

marked increase in the number of communications relating both to foreign lands and to the Americas.

The nature of the work under review is such as to render mathematical exactness impossible. I have endeavored to make the foregoing averages approximate the truth, and believe they can be relied upon to show that American anthropologists have been working in relatively greater isolation than have European anthropologists.

The cosmopolitan character of the programs of the several associations in question is found to be in direct ratio, not only to the area of the colonies and dependencies of the several countries, but also to the tonnage of their merchant marine engaged especially in the foreign trade. The anthropologist's horizon is constantly under limitations imposed by his government's colonial or commercial policy.

With colonies and protectorates beyond the confines of Europe aggregating over 11,000,000 square miles in extent, including India, and with a merchant marine engaged exclusively in the foreign trade, much larger than that of any other country (8,043,860 tons in 1899), open especially to them, the English anthropologists are brought into contact with foreign problems at so many points, it would be strange indeed did they not improve the opportunities thus afforded.

The colonies and dependencies of France cover an area (1901) of 3,740,000 square miles, with a population of 56,000,000. The area of German colonies and dependencies amounts to 1,027,120 square miles with a population of 14,687,000.

The United States became a 'world power' only three years ago. Enough time has not elapsed to show the influence of that step on the programs of Section H, but if we expand along with our opportuni-

ties, it is safe to say that an analysis of the work we shall do in the next twenty years will show different results from that of our record for the epoch just closed.

We may not be able to improve much on the quality or even the quantity, but, with an enlarged horizon, the work should become less and less local and fragmentary. I believe we are at the threshold of a new epoch in which the many interdependent and partially solved problems of the past shall be completed and thereby make possible vast progress in correlative and synthetic anthropology.

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COLLEGE WORK FOR AGRICULTURISTS.

AUTHENTIC information regarding the progress made in the State of New York in the promotion of scientific methods in agriculture and the part taken by science and scientific men in their advancement has often been sought, and yet we rarely find a clear statement of the extensive work which has been done and is still being carried on in aid of scientific and intensive agriculture. The extent of this work is enormous and its value to the state is vastly more than proportionally valuable. It is mainly performed at the experiment station, and in the university extension work, of the College of Agriculture of the 'Land Grant College' of the state, at Ithaca, and at the experiment station at Geneva. A recent statement by the president of Cornell University is the first which has given us a concise, yet definite and satisfying, account of this work. We abstract the principal parts of this statement:

"By the Morrill Act of July 2, 1862, Congress enacted that there should be granted to the several states certain amounts of public land, from the sale of which there should be established a per-

petual fund, 'the interest of which shall be inviolably appropriated * * * to the endowment, support and maintenance of at least one college where the leading object shall be, *without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts.*' The provisions of this act were accepted by New York State; whereupon there was handed over to the State Comptroller New York's share of the congressional land script. The State legislature then passed an act (April 27, 1865) establishing Cornell University and appropriating to it the income from the sale of the script in the State's possession; and providing in the Charter of the University that 'the leading object of the corporation hereby created shall be to teach such branches of learning as are related to agriculture and the mechanic arts, including military tactics. * * * But such other branches of science and knowledge may be embraced in the plan of instruction and investigation pertaining to the University as the trustees may deem useful and proper.' The College Land Script Fund whose income was thus appropriated to Cornell University amounts to \$688,576.12. The State, as guardian of the fund, has turned it into the State treasury,—having issued to Cornell University a certificate of indebtedness on which it pays an annual interest at the rate of five per cent. amounting to \$34,428.80. This is applied to 'instruction in such branches as are related to agriculture and the mechanic arts, etc.'

"Some years later Congress saw that the provision made for the support of the colleges established under the Morrill Act of 1862 was not sufficient, and accordingly, by the second Morrill Act of August 30, 1890, it was enacted that there be 'appropriated to each state for the more complete

endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts established under the provisions of the federal act of July 2, 1862, the sum of \$15,000,' to be annually increased by \$1,000 until the sum of \$25,000 was reached, 'and the amount thereafter to be paid to each state and territory shall be \$25,000 to 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 application in the industries of life, and to the facilities for such instruction.' This congressional appropriation is now \$25,000 annually.

"There is therefore available for 'instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science' \$59,428.80 received from the bounty of the United States. This is all that Cornell University receives from the federal government for any purpose. To prevent misapprehension I should perhaps add that the Federal Agricultural Experiment Station, for which there is an annual appropriation of \$13,500, is located at Cornell. But while the University lends its buildings and grounds and gives freely the services of its administrative officers for the conduct of the experiments and the management of the finances of the station, it gets no financial return, and not a cent of the Experiment Station funds can be used for purposes of instruction. * * *

"In return for the federal land grant, Cornell University gives free instruction, in all departments, to four students annually from each of the assembly districts of the State, making in all 600 free students annually.

"It gives free instruction also to all

agricultural students, of whom at present nearly 200 are enrolled. Thus Cornell University is a benefactor of the State of New York to the extent of conferring upon it annually free instruction for 800 students. On the average it costs a large and well-equipped university like Cornell about \$300 for the education of each student. *Cornell, therefore, annually gives to the people of the State of New York not much less than \$250,000.*

"The entire amount received from the United States—\$59,428.80 annually—does not begin to provide instruction even in 'such branches of learning as are related to agriculture' alone. * * * The total cost of maintaining the Agricultural College at Cornell University is found to be \$141,061.27.

