The
Rockefeller Foundation

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Annual Report

1918

The Rockefeller Foundation

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THE ROCKEFELLER FOUNDATION

Annual Report for 1918

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THE ROCKEFELLER FOUNDATION

President's Review

To the Members of the Rockefeller Foundation:

Gentlemen:—

I have the honor to transmit herewith a general review of the work of the Rockefeller Foundation for the period January 1, 1918, to December 31, 1918, together with the detailed reports of the Secretary and the Treasurer of the Foundation, the General Director of the International Health Board, the General Director of the China Medical Board, and the Director of the Rockefeller Institute for Medical Research as regards the special war activities of the Institute that have been supported by the Foundation.

Respectfully yours,

GEORGE E. VINCENT,
President.

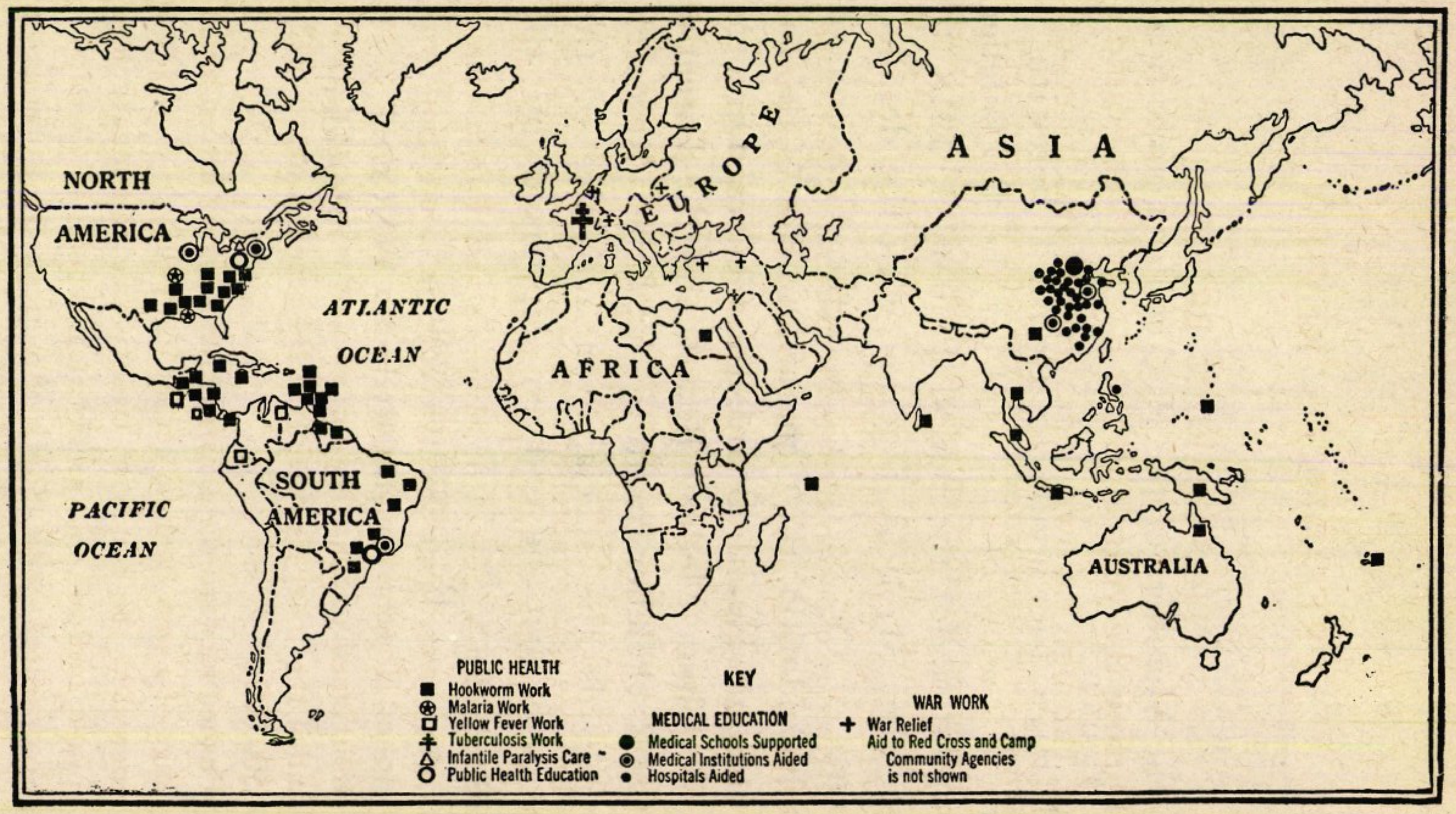

Fig. 1.—World map of activities of Rockefeller Foundation

PRESIDENT'S REVIEW

THE YEAR IN BRIEF

During the year 1918 the Rockefeller Foundation, through its own departments and by co-operation with seventeen independent agencies:

1. Extended a campaign against tuberculosis in France;
2. Conducted demonstrations in malaria control in Arkansas and in Mississippi;
3. Helped to check a yellow fever epidemic in Guatemala;
4. Made investigations and surveys and inaugurated measures against the same disease in Ecuador;
5. Continued or began hookworm control and encouraged sanitation in twenty-one foreign states and countries and in twelve states of the Union;
6. Entered into comprehensive co-operation for improved public health organization in Brazil and in Australia;
7. Supported a School of Hygiene and Public Health which was opened in October in connection with Johns Hopkins University;
8. Continued to contribute to various war-work agencies until the total given since 1914 reached nearly $22,500,000;
9. Pushed forward the construction work on fifteen buildings of a new medical center in Peking;
10. Increased the funds of twenty-four missionary hospitals, medical, and pre-medical schools in China;
11. Co-operated with South American Institutions in establishing certain departments of research and teaching;

12. Maintained sixty-eight fellows and scholars from the United States, China, and Brazil who were studying at American medical schools;
13. Supported studies in mental hygiene;
14. Continued appropriations for the after-care of infantile paralysis cases;
15. Made additional gifts to the Rockefeller Institute for Medical Research;
16. Lent for various services expert members of the Foundation's staff;
17. Brought its studies in industrial relations to an end;
18. Made surveys for the American Red Cross and for the American Social Hygiene Association.

In addition to these more characteristic activities of the Foundation, appropriations in fulfillment of pledges were made to a number of organizations whose work does not lie directly in the fields of public health, medical education, or war service. (For a complete list of appropriations for 1918, see pages 69–71, and the detailed report of the Treasurer.)

WHY SHOULD AMERICA TRY TO TEACH FRANCE ABOUT TUBERCULOSIS?

It may well be asked whether it was not presumptuous for Americans to go crusading against tuberculosis in the land of Louis Pasteur. Was there any justification for sending a Commission overseas, save the fact that France, sorely pressed by war, could spare neither per-

sonnel nor resources for a fight against the white plague? When, in July, 1917, Dr. Livingston Farrand and his colleagues of the Foundation's Commission for the Prevention of Tuberculosis in France reached Paris and began their survey of the field, they found already in existence examples of almost every kind of agency known to modern medicine and public health administration as effective in combating consumption.

French scientific men understood the theory of tuberculosis and the principles which underlie the control of it. In the Leon Bourgeois dispensary in Paris were to be found the essential features of an efficient diagnostic and out-patient clinic: a well-planned and adequately equipped building, the leadership of an expert director, a staff of laboratory and clinical assistants, a group of visiting nurses, a training center for these functionaries, daily sessions for patients, and free public lectures on the nature of the disease and the best ways of guarding against it. In one sense, the Americans had nothing to teach the French about the organization and administration of a tuberculosis dispensary.

Another fundamental institution in the control of tuberculosis is the sanatorium. With respect to this the French had little if anything to learn. For example, the sanatorium at Bligny, thirty miles south of Paris, is said to be

equaled by few and surpassed by only one or two American institutions of this sort. Its tastefully designed fire-proof buildings, situated in spacious and beautiful grounds, afford accommodations to 600 patients. The scientific and other equipment is thoroughly modern. Ample sun porches, pleasant walks, opportunities for simple games and for gardening, are provided. The Director is a recognized specialist who adds to expert knowledge, unusual administrative capacity and a fine devotion to his life work. The daily per capita cost in pre-war days was 3.85 francs; in May, 1918, this had risen to 5.65 francs. Apparently Americans had more to learn than to teach at Bligny.

In the organization of local committees, in relief measures, in issuing literature and in carrying on educational work, in Government provision for tuberculous soldiers, in setting apart hospital beds, and in other ways, much was being done in France when the American Commission arrived. It soon became apparent, however, that these various institutions and activities were few in number, isolated, almost unrelated. In France ideas do not spread rapidly by imitation as they do in the United States. There are few French national organizations which can quickly inform every community of what is being done in every other. The "boosting" spirit is

largely lacking in the Gallic character. Individualism, both personal and of the group or community, is a dominant influence. Thus, there was no efficient, co-operative, centralized organization among French agencies for a united, comprehensive attack on tuberculosis.

TEAM-PLAY AGAINST TUBERCULOSIS

The American contribution, then, has been a demonstration of organized team-play. Only as dispensaries, hospitals, sanatoria, preventoria, open-air schools, home supervision by visiting nurses, relief, extra food, educational campaigns, committees, and government officials are all fitted into a co-operative and unified system, can really effective results be secured. The Commission for the Prevention of Tuberculosis of the Rockefeller Foundation and the Tuberculosis Bureau of the American Red Cross set themselves the task of demonstrating to the French people the possibilities of such team-play. In their own relations these two organizations afforded a striking example of the thing they urged upon others. The Nineteenth Arrondissement in Paris and the Department of Eure-et-Loir of the provinces were selected for intensive organization of the essential agencies of tuberculosis control.

Four dispensaries were planned for the Arrondissement, three of these being opened and in operation before the end of 1918. Groups of nurses, or *visiteuses d'hygiene*, attached to these centers visited patients in their homes. The Red Cross provided extra hospital wards, opened sanatoria and preventoria in the suburbs, and supplied food and clothing to needy sufferers from tuberculosis. Thus, elements relatively ineffective when isolated were combined into a mutually re-enforcing co-operation. As it turned out, the undertaking did more than demonstrate the possibilities of public health progress. During the dark days of April, May, and June, 1918, when air-raids were frequent and the long-range gun was dropping many shells in the Nineteenth Arrondissement, the French and American nurses went their daily rounds, calm, cheerful symbols of normality and quiet courage among the panic-stricken workers and the harassed refugees who crowded that quarter of Paris. These noble women did much to combat tuberculosis, but they did infinitely more to dispel fear and to maintain morale.

During 1918 four central dispensaries and six secondary centers were opened in the Department of Eure-et-Loir. Another six were nearly completed, and seven others were located for future development. It is expected that by

July, 1919, the twenty-three called for in the program will be in operation. In the chief towns the French have set aside hospital beds for the use of the Commission, a sanatorium is being prepared near Dreux, and a day camp is available north of Chateaudun. The French authorities and the local committees are co-operating heartily in securing facilities, and as the Red Cross withdraws will assume increasing responsibility for relief work, the provision of extra food, etc. A systematic campaign of education has been carried on throughout the area, so that no family, however remote, has been wholly untouched by this attempt to organize a typical provincial department for a public health crusade. In increasing numbers, public officials and committee representatives from all parts of France are visiting Paris and Eure-et-Loir to see what American methods are accomplishing in actual operation.

TRAINING LES VISITEUSES D'HYGIENE

When the Commission was organized in 1917, one of the problems was to find public health nurses who were familiar with tuberculosis work and who could speak French fluently. Fortunately, a group of exceptionally able and loyal American nurses was secured. Their services

have contributed in a notable way to the success of the undertaking. But it was soon evident that reliance must more and more be placed upon the training of a French personnel. One of the first tasks, therefore, was to provide centers in Paris in which could be organized special courses consisting of lectures, clinics, hospital and sanatorium experience, and field work in visiting patients in their homes. French and American physicians were engaged as instructors, opportunities of the essential kind were secured, and *bourses*, or scholarships, of 150 francs per month, were offered. French women of a satisfactory type responded in gratifying numbers. About seventy were enrolled by the spring of 1918. At the end of the year, forty-five nurses were in the service of the Commission and fifty-six others were in training—forty-five in three centers and four dispensaries in Paris, seven at a new school in Bordeaux, and four in Lyons. An additional training center had been opened in Nantes. All of the fifty-six pupil nurses were receiving scholarships from the Commission. With the organization of local committees throughout France the demand for *visiteuses d'hygiene* is growing. Training centers on the model of those in Paris are likely to multiply in the near future. It is worth noting that the Commission did not seek to attract French nurses by offering them higher

salaries than they had been accustomed to receive from various other institutions and societies. Instead, it used its good offices with the other agencies to have each of them increase its salary scale for nurses. In this way the different organizations gave an effective example of team-play.

THE MEDICINAL "TANK": ITS CREW AND ITS AMMUNITION

"Do you know the Medicinal Tank?" asks a writer in *Le Matin* of November 30, 1918. "It is an invention of the Rockefeller Foundation. This tank rolls over the roads of France, bearing signboards. . . . Behold this tank entering a city—or a village. It does not come unannounced . . . a delegate arrives. He pays visits to all the newspapers and to the municipal, military, prefectoral, and religious authorities. . . . The Mayor offers a free hall to the impresario—I mean the delegate. After the hall has been obtained the delegate covers the city with posters. And such posters! Barnum and Bailey would not be ashamed of them. . . . The legends and designs make people laugh. They gather in a circle, they are amused, and—instructed.

"In the meantime a train at the station discharges a gentleman lecturer and a lady lecturer. These are accompanied by another lady, the 'demonstrator,' whose task it is to comment on the posters in the exposition room. Finally the automobile truck appears.

"The directors of the 'International Department of Hygiene' of the Rockefeller Foundation are aware that

even the best article does not sell unless you 'hit the nail on the head.' Possessors of that excellent though neglected commodity known as truth, they find that public education is necessary in spreading it, and that this, after all, consists in nothing more than applying the art of advertising to the facts of science. This is their harangue brought to us by posters and cinema:

"'No one, O Frenchmen, has excelled you in the scientific study of tuberculosis. But it is not enough that your scientists combat this disease; each one of you must take part in the battle, must benefit from the knowledge acquired, and perform in his turn the office of educator. . . . Why do you give your patronage to charlatans? Because they advertise. We have taken advertising away from them and use it in the interests of science. You think of tuberculosis only after you have it. We are going to make you think of it all the time so that you may protect yourself against its invasion. . . This way, this way, follow the crowd. . . We put medicine within the reach of little children. This way, this way, tell us what you prefer, moving pictures or the hospital. Our show saves you from the hospital. We are advertising public health.' "

There is little to add to this clever description of the educational campaign of the Commission. During 1918 three traveling exhibits and groups of lecturers visited ten departments, and in 141 towns of 3,000 or more population gave 875 lectures with demonstrations and exhibits. In the same period 2,115,708 pieces of printed matter, posters, pamphlets, post-cards, and games, were

widely distributed throughout the whole of France. A series of twenty-four articles on tuberculosis appeared in thirty-three important provincial newspapers. The Commission's publicity material, written by French men and women, and charmingly illustrated by French artists, has set a new standard for popular public health education.

TURNING THE SYSTEM OVER TO THE FRENCH

A campaign of extension has reached twenty-seven departments. Representatives of the Commission and of the American Red Cross have visited leading towns and cities in a systematic effort to organize local committees and to induce these groups to establish dispensaries as the first step toward a complete plan for the control of tuberculosis. In the twenty-seven departments, at the time of the first visit, twenty-one dispensaries were already in existence. By the end of the year fifty-seven new dispensaries had been opened, twenty other dispensaries were in process of installation, and plans for forty-nine more had been definitely made. Besides these dispensaries, fifteen laboratories were arranged for, thirty-eight new nurses installed, and forty-two new and active committees organized. It is important to remember that almost all of the

expense, not only for the creation but for the maintenance of these activities, is borne by the French themselves. Plans are on foot for the establishment by the French of a complete system of dispensaries for the Region du Nord, which comprises the five departments recently re-occupied by the Allies and restored to France. Urgent requests are coming from many parts of the country for co-operation in organizing tuberculosis work.

Allusion has already been made to progress in the training of French nurses. It is equally gratifying to report that physicians are showing a keen and intelligent interest in the plans of the Commission. Arrangements have been made to bring a group of these men to the United States, and to afford them an opportunity to observe American institutions and methods. It is expected that in this way leadership will be provided for the assumption in France of rapidly increasing responsibility for the campaign. Local societies and committees which have cooperated so cordially with the Commission are apparently ready to do their part, while government officials have expressed the hope that a new ministry of health may be created which will take over the central supervision of the machinery that is being set up. Within a reasonable time, therefore, the Foundation expects to

withdraw, confident that the work will go on until a nation-wide system for combating tuberculosis has become a permanent part of the policy of France.

CHEAPER TO GET RID OF MALARIA THAN TO HAVE IT

The demonstrations begun in 1916 to test the possibilities of ridding a community of malaria, were continued during 1918. In four towns in Arkansas, anti-mosquito measures were carried out with marked success. By draining or filling pools, by ditching sluggish streams, and by oiling surface water which could not be otherwise dealt with, the breeding of the anopheles (malaria-carrying) mosquito was almost wholly prevented. Thus the sole means by which malaria can be transmitted was eliminated. The results, as tested by the number of calls made by physicians on persons who were suffering from the disease, were striking. In Hamburg, Arkansas, the number of calls fell from 2,312 in 1916 to 259 in 1917, and to 59 in 1918, a reduction for the period of 97.4 per cent. The per capita cost for 1917 was $1.45; for 1918 it was only 44 cents. In four other communities the percentage of reduction varied from 94.8 per cent to 78.4 per cent, while the per capita costs ranged from $1.25 to 46

cents. In the computation of per capita costs the overhead expenses of supervision by representatives of the Board have not been included. One could not ask for more convincing proofs that a community may rid itself of malaria on terms which cannot be wisely rejected. It is not surprising that towns and villages are making appropriations faster than trained sanitarians can be found to undertake the work of malaria control.

There are regions in which the anti-mosquito program cannot be successfully carried out because surface waters cannot be controlled. In such cases another method of attack must be adopted: the individuals who harbor malaria germs in their blood must be discovered and treated. In Sunflower County, Mississippi, the Foundation's International Health Board, guided by previous experiments in another county in the same state, undertook a demonstration which aimed at curing the "carriers" of malaria. In this way the mosquito was given no opportunity to receive the infective organism, and therefore no opportunity to transmit it to others. It is believed that in the rural area a malaria control of 80 per cent was secured. For the whole region of about 100 square miles, with a population of 1,000 in the town and 8,000 on the plantations in the country, a large measure of control

was brought about at an initial per capita cost of $1.08. The manager of one plantation, which has a tenant population of 600, estimates that for the past ten years the doctors' bills for malaria in this group have averaged $3,000 per year, or $5 per capita. But, of course, doctors' bills are the least of the items in the total cost of malaria to a community. These demonstrations have left no room for doubt. Malaria elimination is feasible, scientifically and economically; it represents a striking contribution to community progress and human happiness.

STATES UNDERTAKING MALARIA CONTROL

A constant aim of the International Health Board is to turn over to government agencies, public health activities which have been demonstrated to be effective. The anti-malaria campaigns in Arkansas and Mississippi, following an initial experiment begun under the auspices of the U. S. Public Health Service, have been carried out in closest co-operation with the Health Boards of these states. It is a source of satisfaction that the state authorities in Arkansas have decided to create a special division to deal with malaria control. The Legislature has before it a bill which sanctions this arrangement and provides public funds for co-operation with

communities throughout the state in a concerted movement to rid the entire commonwealth of malaria. The measures of control will be based upon the demonstrations conducted under the auspices of the International Health Board, and also upon the results which the U. S. Public Health Service has secured in sanitating, on a large scale, the zones surrounding certain of the army cantonments and camps.

A forward movement is also under way in Mississippi. In 1919 the demonstration described above will be extended to the whole of Sunflower County, which will bear one-half the expense. The State Board of Health is deeply interested and is carrying on the work under its own auspices. If the large-scale experiment proves successful, there is every reason to expect that in the early future the state will assume entire responsibility for a state-wide and persistent effort to eliminate malaria. Among the significant features of the enlarged plans for the Sunflower County demonstration are striking posters, popularly written and illustrated pamphlets, newspaper articles, instruction in the schools, public lectures, and the sale of standardized quinine at low rates by all druggists. It has even been suggested that all individuals who are found free from malaria germs be given buttons as badges of immunity.

ATTACKING THE SEED-BEDS OF YELLOW FEVER

General William C. Gorgas, on his retirement from the office of Surgeon General of the United States Army, in November, 1918, became Director of the Yellow Fever Work of the International Health Board, with freedom to carry out the recommendations of the Special Yellow Fever Commission of which, in 1916, he was the chief. The program called for the determination of the seed-beds of yellow fever, and for systematic attempts to destroy the disease at its sources. To this work General Gorgas immediately addressed himself. Before the end of 1918 he had set out upon a preliminary journey to Central America.

