near the truth. All of the departments, with the exception of medicine, divinity and forestry show an increase. The enrolment in the Sheffield Scientific School has increased from 774 to 1,028, although it should be pointed out that graduate students in science were not included in the Sheffield figures last year, whereas they have been included in this year's table. The final registration is likely to carry the number of freshmen in the scientific school beyond that of the academic freshman class, which is an epoch in the history of the departments. The scientific freshman class is so large that it has had to be divided into twelve divisions instead of ten, as last year. In six years the size of the entering class in the scientific school has risen from 199 to about 400, an increase of over 100 per cent.

The general development of higher education in the United States as reflected in the accompanying tabulation is one that may well give rise to gratification, and it is hoped that the prominent exponents of higher education in this country will vie with one another in constantly increasing the quality of their work and the value of their equipment, instead of laying undue stress on any figures that do not reflect a corresponding development in academic standards and ideals.

Rudolf Tombo, Jr.,
Registrar.

Columbia University.

THE ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE, 1905.

The secretary says that it is in the highest degree gratifying to present evidence of the unprecedented prosperity which has in recent years rewarded the diligence of the farmer and the efforts of his department. A year of unequaled prosperity has been added to the most remarkable series of similar years that has come to the farmers of this country. Farm crops have never before been harvested at such a high general level of production and value. Corn has reached its highest production, over 2,700,000,000 bushels, of a total estimated value of $1,216,000,000. Hay comes second, with a value of $605,000,000. Cotton is expected to yield $575,000,000. The short wheat crop of last year is followed by one of 684,000,000 bushels, and its value, $525,000,000, overtops the highest value ever before reached. While only one crop, corn, reached its highest production this year, four crops—corn, hay, wheat and rice—reached their highest value.

No crop but corn produces the income that the dairy cow does. The estimate of the value of dairy products for 1905 reaches $665,000,000. The farmer's hen competes for precedence with wheat, poultry products aggregating half a billion dollars in value.

The wealth production on farms in 1905 has reached the highest amount ever attained by the farmer of this or any other country, 'a stupendous aggregate of results of brain and muscle and machine,' amounting in value to $6,415,000,000, an excess over last year of $256,000,000. The wealth produced on farms in 1905 exceeds that of 1904 by 4 per cent., that of 1903 by 8 per cent., and that shown by the census figures for 1899 by 36 per cent. Should there be no relapse from his present position as a wealth producer, three years hence the farmer will find that the farming element, about 35 per cent. of the population, has produced an amount of wealth within ten years equal to one-half of the entire national wealth produced in three centuries.

The value of horses and mules on farms exceeded last winter $1,452,000,000. Milch cows are advancing in numbers and are worth $482,000,000. The value of all other cattle is estimated at $662,000,000. Sheep are declining in number and total

value, while swine maintain their previous position, and are valued at over $283,000,000. In the aggregate, the value of farm animals of all sorts has increased over that given in the census of 1900 by 9 per cent.

During the last fiscal year, exported domestic farm products were valued at $827,000,000. This is below the annual average for the five years preceding, and the relative position of farm products in domestic exports is a declining one on account of the gain in exports of manufactures. Nevertheless, during the last sixteen years the domestic exports of farm products have amounted to $12,000,000,000, or $1,000,000,000 more than enough to buy all the railroads of the country at their commercial value, and this with the mere surplus for which there was no demand at home. During these sixteen years the farmer has secured a balance of $5,635,000,000 to himself, out of which he has offset an adverse balance of $543,000,000 in the foreign trade in nonagricultural products, turning over to the nation, from his account with other nations, $5,092,000,000. The exports of forest products were $63,000,000.

Computations based upon census information show that farm products constitute 56.4 per cent. of the total products of the country, and 86.8 per cent. of the total materials of industries utilizing agricultural products as materials. During the last census year farm products employed in manufactures were valued at $2,679,000,000. These industries employed 2,154,000 persons, and had a capital of $4,132,000,000.

