half a million
persons, who are either farmers or closely identified with the agricultural industry. Moreover, accounts of station work are given and discussed in thousands of newspapers. The New York Cornell Station alone estimated some time ago that each one of its publications directly or indirectly reached more than half a million readers. Besides this, a very large correspondence with farmers is carried on, hundreds of public addresses are annually made by station officers before farmers' meetings, and the results of station work are taught to thousands of students in agricultural colleges.

The experiment stations are conducting a wide range of scientific research in the laboratory and plant house and an equally large amount of practical experimenting in the field, the orchard, the stable, and the dairy. Thirty stations are studying problems relating to meteorology and climatic conditions. Forty-three stations are at work upon the soil, investigating its geology, physics, or chemistry, or conducting soil tests with fertilizers or in other ways. Twenty stations are studying questions relating to drainage or irrigation. Thirty-nine stations are making analyses of commercial and homemade fertilizers, or are conducting field experiments with fertilizers. At least fifteen stations either exercise a fertilizer control in their respective States or make analyses on which the control is based. Forty-eight stations are studying the more important crops, either with regard to their composition, nutritive value, methods of manuring and cultivation, and the best varieties adapted to individual localities, or with reference to systems of rotation. Thirty-five stations are investigating the composition of feeding stuffs, and in some instances making digestion experiments. Twenty-five stations are dealing with questions relating to silos and silage. Thirty-seven stations are conducting feeding experiments for milk, beef, mutton, or pork, or are studying different methods of feeding. Thirty-two stations are investigating subjects relating to dairying, including the chemistry and bacteria of milk, creaming, butter making, or the construction and management of creameries. Forty-five stations are studying methods of analysis and doing other chemical work. Botanical studies occupy more or less of the attention of twenty-seven stations; these include investigations in systematic and physiological botany, with especial reference to the diseases of plants, testing of seeds with reference to their vitality and purity, classification of weeds and methods for their eradication. Forty-three stations work to a greater or less extent in horticulture, testing varieties of vegetables and large and small fruits, and making studies in varietal improvement and synonymy. Several stations have begun operations in forestry. Thirty-one stations investigate injurious insects with a view to their restriction or destruction. Sixteen stations study and treat animal diseases or perform such operations as dehorning of animals. At least seven stations are engaged in bee culture, and three in experiments with poultry.
In general the work of the agricultural experiment stations, as organized in this country, may be classified as follows: (1) They act as bureaus of information on many questions of practical interest to the farmers of their several localities; (2) they seek by practical tests to devise better methods of agriculture and to introduce new crops and live stock, or to establish new agricultural industries; (3) they aid the farmer in his contest with insects and with diseases of his crops and live stock; (4) they help to defend the farmer against fraud in the sale of fertilizers, seeds, and feeding stuffs; (5) they investigate the operations of nature in the air, water, soil, plants, and animals in order to find out the principles which can be applied to the betterment of the processes and products of agriculture.

OFFICE OF EXPERIMENT STATIONS.

As already stated above, the Office of Experiment Stations was established in the United States Department of Agriculture to render such advice and assistance to the stations as would best promote the objects for which they were established. Its main business has been the examination of the work of agricultural experiment stations in this and other countries and the collation and publication of data regarding experimental inquiries in agriculture for the information of station workers, farmers, and others interested in the progress of the science and art of agriculture. There are now some 320 experiment stations in operation in the different countries of the world. Besides the publications which these stations issue, very many reports of agricultural inquiries at these and other institutions are published in current periodicals. As far as practicable this office seeks to traverse this large mass of literature and to cull from it such information as will enable our station workers to keep posted regarding the progress of agricultural science, and will promptly bring to our farmers the practical outcome of these investigations in the different countries.

Up to January 1, 1895, the office had issued 135 documents, including 5 volumes of the Experiment Station Record, 20 bulletins, and 9 Farmers' Bulletins.