A yellow fever epidemic was reported in Guatemala in June, 1918. In view of the large concentrations of United States troops near Southern ports, the existence of an uncontrolled epidemic so near the border was regarded by the Surgeon General of the Army and by the United States Public Health Service as a menace calling for energetic measures. After consultation with the Guatemalan Minister in Washington, the International Health Board tendered its services to the President of the Republic, and offered to send a competent medical officer, with funds, to co-

operate in bringing the epidemic under control. This offer was promptly accepted, and on July 11, 1918, Dr. Joseph H. White, released from the Army and granted leave by the Public Health Service, sailed for Guatemala. He was cordially received, granted full authority, and given necessary aid. Quarantine was established, physicians were drafted into service, and all well-tested measures for the control of yellow fever were promptly put into effect. The epidemic was brought under control, so that when, on September 19, the expiration of his leave compelled Dr. White to return, infection was left at only one point. The resident representative of the Board took charge and continued appropriate measures. On December 4 he reported that no yellow fever remained in Guatemala.

The diagnosis of yellow fever is a difficult task. Some of the symptoms closely resemble those of other diseases, notably infectious jaundice. The germ of yellow fever has never been identified, so that laboratory tests cannot be used to determine the presence of the malady. In order that first-hand studies and investigations might be made in the field, a commission of five men, with laboratory equipment, was sent to Guayaquil, Ecuador, in June, 1918, for a stay of two months. As a result of this trip, important information was secured with respect to the sanitary conditions

in Ecuador and concerning the bacteriological, chemical, and clinical aspects of yellow fever.

Measures for the control of yellow fever in the city of Guayaquil were actively inaugurated on November 27, 1918. These measures are being conducted with the hearty co-operation of the Government of Ecuador and of the municipality. The attack is being directed against the stegomyia mosquito by which alone yellow fever can be communicated. At the end of December, 125 men, divided into squads of five men each, were systematically at work in the city of Guayaquil. It is hoped that measurable results in the reduction of infection will be disclosed in the near future. Yellow fever is being pressed further and further into isolated areas. This seems to be one disease which by persistent activity may be brought completely under control.

PROGRESS IN CONTROL AND PREVENTION OF HOOKWORM INFECTION

By far the most extensive work of the International Health Board has to do with this intestinal infection, which prevails in almost all tropical and semi-tropical lands, in the Southern States of America, and in the mining districts of several European countries. The policy of the Board is to work only in co-operation with

Governments, and to turn the undertaking over to public control as soon as possible after a successful demonstration has been made. The usual program of procedure includes: (1) an infection survey to determine the prevalence of the disease; (2) an intensive demonstration of treatment to cure the victims of the malady, together with (3) a campaign of popular education as to the nature, control, and prevention of hookworm disease; and (4) a persistent effort to secure the provision of proper sanitary facilities and regulations by which alone the pollution of the soil and the reinfection of the population can be avoided.

Work for the relief and control of hookworm disease was conducted during 1918 in co-operation with twelve states in the United States and with twenty-one foreign states and countries. Infection surveys were completed in the State of Sao Paulo, Brazil, in Jamaica, and in Guam. New work was undertaken in Queensland, Australia, and in Minas Geraes, Brazil. Of several invitations to begin new co-operative work it was possible to accept only one, that of the Madras Government of India. As a result of the demonstrations of the Board, a number of Governments, quite on their own account, have inaugurated hookworm control measures. In Ceylon, gratifying progress is reported in hookworm control, in sanitation, and in the training of a

native medical staff. Siam is planning to extend its work and to increase appropriations. The survey of the United States Pacific Island of Guam disclosed an infection of 71 per cent, but of a mild type. Jamaica, after a survey, has undertaken appropriate measures. Distinct advances in sanitation and the compulsory installation of latrines were reported from Ceylon, Queensland, Brazil, the Seychelles Islands, Siam, the West Indies. The control and sanitary program being carried out in the Pinghsiang Colliery in China is a most encouraging evidence of what a carefully conducted demonstration can accomplish.

SIGNIFICANT DEVELOPMENTS IN BRAZIL AND AUSTRALIA

While the relief of large populations from the limitations and suffering which are consequent upon hookworm disease is in itself a highly important aim, the International Health Board has always regarded its hookworm demonstrations as a means to an even larger end, namely, the establishment of inclusive Public Health Services capable of dealing with all aspects of public health for a community, a state, or a nation. For this reason, two developments during 1918 have been welcomed with especial satisfaction.

Several of the states of Brazil have taken up hookworm campaigns energetically in co-operation with the Board. The movement has gained momentum because the Federal Government has made large appropriations for subsidizing the efforts of the various states. In order to further this nation-wide program, the International Health Board has largely increased its contributions, and has lent a specialist to make, under Federal auspices, a survey of rural health problems for the whole of Brazil. The bearing of all this upon the development of public health administration in that country is obvious.

A hookworm survey of Papua and of a region in Queensland has led to unexpected developments. The authorities, both of Queensland and of the Federal Government of Australia, have shown deep interest. They have proposed a five-year period of co-operation in carrying out for Queensland and for Papua a program of rural sanitation in which hookworm control is to play a leading, but not an exclusive, rôle. The Board will contribute the services of an expert sanitarian and appropriate a fairly large annual sum at the outset. This will decrease by 20 per cent annually, until at the end of the period the entire expense will be borne by Australia.

A NEW SCHOOL OF HYGIENE AND PUBLIC HEALTH

In October, 1918, the School of Hygiene and Public Health, made possible by gifts from the Rockefeller Foundation for building, equipment, and maintenance, was opened under the auspices of Johns Hopkins University in Baltimore. A former physics laboratory, temporarily prepared for the purpose, afforded reasonably satisfactory quarters. The erection of a permanent building is contemplated in the early future. Because of war conditions the initial enrolment was not large. Seventeen students were in attendance during the first semester. It is expected that the number will rapidly increase. The demand for public health functionaries has been stimulated by the war and by the prospective needs of peace. The Foundation's interest in preventive medicine and the conviction that a trained personnel is an essential condition of progress have led to the establishment of this institution.

The new school will not only provide thorough courses in the fundamental chemical, biological, and medical subjects in their many specialized phases, but will lay stress upon vital statistics, upon sanitary engineering, upon the sociological aspects of public health, upon community surveys, and upon the technique of administration.

It is significant of the new attitude of preventive medicine that from the outset attention is being given to the problems of nutrition. It is proposed to work out basic standards of food for human beings under various conditions. Prevention is being more and more positively interpreted into a better standard of living, in terms of working conditions, housing, food, exercise, recreation, sociability, and happiness. The field of industrial hygiene has great possibilities. Studies of fatigue, of occupational diseases, of light and ventilation, of medical care of employes, etc., are opening new vistas.

FUTURE PLANS FOR PUBLIC HEALTH AND MEDICAL EDUCATION

The past activities of the Foundation, including certain war-time experiences, have led, during the year, to the consideration of plans and policies for the future. The coming of physicians and medical students from Brazil, from China, from France, on Foundation fellowships, to pursue courses in leading medical schools of the United States, and the necessity of furnishing accurate information to these men and women, have suggested the importance of gathering data with respect to the personnel, equipment, and resources of such American institutions.

Successful demonstrations with hookworm and malaria have raised the question as to whether more comprehensive surveys and programs may not be carried out in co-operation with local officials and voluntary societies in typical urban and rural communities.

Significant progress in such undertakings is reported from North Carolina. In nine counties, three-year programs have been inaugurated which make definite attacks upon the more important public health problems, such as soil pollution and its attendant diseases, typhoid fever, infant diarrhea, dysentery, and hookworm. The medical inspection and treatment of school children, the quarantine of infectious diseases, the prevention of tuberculosis, and work for infant welfare, are also included in the plan, which is supported by the combined contributions of the State, the counties, and the International Health Board. The administration of these campaigns is unified under the leadership of the State Board of Health. Several other counties have undertaken similar programs on their own initiative.

The problem of the functions and the appropriate training of the public health nurse has been raised by a number of applications for Foundation aid. It was deemed wise to call a conference of the leading groups which are con-

cerned with this question. As a result of such a meeting, held in December, 1918, a special committee was appointed to study the situation and to make recommendations. In view of the Foundation's special concern with the field of preventive medicine, it has been decided systematically to collect information about public health organization and procedure in the leading countries of the world. It is proposed gradually to extend the policy already begun in Brazil,—of helping to establish new departments or of strengthening existing courses in public health and medicine in certain universities in countries where the Foundation is at work. Another plan is to attach to the central staff of the International Health Board, one or more trained public health laboratory experts whose services may be put at the disposal of state or municipal boards of health which desire aid in extending and improving their public laboratory service.

THE "GREEN CITY" IN PEKING

Work on the fifteen buildings of the Peking Union Medical College, which are being constructed under the auspices of the China Medical Board of the Rockefeller Foundation, has gone steadily forward during 1918. There have been inevitable delays due to difficulty in securing

materials from the United States. Costs have increased enormously, not only because of war prices, but by reason of most unfavorable rates of exchange. Nevertheless the progress has been encouraging. The Chinese laborers take kindly to American building methods. The re-enforced concrete construction which was employed was a welcome novelty. The use of woodworking machinery has aroused much interest. The turning out of uniform sash, doors, window frames, etc., was a new idea to a people accustomed to hand work, whose nearest synonym for identical is "not so very different." Because glazed green tiles are being used to cover the high Chinese-like roofs of the new buildings, the people have already named the group "The Green City."

The pre-medical school which opened in 1917 with eight pupils, increased its enrolment in 1918 to seventeen. The quality of these students is reported to be exceptionally promising. Additions to the faculty of the medical school were made during the year, until, by the end of December, thirty-four men and women were under appointment to the staff proper. Of these, twenty-three were already in Peking. In addition, a number of lesser appointments have been made. Laboratory facilities will be available for work in the autumn of 1919, but the new

hospital wards probably will not be ready until a year later. Meantime an old hospital of limited capacity is being operated. Before the end of 1920 it is hoped that the new plant will be finished, and that the work of the most completely equipped and adequately manned center of medical research and teaching in China will be auspiciously under way.

MEDICAL EDUCATION IN CHINA AND SOUTH AMERICA

The program of the China Medical Board includes, in addition to the Peking medical center, another at Shanghai. The building of this has been deferred for a time because of war conditions and high costs of construction. The Board during 1918 gave aid to three medical schools and to nineteen hospitals which are conducted in China under the auspices of several missionary boards. In this way a total sum of $181,235 was expended. The purpose of these appropriations was to strengthen teaching centers and to provide better equipment and a larger personnel for hospitals. It has seemed wise, during the period preceding the opening of the new medical school at Peking, to co-operate with a considerable number of institutions, but it is probable that in the future the China Medical Board will adopt the

policy of concentrating its subsidies upon a few significant and strategic centers. The best educational opportunities can be provided only in places where clinical facilities are abundant and varied, and where a sufficiently large staff permits the requisite specialization. Facilities will be offered in this way not only for native students to secure fundamental training, but for medical missionaries to keep abreast of the advances in science and technique through frequent, even though brief, periods of resident study.

It seems a long way from Peking to Sao Paulo, Brazil, but the commonwealth of science knows no national boundaries and ignores distances. In March, 1918, a new Department of Hygiene was opened in connection with the *Faculdade de Medicine e Cirurgia* at Sao Paulo. The International Health Board has lent two American scientists to this school for a period of five years. It has also provided scholarships for two Brazilian physicians who, during this time, are to receive special training at schools of medicine and public health in America, with a view to their taking over the new department in Brazil. A somewhat similar arrangement made with the Oswaldo Cruz Institute for introducing a department of pathology, has been carried through successfully. Because of its interest in medical progress in South America, the Foundation has also agreed

to underwrite, for a five-year period, half of a specified deficit which may attend the printing and the circulation in Central and South America of a Spanish edition of the *Journal of the American Medical Association*.

INTERNATIONAL FELLOWSHIPS AND SCHOLARSHIPS

Frequent allusions have been made to fellowships and scholarships which are granted to students from foreign countries or to American missionaries at home on furlough. Since 1915 it has been the policy of the Foundation to bestow study stipends of this kind. In 1918 a total of $55,000 was expended for this purpose. There were sixty-eight fellowships and scholarships distributed as follows: Brazilian physicians three, Chinese graduate physicians eleven, Chinese undergraduate medical students (formerly students of the Harvard Medical School of China) ten, Chinese pharmacists three, Chinese nurses six, medical missionaries on furlough twenty-six, candidates under consideration for the new schools at Peking and Shanghai nine. Provision was also made for bringing French physicians to the United States for special training in anti-tuberculosis measures, but no actual appointments were made in 1918. The International Health Board has adopted a system of

"study leave," by which members of its staff of medical officers, now nearly sixty in number, may pursue special courses in public health at leading American or foreign institutions, at the expense of the Board and under favorable conditions of salary. In this way the equivalent of additional graduate fellowships has been created. Furthermore, the Foundation gave assurances to the School of Hygiene and Public Health at Johns Hopkins and to the Rockefeller Institute for Medical Research, that additional appropriations would be considered if special fellowships should be needed for unusually promising men who, on being discharged from the army, preferred public health careers to a return to private practice. A study of the public health and medical education fields makes it clear that a largely augmented personnel of well-trained and experienced experts is a first requisite. The wise provision of stipends for the training of such persons is a fundamental contribution to progress in each nation, and may be made a means of promoting international understanding and good will.

AID TO RESEARCH INSTITUTE, MENTAL HYGIENE, INFANTILE PARALYSIS

As in previous years, the Foundation made appropriations to the budget of the Rockefeller

Institute for Medical Research to cover a margin by which the income failed to meet all the current expenses. The erection of additions to buildings, war costs for supplies and scientific equipment, increases in wages and salaries, special compensations, etc., made it impossible to get through the year without supplementary appropriations which aggregated $265,299. This amount is in addition to appropriations made to the Institute for special war-work in research, serum production, hospital care, and instruction of medical officers.

Additional appropriations have made possible studies in mental hygiene, the completion of the special after-care of infantile paralysis cases in New York City and State which the Foundation undertook in the summer of 1916, a study of dispensaries of New York City, and an expansion of the work of the National Organization for Public Health Nursing.

STUDIES IN INDUSTRIAL RELATIONS

Permission granted Mr. W. L. Mackenzie King, at a meeting of the Rockefeller Foundation, to publish as his own property the result of his inquiries into industrial relations, marked the conclusion of his official connection with the Foundation and brought to an

end that institution's work of investigation in this field.

When, in 1914, Mr. King, who had had wide experience in connection with labor conditions in their larger aspects and had served for some time as Minister of Labor in the Canadian Cabinet, was entrusted by the Rockefeller Foundation with a study of industrial relations, it was expected that he would visit the leading countries of the world, make first hand investigations, and, as a result of these inquiries, offer constructive suggestions concerning industrial and social policies.

The war not only prevented Mr. King from making these studies, but so completely changed the industrial situation in all countries that he was compelled to modify his plan. He decided, therefore, to prepare, on the basis of his own experience and the literature available, a statement of the underlying principles which are finding expression in the organization of industrial society. The resulting volume* has been published, not as an official report of the Foundation, but as a contribution by Mr. King personally to this important subject.

The war did more than change the present. It forced the consideration of the future on a

* *Industry and Humanity* by W. L. Mackenzie King: Houghton Mifflin Co., Boston and New York, 1918, pp. xii + 566.

scale never before attempted. England, France, and Germany are already formulating comprehensive programs of national reconstruction which include transportation, industry, housing, health, and education. In the United States many reconstruction proposals are being put forward by both governmental and private agencies. In these circumstances the Rockefeller Foundation deemed it fitting to discontinue studies of industrial relations, and to devote itself primarily to the program of medical education, public health demonstration, and war work co-operation to which it had become increasingly committed.

A RESUME OF WAR-WORK APPROPRIATIONS 1914–1919

The table on pages 54–55 gives a complete conspectus of all contributions made by the Rockefeller Foundation for war purposes from the beginning of hostilities in 1914 up to and including the appropriations voted in 1918 but payable in the year 1919. The total sum for the six years is approximately twenty-two and one-half millions. During the years 1914–1916 the Foundation maintained its own relief organization in Europe, but when the United States entered the war, this staff was withdrawn and

appropriations for allied countries were made directly to the American Red Cross. The policy of the Foundation has been to work so far as possible through a few co-ordinated agencies rather than to distribute relatively small sums to a large number of independent societies. Thus, in the field of Camp and Community Welfare, the recommendations of the government-appointed Commissions on Training Camp Activities were accepted as a guide. For example, the large gifts to the American Social Hygiene Association were toward budgets which were a part of the government's program for law enforcement and vice control in the areas tributary to army and navy camps.

In the field of medical research and relief, special appropriations were concentrated upon the Rockefeller Institute, which maintained a war hospital for 363 patients, prepared about 25,000 doses of serums, conducted special investigations, and gave instruction to 1,540 army and navy officers, nurses, and others; upon the National Research Council, a semi-governmental agency manned by the leading scientific men of the country; and upon the National Committee for Mental Hygiene, which rendered important aid in helping the army to recruit trained psychiatrists whose services proved so valuable in examining soldiers and sailors and in treating nervous

TABLE 1: *War Work Expenditures 1914–1919—Payments to December 31, 1918, and Appropriations for 1919*

	Expenditures					Appropriations 1919	Total
	1914	*1915*	*1916*	*1917*	*1918*		
CAMP AND COMMUNITY WELFARE							
Y. M. C. A.			$95,000	$1,270,000	$2,500,000		$3,865,000
Y. W. C. A.				46,974	603,026		650,000
Knights of Columbus					200,000		200,000
Jewish Welfare Committee				100,000			100,000
War Camp Community Service				145,000	100,000		245,000
United War Work Fund					2,514,700	$2,500,000	5,014,700
Commission on Training Camp Activities, Auxiliary Fund				25,000	38,893		63,893
American Social Hygiene Association				22,377	170,116	210,000	402,493
Committee of Fourteen, New York City				5,000			5,000
MEDICAL RESEARCH AND RELIEF							
Medical Division, National Research Council					13,857	15,000	28,857
Rockefeller Institute:							
War Demonstration Hospital				200,000	175,000	55,000	430,000
War Research, Relief and Instruction (including work of Dr. Carrel)	$5,000	$25,000		1,836	135,701	15,000	182,537
Yale Mobile Hospital Unit				25,000			25,000
National Committee for Mental Hygiene				1,798	25,000	20,000	46,798
Demonstration in Teaching Hygiene					1,000		1,000

TABLE 1—CONTINUED: *War Work Expenditures 1914–1919—Payments to December 31, 1918, and Appropriations for 1919*

	Expenditures					Appropriations 1919	Total
	1914	*1915*	*1916*	*1917*	*1918*		
HUMANITARIAN AID							
Armenia and Syria		70,000	490,000	50,000			610,000
Belgium	984,042	301,251	30,000	107,483	24,696	51,000	1,498,472
*France				10,611			10,611
Poland			25,531	61,250			86,781
Serbia		104,332	59,563				163,895
Turkey			25,000	30,504			55,504
Miscellaneous:							
American Red Cross	10,000			3,544,372	4,529,400		8,083,772
Prisoners of War Welfare		25,000	200,378	250,817	75,000		551,195
Contributions by War Relief Commission			6,377	3,204			9,581
War Relief Commission—Administration	5,571	31,757	34,819	43,742	1,395		117,284
Credit on % adjustment of exchange during previous years					(Credit) 2,558		(Credit) 2,558
Total	$1,004,613	$557,340	$966,668	$5,944,968	$11,105,226	$2,866,000	$22,444,815

* The sum of $10,611 represents the cost of a survey of the tuberculosis situation in France resulting from the war. A commission for the prevention of tuberculosis in France was later formed but as its activities are more in the nature of public health than of war work, its expenditures are not included in the above table.

disorders among the men. The work of the Tuberculosis Commission in France has been reported as a part of the public health program of the International Health Board.

It is to be noted that relief funds for Europe and Asia were entrusted, so far as the large items are concerned, to a few agencies which the Foundation believed were best able to use the money effectively. The American Red Cross, the Commission for Belgian Relief, the Committee for Armenian and Syrian Relief, and the International Y. M. C. A. Service for Prisoners of War, received the bulk of the appropriations. It is not to be inferred that the Foundation did not realize that a considerable number of other societies were doing excellent and needed work. It believed, however, that one of the duties of the American Red Cross was to unify or at least to correlate American efforts, and that it was not the function of the Rockefeller Foundation to set itself up as a censor or standardizer of relief agencies.

FINANCES FOR 1918

The table on page 57 presents a summary of receipts and expenditures for the fiscal year 1918.