One of the most notable outgrowths of savings by farmers is the great multiplication of small national banks in recent years. As many as 1,754 banks, each with a capital of less than $50,000, were organized from March, 1900, to October, 1905. These were distributed mostly throughout the south and the north central states, in rural regions. In the south 633 of these banks were organized, and in the north central states 792. The capital of these banks has come from the farmers. The increase of bank deposits in agricultural states is most extraordinary. The increase during the year which ended June 30, 1905, in Iowa and South Dakota was 14.9 per cent.; in Nebraska, 13.5 per cent.; in Kansas, 9.7 per cent. and in North Dakota 25 per cent. During the same time bank deposits in Massachusetts increased 9.1 per cent. But still more remarkable is the bank statement for the south central states. Throughout the whole area of that division the increase was 22.8 per cent., while the general average increase for the United States was but 13.5 per cent. For the first time in the financial history of the South, deposits in the banks of that region now exceed $1,000,000,000. These remarkable increases in bank deposits in agricultural States and the increase in the number of small country banks are directly and indirectly because of the profits that have come to the farmers.

The department this year undertook, and has just completed, an investigation of the changes in the value per acre of medium farms since the census of 1900. Inquiries were addressed to 45,000 correspondents distributed throughout every agricultural neighborhood in the United States, and returns from these correspondents warrant the following statements:

During the past five years the value of medium farms in this country has increased 33.5 per cent. as compared with an increase of 25 per cent. for the ten years preceding. The increase in the south central group is 40.8 per cent.; in the western group, 40.2 per cent.; in the South Atlantic group, 36 per cent.; in the north central group, 35.3 per cent., and in the North Atlantic group, 13.5 per cent.

Figured in dollars of gain per acre, the increases during the five years past of medium farms were in the north central division $11.25; in the western division $5.36; in the North Atlantic $5.26; in the South Atlantic division $4.93; and in the south central division $4.66. The average increase for the United States was $7.31. The returns showed that farms of less intensive culture and crop have increased in value less than the farms having more valuable crops and receiving high culture. Everywhere is revealed a more intelligent agriculture. Farmers are improving their cultural methods and changing from less to more profitable crops. Other causes for higher values are better buildings, better fences, tile draining, new facilities for transportation, more railroads, and better wagon roads.

The cotton farms have increased in value $460,000,000, so that it might be said that during the past five years the cotton plantations have had six crops, one of them a permanent investment promising to pay a good return year by year. Hay and grain farms show an increase of $2,000,000,000; livestock farms a still larger gain; dairy farms $369,000,000; tobacco farms, $57,000,000; rice farms $3,300,000; fruit farms $97,000,000 and vegetable farms $113,000,000. Every sunset during the past five years has registered an increase of $3,400,000 in the value of the farms of this country. Every month has piled value upon value until it has reached $102,000,000; that portion of the national debt bearing interest is equaled by the increased value of farms in nine months, and this increase for a little over a year balances the entire interest-bearing and non-interest-bearing debt of the United States.

The secretary thus summarizes the economic position of farmers:

> If the farmers' economic position in the United States is to be condensed to a short paragraph, it may be said that their farms produced this year wealth valued at $6,415,000,000; that farm products are yearly exported with a port value of $875,000,000; that farmers have reversed an adverse international balance of trade, and have been building up one favorable to this country by sending to foreign nations a surplus which in sixteen years has aggregated $12,000,000,000, leaving an apparent net balance of trade during that time amounting to $5,092,000,000 after an adverse balance against manufactures and other products not agricultural, amounting to $543,000,000 has been offset. The manufacturing industries that depend upon farm products for raw materials employed 2,154,000 persons in 1900 and used a capital of $4,132,000,000. Within a decade farmers have become prominent as bankers and as money lenders throughout large areas; and during the past five years prosperous conditions and the better-directed efforts of the farmers themselves have increased the value of their farms 33.5 per cent., or an amount approximately equal to $6,133,000,000.

Following his introduction he refers to the fact that this is the first annual report of his third term as secretary, and on this ground he presents rather a review of the work of the department during the eight years just elapsed than the ordinary synopsis of the operations of the year.

