just beginning; when the constitution of the cells and tissues on the basis of their genetic nature was a blank page, and the mind-body relationship was almost entirely mystical; and when the question of whether vitalism or mechanism was the basis of physiological processes was a subject of serious debate. We need strength and courage to dare dream what the next thirty-seven years may bring and to realize how crude and even false many of the scientific positions of to-day may then seem.

The new laboratory is a new home for physiologists. It has all the future of this science within it. Who can say that the greatest discovery may not happen there; the arrangements which bring forth life itself must some day be found in some laboratory. May all those who work in this laboratory be inspired by the spirit of Theobald Smith, and with a quiet modesty may they whisper their questions to nature, and if she answers, may they have the simplicity to understand.

AGRICULTURAL RESEARCH IN CHINA.[1] II

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Entomology: Courses in entomology are taught in each of the agricultural colleges previously listed and courses are given also in the private colleges of Yenching University, the Peiping Union Medical College, the Soochow University, the Chen Tan University and in Fukien Union College. Research work of various sorts is carried on at most of these institutions. Mr. F. C. Woo, head of the department of plant pathology and entomology of the National Agricultural Research Bureau, furnished a list of entomological workers in China. This list consisted of 26 professors, 4 assistant professors, 11 instructors, 17 senior entomologists, 7 assistant entomologists and 12 assistants. This list of 77 workers in entomology, many of whom have had advanced training, gives some idea of the status of entomology in China. It should be appreciated that in entomology and other fields of agricultural research there is a large body of students who have graduated from middle schools, and other schools of a similar nature, and who make admirable assistants but who have not been listed in this survey.

Several special schools have been conducted for the purpose of training research assistants and extension workers. A one-year short course was held by Southeastern University in 1928–29 and 20 students completed the course work. The Bureau of Entomology of Chekiang conducted a similar training school for each of three years from 1931 to 1934 and 87 students completed the short course. In 1936 the National Agricultural Research Bureau conducted a National Training School for Insect Control. Eighty-seven technical workers or agricultural school teachers from 15 provinces were in attendance.

The first application of scientific methods for the control of insects in China, since the formation of the Republic, was in 1919 when private funds were given at the request of Dean Tsou, of Southeastern University, to aid in controlling an outbreak of the cotton looper. A few years later the Kiangsu Provincial Bureau of Entomology was established at Southeastern University, now called Central University.

In 1924 the Chekiang Government established a Bureau of Entomology, which was located at Kashing but moved to Hangchow in 1934. This laboratory has made many important studies of injurious insects, has an extensive insect collection and a good library. The provincial governments of Szechuan, Kiangsi, Kwangtung and Honan have Provincial Departments of Entomology connected with their local departments of agriculture.

The Entomological Department of the National Agricultural Research Bureau consists of six experienced entomologists, one senior chemist and fourteen assistants. Studies of the rice borer and of stored-grain insects are conducted in cooperation with the National Rice and Wheat Improvement Institute. Other research studies are carried on with the migratory locust, forest insects and insecticides. The most important contribution of this department in cooperation with the Cotton Improvement Institute is the invention of cotton-seed-oil emulsion for aphis control. The new insecticide is more satisfactory and the cost is only about one third as great as kerosene oil emulsion.

This brief summary gives some idea of the status of entomology in China and indicates rapid development of this important field in recent years.

Horticulture: Several of the agricultural colleges have departments of horticulture. The more important of these are the Colleges of Agriculture of the Universities of Nanking, Chekiang and Lingnan, the Hopei Provincial Agricultural College and the Northwestern College of Agriculture at Wukung. Horticultural crops in China are of great importance and China is particularly fortunate in the large variety of

[1] Address of the vice-president and chairman of the Section on Agriculture, American Association for the Advancement of Science, Atlantic City, December, 1936.

vegetable crops that are so widely grown. The more extensive experimental work with some farm crops, as with wheat, rice kaoliang and millet, than with most horticultural crops is without doubt due to the necessity of increasing the supply of food of those crops that represent the basic food supply of the nation. As time and funds permit it may be expected in the near future that the work with horticultural crops will be greatly expanded.