The income from invested funds was approximately seven and a half millions. An additional

TABLE 2: *Receipts and Disbursements in 1918*

Receipts			*Disbursements**	
Income collected during year		$7,610,827	War Work	$11,105,226
			Public Health	1,255,990
Extraordinary Funds Available			Medical Education and Research	2,419,866
Balance from 1917			Miscellaneous Appropriations	128,312
Held for payments on pledges for 1917 and prior years	$4,133,973		Administration	140,808
Held for payments on pledges for 1918	6,223,737			$15,050,202
Undesignated	1,271,338			
		11,629,048		
Gift from Founder to make possible larger gifts to Red Cross and United War Work Fund		1,000,000	Balance carried forward, all of which has been pledged for expenditure in 1919	5,189,673
TOTAL		$20,239,875	TOTAL	$20,239,875

* For detailed statement of disbursements, see pages 69 to 71.

gift of one million from the Founder was credited to current income and not to the principal fund. The balance of eleven and a half millions carried over from 1917 was largely mortgaged by pledges made in that year but not payable until 1918. This applies also to the balance of five millions carried forward into the budget of 1919. The estimated balance available for appropriation in 1920 falls below a half million. Only the spending of five millions of principal and the receipt of six and a half millions in gifts have made possible the extraordinary expenditures for war purposes during 1917 and 1918. With the return to a peace basis the regular expenses for public health and the heavy costs of building programs in China will for some time to come absorb a large part of the current income. The table on pages 69 to 71 gives a complete list of the expenditures made for all purposes during 1918, while the Treasurer's report (see pages 281 to 355) contains a full statement of all details as to the investments, other property, income, and expenditures of the Foundation.

THE WELFARE OF MANKIND THROUGHOUT THE WORLD

The many activities described in the foregoing pages are consistent parts of a unified

program which is dominated by a purpose to promote the general aim of the Foundation as expressed in its charter: the Welfare of Mankind throughout the World. With the coming of peace the nations are making an effort to come into closer relations of understanding and good will. Gradually, more normal conditions of intercourse will be re-established. Restrictions upon travel and commerce will be relaxed. There will be an exchange not only of commodities but of ideas. Each country will be urged to contribute its best achievements to a common fund upon which all lands may draw. In this commerce of culture, science, sympathy, and idealism, the Rockefeller Foundation desires to put its policies, personnel, and resources at the service of the world.

THE ROCKEFELLER FOUNDATION

Report of the Secretary

To the President of the Rockefeller Foundation:

Sir:—

I have the honor to submit herewith my report on the activities of the Rockefeller Foundation for the period January 1, 1918, to December 31, 1918.

Respectfully yours,

EDWIN R. EMBREE,
Secretary.

SECRETARY'S REPORT

The review by the President outlines the policies by which the Rockefeller Foundation is being guided in its work, sketches its present program, and describes the results aimed at and accomplished during the year 1918. The following report depicts the organization and the agencies through which these results were reached, and outlines the methods by which the programs of the several departments were carried out.

ORGANIZATION AND AGENCIES

The officers and members of the Rockefeller Foundation during 1918 were as follows:

John D. Rockefeller, Jr.	*Chairman of the Trustees*
George E. Vincent	*President*
Edwin R. Embree	*Secretary*
Louis G. Myers	*Treasurer*
Robert H. Kirk	*Comptroller*
Lefferts M. Dashiell	*Assistant Treasurer*
Edyth L. Miller	*Librarian*

MEMBERS

Wallace Buttrick	Starr J. Murphy
Simon Flexner	John D. Rockefeller
Harry E. Fosdick	John D. Rockefeller, Jr.
Frederick T. Gates	Wickliffe Rose
A. Barton Hepburn	Julius Rosenwald
Charles E. Hughes	Martin A. Ryerson
Harry Pratt Judson	Frederick Strauss

George E. Vincent

EXECUTIVE COMMITTEE

George E. Vincent, *Chairman*

Wallace Buttrick — Starr J. Murphy

Simon Flexner — Wickliffe Rose

Edwin R. Embree, *Secretary*

Regular meetings of the Foundation were held in February, May, and December. Details of work, within general policies approved by the Foundation, were determined upon from time to time by the Executive Committee, which held eighteen meetings during the year.

METHODS OF CARRYING OUT WORK

The agencies through which the Foundation accomplishes its work are of two classes:

1. Those agencies which it creates to carry out specific programs.
2. Other existing organizations, unaffiliated with the Foundation, to which it makes appropriations in order to enable them to carry out specific programs.

Agencies of the first class, that is, departmental organizations, have been maintained during the year, as follows:

1. International Health Board.
2. China Medical Board.

The following were the members and the principal officers of these departmental boards:

INTERNATIONAL HEALTH BOARD

George E. Vincent, *Chairman*

Hermann M. Biggs
Wallace Buttrick
Simon Flexner
Frederick T. Gates
William C. Gorgas
Starr J. Murphy
Walter H. Page
John D. Rockefeller, Jr.
Wickliffe Rose
William H. Welch

Edwin R. Embree, *Secretary*

Wickliffe Rose,	*General Director*
John A. Ferrell, M.D.,	*Director for the United States*
Victor G. Heiser, M.D.,	*Director for the East*
H. H. Howard, M.D.,	*Director for the West Indies*
W. Perrin Norris,	*Associate Director for the East*
L. W. Hackett,	*Associate Regional Director (for Brazil)*
Ernst C. Meyer,	*Director of Surveys and Exhibits*

CHINA MEDICAL BOARD

George E. Vincent, *Chairman*

Wallace Buttrick
Simon Flexner
Frederick L. Gates
Frank J. Goodnow
Roger S. Greene
Harry Pratt Judson
John R. Mott
Starr J. Murphy
Francis W. Peabody
John D. Rockefeller, Jr.
Wickliffe Rose
William H. Welch

Edwin R. Embree, *Secretary*

Wallace Buttrick,	*General Director*
Roger S. Greene,	*Resident Director in China*

These Boards have carried out their programs with funds appropriated by the Rockefeller Foundation.

ASSISTANCE TO OTHER AGENCIES

In addition to the work carried out through the departmental organizations described above, the Rockefeller Foundation has contributed during the year to the accomplishment of work undertaken by other and unaffiliated organizations.

The work of the year, whether through its own agencies or by assistance to unaffiliated organizations, has been chiefly within the three fields of war work, public health, and medical education.

On pages 69 to 71 will be found a summary of payments made by the Rockefeller Foundation for all purposes during the year 1918. This tabular summary outlines, in terms of expenditures, the work described in terms of aims and results in the President's review. In many instances these payments involve sums expended on account of appropriations made in former years. On the other hand, they represent but partial payments on many of the appropriations made during 1918, which will provide for continuing work during succeeding years. For a full statement of the finances of the Foundation, see the Report of the Treasurer, pages 281 to 355.

TABLE 3: *Expenditures of the Rockefeller Foundation for the Year 1918*

I. WAR WORK

Camp and Community Welfare

United War Work Fund	$2,514,700
Y. M. C. A.	2,500,000
Y. W. C. A.	603,026
Knights of Columbus	200,000
War Camp Community Service (Playground and Recreation Association of America)	100,000
Commissions on Training Camp Activities, Auxiliary Fund	38,893
American Social Hygiene Association and New York Committee of Fourteen for work under direction of Commissions	170,116
	$6,126,735

Medical Research and Relief

Rockefeller Institute—War Demonstration Hospital and Medical Research	$310,701
National Research Council (Medical Division).	13,857
National Committee for Mental Hygiene	25,000
Demonstrations in Teaching Hygiene to Troops at Camp Meade	1,000
	$350,558

Humanitarian Aid

American Red Cross	$4,529,400
Belgian Professors and Belgian Children	24,696
Prisoners of War Welfare	75,000
Other Expenditures in Various European Countries	1,395
Credit on Account Adjustment of Exchange during Previous Years	(Credit 2,558)
	$4,627,933

Total War Work	$11,105,226

II. PUBLIC HEALTH

International Health Board

Hookworm, Malaria, and Yellow Fever Work Throughout the World	$514,504
Tuberculosis in France	447,574
Public Health Education in Brazil	18,881
Miscellaneous	108,335
After-Care of Infantile Paralysis Cases in New York City and State	38,957
Studies and Demonstrations in Mental Hygiene	17,050
School of Hygiene and Public Health of Johns Hopkins University	91,960
Study of Dispensaries	3,729
National Organization for Public Health Nursing	15,000
	$1,255,990

III. MEDICAL EDUCATION AND RESEARCH

China Medical Board

Development of Medical Schools in Peking and Shanghai	$1,850,344
Assistance to Unaffiliated Medical Schools	57,549
Assistance to Hospitals	123,686
Fellowships and Scholarships	51,575
Administration	45,677
Miscellaneous	2,757
Rockefeller Institute—Current Expenses	265,299
University of Chicago—Medical School	22,979
	$2,419,866

IV. MISCELLANEOUS

(Chiefly payments on continuing pledges of earlier years.)

American Academy in Rome (Payment on ten-year pledge made in 1914)	$10,000
Bureau of Municipal Research (Payment on five-year pledge made in 1915 for current expenses)	25,000
Committee on Scientific Research in Governmental Problems (Final payment on appropriations and pledges made in 1916)	8,000

Committee on Reference and Counsel of Annual Foreign Missions Conference of North America (Payment on ten-year pledge made in 1914 for correlating educational work in foreign fields)	$50,000
National Committee for Prevention of Blindness (Final payment on five-year pledge made in 1914)	5,000
Study of Industrial Conditions (Completion of study begun in 1914)	2,440
New York Association for Improving Condition of the Poor (Payment on ten-year pledge made in 1914 for demonstration of social relief measures)	20,000
Grand Chenier Bird Refuge—Taxes and Expenses	7,872
	$128,312

V. ADMINISTRATION

Maintenance of Executive Officers and Treasurer's Office	$137,713
Purchase of Books and Furniture	3,095
	$140,808

Grand Total	$15,050,202

INTERNATIONAL HEALTH BOARD

Report of the General Director

To the President of the Rockefeller Foundation:

Sir:—

I have the honor to submit herewith my report as General Director of the International Health Board for the period January 1, 1918, to December 31, 1918.

Respectfully yours,

WICKLIFFE ROSE,
General Director.

INTERNATIONAL HEALTH BOARD

OFFICERS AND MEMBERS

George E. Vincent, *Chairman*
Wickliffe Rose, *General Director*
Hermann M. Biggs
Wallace Buttrick
Simon Flexner
Frederick T. Gates
William C. Gorgas
Starr J. Murphy
Walter H. Page
John D. Rockefeller, Jr.
William H. Welch

Edwin R. Embree, *Secretary*

PERSONNEL OF STAFFS DURING 1918

ADMINISTRATIVE STAFF

WICKLIFFE ROSE, *General Director*
JOHN A. FERRELL, M.D., *Director for the United States*
VICTOR G. HEISER, M.D., *Director for the East*
HECTOR H. HOWARD, M.D., *Director for the West Indies*
W. PERRIN NORRIS, *Associate Director for the East*
L. W. HACKETT, *Associate Regional Director (for Brazil)*
ERNST C. MEYER, *Director of Surveys and Exhibits*

FIELD STAFF

HOOKWORM WORK

Australia:	J. H. Waite, *State Director*
	S. M. Lambert, *Special Member of Staff*
Brazil:	L. W. Hackett, *Associate Regional Director*
	J. L. Hydrick, *State Director*
	Paes de Azevedo, *Associate State Director*
British Guiana:	F. W. Dershimer, *State Director*
Ceylon:	W. Perrin Norris, *Associate Regional Director*
	W. P. Jacocks, *Senior State Director**
	J. E. Snodgrass, *State Director***
	S. A. Winsor, *Senior Field Director*
China:	F. C. Yen, *Associate State Director*
	J. B. Grant, *Associate State Director*
Costa Rica:	L. Schapiro, *Senior State Director*
Dutch Guiana:	W. H. Kibler, *State Director***

* In Military Service.
** Resigned.

Guatemala:	A. M. Struse, *State Director****
	J. L. Rice, *Associate State Director***
Fiji:	G. P. Paul, *State Director**
Maryland:	F. A. Miller, *Senior Field Director**
Mississippi:	C. Cross, *Associate State Director*
Nicaragua:	D. M. Molloy, *Senior State Director*
North Carolina:	B. E. Washburn, *Senior State Director*
Panama:	W. T. Burres, *State Director*
St. Vincent:	P. B. Gardner, *State Director*
Salvador:	C. A. Bailey, *State Director*
Seychelles:	J. F. Kendrick, *State Director*
Siam:	M. E. Barnes, *State Director*
Texas:	P. W. Covington, *Senior State Director*
Trinidad:	G. C. Payne, *State Director*

MALARIA WORK

Arkansas:	H. A. Taylor, *State Director*
Mississippi:	C. C. Bass, *Scientific Director*
	H. H. Howard, *Regional Director, in charge of control measures in Hinds county*

YELLOW FEVER WORK

Commission to Ecuador

A. L. Kendall, *Chairman*
Hideyo Noguchi
C. A. Elliott
Mario G. Lebredo
H. E. Redenbaugh

---

* In Military Service.
** Resigned.
*** Deceased.

Commission to Central America

William C. Gorgas
C. L. Furbush
Victor G. Heiser

Guatemala: J. H. White

Ecuador: M. E. Connor, *State Director*

SPECIAL WORK

Tuberculosis Work in France

Livingston Farrand, *Director*
James Alexander Miller, *Associate Director*
Selskar M. Gunn, *Associate Director*
B. L. Wyatt, *Associate Director*
Homer Folks (Representing the American Red Cross)

Hospital Ship for the Philippine Islands

A. F. Coutant, *Physician in Charge*
Teresa McKimmey, *Nurse*
Mrs. A. F. Coutant, *Bacteriologist*

Brazilian Advisory Committee

Carlos Chagas, *Chairman*
Alexander Pedroso
Vital Brazil

School of Hygiene and Public Health, Sao Paulo

S. T. Darling, *Professor of Hygiene and Public Health*
W. G. Smillie, *Associate Professor of Hygiene and Public Health*

Adviser in Medical Education

R. M. Pearce

INTERNATIONAL HEALTH BOARD

The resolutions creating the International Health Board dedicated it to the field of preventive medicine. Its immediate object was to extend measures for the relief and control of hookworm disease to countries throughout the world, and to follow up these measures with efforts to assist in the establishment of permanent agencies for promoting public sanitation and spreading the knowledge of scientific medicine. It was contemplated that the treatment and cure of hookworm disease would make a strong appeal, and serve as an excellent starting-point from which the various states and nations might develop and put into execution well-rounded, comprehensive programs for advancing the public health.

THE POLICY JUSTIFYING ITSELF

It is therefore especially gratifying that in submitting this, the Fifth Annual Report, it is possible to present much additional information showing that hookworm disease is a serious menace to many millions of people. As further experience is gained with measures for its control, the evidence becomes more and more convincing that these measures afford one of the best single means of creating a widely understood concept

of what modern health measures may accomplish. Hookworm control demonstrations almost everywhere are being followed by a desire on the part of the people for better public health administration.

INCREASED APPROPRIATIONS BY HEALTH DEPARTMENTS

One of the most significant developments of the year's work was the increased financial participation of official health agencies in demonstrations for the control of hookworm disease. Incidentally, these demonstrations resulted in the organization and development of permanent agencies for the improvement of general health conditions. In Brazil, in Australia, in Ceylon, and in the Southern United States, local agencies enlarged their hookworm programs and provided additional funds. The method of manifesting interest through an increase in local appropriations found expression, however, in a number of other countries as well. In fact, peoples and governments everywhere seemed actuated by the desire to increase their health activities. The people at large are realizing more and more that the health of their communities is their responsibility, and that all work for bettering health conditions is their task,—theirs to support, theirs to administer, and theirs to profit by.

CONTROL OF YELLOW FEVER

In 1916 a Commission was organized to locate the endemic foci of yellow fever and to ascertain the practicability of eradicating the infection from these centers. The Commission visited all regions in South America in which yellow fever had been reported or suspected in recent years, and reported its findings. War conditions made it necessary to suspend the operations which, following the Commission's recommendations, had been authorized for 1917, but work under the direction of Major General W. C. Gorgas was again begun in 1918.

INVESTIGATION OF YELLOW FEVER AND RELATED INFECTIONS AT GUAYAQUIL

Arrangements were completed in June, 1918, to undertake at Guayaquil, Ecuador, a study of yellow fever infection and related infections which are frequently confused with yellow fever. The diagnosis of this fever has been extremely difficult. There have been no definite symptoms nor group of symptoms nor laboratory tests that could be accepted as conclusive. Even the findings of competent commissions have not in all cases sufficed to dispel the last honest doubt. It seemed advisable, therefore, before undertaking control measures on a large scale, to subject

these baffling infections to careful laboratory study with a view to contributing, if possible, to the true etiology of yellow fever. Guayaquil seemed to offer the material and the Government of Ecuador welcomed the proposal.

Personnel of Commission to Guayaquil and Subjects Studied

The investigation was entrusted to a Commission composed of Dr. Arthur I. Kendall, Dean of the Northwestern University Medical School, Chairman, Dr. Hideyo Noguchi, of the Rockefeller Institute for Medical Research, Dr. Mario G. Lebredo, of Cuba, Dr. Charles A. Elliott, and Mr. Herman E. Redenbaugh. The Commission, provided with laboratory equipment, arrived in Guayaquil on August 2. It was extended the courtesy of an official reception and was given every facility for the conduct of its investigations. The results of its activities have been reported in the form of four separate studies, as follows:

1. A Sanitary Survey of the Republic of Ecuador, by Drs. Kendall and Lebredo;
2. A Bacteriological Study of Yellow Fever, by Dr. Noguchi;
3. A Clinical Study of Yellow Fever, by Dr. Chas. A. Elliott, and Supplementary Report by Dr. Lebredo;
4. A Chemical Study of Yellow Fever, by Mr. Redenbaugh.

Isolation of Yellow Fever Organism

Dr. Noguchi succeeded in isolating an organism, to which he has given the name of *Leptospira icteroides*, which is the apparent cause of yellow fever. At the end of 1918 much work was still required to demonstrate that the true etiologic agent had been discovered, but the prospect for success is most encouraging. If the germ of yellow fever has been discovered it will still further simplify the problem of eradicating the seed-beds of yellow fever; and upon the successful completion of that task, the disease should disappear from the earth.

YELLOW FEVER EPIDEMIC IN GUATEMALA

An epidemic of yellow fever made its appearance in Guatemala in June, 1918. At that time there were large concentrations of American soldiers in the neighborhood of the southern ports of the United States. The Surgeons General of the United States Army and the United States Public Health Service therefore regarded the presence of an uncontrolled epidemic so near the border as a menace calling for energetic measures. After consultation with the Guatemalan Minister in Washington, the Board tendered its services to the President of the Republic of Guatemala, offering to send a competent medical officer to co-operate in bringing the epidemic under con-

trol. The offer was promptly accepted. On July 11, 1918, Senior Surgeon Joseph H. White, who had been released by the Army and granted leave by the Public Health Service for the detail, undertook this task.

Route Traversed by Infection in Guatemala

On arriving in Guatemala and making an inspection of the infected region, it was ascertained that the disease had spread to seventeen communities on or near the west coast. The infection seems to have been introduced into Guatemala from southwestern Mexico. Entering Guatemala apparently from Tapachula and appearing first in that country in the town of Ayutla, it spread from that point along the International Railway, eventually reaching Retalhuleu and Escuintla, and extending as far south as San Jose. In the seventeen communities into which the infection was introduced, 550 cases of yellow fever and 200 deaths were reported.

Control Measures Pursued in Guatemala

The President of Guatemala gave Dr. White full authority and directed the Governors of Guatemalan states to give all necessary aid. Quarantine was established and maintained, physicians were drafted into service, a system of

daily house-to-house inspection was established in each infected community, suspected cases were promptly isolated, the houses from which they were removed were fumigated, and measures were inaugurated and systematically carried out for the destruction or control of the breeding places of the stegomyia mosquito. Special quarantine measures were employed to prevent the spread of the disease to the Atlantic coast. As the only route by which yellow fever was likely to spread to the Atlantic Coast was by the railroad which passed over the dividing mountain at an elevation of 5,000 feet, this was comparatively simple.

By September 19 the disease was under complete control, and after December 2 no further cases occurred. Vigilance was continued, however, up to the end of the year. The outcome was especially gratifying and encouraging in that it demonstrated that yellow fever could be controlled with the personnel and facilities available in Central American countries, and at a cost well within their financial ability.

EFFORTS TO EXTERMINATE YELLOW FEVER AT GUAYAQUIL

An arrangement has been entered into with the Government of Ecuador by which an effort is to be made to free that country and the west

coast of South America of yellow fever infection. Operations to this end are now under way. Following the departure of the Yellow Fever Commission, Dr. M. E. Connor, a member of the Board's field staff, was detailed to inaugurate measures for the extermination of this disease at Guayaquil. He arrived in Ecuador on November 12 and was most courteously received. Plans were agreed upon, Dr. Connor was made a director of the work under the department of health, and on November 27 active operations began. By the end of December, 125 men had been engaged and twenty-five mosquito squads under competent direction were at work. The Government, the people, and the press are giving energetic co-operation. Yellow fever is reported as having been unusually prevalent this season. The work now in progress, however, is expected to result in the near future in a definite reduction in the number of cases, and ultimately in the extermination of the disease.