He presents the results accomplished by the Weather Bureau for the benefit of the farmers, mariners and manufacturers, and points out that with all the development of this work the average per annum increase in the cost of the service for the past ten years is but 4.41 per cent. He emphasizes the necessity of scientific research with the view to acquiring a greater knowledge of meteorological science. With this view he established three years ago a station at Mount Weather, Va., devoted to meteorological research. He proposes that the Weather Bureau shall hereafter attain as eminent a position in the work of scientific research as it has heretofore admittedly held in practical meteorology.

Of the Bureau of Animal Industry he says that the work of fighting contagious

diseases of animals has been unremittingly carried on. The report refers in detail to the principal diseases which have been made the subject of study, and concludes that in every case the efforts of the bureau have been attended with a more satisfactory control or complete eradication. He commends highly the skill and energy which characterized the suppression of foot-and-mouth disease in the New England States in 1902 and 1903. He dwells at some length on the subject of tuberculosis and the danger of its being communicated from animals to man. Of the cattle and meat inspection he says its importance is shown by the fact that upon the government certification as to the healthfulness of animals and animal products the country depends for its access with its products to foreign markets. He deprecates the possibility of abandoning any part of this work, a contingency, nevertheless, which he foresees to be unavoidable unless adequate appropriations are promptly provided for this work.

To the Dairy Division of the Bureau of Animal Industry was assigned under the law of May 9, 1902, the inspection of materials, factories and processes employed in the manufacture of renovated butter. The results have been very satisfactory. This division has accumulated and published in the past few years a large amount of valuable information of value to the dairymen and those interested in dairy products.

The Bureau of Plant Industry is organized into eleven offices and employs over 500 persons, about 60 per cent. of whom are engaged in distinctly scientific work. The review of its investigations and treatment of plant disease shows that all important diseases have been studied with results which in many cases have enabled farmers and fruit growers to greatly diminish their losses from this cause.

In its systematic work in securing new plants and seeds from foreign countries the Bureau of Plant Industry has been highly successful. Success has also attended its work in cotton breeding, undertaken with the view to obtaining new sorts combining improved length of staple with productiveness. The secretary records the production of a new citrus fruit, the citrange, several varieties of which—the Rusk, the Willets, the Morton—have been developed. Another interesting product is the new tangelo, a hybrid of the pomelo and the tangerine.

Of the work on nitrogen-fixing bacteria the secretary says that there is yet much to be done in determining the conditions under which the use of the tubercle-forming bacteria will give the best results, but that the Bureau of Plant Industry has developed a successful method of growing and distributing them and increasing their nitrogen-fixing power.

Many intelligent boards of health and water engineers are recognizing the value of the method recommended for the destruction of algal and bacterial contaminations of water supplies.

Much has been done also in perfecting the methods for testing seeds. The farmers' attention has been called to the adulteration of field seed, and they have been invited to submit samples for testing.

The secretary records the practical establishment of Durum wheat, of which several million bushels have been exported this year, and reports highly satisfactory results with new varieties of oats and barley, and the extension of the winter grain area. The last few years have witnessed a great progress in rice growing and in beet-sugar production. Valuable information has been made available in reference to the shipment and transportation of fruit. At the Summerville tea farm 9,000 pounds of tea was the product for the past season,

and a promising tea farm has been established in Texas.

Very considerable importance is recorded in the manner of seed distribution. A special feature has been the encouragement of school-garden work thereby.

The work of the forest service has been greatly developed. Of the eleven persons employed July 1, 1898, only two were professional foresters. To-day the forest service employs 153 professional foresters out of a total force of over 800 persons. An important achievement of this service during the past few years has been to enlist the sympathy and cooperation of lumbermen and forest owners, and the secretary urges that the work of education continue until public opinion will not tolerate heedless waste or injudicious loss. In the saving of waste the service has added vastly more to the national wealth than its total expenditures during its entire history. The control of the forest reserves, embracing property worth in cash at least $250,000,000, has been transferred to the forest service. This property is administered at a cost of less than one-third of 1 per cent. of its value, which increases at the rate of 10 per cent. per annum. The service continues to afford important aid to private forest owners.