Citrus fruit crops have been worked with extensively in Chekiang, Fukien, Kwangsi, Kwangtung, Hopei and Kiangsi. Varietal surveys and storage problems have received the most attention. Varietal surveys with peaches have been made in the provinces of Chekiang, Kansu and Shantung and the better varieties have been learned. The problem of de-astringing persimmons that belong to the astringent group has been worked out.

With vegetable crops extensive breeding studies are under way at the University of Nanking with varieties of radish and cabbage. Studies of watermelon have been made in several provinces with particular reference to varietal differences, cultural methods and the breeding of improved varieties. Cultural studies are being made with orchids at the University of Chekiang, and propagation and classification studies have been made with shrubs and trees at the Lushan Arboretum and Botanical Garden in Kiangsi.

Many of the larger cities in China have well-developed park systems, and the work in these parks along horticultural lines is rather extensive. Studies of varieties of fruits, such as watermelons, peaches and pears, and of ornamentals, like chrysanthemums, peonies and roses, are of great value in varietal surveys and in education of the public.

Forestry: According to D. Y. Lin,[7] who discussed forestry in the Chinese Yearbook, regular college courses in forestry are given at Nanking University Peiping Agricultural College and the Agricultural College of Central University. Special courses in forestry are given also at several agricultural colleges in the provinces of Chekiang, Honan, Anhwei, Kwangsi, Szechuan, Hopei and Kwangtung. The Northwestern College of Agriculture and Forestry at Wukung has been organized recently.

Under various provincial bureaus, such as the bureau of reconstruction, the bureau of industries or the office of forestry, extensive work is under way in most of the provinces. The budget for this work is over one million dollars annually, the total number of district forest stations is 80 and the number of technical trained men at these stations is 118.

The Central Afforestation Bureau organized in 1929 by the Central Government has set up a model forestry area around Nanking and over fourteen million seedlings have been set out.

The National Agricultural Research Bureau has a department of forestry with 6 research workers. Experiments are conducted at the bureau in cooperation with the Sun Yatsen Memorial Park, where experiments are being made on reforestation. Studies of forest plantings are being made with the College of Agriculture of Honan University and the Chan Shan Provincial Forest Station of Chekiang.

Animal Husbandry and Veterinary Science: In an article on animal husbandry in the Chinese Yearbook for 1935–36 Mr. Vougi Tsai[8] makes the statement that "China ranks second in the world animal industry." An estimate of number of units of live stock in 1935 was made in "Crop Reports" by the National Agricultural Research Bureau.[9] This includes the provinces of Chahar, Suiyuan, Ninghsia and Tsinghai and 17 provinces in China proper but lacks data for the province of Kwangsi. These data then include the numbers of units of live stock for 1935 for 21 provinces (see Table 4).

TABLE 4
UNITS OF DIFFERENT KINDS OF LIVE STOCK
(UNIT, 1,000 HEADS)

Productive animals		Labor animals	
Kinds	No. units	Kinds	No. units
Sheep and goats ...	42,890	Water buffaloes ..	11,603
Hogs	62,639	Oxen	22,647
Chickens	246,688	Horses	4,080
Ducks	56,724	Mules	4,666
Geese	10,538	Donkeys	10,547

It is apparent that animal industry is of great importance in China. It should be remembered, except for a few provinces, that crops are raised primarily for human consumption and that by-products are used as fodder. In general there is little use of hay and pasture crops and except in the region of larger cities no dairy industry. In Northwestern China there is a large area of grazing land, and alfalfa is grown rather extensively in certain sections. Wool production is the principal animal industry in this region.

Several of the agricultural colleges have departments of animal husbandry. These are found at Central University, Nanking; Sun Yatsen University, Canton; Honan Agricultural College, Honan University; the Agricultural College of Peiping University; Northwestern College of Agriculture, Wukung; the College of Agriculture of National Szechuan University and the Institute of Kansu, with a Junior College of Agriculture and courses both in animal husbandry and veterinary medicine.

Veterinary schools comprise: (1) the Army Vet-

[7] D. Y. Lin, "The Chinese Year Book," pp. 769–785, 1935–36.

[8] Vougi Tsai, "The Chinese Year Book," pp. 786–805, 1935–36.