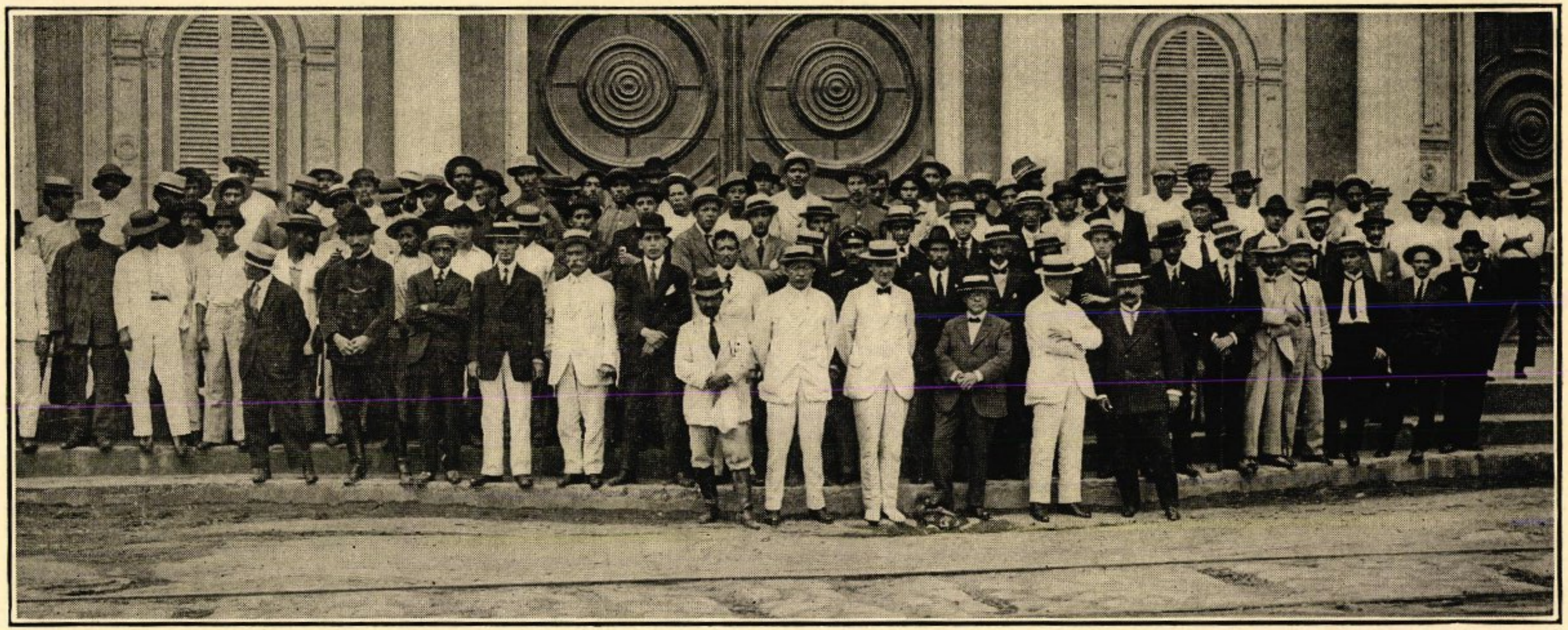

Fig. 2.—Yellow fever commission and staff in Guayaquil, Ecuador

Fig. 3.—Anti-mosquito squad and implements. Yellow fever campaign. Guayaquil, Ecuador

SIGNIFICANT DEVELOPMENTS AND RESULTS IN HOOKWORM CONTROL

During the year, work for the relief and control of hookworm disease was conducted in co-operation with the following states and countries:

Southern United States:

Alabama
Arkansas
Georgia
Kentucky
Louisiana
Maryland
Mississippi
North Carolina
South Carolina
Tennessee
Texas
Virginia

The East:

Ceylon
China
Fiji
Seychelles
Siam
Queensland (Australia)

West Indies:

British Guiana
St. Lucia
St. Vincent
Trinidad

Central America:

Costa Rica
Guatemala
Nicaragua
Panama
Salvador

Brazil:

Federal District
Rio de Janeiro
Sao Paulo

In addition, hookworm infection surveys were completed in Jamaica, Guam, and the State of Sao Paulo, and another was begun, but not completed by the end of the year, in the State of Minas Geraes, Brazil.

Agencies Undertaking Control Measures Independently

The Republic of Paraguay, the State of Pernambuco (Brazil), and Bengal and United

Provinces in India, inaugurated work for the control of hookworm disease entirely under Government auspices. The city of Rio de Janeiro, Brazil, with a population of 1,130,000 and a school population estimated at 275,000, arranged to examine and treat its school children, and the Government of Java began the treatment of all infected soldiers in its army.

Invitations to Participate in Control Measures

Notwithstanding the unsettled conditions produced by the war, requests for participation in measures for the control of hookworm disease continued to arrive from various countries. During the year, invitations of this kind were received from Colombia in South America, from Barbados, Curacao, and Santo Domingo in the West Indies, from the Madras Presidency in India, from Kelantan in the Federated Malay States, and from Mauritius.

Findings of Infection Surveys

The three infection surveys completed during the year indicated that in Jamaica approximately 60 per cent of the inhabitants have hookworm disease; in Sao Paulo, approximately 60 per cent; and in Guam approximately 70 per cent. The surveys of Jamaica and Sao Paulo are to be followed by comprehensive co-operative

attacks on the disease, and it is likely that the medical service of Guam will undertake similar measures entirely under its own auspices.

Mental Retardation from Hookworm Disease

The examinations for hookworm disease made among United States soldiers confirmed in a striking way the Board's experience of the past few years, and demonstrated that even light hookworm infections are of great importance. Judged by the Binet-Simon and other tests, many full-grown soldiers who harbored comparatively few hookworms had the mentality of persons only twelve years of age. The mentality of 10,000 white men at Camp Travis who harbored the disease was about 33 per cent below normal. Negroes were infected quite as frequently as whites, but they appeared to be relatively immune to the serious effects of the disease and did not show the same predisposition to other diseases or the same reduction in mentality.

Mental tests of a similar nature among 340 school children in Queensland, Australia, showed that there was an average retardation of approximately two years among heavily infected children. The longer the infection persisted, the greater was the retardation. The average retardation of lightly-infected cases was nine months.

Physical Improvement Following Treatment

In Siam, the weights of ninety-nine lightly infected soldiers were taken upon their entrance to the army, and again at the expiration of a year. Meanwhile, sixty-nine of these soldiers were treated for hookworm disease, and the other thirty remained without treatment. Those who were treated gained an average of 10.6 pounds in a period of one year; those who were not, an average of only 1.1 pounds. In Ceylon—where the infection rate among estate laborers averages 98 per cent and many severe infections are found—there had been 3,694 admissions to hospital in one district the year before treatment for hookworm disease was carried out. The following year, with an increased population, the number dropped to 2,604,—a reduction in the morbidity rate of at least 27 per cent. Again, in the same colony, among a laboring population of 17,838 on a certain group of estates, the death rate from influenza was twice as high among those who had not been treated for hookworm disease as among those who had received treatment.

Increased Wages and Greater Earning Capacity

In Costa Rica, sixty-six laborers before being treated for hookworm disease normally cultivated 563 acres of coffee monthly. After

being treated for hookworm disease they cultivated 750 acres, resulting in a net monthly increase in wages of 27 per cent after allowing for a 15 per cent reduction in unit pay. Moreover, in India, Clayton Lane reports that the amount of work increased 20 per cent on one estate and 50 per cent on another, and on both was of better quality than before the laborers were treated; while reports from British Guiana indicate that the efficiency of the laborers employed by one company increased from 25 to 50 per cent after hookworm measures were put into operation.

Importance of Mild Infections

It will be apparent from the preceding paragraphs that mild infections require treatment. One mildly infected person in a short space of time may transmit the disease to an unlimited number of other persons. The fact that in any locality the disease is found in only a moderate or mild form should not encourage that locality to neglect measures for its control. Not only may the disease be readily stamped out when the infection is light, but unless active control measures are undertaken it is almost certain to spread and to increase in intensity, and to develop into a problem of serious import to the community.

Soil Sanitation as a Means of Control

The crux of the hookworm problem is to prevent the infected soil from coming into contact with the hands, feet, or other bare portions of human beings. The most important undertaking in all efforts to stamp out the disease is therefore to prevent the deposit of ova-impregnated feces upon the surface of the ground. This may be accomplished by providing for the construction and use of properly built and adequate latrines to serve as receptacles for the contaminated human discharges. To assure the installation, maintenance, and use of sufficient and satisfactory latrines is, however, a formidable undertaking, and involves the task of inducing hundreds of millions of people in infected regions to abandon habits ingrained by centuries of custom. During recent years much of the Board's attention has been directed to aiding health departments to bring about the safe disposal of human excrement. Many of the details in relation to this work are of extreme interest and will be found on pages 166 to 185 of the appendix.

Latrine Construction Prerequisite to Hookworm Treatment

It is now fairly well recognized, and is becoming more so with increasing experience, that in order to make hookworm control measures

effective, thorough provision must be made in advance for the proper disposal of human discharges. Thus, in Nicaragua, Seychelles, Ceylon, Jamaica, Barbados, and other countries, communities desiring the Board's participation in efforts to control hookworm were advised that assistance could not be rendered unless latrines or other proper methods for disposing of human excrement were installed and in use in advance of treatment being undertaken. There is every reason to believe that in this way the number of re-infections can be greatly reduced.

Growth of Interest in Public Health throughout Brazil

Increased interest and support for rural health work have followed the hookworm demonstrations which have been conducted in Brazil during the past few years. The Federal Government has appropriated $250,000 with which to co-operate with the states in a program of rural sanitation in which the control of hookworm disease through soil sanitation, and the control of malaria, are

Fig. 4.—Brazilian states appropriating for hookworm work. Solid star denotes co-operative effort; open star, work conducted wholly by state

to be given foremost consideration. The several states of Brazil are meeting the Federal proposal with liberal appropriations. Up to the end of the year approximately $750,000 had been made available for the purpose.

County Health Service in Southern United States

Directly as a result of the interest in disease control created by the hookworm demonstrations in the Southern States, county health departments with full-time health officers are gradually being organized. North Carolina was the first state in the South to meet its rural health problems by effective organization on a county basis. Other states are rapidly introducing similar programs. In order to stimulate rural sanitation, the Board assumes part of the expense involved. Its contribution, in the case of North Carolina, is on a decreasing scale for a three-year period. At the expiration of this time, the State and the counties jointly will bear the entire expense.

Health Developments in Australia

On invitation by the Commonwealth Government of Australia, a hookworm infection survey was conducted in Papua in 1917. The survey revealed that the concentration of laborers on plantations and the periodical return of the laborers to their villages intensified the hookworm infection and assisted in spreading the disease among

Fig. 5.—County health rally in North Carolina

the native population. Following the survey, the Australian Government approved a proposal for the organization of a health service for the colony and the inauguration of active measures for the control of hookworm disease, and made a preliminary appropriation of $5,000 for carrying out the plan. If the proposals of the Peace Conference are carried into effect, Australia will be charged with the responsibility of administering the former German possessions in New Guinea, and, as a result, it seems likely that the health program proposed for Papua may be extended to include the whole island of New Guinea.

Fig. 6. — Australia and New Guinea. State of Queensland indicated by hatching. Area of intensive work against hookworm disease (1918) in solid black

The survey of Papua was followed by a demonstration in hookworm control in Queensland. This demonstration was carried out in co-operation with the health department of that State. The Commonwealth Government has now proposed a five-year period of co-operation in carrying out in Queensland and in the other states of Australia, a program for rural sanitation in

which hookworm control is to play a leading part. At the outset the Board will make a substantial contribution toward the maintenance of this project. This contribution will decrease 20 per cent annually and at the end of five years the entire expense will be borne by Australia.

TUBERCULOSIS WORK IN FRANCE

During 1918 the work of the Commission for the Prevention of Tuberculosis in France was conducted in four departments or divisions: the educational division, the medical division, the department of nursing, and the department of extension. All the work was done in close co-operation with the governmental authorities, private agencies, and the American Red Cross. The work of the department of extension was carried on in common by the American Red Cross and the Commission in twenty-seven departments of France. Further details with regard to the work in France will be found in the appendix, pages 201 to 206.

MALARIA CONTROL

The field experiments which have been conducted during the past three years in conjunction with Federal and state health agencies, have proceeded sufficiently far to warrant the assump-

tion that malaria control in the average town in the Southern States may be accomplished at a cost well within the means of the average community. It is hoped that these demonstrations will stimulate health departments throughout the Southern States to test the malaria measures which have been employed, and to carry out state-wide campaigns for the control of this disease if they find these methods successful.

Malaria is recognized as one of the most serious of the disabling diseases of man. In India it is estimated that each year there are 1,130,000 deaths and more than 100,000,000 cases of illness. The económic loss in our Southern States is incalculable. The greatest incidence of the disease occurs during October, which is the period of the year when labor is most in demand to harvest the crops. Therefore, anything which will tend to reduce the incidence of this disease will prove of enormous value in reducing human ills and will save vast sums in treasure. More detailed information with regard to the experiences with malaria during the past few years will be found in the appendix, pages 186 to 200.

PUBLIC HEALTH TRAINING

In March, 1918, the Department of Hygiene which has been established in connection with the *Faculdade de Medicina e Cirurgia*, at Sao Paulo, Brazil, was formally opened. This school is to be maintained jointly by the Medical School and the Board for a period of five years. If at the expiration of this period, the Department shall have justified itself, Government will assume its entire support. The services of two American scientists—Drs. Samuel T. Darling and Wilson G. Smillie—have been lent to the school for the five-year period, and fellowships have been provided for training two Brazilian physicians at the Hopkins School of Hygiene and Public Health, with a view to their returning to Brazil for service in the Department.

The school was particularly fortunate in beginning its work at a time when a new interest in public health was being manifested throughout Brazil. The Federal and state Governments were making liberal appropriations for rural sanitation, popular articles on disease prevention were appearing in the leading dailies, and two Brazilian societies of large influence were undertaking campaigns for acquainting their members and the public generally with the teachings of hygiene. As one result of this awakened interest,

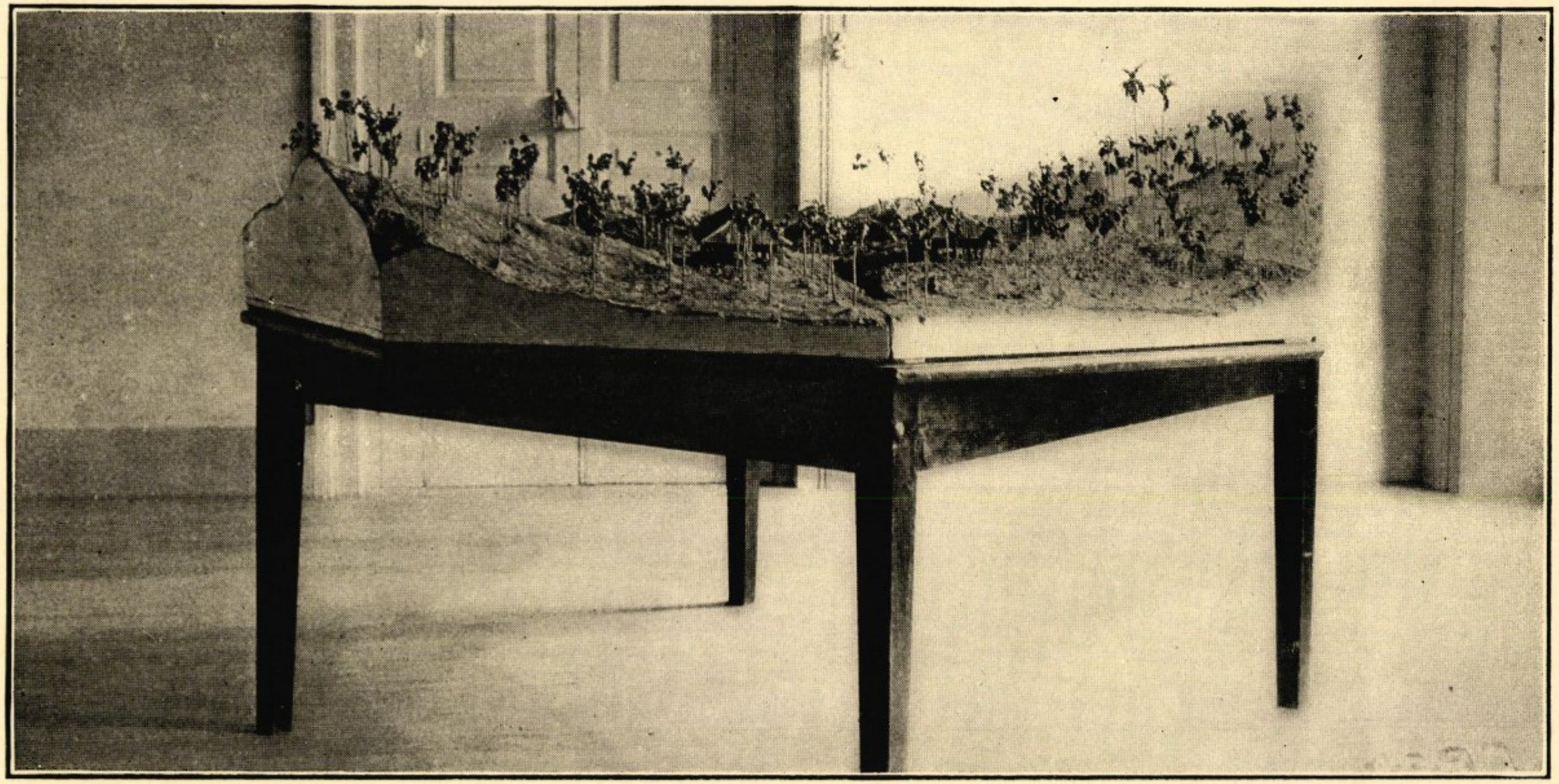

Fig. 7.—Model to demonstrate malaria control operations. Department of Hygiene, University of Sao Paulo

the Medical Faculty of the University of Rio de Janeiro decided to establish, in connection with that institution, a two-years' course in hygiene.

PUBLICATIONS

The following reports and publications were issued during the year:

PRINTED REPORTS (*for general distribution*)

Annual Report for the Year 1917.

LITHOGRAPHED REPORTS (*for limited distribution*)

Annual Reports for 1917 on Work for the Relief and Control of Hookworm Disease in the following countries:

West Indies:

Antigua	Dr. D. M. Griswold
British Guiana	Dr. F. W. Dershimer
Dutch Guiana	Dr. W. H. Kibler
Grenada	Dr. H. S. Colwell
St. Lucia	Dr. Stanley Branch
St. Vincent	Dr. P. B. Gardner
Trinidad	Dr. G. C. Payne

Central America:

Costa Rica	Dr. Louis Schapiro
Guatemala	Dr. A. M. Struse
Nicaragua	Dr. D. M. Molloy
Panama	Dr. W. T. Burres
Salvador	Dr. C. A. Bailey

The East:

Ceylon	Dr. W. P. Norris and others
Fiji	Dr. G. P. Paul
Seychelles	Dr. J. F. Kendrick
Siam	Dr. M. E. Barnes

Reports on Hookworm Infection Surveys in the following countries:

State of Rio de Janeiro, Brazil	Dr. L. W. Hackett
Pinghsiang Colliery, China	Dr. F. C. Yen
Guam	Dr. J. B. Grant
Java	Dr. S. T. Darling

Report on Malaria Control Demonstration at Hamburg, Arkansas—Dr. H. A. Taylor.

Report for the Year 1917 on Work of the Commission for the Prevention of Tuberculosis in France—Dr. Livingston Farrand.

In addition, staff members of the Board contributed the following articles and reports to various publications:

DR. A. F. COUTANT. An epidemic of influenza at Manila, P. I. *Journal of the American Medical Association*, Chicago, 1918, LXXI: 1566–1567.

DR. P. W. COVINGTON. Activities of the Bureau of rural sanitation of Texas. *Texas State Journal of Medicine*, Fort Worth, 1918, XIV: 173–175.

DR. S. T. DARLING, DR. M. A. BARBER, and DR. H. P. HACKER. *Treatment of hookworm infection. *Journal of the American Medical Association*, Chicago, 1918, LXX: 499–507. Same reprinted; also summarized in Spanish by Dr. Emilio Echeverria.

DR. L. W. HACKETT. A Rockefeller Foundation e a sua accao mundial; campanha contra a uncinariose. *Parana Medicina*, Coritiba, 1918, III: 484–488.