The Bureau of Chemistry has conducted important investigations relating to our cereal products and prepared meats. The latter included a systematic examination of canned goods. Its practical experiments have developed the fact that, without exception, the addition of the ordinary preservatives to foods is prejudicial to health. The secretary argues the need of protecting the public from these evil effects by legislation. The Bureau of Chemistry inspects all food products intended for export where the exporters desire such inspection, which enables them to send foods to foreign countries with a certificate of inspection which, as a rule, is accepted. Of imported foods inspected 712 out of 3,576 invoices were of a character forbidden by law. Elaborate studies have been made of insecticides, in cooperation with the Bureau of Entomology, and also of materials furnished under contract to the United States government. In this work the Bureau of Chemistry has cooperated considerably with other departments of the government.

In spite of the activity of the survey force of the Bureau of Soils, there are on file at the present time requests for mapping 215 counties in 40 states and territories. The bureau has made a special study in regard to the alkali soils and into the problem of soil fertility. In this work the problems encountered in the field depend for their final solution on the work in the laboratory. The purpose of the soil survey is to indicate the most economical method of securing the best results in handling the various soils and in the production of food products from them. The surveys already made aggregate 63,000,000 acres in 44 states and territories. The soils adapted to special crops such as the grape, the apple, citrus fruits, the sugar-beet, alfalfa, rice, corn, cotton, etc., have all been made subjects of special study based on the field surveys. The demands for reports of the surveys are numerous and varied, all classes seeming to be interested in them. The investigations of this bureau into the question of soil fertility and manurial requirements have attracted general attention and much comment. As the bureau's methods of investigation are becoming more thoroughly understood they are being gradually adopted for scientific work by investigators outside of the department. Much practical work has been done in the reclamation of alkali lands. Important work in regard to tobacco has been continued in Texas, Ohio, Virginia and Connecticut. The secretary recommends in-

vestigations of the same kind in the tobacco districts of several other states.

In discussing the work of the Bureau of Entomology considerable space is devoted to the Mexican cotton boll weevil, in the work against which this bureau has had the active cooperation of the Bureau of Plant Industry. It is also cooperating with the Louisiana Crop Pest Commission and the Texas Experiment Station. The subject of dissemination of the weevil through cotton gins has been very carefully investigated, and important results have been obtained, resulting in recommendations to the ginners calculated to greatly reduce this danger.

Of recent years important work has been done by the Bureau of Entomology in the introduction of the fig fertilizing insect of South Europe, the introduction of a parasite of the black scale so injurious to citrus and olive crops in California from South Africa, and the introduction with success in the southern states of a parasite of the San Jose scale from China. Useful insects are also sent abroad at the request of foreign departments of agriculture.

Fruit growers in California and other states testify that their operations have been rendered much more profitable through the information derived from the investigations of insects injurious to fruit. The insects damaging forests, injuring stored fruits, carrying diseases, affecting live stock, and injuring field crops have all been the subject of study by the entomologists of the department.

In 1902 the Bureau of Entomology undertook once more a systematic effort to introduce the culture of the domestic silkworm into the United States. Guaranteed eggs were purchased in Italy, skilled reelers were brought over from France, and mulberry trees were distributed to persons desiring to experiment.

Much emphasis is laid upon and considerable information is given as to the saving from insect losses resulting from the work of the Bureau of Entomology. The actual loss to agriculture through injurious insects is almost beyond computation.

The work of the Bureau of Biological Survey includes the determination of the boundaries of the natural life zones of the United States and the corresponding crop zones. The chief purpose is to ascertain the boundaries of natural life zones with a view to aiding the farmer in selecting crops best adapted to his locality and in avoiding crops unsuited to it.

One section of the Biological Survey is engaged in the study of birds and their various relations to man, especially to determine whether birds damage crops, whether they protect insects either injurious or beneficial, and to what extent they feed upon weed seeds. Thousands of birds' stomachs are examined in gathering facts on this subject.

Other duties of the Biological Survey are the supervision of game protection and introduction assigned to the Department by Congress. Through cooperation with the Department of Justice and with game officials throughout the United States 166 violations of the Lacey Act were investigated and 49 convictions have resulted. Railroad and express companies have lent cordial cooperation in securing a more rigid observance of the game laws.