[9] Nat. Agr. Res. Bur. China, Crop Reports. Vol. IV, No. 4: 115–118. 1936.

erinary School, under the Ministry of War, with over 30 years' history. Seventeen classes consisting of approximately 500 students have graduated from this school. (2) The Technical School of Veterinary Science at Shanghai, organized in 1932, which gives two years' college training to middle school graduates. The first two graduating classes consisted of about 60 men, most of whom obtained positions immediately. (3) Central University, giving a four-year course, from which approximately 20 men have graduated.

In animal husbandry improvement projects with swine are carried at Central University and at Sun Yatsen University in Canton. The studies at Central University comprise a multiplication of several foreign breeds for extension work, including Large Yorkshire, Berkshire, Hampshire and Poland China and studies on the growth rate of Chinese breeds of swine, while grading up of Chinese breeds is being studied at Central University and at Sun Yatsen University. Breed characteristics of the Peking duck and fattening projects are under way at Central University as well as studies of grading up of Chinese cows for improvement of dairy characteristics by the use of Jersey sires. The milking quality of the Chinese water buffalo has been studied for years at Lingnan University, Canton. With liberal feeding some animals give 4,000 pounds of milk per year with a fat content of from 10 to 15 per cent.

At provincial stations in several provinces there are improvement projects with live stock. The Szechuan Bureau of Animal Industry is carrying on studies with swine and sheep breeding, and the Chekiang Provincial Station recently has started a project on swine breeding. The Kiangsi Provincial Bureau has a department of animal husbandry and is making studies on swine grading, poultry improvement and with the Peking duck. The Kwangtung Provincial Bureau of Agriculture is studying swine improvement. Under the Ministry of Industry there is a Northwestern Breeding Station working chiefly on sheep, while the Ministry of War has an extensive horse-breeding station, where studies are made also of disease control.

Much of the live stock of China has become adapted to particular conditions of environment through long years of selection and while inferior to foreign breeds in many respects it is generally believed that the native breeds are hardier and better adapted to local conditions than introduced breeds. For these reasons it appears feasible to grade up native breeds through crosses with foreign breeds rather than introduce foreign breeds for direct use.

The department of animal husbandry and veterinary science of the National Agricultural Research Bureau under the Ministry of Industry has a force of two senior veterinarians, one bacteriologist and five veterinary assistants at the Central Station in Nanking and two field stations, one in Kiangsu and the other in Chekiang Province, with one senior veterinarian and five assistants. Ten different kinds of serum, vaccine and diagnostic reagents are being produced. Anti-hog-cholera serum is being produced on a large scale to supply field stations for hog cholera control. Special attention is being given to the development of serums and vaccines and special research studies are being made of important diseases of animals.

There is a serum laboratory at Tsingtao in Shantung Province under the Ministry of Industry and a Northwestern Epidemic Prevention Bureau for the control of human and animal diseases. Several provinces have provincial bureaus where studies are carried on for the control of diseases. The Kwangsi Provincial Bureau of Animal Husbandry is producing rinderpest serum and vaccine on a large scale and has as its aim the eradication of rinderpest in the province. The Agricultural Institute at Nanchang in Kiangsi Province is developing a comprehensive plan for the control of animal diseases and is manufacturing serums for provincial use. The Szechuan Provincial Bureau of Animal Industry and the Kwangtung Provincial Bureau of Agriculture have project work on the control of animal diseases.

A partial picture of the status of animal husbandry and veterinary medicine in China can be gained by summarizing the number of men in teaching and research with a college degree. Disregarding the Army Veterinary School at Shanghai and making estimates for those institutions where the number of assistants was not known would give 8 professors and 16 assistants in animal husbandry in colleges giving courses and carrying on research in animal husbandry and 4 project leaders and 14 assistants in provincial departments carrying on research in animal husbandry.

In veterinary medicine there are approximately 5 professors and 8 assistants in college departments, 4 project leaders and 14 assistants in provincial departments and 7 project leaders and 14 assistants in departments under the control of the National Government. To this list must be added a large number of assistants who are graduates of middle schools and who have had special training in short courses.