Conferencia sobre a prophylaxia da uncinaria. *Gazeta Clinica*, Sao Paulo, 1918. (Newspaper article)

Escolha de um medicamento melhor e methoda de administracao na uncinariose. Rio de Janeiro, Bensuard, 1918.

Hygiene internacional. *Saude*, Rio de Janeiro, 1918, I: 178–183.

Resume of results of the year's work in Brazil. *Boletin de Academia Nacional de Medecina*, Rio de Janeiro, 1918, LXXXIX: 212–224.

DR. V. G. HEISER. American sanitation in the Philippines and its influence on the Orient. *American Philosophical Society, Proceedings*, Philadelphia, 1918, LVII: 60–68.

Barrack life and respiratory diseases: some epidemiological observations on the recent outbreak of influenza. *Journal of American Medical Association*, Chicago, 1918, LXXI: 1909–1911.

Death from volvulus caused by round worms. *Medical Record*, New York, 1918, XCIV: 65. Same reprinted.

Some of the accomplishments of Italian medical men in the war. *Journal of the American Medical Association*, Chicago, 1918, LXX: 24–27. Same reprinted.

Waste caused by preventable diseases of intestinal origin. *Annals of the American Academy of Political and Social Science*, Philadelphia, 1919, p. 48–50. Same reprinted.

DR. A. I. KENDALL. Recent developments in intestinal bacteriology. *American Journal of Medical Sciences*, Philadelphia, 1918, CXLI: 157. Same reprinted.

DR. J. A. MILLER. How America is helping France with her tuberculosis problem. *American Review of Tuberculosis*, Baltimore, 1918, II: 409–434.

Social conditions in France. *New York Conference on Social Service, Proceedings*, 1918, p. 58–80.

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* Reprints available.

Dr. G. P. Paul. Disposal of human bowel excreta in the tropics. *New Orleans Medical and Surgical Journal*, 1918, lxx: 707–712.

Dr. Louis Schapiro. El serampion. San Jose, Govt. 1918.

Dr. J. H. Waite. The Queensland hookworm campaign (first progress report, covering period April 17 to December 1, 1918). *Medical Journal of Australia*, Sydney, 1918, ii: 505–510.

Dr. B. E. Washburn. The North Carolina plan of county health work (with discussion). *Southern Medical Journal*, Birmingham, 1918, xi: 425–430.

Dr. F. C. Yen. Hookworm infection survey at the Pinghsiang colliery, China. *National Medical Journal of China*, Shanghai, 1918, iv: 81–89, 140–145.

Uncinariasis in Pinghsiang colliery. *National Medical Journal of China*, Shanghai, 1918, iv: 8.

ADDITIONAL INFORMATION IN THE APPENDIX

The previous annual reports of the Board have been confined mainly to a general discussion of outstanding results. Frequent inquiries have been received for more detailed information, particularly with regard to the problems to be met in the control of various diseases and to the working methods employed in meeting these problems. This has seemed to justify including in this report a considerable amount of such information. The material is submitted in the following pages in the form of an appendix. It discusses somewhat at length the Board's experience with measures for the prevention, cure, and control of hookworm disease, its field experiments in malaria control, and its activities against tuberculosis in France.

APPENDIX

I

EXTENT AND SEVERITY OF HOOKWORM DISEASE

Hookworm disease exists wherever the larvae of the hookworm find favorable conditions of shade, moisture, and temperature for their propagation and growth. These conditions are commonly found in tropical and sub-tropical countries in the zone which encircles the earth between parallels 36° north and 30° south. The most favorable temperature for the development of the larvae is from 25 to 35° centigrade. Below 22° centigrade few larvae develop. Rainfall is an important contributing factor in the spread of the disease. In six adjoining settlements of Queensland, Australia, in which work was conducted during 1918, the percentage of hookworm infection ran parallel with the amount of rainfall. Thus, in two districts having an annual rainfall of less than 90 inches, the percentage of infection was 13.8, while that in four districts having more than 90 inches of rainfall was 27.8.

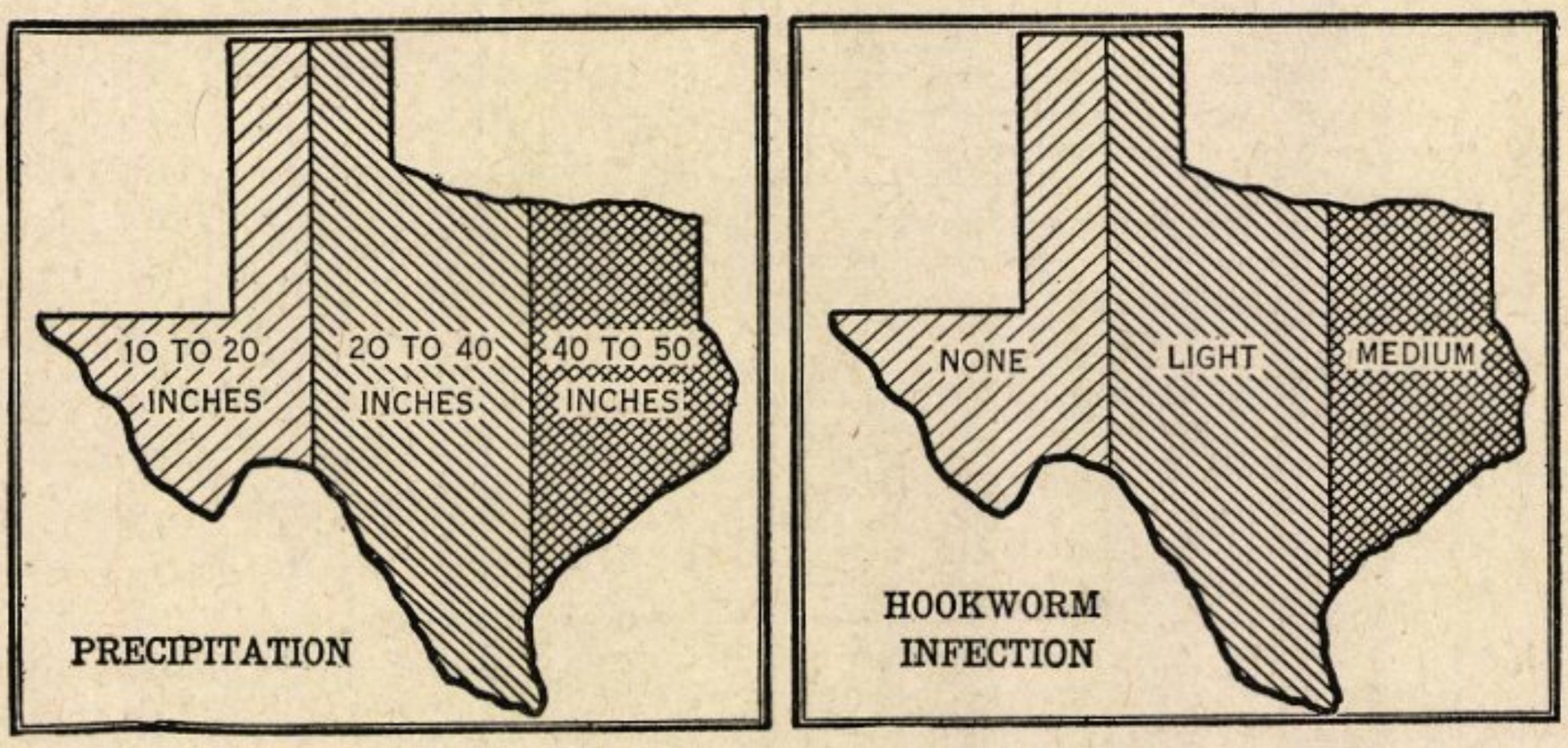

Fig. 8.—Correlation between rates of hookworm infection and amount of rainfall. Texas

Hookworm Primarily a Rural Disease. Persons who live in the country, away from sewerage, and who work in the soil, are much more frequently infected with the disease than city residents (see Fig. 9, page 112); while those who go barefoot, or in other ways allow the bare skin to come into contact with polluted soil, show correspondingly higher rates of infection than those who wear shoes. For example, the survey of the State of Sao Paulo, Brazil, concluded during 1918, showed 41.2 per cent infection among shoe-wearers, as

compared with a rate of 62.9 per cent among persons who went barefoot.

Wide-Spread Prevalence within Infected Region. An idea of the extensive prevalence of the disease within the infected zone may be gained from the following statements. In the sixteen foreign countries enumerated on page 91, measures for the relief and control of the disease were terminated during 1918 in 124 rural areas having an average population of 2,097. In three-fourths of these areas, more than sixty of every hundred persons examined were found to be infected. In eighteen of the areas the infection rate was between 90 and 100 per cent; in nineteen between 80 and 90 per cent; in twenty-four between 70 and 80 per cent; and in twenty-nine between 60 and 70 per cent. In only one area—the canton of San Domingo, in Costa Rica—was a rate lower than 20 per cent recorded. Here only 9.2 per cent of the inhabitants were found to be infected.[1]

High Rate of Infection in India. Microscopic examination in Ceylon of more than 50,000 Tamil coolies from Southern India has shown more than 98 per cent of them to be infected. This confirms the investigations carried out by the Indian Medical Service at Negapatam—the great clearing port for labor leaving South India—which showed 99.8 per cent of the emigrant laborers to be infected. Much of India's population of 300,000,000 is under the burden of a heavy hookworm infection and is the source from which the disease is carried to many parts of the world. In some of the rural regions of this country, from 80 to 100 per cent of the population are infected.

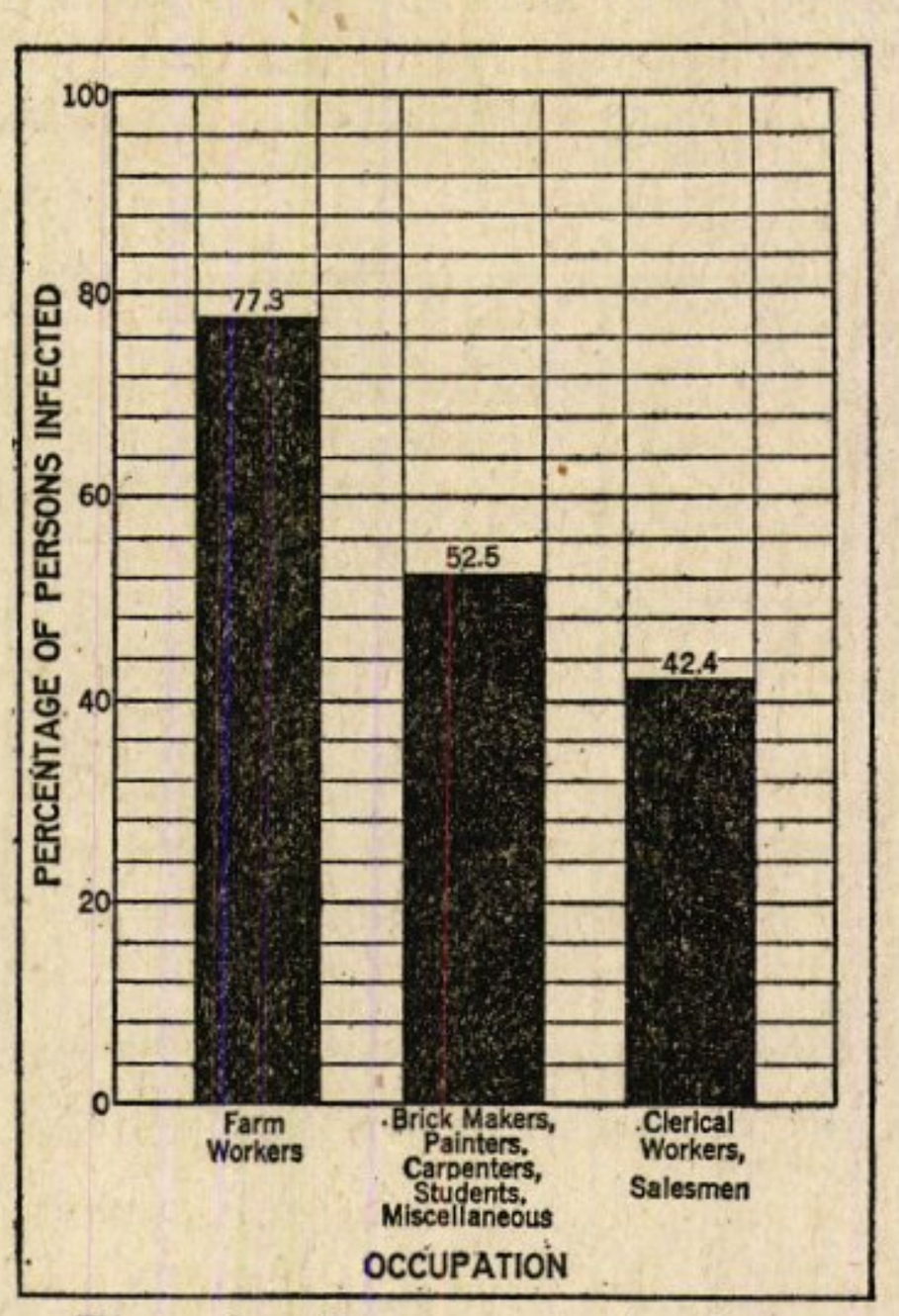

Fig. 9.—Rates of hookworm infection by occupation. Sao Paulo, Brazil

The original investigation carried out by Lieut.-Colonel Clayton Lane under the auspices of the Indian Research Fund Association, in a group of tea gardens in Assam, showed 63 per cent of the 33,590 persons examined to be infected, and a second inquiry carried out by the same investigator under the same auspices, in the jails of Bengal presidency, demonstrated the infection in 8,973, or 71.3 per cent of

[1] This low infection rate is ascribed by the director to the fact that all of the people are well-to-do and have for some time had adequate medical service at hand.

the 12,570 prisoners examined. In all, twenty-six jails were visited, and the rates of infection recorded ranged from 47.9 in the Presidency jail at Calcutta to as high as 86 per cent in the jail at Hooghly. The sanitary authorities believe that more than 30,000,000 of the 45,000,000 inhabitants of Bengal proper are infected, and are undertaking a systematic attack on the disease, beginning with a campaign in the schools.

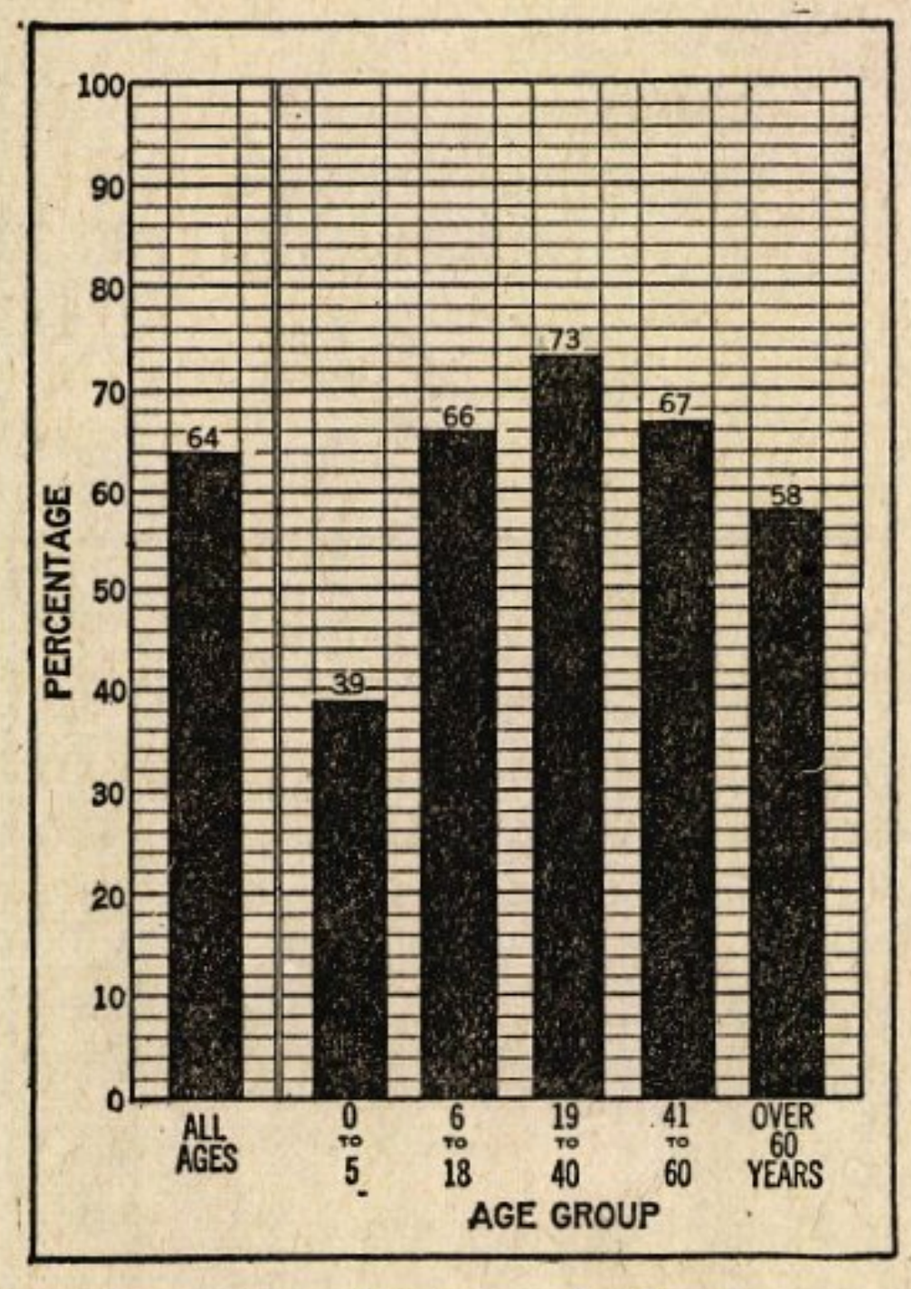

Fig. 10.—Rates of hookworm infection by age—all countries. Based on examinations from March 12, 1914, to December 31, 1918

Prevalence of the Disease in Brazil. The Director of Rural Sanitation estimates that more than 80 per cent of the adults and more than 90 per cent of the children living in rural portions of the Federal District of Brazil are infected with some form of intestinal parasite. The number infected with hookworm he puts at 100,000, or two-thirds of the district's rural population. Among the first 1,839 persons examined in Jacarepagua, a typical rural community of this District, the percentage found infected with hookworm was 75, and only six persons were found who were free of some form of intestinal parasite.

In the survey of the State of Sao Paulo, two of every three persons examined were found to be infected with hookworm disease, and four of every five with some type of parasite; while in two rural areas in the State of Rio de Janeiro, the percentages of hookworm infection recorded were 67.7 and 88.5. Among the first 450 persons examined in the State of Parana every one was found to be infected with hookworm, thus indicating that the littoral of this State, though well within the temperate zone, will show an incidence of infection among the highest in Brazil. In this country, as elsewhere, children and young adults are found to bear the brunt of the disease.

Infection Rates in Countries Newly Inaugurating Control Measures. An infection rate of 59 per cent among the first 3,354 persons examined in China is reported; of 76.7 among 31,298 residents of Siam; and of 22.5 per cent among 11,678 persons living in six small settlements of Queensland, Australia. These are countries in which co-operative control measures were first undertaken during 1918,

Reports from Australia had indicated that there was little or no infection among the aborigines, but from 60 to 100 per cent of all those examined to date have been found infected. Arrangements for their treatment are now being made through the Chief Protector of Aborigines.

SEVERITY OF THE INFECTION

The severity of the disease is now believed by many authors to depend primarily upon the number of worms harbored by infected individuals. Generally, the higher the percentage of persons infected in a given locality the larger is the average number of worms harbored by infected individuals, the more severe are the symptoms found, and the more difficult is the disease to bring under control. The difficulty of effecting cures in localities with high rates of infection is strikingly illustrated by figures compiled in Brazil and in Trinidad. In the former country, the percentage of persons cured by two treatments of the same drug, administered in the same manner and under practically the same conditions, was 38 in Rio Bonito, a municipality having an infection rate of 88.4 per cent, and 71 in Guarulhos, where the infection was 57 per cent.