In discussing the work of the Division of Publications the secretary points out that the terms of the law requiring the department to diffuse information of value to agriculture are mandatory, and the most economical and available means of diffusion is through publication. He maintains that this work has been conducted with due regard to economy, and that every precaution has been taken to lessen the waste inevitably attendant upon any system of gratuitous distribution. Of the more than

twelve million copies of all publications distributed by the department during the past year nearly 45 per cent. were distributed through senators and representatives in congress, over which distribution, of course, the secretary has no control. He notes with approval a growing demand for the department publications from institutions of learning and other agencies interested in agricultural education.

Referring to the work of the Bureau of Statistics, the secretary says that the development of organizations to fix prices, and in some cases to force temporary changes giving unnatural advantages to price manipulators, has led to the need for a strong and impartial agency to make comprehensive reports of actual facts relating to prospective crops and yields, that all concerned may know how to buy and sell. He describes the various processes of crop reporting, the conditions under which, and the methods by which the reports are made.

The secretary states that as the result of a gross breach of trust on the part of one of the officials, an entirely new method of handling these reports is being devised, which he believes makes it practically impossible for such another breach of confidence to occur. He reports the prompt dismissal of the culpable official and the transfer of the whole matter to the Department of Justice, with a view to the prosecution of the guilty party. He expresses regret that while the department handled the case of its own official with vigor and promptness, no corresponding action has so far reached the traders' end of the line.

Where gamblers interested neither in production nor in consumption disturb values to the injury of both and make loud outcry when creatures of their kind bribe officials to betray confidence for the love of money, the responsibility for this leak is shared by every one who to get money without work gambles in farm products. When this form of industry ceases, he adds, these parasites who tempt department officials will have to work for their bread.

He reports the assignment of Assistant Secretary Hays to take charge of the work of the Bureau of Statistics for the present.

Of the Division of Foreign Markets, the secretary says one of its useful lines of investigation in behalf of exporters has been an examination of conditions found in countries which have a surplus in certain agricultural products which meet those of this country in common markets. Another useful undertaking has been to ascertain in detail the quantities and values of the agricultural imports of countries receiving a large share of such imports from the United States. In regard to the possibility of a foreign cotton competition, the inquiries of the department do not reveal that it has any reasonable immediate prospects, and he believes that if such competition is to arise, it will be as the result of years of effort and development. Most of the countries wherein a new production is admitted, moreover, produce a non-competing variety like the Egyptian.

Of the library the secretary reports the present quarters to be inadequate for housing its collection of 87,000 books and pamphlets. In addition to space for this valuable possession of the department, the protection from fire is an urgent need. Such protection he anticipates will soon be provided by the new building. The library is found available for information to be given in response to inquiries from all parts of the country, and much valuable material is added to its files through the foreign exchange system.

The work of the Office of Public Roads is primarily educational in character. Its province is to detail experts to give information and advice. In many communities it is found advisable to supplement advice by practical demonstration of effective road building. The total number of ex-

perimental and object-lesson roads built under the direction of this office since its organization is 96, with a total length of about 39 miles. These roads were built in 38 states. The secretary proposes to utilize the services of the greatly increasing corps of highway engineers and experts of the office wherever practicable in the construction and maintenance of roads in the forest reserves. In order to secure engineers with the necessary technical training and to supplement such training by special work for highway engineering, graduates of reputable engineering colleges are appointed as civil engineer students in the Office of Public Roads. The work of such students is of great assistance to the office, besides being of practical value to the public. The secretary believes that highway engineering should receive greater attention at the present time in the colleges. A Division of Tests has been organized in the office, primarily to test road materials, but the equipment necessary for this purpose has been also available for testing other materials of construction, such as steel wire for fences, concrete posts, etc.

The work of the Office of Experiment Stations has greatly increased during the past eight years. Through this office the secretary exercises a certain supervision of the federal funds granted to the experiment stations. He says that the stations have been not only a benefit in making the department's work more effective, but that they have by their own investigations raised American agriculture to a higher plane. He expresses the hope that congress will recognize the need of providing the stations with means to meet the demands made upon them, and states that there is no direction in which public moneys can be appropriated that will bring more certain and lasting returns than in helping the state experiment stations.