The Experiment Station Record is issued in monthly parts, and contains abstracts of current publications of all the American stations, of the several divisions of the United States Department of Agriculture, and of reports of foreign investigations in agricultural science. General information is also given regarding the stations and kindred institutions in this and other countries, and suggestions regarding methods and lines of investigation which may usefully be followed by our stations are made in articles by the editors and by distinguished experts in the different specialties at home and abroad. A detailed subject and author index is published with each volume. As the condensed form of the Record makes its language necessarily somewhat technical, it is distributed only to such persons and institutions as make a special
request for it after examination of a sample copy. The fifth volume of
the Experiment Station Record comprises 1,227 pages, and contains
abstracts of 267 bulletins and 43 annual reports of 55 experiment sta-
tions in the United States and 67 publications of the Department of
Agriculture. The total number of pages in these publications is 17,161.

There are also 227 abstracts of reports of foreign investigations. The
total number of titles abstracted is 973, classified as follows:

<table>
<thead>
<tr>
<th>Field</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>46</td>
</tr>
<tr>
<td>Botany</td>
<td>42</td>
</tr>
<tr>
<td>Bacteriology</td>
<td>4</td>
</tr>
<tr>
<td>Zoology</td>
<td>6</td>
</tr>
<tr>
<td>Mineralogy</td>
<td>1</td>
</tr>
<tr>
<td>Meteorology</td>
<td>36</td>
</tr>
<tr>
<td>Water and soils</td>
<td>36</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>72</td>
</tr>
<tr>
<td>Field crops</td>
<td>155</td>
</tr>
<tr>
<td>Horticulture</td>
<td>84</td>
</tr>
<tr>
<td>Forestry</td>
<td>10</td>
</tr>
<tr>
<td>Seeds</td>
<td>16</td>
</tr>
<tr>
<td>Weeds</td>
<td>8</td>
</tr>
<tr>
<td>Diseases of plants</td>
<td>66</td>
</tr>
<tr>
<td>Entomology</td>
<td>74</td>
</tr>
<tr>
<td>Foods and animal production</td>
<td>119</td>
</tr>
<tr>
<td>Veterinary science</td>
<td>18</td>
</tr>
<tr>
<td>Dairying</td>
<td>89</td>
</tr>
<tr>
<td>Agricultural engineering</td>
<td>18</td>
</tr>
<tr>
<td>Technology</td>
<td>4</td>
</tr>
<tr>
<td>Statistics</td>
<td>69</td>
</tr>
<tr>
<td>Chemistry</td>
<td>46</td>
</tr>
<tr>
<td>Botany</td>
<td>42</td>
</tr>
<tr>
<td>Bacteriology</td>
<td>4</td>
</tr>
<tr>
<td>Zoology</td>
<td>6</td>
</tr>
<tr>
<td>Mineralogy</td>
<td>1</td>
</tr>
<tr>
<td>Meteorology</td>
<td>36</td>
</tr>
<tr>
<td>Water and soils</td>
<td>36</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>72</td>
</tr>
<tr>
<td>Field crops</td>
<td>155</td>
</tr>
<tr>
<td>Horticulture</td>
<td>84</td>
</tr>
<tr>
<td>Forestry</td>
<td>10</td>
</tr>
</tbody>
</table>

Classified lists of titles of foreign articles not abstracted are also
given in each number. The aggregate number of titles thus reported
is 1,514. Special articles contributed by eminent foreign workers in
agricultural science were translated in the office and published in the
Record. A notable feature of the fifth volume of the Record is a review
of recent work in dairying, prepared by Dr. E. W. Allen, assistant
director, which serves to show how large and important a feature of
experiment-station work investigations on dairying are.

In connection with the exhibit of the experiment stations at the
World's Columbian Exposition the office prepared a Handbook of
Experiment Station Work, which contains a résumé of the publications
of the stations during nearly twenty years.

The office is also engaged in the preparation of a card index of experi-
ment-station literature, which is freely distributed to the agricultural
colleges and experiment stations, and is sold to a limited number of sub-
scribers, the price covering the expense of printing the cards. Other
indexes of the literature of agricultural science are prepared in the
office for use in its work. So far as practicable, these indexes will be
made available to station workers and other investigators.

Schedules for the financial reports of stations, as now required by
Congress, are prepared in this office, and the office will also make an
examination of the work of the stations as the basis of the report of
the Secretary of Agriculture to Congress regarding the expenditures
and work of the stations.

Congress having recently given the Department an appropriation for
investigations on the nutritive value of human food, the supervision of
this work has been assigned to this office, and the investigations will be
carried on in cooperation with the agricultural colleges and experiment
stations.