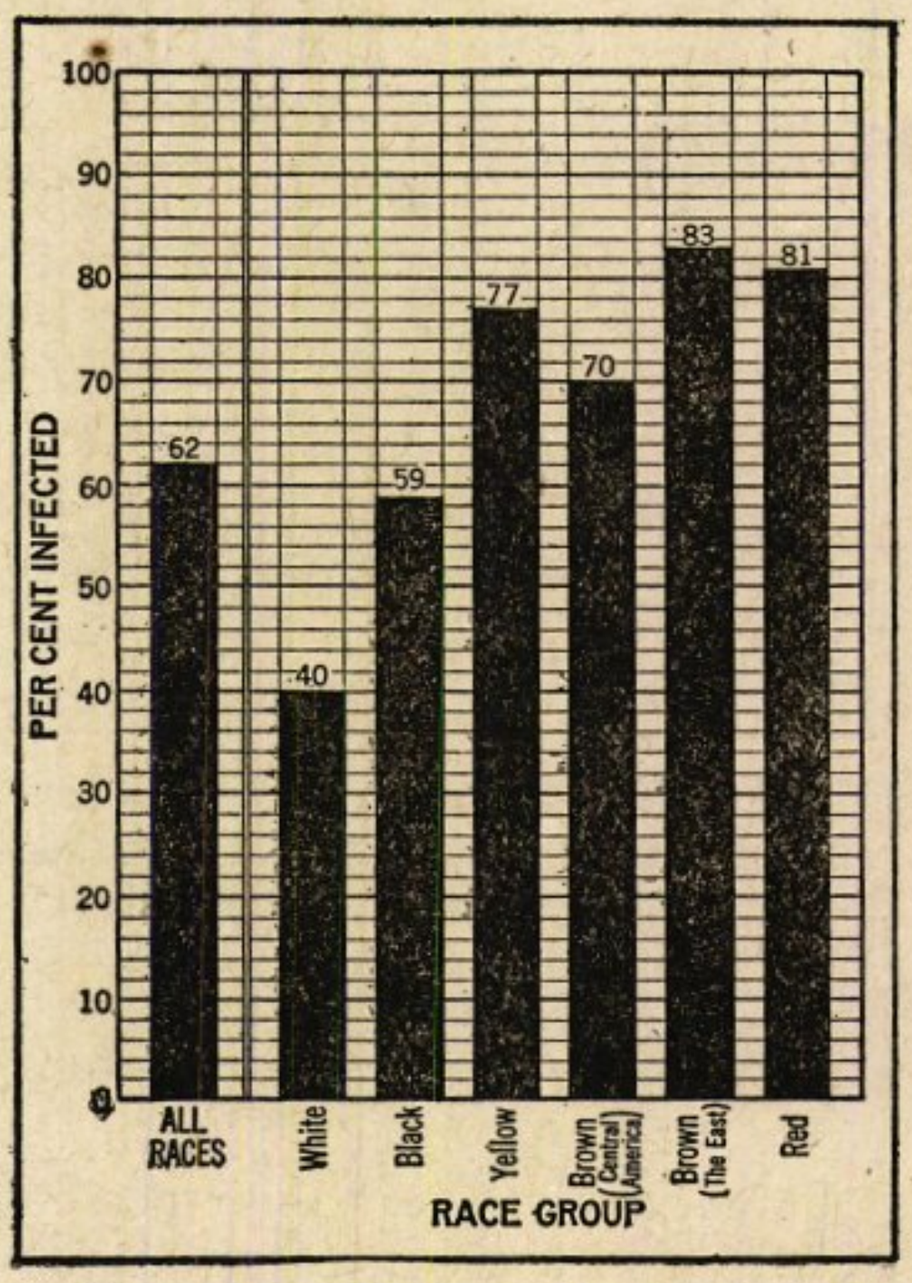

Fig. 11.—Rates of hookworm infection by race—all countries. Based on examinations from March 12, 1914, to December 31, 1918

The statistics for Trinidad (see Fig. 14, page 117) cover the examination of 42,284 residents of that colony during the period from May 15, 1915, to December 31, 1918. It will be noted that in districts with 25 to 29 per cent of their inhabitants infected, the percentage of infected persons cured by two treatments was as high as 75. As the rate of infection rose, the difficulty of curing increased, until in localities with extremely high rates of infection—representing between 95 and 99 per cent of their inhabitants—only 19 per cent of the infected persons could be cured by two treatments. The drugs used and the conditions of administration were practically the same in all districts.

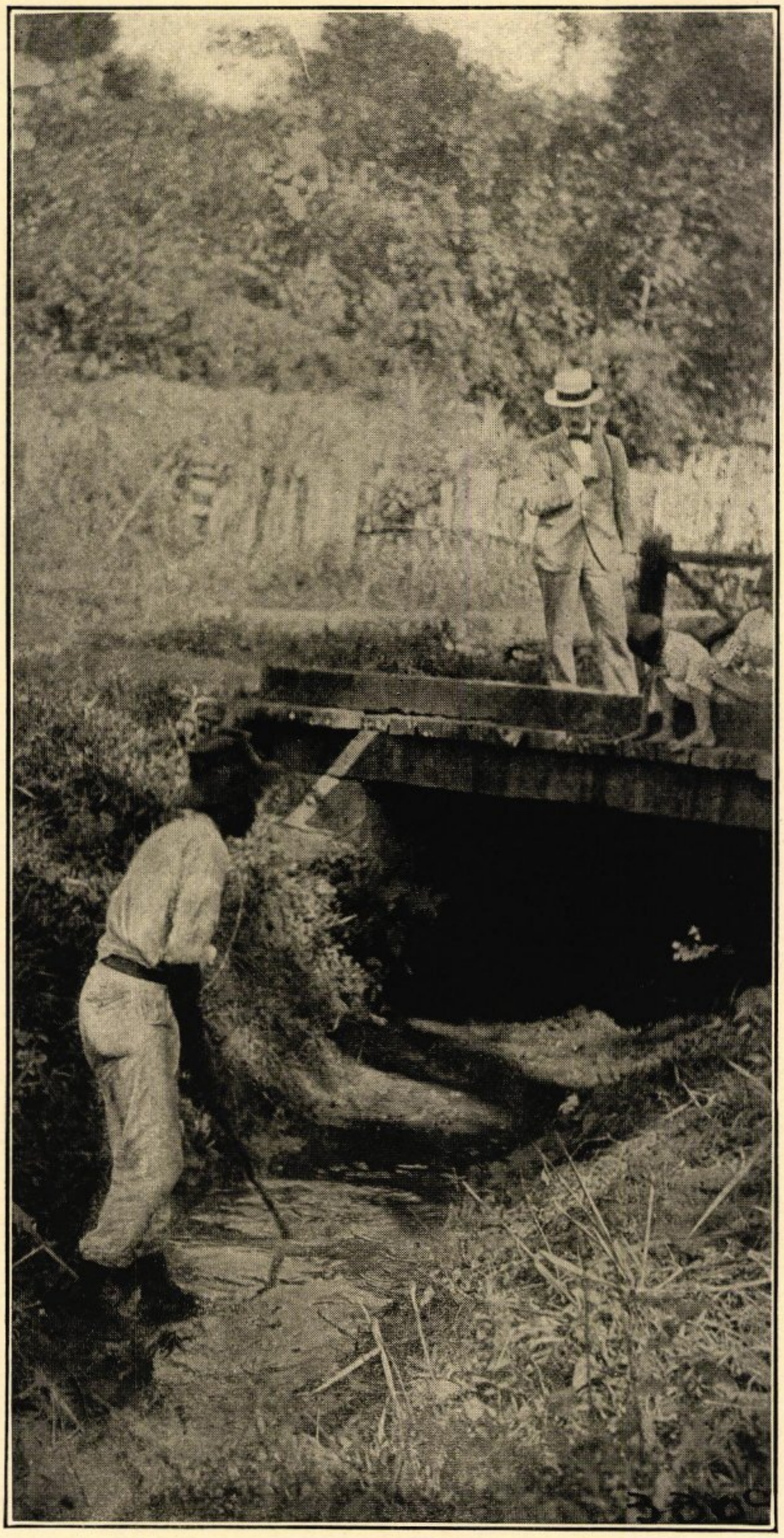

Fig. 12.—One means of acquiring hookworm disease: bare feet in contact with infected mud. Brazil

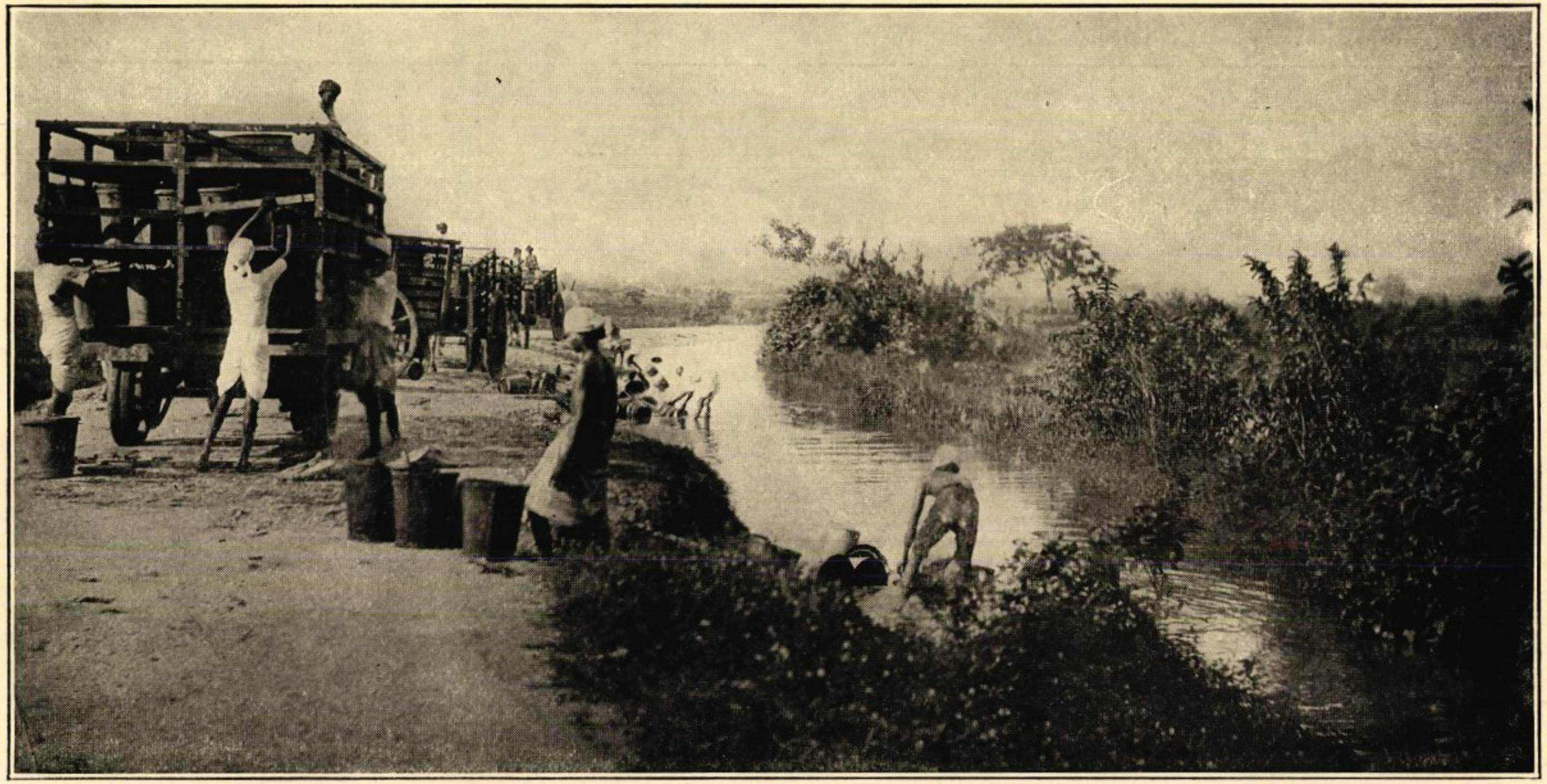

Fig. 13.—Method of night soil disposal in Federated Malay States. Permits dissemination of infected material

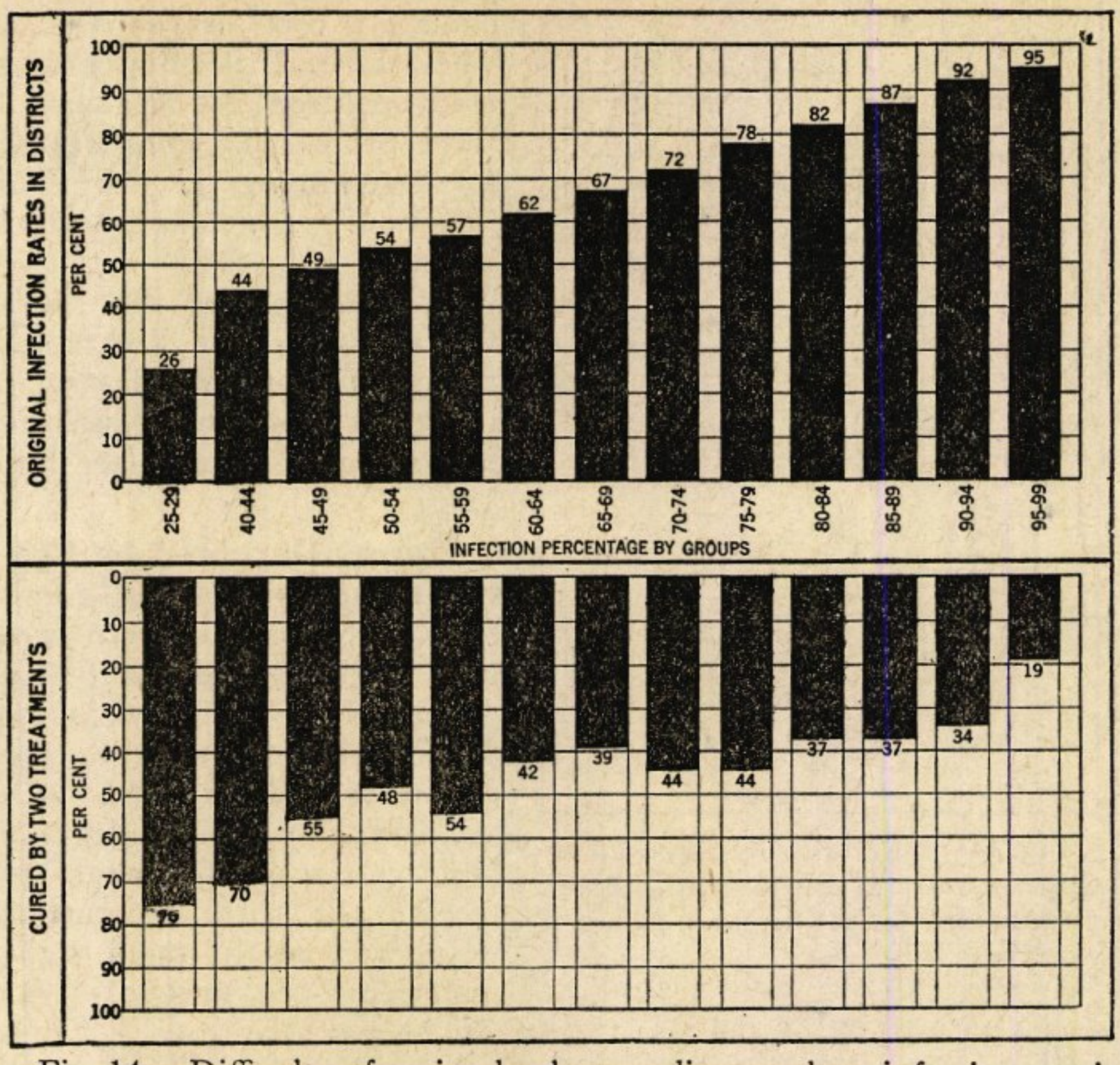

Fig. 14.—Difficulty of curing hookworm disease where infection rate is high. Relationship between rates of hookworm infection and cures by two treatments. One hundred fifty districts in Trinidad. Persons examined 42,284

Determining Severity by Counting the Worms. The number of worms harbored by a group of individuals may be ascertained quite accurately by giving them a vermifuge and counting the worms expelled after the drug has acted. It is usual to count the worms for a period of two or three days following each treatment. Worm-counts are of value not only because they reveal the average degree of infection in different communities, as well as the type of worm harbored, but also because they are of much assistance as a means of demonstrating the presence of the disease and of enlisting popular support in measures for its control. They were made a feature of the work during 1918 in Siam, Nicaragua, China, and Brazil.

Infection Index in Different Regions. In Siam the feces of fifty-nine persons were examined for seven hours after first treatment. The average number of worms expelled was forty-five. More than half (39) of the cases harbored less than twenty worms each. In Nicaragua, on the other hand, as many as 4,000 worms were recovered from a single patient, and in Brazil particularly high worm counts were obtained in the States of Sao Paulo and Rio de Janeiro. Here the incidence of the infection is reported to be high and the disease severe in form despite the fact that the

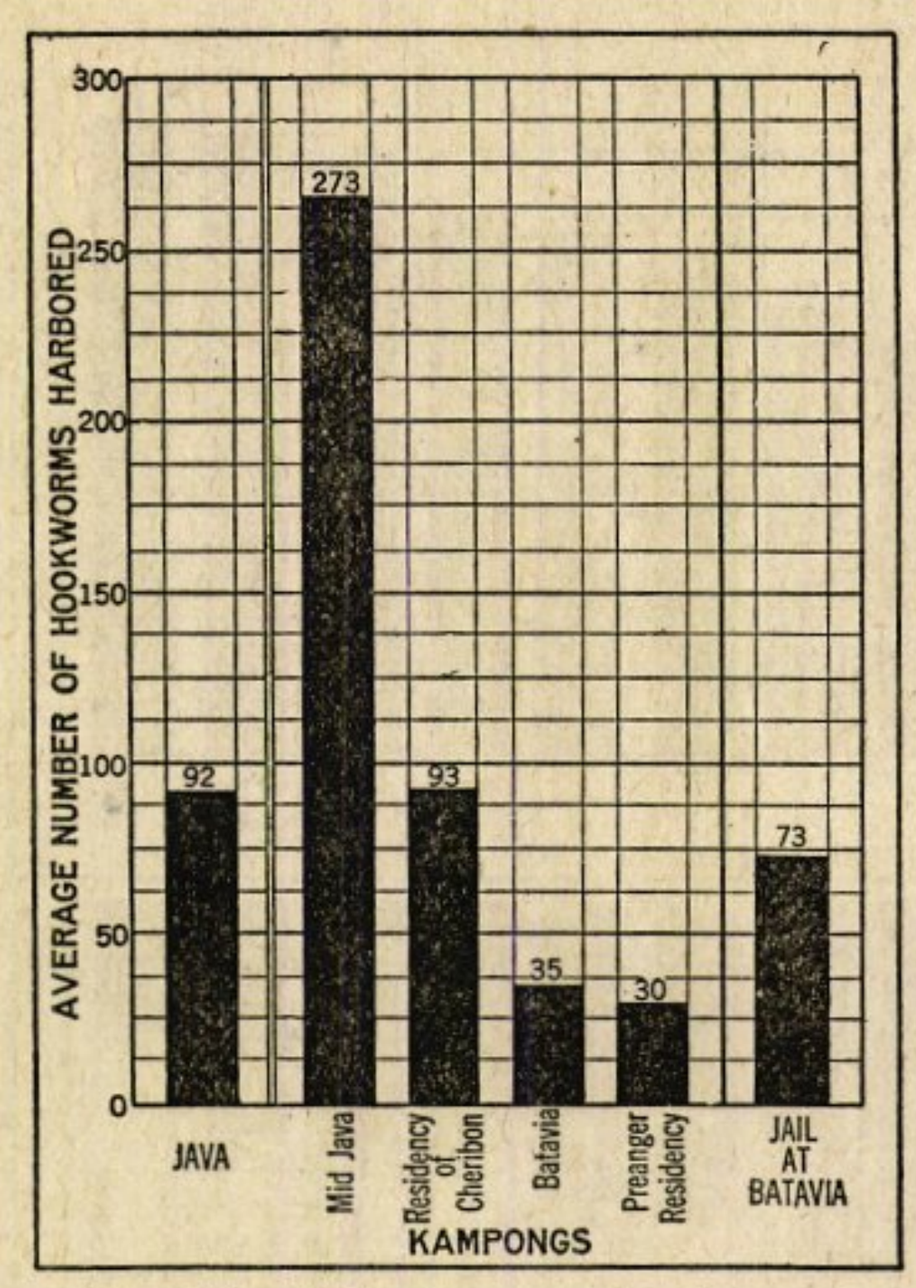

Fig. 15.—Hookworms harbored by three hundred seventy-eight infected persons in Java. Distribution by localities

climate is cool the year round. The total of 29,029 hookworms recovered from 280 residents of these States, who were treated for determining the degree of infection, gave an infection index[1] of 104. This is twelve points higher than the index for Java, where the disease was thought to be more wide-spread in extent and more severe in form than in Brazil (see Fig. 15).

Worms Harbored by Brazilian Vagabond Boys. Nearly 11,000 worms were recovered from a group of eighty-one vagabond boys treated in the State of Rio de Janeiro. The counts ranged from 2 to 982; the average was 133. Another boy who was too weak to receive the three treatments which were administered to the first eighty-one, expelled 1,912 worms as a result of the two treatments he was able to take. In a similar experiment among forty-five vagabond boys in the State of Sao Paulo, an average of 233 worms was obtained after treatment from nineteen boys who had always lived in the country, and an average of 59 from twenty-six boys who had always been city residents.