To diffuse among farmers the results obtained by stations, the department undertook the publication of a series of popular resumes of practical features of the station work. Over thirty numbers have been issued as a part of the Farmers' Bulletin series. The secretary reports great activity in the development of agricultural education, and through the Office of Experiment Stations the department has taken a leading part in this work. The permanent success of agriculture, he argues, depends upon the technical intelligence and knowledge of the farmers. In this line of work the farmers' institutes, established under the authority of the various states and territories, furnish the most useful agencies. Practical benefit to the people interested is reported as the result of the establishment of experiment stations under the direct control of the department in Alaska, Hawaii and Porto Rico.

Nutrition investigations are conducted by this office and during the past eight years some 200 dietary studies have been made, and not far from 800 experiments in which the digestibility of different foods was determined with healthy men under normal conditions. It has been found as the result of some of these studies that white bread furnished the body with more protein and energy, pound for pound, than whole wheat or graham flour for the same amount of grain, any deficiency in the composition of the white flour being more than offset by its more thorough digestibility.

The irrigation and drainage investigations of the department have resulted in the systematic study of the agricultural and legal features of irrigation. Measurements of the quantity of water used in ordinary practise have been followed by more careful experiments to determine the frequency of irrigation and the amount of water to be applied to get the best results. The studies of irrigation laws have included the collection of facts showing the

character and amount of water rights. Experiments are being made to determine how far drainage can be made to protect hillsides from destructive effects of erosion. In the whole country there are 100 million acres of swamp and poor lands, which can be reclaimed only through drainage.

Of the new buildings the secretary says that the structures now being built will cost about one and one half million dollars, and should be completed in two years, by which time it is hoped that further appropriations will be available to continue the building work inaugurated.

Speaking of the growth of the department, the secretary reports the number of persons on the rolls July 1, 1905, to be 5,446. Of these, 2,326 are rated as scientists and scientific assistants. This shows an increase since July 1, 1897, of 3,003 persons on the rolls of the department, of which the increase in the number of the scientific staff in the same period was 1,401.

In conclusion, the secretary says it has been a grateful task to present to the president and thus to the American people a pen picture of the American farmer as he is to-day, to make clear the position of the farming industry, its wonderful productiveness, and its large contribution to the general prosperity of the country. He has also pointed out some of the more important work illustrative of the methods by which the department seeks to benefit the farmer. Its work is two-fold. It seeks to add to the sum of intelligence in the man and to increase the productive capacity of the acre. In this work the department has the hearty cooperation of the agricultural colleges and experiment stations, all working with the department to the same great end. The gratifying evidences of well-being in the farming community, the extraordinary progress made, and the enlarged recognition of the true position of the farming industry in the economic life of the country are mainly the result of this continued and combined effort on the part of these agencies to add to the sum of the farmer's knowledge, and must be regarded as the triumph of intelligence in the application of scientific knowledge to the tillage of the soil. This he maintains is so true that it would be superfluous to urge the generous maintenance of the department in its grand work.

Great as has been the work undertaken and accomplished, gratifying as have been the results as shown in the first few pages of this report, be it remembered that we are still at the threshold of agricultural development and that the educational work which has led to such grand results has only been extended as yet to a portion of our agricultural population.

SCIENTIFIC BOOKS.

NEWCOMB'S REMINISCENCES.[1]

When a man lays down the arduous pen of the mathematician, which he has used throughout a long life to the admiration of the world, and takes up in leisurely fashion that of the autobiographer, he is tolerably sure of our respectful attention. But Professor Newcomb has won from us far more than this: he has earned our lasting gratitude by the production of a book which is delightful to read and which makes several contributions to the history of astronomy. Of the eminently readable character of the book it is easy to assure oneself by opening it at random, for on almost every page there is an anecdote or the equivalent, rendered accessible to the lay reader, where necessary, by admirable exposition of astronomical terms and touched infallibly with a genial humor. The variety of topic is specially noteworthy; the author is as much at home in explaining why the United States results from the Transits of Venus were not reduced (because after spending $375,000 on the observations it was found to be impossible to secure $5,000 for the computations—see p. 178) as he is in vividly sketching Mr. Gladstone thus:

[1] 'The Reminiscences of an Astronomer,' by Simon Newcomb. Houghton, Mifflin & Co., 1903.