"Towards the maintenance of this Agricultural College by Cornell University, the State of New York does not contribute. It appropriated, a few years ago, \$50,000 for a Dairy building, which was intended to form one wing of a great State Hall of Agriculture. But that hall remains unbuilt.

"I should mention the \$35,000 granted to the College of Agriculture by chapter 430 of the laws of 1899, which can be applied only to the special object for which it was granted, and that is the promotion of agricultural knowledge throughout the State by university extension methods. The College is happy to aid the State in so useful and helpful a work, but the College itself receives no benefit from it. For the sake of completeness I will add that the State maintains at Cornell University a New York State College of Forestry, for which it makes an annual appropriation of \$10,000, and a New York State College of Veterinary Medicine, for which it makes an annual appropriation of \$25,000. *No other appropriation of any kind, either for*

the University or for State institutions located here, is received by Cornell from the State of New York. All the rest of the revenues of the University is derived from private endowments. * * *

"Since the College of Agriculture was established it has given instruction to more than sixteen hundred students in residence at Ithaca, and it has become one of the foremost colleges of its kind in the United States. * * *

"There are in attendance at the present time some two hundred students in the various courses. Tuition is free in all courses. During the last five years there have been from ten to twenty graduate students in the University each year who have selected both their major and minor subjects or their major subject in the College of Agriculture. This indicates the opinion that students from other colleges have of the work being done here.

"In addition to the students in residence, we are teaching a vast number of students scattered throughout the State by means of correspondence courses. This work is for the promotion of agricultural knowledge throughout the State. There are enrolled in the Farmers' Reading Course department 30,000 students; in the Farmers' Wives' Reading Course, 8,000 students; in the Junior Naturalists' Club, about 30,000 pupils organized into 1,700 clubs; in the Home Nature Study Course, about 1,500 teachers. * * *

"Nearly five hundred farmers have conducted experiments on their own farms under the careful supervision of members of the teaching force. This is in addition to the investigations carried on at the University. There is scarcely a subject connected with fruit or field crops that has not been studied from close range in a majority of the counties of the State.

"I cannot state accurately how many

lectures before farmers' organizations have been delivered since the College was established, but they certainly number several thousand. In addition to all this, the College has done a vast work in helping the farmers out of their difficulties by personal correspondence. From five to ten thousand letters per year in answer to questions are written by the staff. This work alone is a great tax upon the College, but the benefits derived are so great that the practice still continues of answering, to the best of our ability, all questions related to agriculture, directly or remotely.

"The Experiment Station, a department of the College of Agriculture, has published 196 bulletins, in editions averaging more than 20,000 each, and fourteen annual reports. Whenever there is a serious outbreak of insects or fungi, a specialist is dispatched immediately to make investigations and to help overcome the difficulty. * * *

"Agricultural students have gone to all parts of the State and carried with them the light of science to aid the farmer in his arduous and difficult, though independent and noble, calling. Professors, by their investigations on the diseases that attack grains and fruits and flocks and herds, have saved millions of dollars to the State. The Cornell method of combating the pear-sylla saved over a million dollars to a single county. Methods of orcharding have added noticeably to the prosperity of farmers and fruit growers."

CORNELL UNIVERSITY. R. H. THURSTON.

SCIENTIFIC BOOKS.

Die heterogenen Gleichgewichte, vom Standpunkte der Phasenlehre. Erstes Heft: Die Phasenlehre: Systeme aus einer Komponente. By H. W. BAKHUIS ROOZEBOOM. Braunschweig, Friedrich Vieweg und Sohn. 1901. 14x22 cm. Pp. xiii+217. Price, paper, 5.50 Marks.

Every one who lectures on a subject feels the necessity of presenting it, so far as may be, in a systematic, coherent manner. For this reason we make the 'periodic law' the basis of lectures on inorganic chemistry, while we classify organic substances according to their constitution formulas. In physical chemistry the order of treatment has been based largely on the physical state of the system, gaseous, liquid or solid. It is an open question whether the orthodox classification is or is not the best in the case of inorganic and organic chemistry; but it is certainly not satisfactory for physical chemistry. The ideal classification for this last subject is based on the phase rule of Willard Gibbs and depends primarily on the number of components and secondarily on the degrees of freedom. By the components we mean the substances from which the system can be made, and we classify our material first as one-component, two-component, three-component systems, and so on, usually grouping systems containing more than three components under the single head of multi-component systems. We next subdivide each group according to the degrees of freedom, this depending on the relation between the number of independently variable components and the number of phases. By phases we mean the physically distinct portions of the system, such as the solution or liquid phase, the vapor phase, the solid phase or phases. When the only factors to be considered with relation to equilibrium are the pressure, temperature and the relative masses of the components, the state of the system is fixed when there are two more phases than there are components. Such a system is called an invariant system. When there is only one more phase than there are components, the system is called a univariant system, and it is said to have one degree of freedom because the state is not fixed until we settle arbitrarily the value of one of the independent variables. When the number of phases equals the number of components, the system is a divariant one having two degrees of freedom. Each decrease in the number of phases means an equal increase in the degrees of freedom.