Degree of Infection Among Agricultural Workers in Brazil. Townspeople are always more lightly infected than agriculturists. This is shown, for example, in Fig. 16, page 119, which compares the infection indices of town residents, mountaineers, and agricultural workers in Java. The urban dwellers treated in Brazil yielded, on the average, less than fifty worms, while groups of farm laborers expelled from 55 to 233. From three adult farm workers in Guarulhos, 1,390, 1,031, and 405 worms apiece, or 972 average, were obtained. The average number of worms harbored by all workers on coffee plantations in the States of Rio de Janeiro and Sao Paulo doubtless reaches 160 or more; children under fourteen years of age living on these farms have been found to harbor as many as 365 worms. Coffee growers and employers of agricultural labor in general realize what this means as a cause of debilitation and inefficiency, and are becoming interested in efforts to promote the health and work-

[1] Average number of worms per case.

ing capacity of their laborers through treatment for hookworm disease and the prevention of soil pollution.

Severity of Infection Among Southern Troops in U. S. Army. Knowlton, in his work at Camp Jackson, South Carolina, treated for hookworm disease a large number of infected soldiers from the Carolinas and Florida. Among sixty-nine white and eighteen colored cases, the average number of worms obtained from the whites was 155.3; from the colored, 38.3. In a considerable proportion of the soldiers the infection was mild in form, but all grades were encountered, and in a few cases the infection was severe; three white patients yielded 1,010, 1,263, and 1,704 worms, respectively.

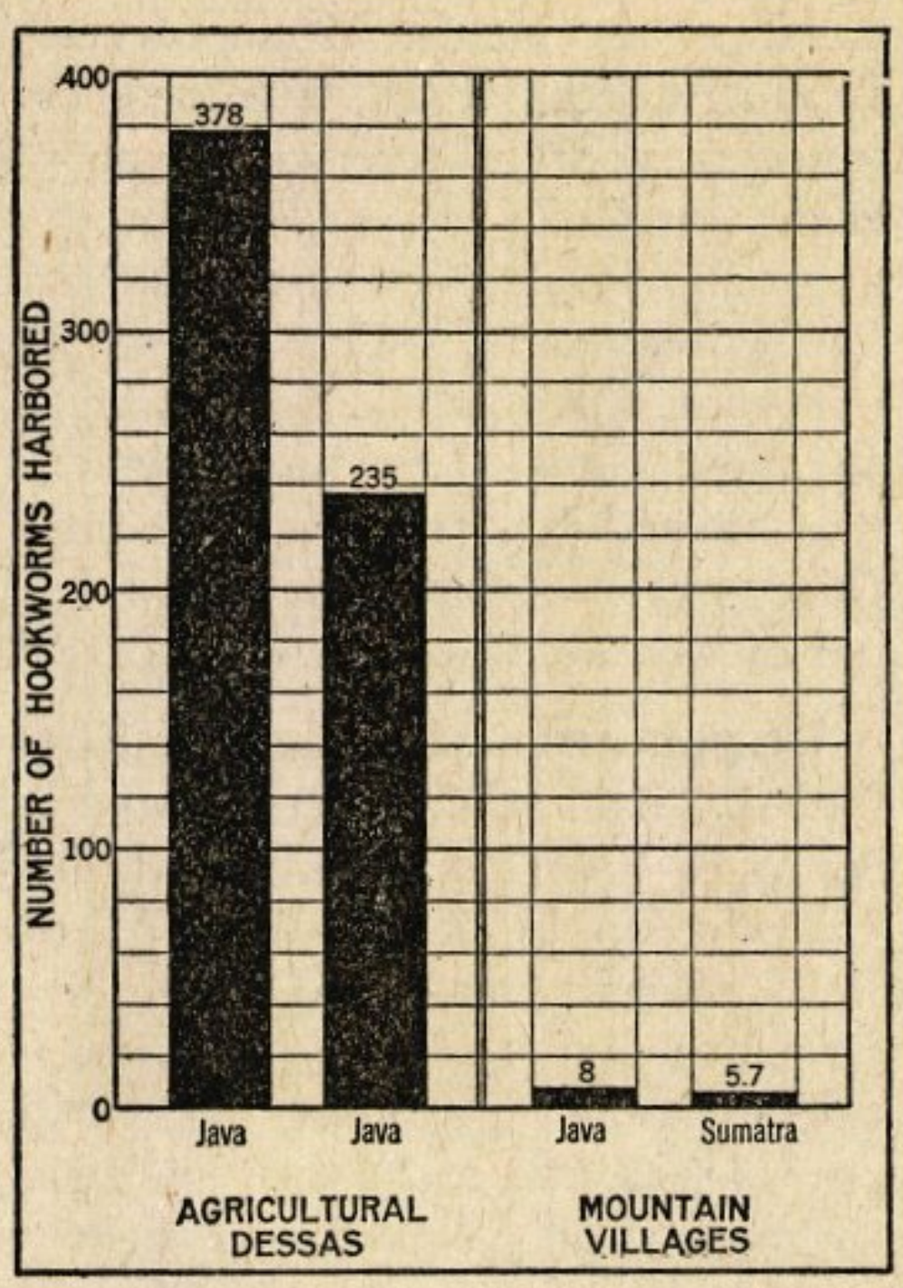

Fig. 16.—Comparison of number of worms harbored by agricultural workers and dwellers in mountain villages. Java and Sumatra

Through the means of the laboratory car *Metchnikoff* there were unsurpassed facilities for observing the effects of hookworm disease upon troops of the Southern Department of the United States Army, embracing recruits from the States of Texas, Oklahoma, Arizona, and New Mexico. Marked clinical symptoms were absent in 90 per cent of the men who, upon microscopic examination, were found to be infected; on treatment the number of worms expelled the first day by 80 per cent of the infected soldiers ranged only from one to five. This is an unusually light infection. The men dealt with, however, were between twenty and thirty years of age, an age period in which individual infections are dying out, and only a small proportion came from regions of heavy infection.

CORRELATION BETWEEN NUMBER OF WORMS AND PERCENTAGE OF HEMOGLOBIN

In general, there is definite relationship between the number of worms harbored and the amount of blood loss or anemia. This may perhaps be obscured by the resistance of the infected person, by abundant food, opportunities for rest, or by exceptionally active blood-forming processes, but the drain is none the less real and a

constant tax on the vital powers. Thus, in the State of Sao Paulo, Brazil, during 1918, the average hemoglobin of six boys above fourteen years of age who harbored more than four hundred worms each, was 63.7 per cent, as compared with an average of 72.7 per cent among forty-six boys of the same age who harbored less than seventy-five worms each. The normal hemoglobin of boys of this age is 84 per cent. Knowlton found, in his work among soldiers at Camp Jackson, South Carolina, that no severe reduction in hemoglobin was caused by less than five hundred worms. The hemoglobin of thirty-three of his patients each of whom had fewer than this number of worms, was between 80 and 89 per cent.

Importance of Other Factors Which Lower the Hemoglobin Index. All anemia encountered among the people in infected regions is not, of course, to be attributed to hookworm disease. Malaria and underfeeding, to say nothing of other devitalizing diseases and conditions, play important parts. The hemoglobin index of all 109 prisoners in the jail at Batavia, Java, for example, was 25.8 points below the normal 95 per cent. Experiments indicated that a loss of 6.8 points was due to hookworm disease, of 10.3 to malaria, and of 8.0 to hard labor. Again, in Fiji, where there is no malaria, underfeeding resulted in a group of East Indians having 9.5 per cent lower hemoglobin than another well-fed group of the same race. Both groups harbored the same number of hookworms.

Varying Effect of Equal Numbers of Worms Upon Men, Women, and Children. The Board's Uncinariasis Commission to the Orient, working with large numbers of persons from whom practically all hookworms had been expelled by vermifuge and counted, found that on the average, in the presence of the conditions that obtained in the areas dealt with, twelve hookworms caused a reduction of one per cent in hemoglobin. An equal number of worms produced more anemia among children than among women, and more among women than among men. Furthermore, when the types of infection resulting from equal numbers of *Ancylostome duodenale* and *Necator americanus* were compared, it was found that the former produced a more severe form of the disease than the latter.

II

EFFECTS OF HOOKWORM INFECTION

Hookworm infection works subtly through long periods of time. Its cumulative effects are handed down from generation to generation. The disease destroys economic efficiency and social development on the one hand, the while it undermines physical and mental health on the other. It is a menace and an obstacle to all that makes for civilization. As a handmaiden of poverty, a handicap of youth, an associate of crime and degeneracy, a destroyer of energy and vitality, it stands in the very forefront of diseases. Its effects express themselves in stunted physical and mental growth, blighted health and efficiency, retarded economic progress, and general degeneracy and decay. Labor is impaired, home standards are lowered, mental development is inhibited, and there is a tendency for the human machine to wear out before its time. Wherever treatment is systematically carried out and followed by rigorous control of further infection, marked improvement in health and general capacity results.

PHYSICAL RETARDATION

Hookworm disease saps the strength by such imperceptible stages that usually the patient himself does not sense any change in his physical condition from day to day, until his powers of resistance eventually become so lowered that the germs of tuberculosis, of pneumonia, of typhoid fever, or of some other acute infectious disease find favorable lodgment and all too frequently a fatal outcome results. Statistics show that the mortality rate of hookworm is greatly exceeded by the rates of the more spectacular diseases. But by its steady sapping of the strength of millions of people, continued without interruption over many generations, hookworm disease causes human misery and suffering of a much more severe character than its low death rate would lead one to expect.

Retardation as Measured by Hemoglobin Content. In Costa Rica, Nicaragua, Panama, and a number of other countries, blood examinations have been made with a view to determining approximately the degree of anemia which is associated with the infection. Among a total of 142,881 persons whose blood has been examined to date, three-fifths had a hemoglobin index below 70 per cent. By far the largest number of cases in any single group (69,718) fell between 50 and 69. Sixteen thousand, five hundred and forty-seven (16,547) cases were between 30 and 49, 2,493 between 10 and 29, and 201 below 10 (see Fig. 17). Of course not all this anemia is due to hookworm infection, as hard labor, underfeeding, malaria, and

a number of other devitalizing diseases and conditions play their parts in impoverishing the blood.

Increase in Hemoglobin Following Treatment. From a number of countries, distinct gains in hemoglobin have been reported among groups of infected persons after treatment for hookworm disease. In Porto Rico, the average hemoglobin as estimated for the total population over a large area where the test was made, was raised from 43 in 1904 to 72 in 1914; in Dutch Guiana the average hemoglobin in a group of infected persons was 71 before treatment and 90 six months or more afterwards; in five towns of Nicaragua the hemoglobin index of infected persons rose from 61 to 74 as a result of treatment; in two areas of Panama from 59 to 68; and among a small group in Chiengmai province, Siam, from 65.5 to 77.5.

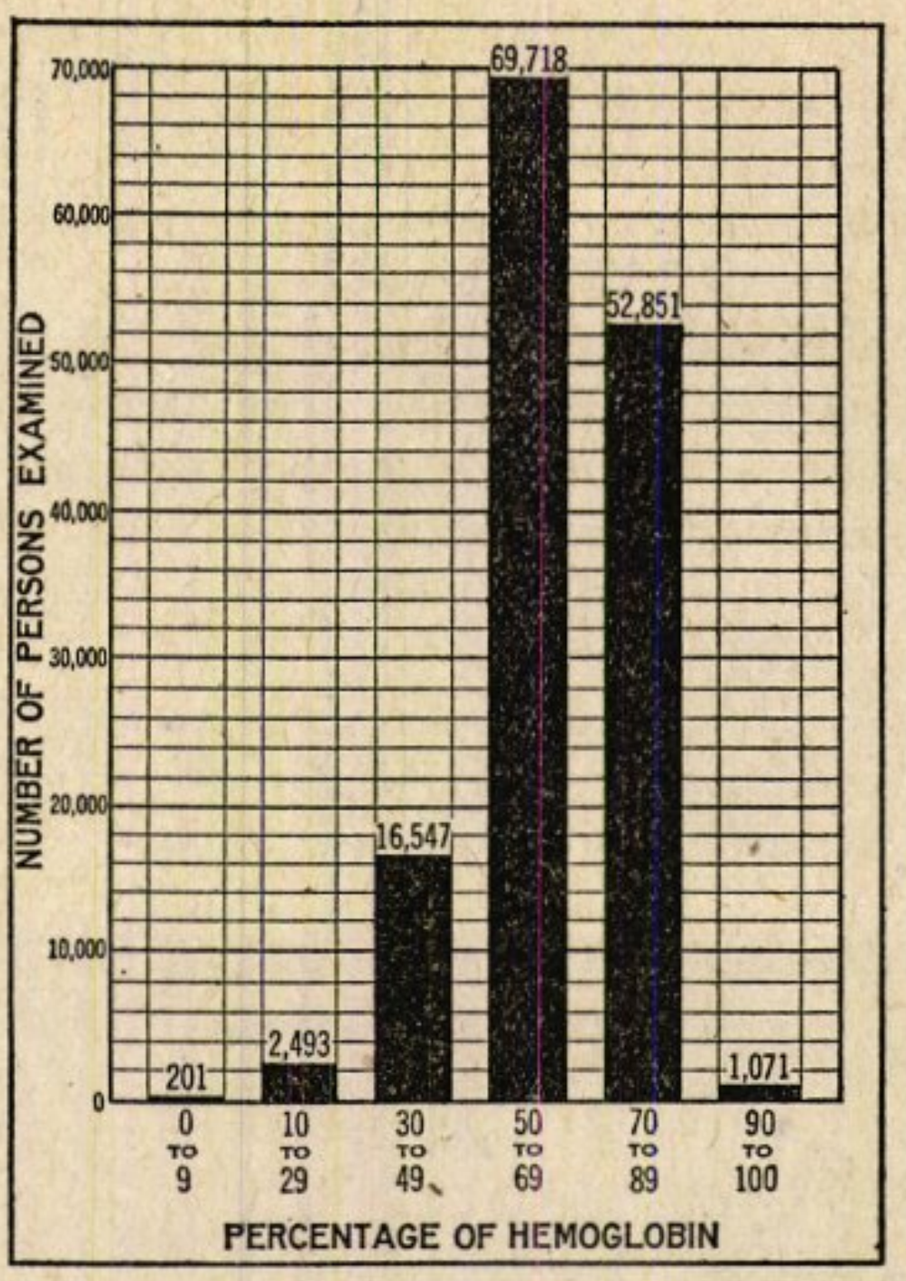

Fig. 17.—Reduction in hemoglobin associated with hookworm disease. Total of 142,881 persons examined to date

During 1917 and 1918 the director of the work in Costa Rica had opportunity to test the blood of 40,402 infected persons before treatment for hookworm disease, and of 13,489 of the same persons (33 per cent) six months or more after they had been treated.[1] The examinations before treatment showed an average hemoglobin of 64.6 per cent; those after treatment, of 76.8 per cent. In different cantons of this country the gain ranged from as low as 3.0 per cent in San Marcos to as high as 25.0 in Alvarado.

That the hemoglobin index continues to rise for a considerable period following the close of regular campaign measures is suggested by observations made on the estate of Rodeo, in the canton of Mora, Costa Rica. On this estate the average hemoglobin index of persons just cured was 63.3. In a re-survey conducted two years later, it was 76.8 among the persons remaining uninfected.

Gain in Body Weight by Siamese Soldiers. It is customary for striking gains in body weight to follow treatment for hookworm disease. Such improvement in individuals has often been noted, and

[1] It would, of course, be preferable to confine the comparison before and after treatment to the same number of persons. However, since the cases examined after treatment were taken at random and large numbers were involved, the figures are doubtless sufficiently accurate for practical purposes.

large numbers of separate instances could be cited of remarkable increases in weight within short periods of time. During 1918, Hluang Boriracksha, of the Siamese Army Medical Service, made observations on ninety-nine soldiers of the Siamese Army. All of these men had hookworm disease. Sixty-nine of them were treated once with fifty grains of thymol. The other thirty were given no treatment whatever. The treated men gained an average of 10.6 pounds in weight over a period of one year, while the untreated gained during the same period an average of only 1.1 pounds.

Hookworm as a Predisposing Factor to Other Diseases. The 1918 influenza epidemic in Ceylon showed that on all the estates embraced within the Maskeliya area, with a total laboring population of 17,838, the death rate from influenza and its sequelae was twice as high among persons who had not been treated for hookworm disease as among those who had. The deaths numbered 111, or 7.5 per thousand, among 14,659 persons who had been treated for hookworm infection before being attacked by influenza, as compared with 43, or 13.8 per thousand, among 3,253 persons who had not been treated for hookworm. Similarly, Major Kofoid, of the United States Army Medical Service, reports that the hospital statistics and sickness records of 24,000 men at Camp Bowie during the period from October, 1917, to May, 1918, indicated that the resistance to disease was lowest and the mortality rates were highest among the organizations in which hookworm disease was most prevalent.

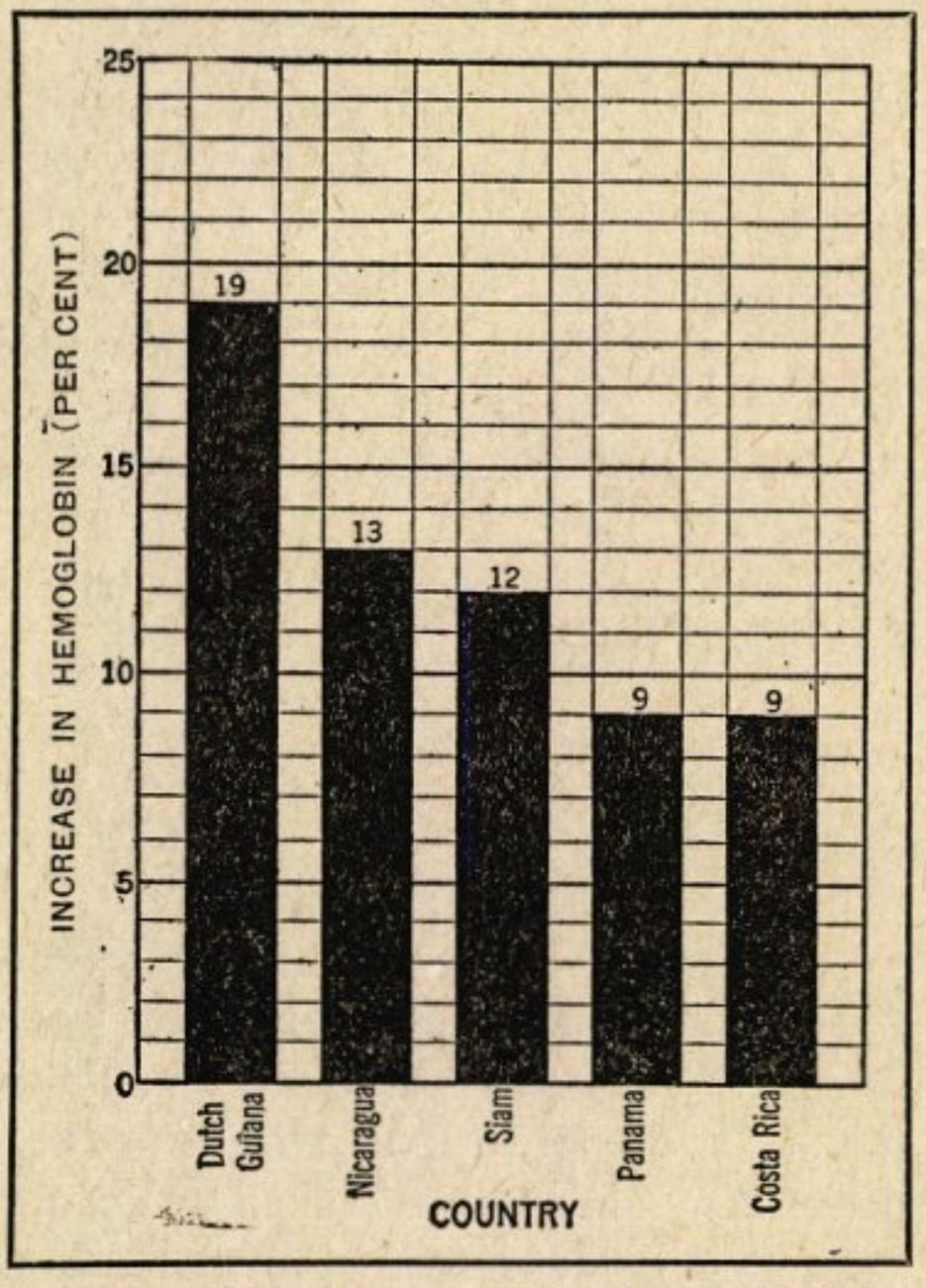

Fig. 18.—Increase in hemoglobin following treatment for hookworm disease.[1] All countries

Reduction of Morbidity Following Hookworm Campaigns. That improved health follows treatment for hookworm disease is illustrated by the following instances:

a. Decrease in admissions to estate and asylum hospitals in Trinidad. On one estate in Trinidad, as well as at the Orphanage and Industrial School located at Tunapuna in that colony, sanitary reform and the treatment of infected persons reduced by two-thirds the number of

[1] The figures indicate the difference between the hemoglobin index of infected persons before treatment and their index after treatment.

patients admitted to hospital. The work in the Orphanage was completed in April of 1916. During the last two months of the year, only three patients were admitted to the hospital, as compared with a monthly average of forty admissions for the previous four years. In another institution in the same colony, the Boys' Reformatory, the regular hookworm control measures were completed in March, 1918. Sixty or seventy ulcers had to be dressed daily before the boys were treated for hookworm disease, as compared with seventeen after they were treated. Of the latter number, only three were serious enough to require much attention.

b. Diminished sickness in areas of British Guiana. From the Peter's Hall and Belle Vue districts of British Guiana, where operations against hookworm disease were in progress during 1914 and 1915, the number of patients admitted to the public hospital at Georgetown during 1916 was 31.5 per cent lower than during 1914. In contrast with this, the reduction for rural districts in which measures against hookworm disease were not carried out, was only 6.5 per cent.