This seems to be a relatively small number of research workers in animal industry in proportion to the value of the industry in China.

Sericulture: Some time ago raw silk was of first importance in China's export trade. While the rapid decline in the value of raw silk exports in recent years may be due largely to world-wide depression, the value of the industry in China has led to extensive and intensive studies for the improvement of the silk industry.

The Department of Sericulture of the National Agricultural Research Bureau, Nanking, with 6 project leaders, is centering its attention on the improvement of silkworms by breeding, using methods that rather closely parallel those which have been used successfully in the United States with corn. Diseases and parasites and their control are being studied also as well as varietal trials of the mulberry tree.

There are departments of sericulture at the National Central University, the University of Nanking, National Chekiang University, National Sun Yatsen University, Lingnan University and Liao Chung Kai Agricultural and Industrial School, Canton. At these institutions there are 16 project leaders working with silkworms. The breeding of silkworms is being studied at all 6 schools, the genetics of silkworms at 2 schools, diseases at 3 schools and varietal trials with the mulberry tree at 2 institutions.

The Provinces of Kiangsu, Chekiang and Szechuan have sericultural experimental stations, with 5 project leaders. All three stations are studying silkworm breeding, while the stations in Kiangsu and Chekiang are making varietal trials of the mulberry tree. Diseases of silkworms are being studied in Szechuan Province. Several of the provincial stations are distributing silkworm eggs to the growers. Thus in the provinces of Kiangsu and Chekiang more than three million sheets of improved eggs were used in 1934.

In addition to the above institutions and experiment stations the International Committee for the Improvement of Sericulture is carrying on a silkworm breeding project and the Bureau of Sericulture in Canton is making studies on the uses of silk, the control of diseases and the breeding of improved varieties.

The Sericulture Improvement Committee of the National Economic Council, organized in 1934, has extensive studies under way for the improvement of all branches of the silk industry.

The provinces of Szechuan, Chekiang, Anhwei, Hupeh, Shantung and Kiangsu have extension bureaus for sericulture. The most important phase of their work is the distribution of improved disease-free eggs, a total of over one hundred thousand cards of eggs having been distributed. Other phases of work in some provinces include the distribution of improved mulberry trees and the organization of cooperatives for the sale of farmers' products.

Other research fields: In addition to the lines of work mentioned already, probably the most important other phase of agricultural research in China is in agricultural economics. The studies of Dr. Buck at the University of Nanking are well known. This work is being continued on a large scale, is well supported and is making available to workers in other countries an accurate picture of farming conditions in China. It is helping, also, to make known some of the important farm problems and is aiding in their solution. The Crop Reporting Service of the National Agricultural Research Bureau, inaugurated in 1933, is of great value in making available statistics of crop production.

According to statistics made available by W. S. Tong, of the Department of Agricultural Economics of the National Agricultural Research Bureau, there are four colleges or universities that have special departments of agricultural economics, and courses in agricultural economics are given in 18 other colleges or universities. To date 121 graduates have majored in agricultural economics, including students from the University of Nanking, National Peiping University and National Chekiang University. In addition to the University of Nanking and the Research Bureau, already mentioned, twelve other institutions are conducting research on agricultural economics.

Research along agricultural engineering lines is being developed at several institutions, although work in this field has not been undertaken to any great extent.

Conclusion

The rapid expansion of agricultural research in China in recent years is one indication of the widespread interest among Chinese leaders in improving the living conditions of the people. The present tendency is to work primarily on problems of an immediate practical importance. With the basic farm crops the immediate end in view is to make China self-sufficient. There is, however, in China a growing appreciation of the value of agricultural research as one means of helping to develop efficiency in agriculture.

OBITUARY

JAMES BERTRAM OVERTON

News of the death, on March 18, of Professor Overton came with a shock to a wide circle of close friends, and particularly to the many who have worked with him as students.

James Bertram Overton was born at Richmond, Michigan, on October 23, 1869. His graduation from the University of Michigan in 1894 was followed by a year of high-school teaching at Black River Falls, Wisconsin, and this by three years as senior master in mathematics at St. John's Military Academy, Delafield. In 1898 he began graduate work at the University of Chicago, where he received the degree of Ph.D. in 1901.