On one estate in this colony the amount of sickness had increased to such an extent that before the laborers were treated for hookworm disease an addition to the estate hospital was planned. As a result of the hookworm campaign which intervened between the planning of the addition and its erection, the addition was found unnecessary. So great was the reduction in the sickness after hookworm disease had been treated, that even the original quarters were seldom filled to capacity.

c. Lowered record of sickness calls on Ceylon estates. On seven estates of Ceylon there was a decrease of 1,132 sickness calls, or 44 per cent, for four months of 1917, following treatment of the laborers for hookworm disease, as compared with the same four months of 1916, before the laborers had been treated for the disease. The largest reduction occurred in the calls for second and third treatments, indicating that the improvement in health effected by treatment for hookworm disease resulted in the patients being more readily cured of all their maladies. The decrease in bowel complaints and in malarial fevers among the coolies on these estates was especially marked.

In another area the District Medical Officer reported that only 2,604 patients were admitted to hospital in 1918, after treatment for hookworm disease had been carried out in his locality, as compared with 3,694 in 1916, before systematic work against the disease had been begun. This represents a reduction of 27 per cent in the number of hospital admissions.

d. Lessening of sickness absenteeism on Indian tea estates. The investigation conducted by Lieut.-Col. Clayton Lane in the Darjeeling district in India showed that treatment resulted in noticeable improvement in the health and efficiency of labor. One manager wrote Dr. Lane that during the three months preceding the campaign against hookworm disease, at least forty-five men were continuously

Fig. 19.—Javanese severely infected with hookworm disease. Before treatment. Emaciated, weak. Unable to work for twelve years. Hemoglobin, 13 per cent

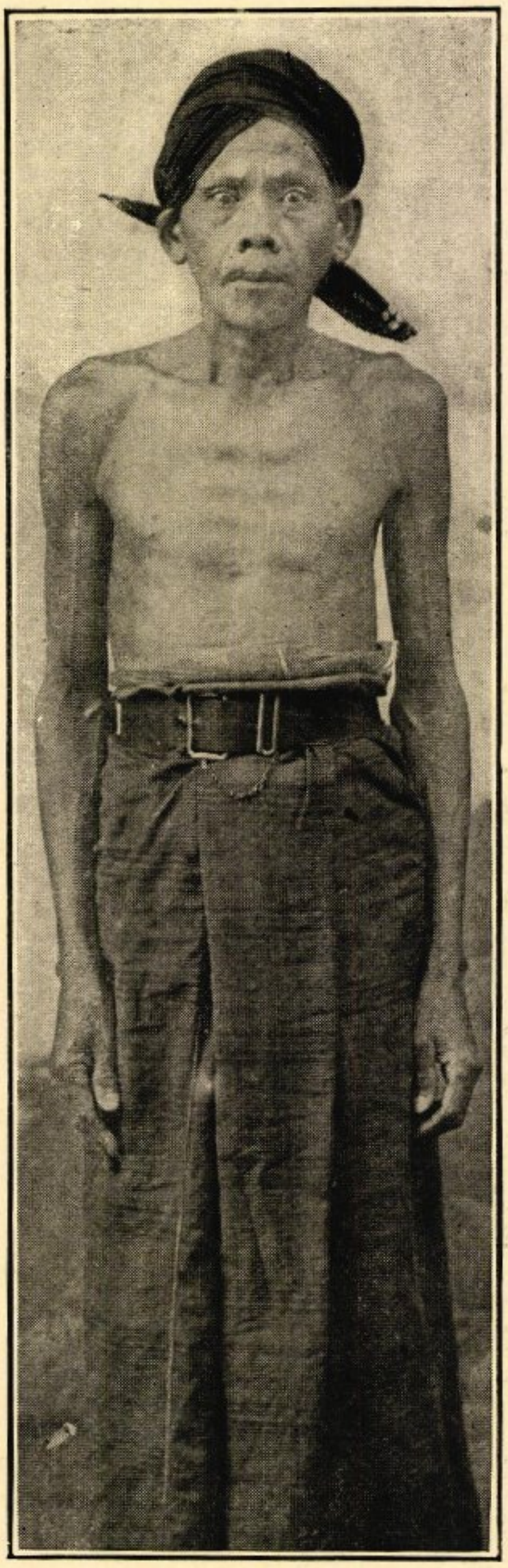

Fig. 20.—Same patient one year later, after treatment. Expelled 1,139 hookworms. Now employed in rice fields. Hemoglobin, 60 per cent

Fig. 21.—School children applying for hookworm treatment in Salvador. Pupils must be hookworm-free to enter school

absent from work because of sickness. During the same three months of the following year, after the hookworm campaign, only twenty-six men were laid off for this reason,—a reduction of 42 per cent. Another manager reported that previous to the time treatment was given his laborers, between 150 and 200 of them were absent from work daily during the rainy season. In 1918, after treatment had been administered, the number daily absent from work during the rains never exceeded sixty, and usually was considerably less than this figure.

Effect of the Disease on the Birth Rate. It is probable that hookworm disease has a deterrent effect upon the birth rate. Not only do the sterility and impotence commonly caused by the infection reduce the frequency of conception, but the effects of the disease, falling most heavily on women of child-bearing age, cause a large proportion of the pregnancies that do occur to terminate in abortions or miscarriages. Wherever treatment is carried out over large areas, the birth rate is stimulated in marked degree. Many women become pregnant who have not borne children for years. The regularity of menstruation is restored, sterility reduced, the number of pregnancies correspondingly increased, and the proportion of unfavorable terminations reduced. This is a fact of vital economic significance in view of the present shortage of man-power throughout the world.

MENTAL RETARDATION

During 1918 the Ministers of Public Instruction in Nicaragua and Salvador issued decrees calling for the examination of all school children for hookworm disease and for the treatment and cure of those infected; and the Prefect of the Federal District of Brazil, similarly, ordered the examination and treatment of the pupils in the public schools of the city of Rio de Janeiro. These acts were prompted by recognition of the fact that aside from its baneful influence in retarding physical development, hookworm disease causes a further loss to the state by impairing the intellectual character and capacity of its citizenship.

Comparative Scholarship Gradings of Infected and Non-Infected. Lists of the children found infected usually correspond with those of the dullest pupils in their grades. In one women's college in the Southern States, for example, the average standing of fifty-six students found infected was 78 per cent, whereas fifty-six students found free of infection averaged 89 per cent. In another instance, twenty-five infected boys in a Southern academy averaged 64 per cent in their studies, as compared with the percentage of 86 maintained by the same number of non-infected boys. Here the retardation was approximately 25 per cent. Teachers everywhere

are practically unanimous in reporting that treatment of the infected pupils results not only in marked gains in weight and physical appearance, but in decided improvement in zeal and intelligence as well.

Mental Retardation from Hookworm Disease in U. S. Army. Major Kofoid reports, on the basis of his experience with hookworm disease among troops in the Southern Department of the United States Army, that when the findings of the hookworm survey were compared with those of the psychological board in the case of 10,000 men at Camp Travis, Texas, the mentality of white men with hookworm disease was found to be about 33 per cent below the mentality of those without it.

Study of Mentality of Infected Children in Queensland. During 1918 a thorough investigation was made of the mental retardation due to hookworm infection among the school children of Queensland, Australia. The study was made possible by the Queensland Department of Public Instruction, which provided a school nurse for six months and all necessary facilities for carrying out the work. Three hundred forty children between the ages of six and fourteen years were selected for mental testing. As far as possible, effort was made to obtain a fair representation of the 5,000 or more school children residing within the areas visited, both as to strata of society and the sections of town or country from which they came. The children selected fell naturally into one of three groups, according as microscopic examination of the fecal specimens which they submitted showed that they were not infected, only lightly infected, or heavily infected with hookworm disease.

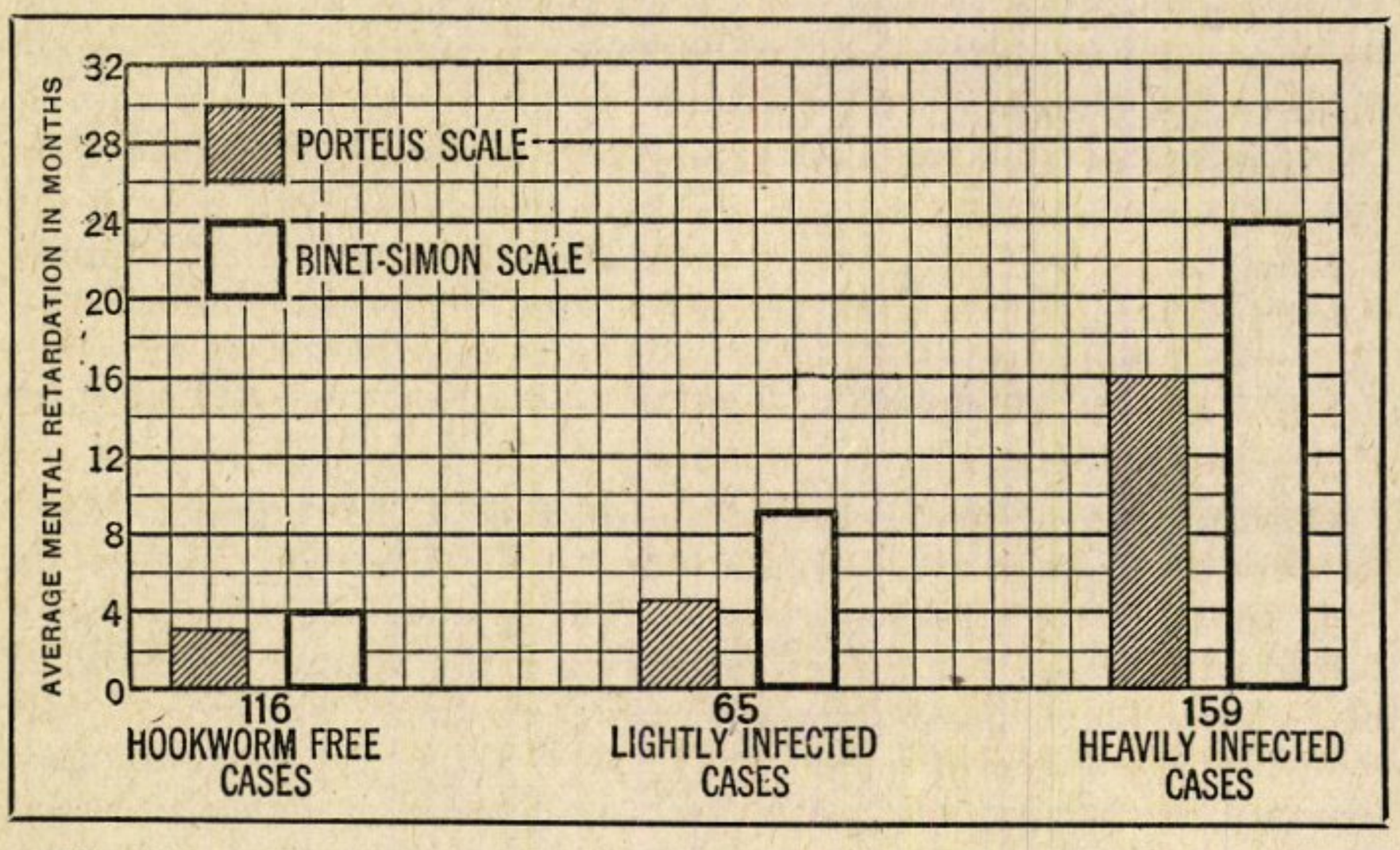

Fig. 22.—Comparative mental retardation, in months. Hookworm free, light hookworm infections, and heavy hookworm infections. Three hundred forty school children of Queensland, Australia. 1918

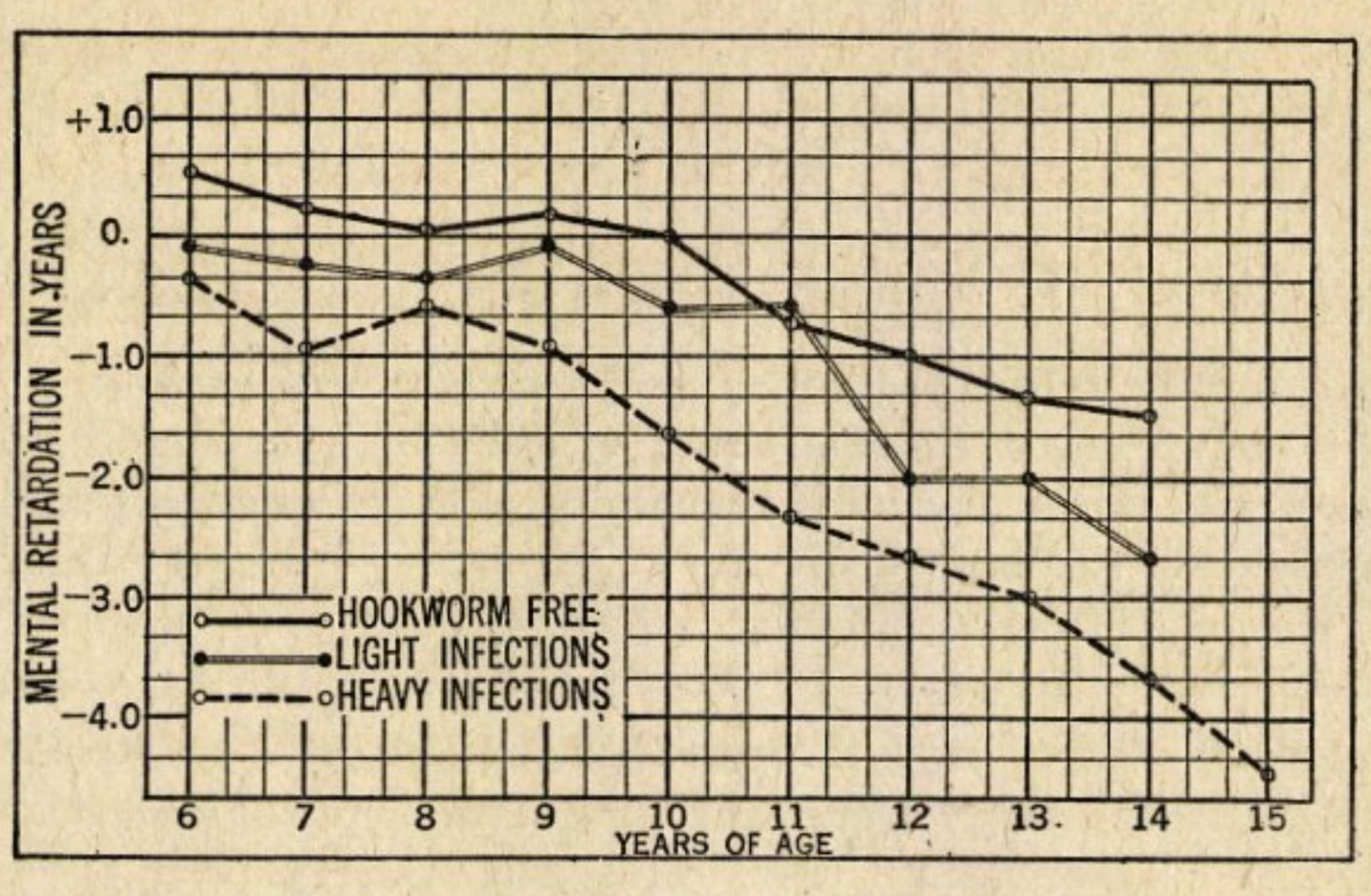

Fig. 23.—Results of Binet-Simon mental tests by age groups. Three hundred forty school children. Queensland, Australia. 1918

Measures of Mentality Employed in Queensland Study. The method of selection on the basis of stool examinations kept a constant factor of other causes of retardation, such as hereditary mental defects, syphilis transmitted from parents, parental alcoholism, tonsils and adenoids, and so forth. The tests were applied by the nurse, without knowledge as to what result the microscopic examination of the child's feces had yielded. Goddard's revision of the Binet-Simon tests, the Porteus mazes, and a special modified dot-counting test were employed in gauging the mentality of the children. In using the Binet-Simon tests, special adjustments were made to adapt them to Australian children. From thirty-five to forty minutes were taken for applying the tests to each child.

Findings of Queensland Mental Retardation Study. Figs. 22 and 23 exhibit graphically the principal facts disclosed by the survey. Lightly infected cases had, on the average, a retardation of 9.3 months in their mental development as measured by the Binet-Simon tests, and of 4.9 months as measured by the Porteus; while heavily infected cases were retarded 23.4 months as measured by Binet and 16.6 months as measured by Porteus. The longer the infection had persisted in the child, the greater was the retardation found to be. Thus, in infected children eight years old the retardation was only 6.6 months, while in those eleven years old it was 19.0 months and in those fourteen years old, 25.9 months. In extreme cases accompanied by the most severe types of individual infection, a retardation of as much as five years was recorded.

III

DIAGNOSIS OF HOOKWORM INFECTION

Work for the relief and control of hookworm disease, to be of the greatest value, must be conducted in such manner that its benefits may not only reach the more advanced and prosperous peoples, but also extend to the many millions of primitive folk who inhabit the more remote and inaccessible regions of the earth. This means that field activities must often be carried out under conditions far from ideal. In all of the work the aim has been to achieve accuracy and simplicity. If the latter requirement is to be met, the apparatus and equipment cannot be elaborate, nor should extensive preliminary training on the part of the examiners be necessary. At all times the cost of the work must be kept within the means of the masses.

Methods of Diagnosing the Infection. The disease may be diagnosed by administering a vermifuge and searching the stools for hookworms, or the vermifuge may be omitted and specimens of feces may be microscopically examined for ova. It has been customary to rely almost entirely upon several variations of the latter method. There are also various culture methods for demonstrating the infection, but these are hardly practicable for extensive use in the field.

How Fecal Specimens are Received and Examined. When microscopic examination of the feces is the basis for demonstrating the disease, every person in an infected area who desires to know whether he has hookworm disease is invited to submit a specimen of his feces for examination. For this purpose small tin boxes about one inch in diameter, with the lid of each properly marked for identification, are supplied. Every effort is made to insure careful and accurate diagnosis of the specimens submitted. In each country the examiners are native young men who have been especially selected for their reliability and later trained in the detection of ova. The specimens found negative by one man are in almost all cases re-examined by one or two others, and head examiners are usually employed to watch over the work and safeguard the accuracy of the results.

MICROSCOPIC DIAGNOSIS WITH PLAIN SMEAR

Until 1914 the plain smear method of microscopic examination was used almost exclusively. This consists of the careful search of not less than three smears from each specimen before pronouncing free of infection the person who submitted it. The glass slides on which the smears are examined measure not less than one by three

inches. The disadvantage of this method lies in the fact that it requires more time for thorough examination than can be devoted to each specimen. Furthermore, the specimens themselves are too small to yield entirely trustworthy results. Nevertheless the method is fairly satisfactory when large or moderate numbers of the parasites are harbored.

DIAGNOSIS WITH THE AID OF THE CENTRIFUGE

When only a few worms are in the intestines, the number of eggs in the feces is, of course, correspondingly reduced. It then becomes necessary to employ a ready means of concentrating the eggs, not merely to facilitate the search but also to assure a greater degree of accuracy in the findings. In recent years a multiple-tube hand centrifuge, which goes far toward meeting these needs, has come into general use. When this machine is employed, two or three slides from each specimen are first examined by the ordinary plain smear method. Those specimens which seem to be negative by this process are set aside and centrifuged in groups of twenty; and from the concentrated sediment thus obtained, two or three slides are usually prepared from each specimen for further examination with the microscope. Experiments have shown that the number of specimens found positive is about twenty per cent higher when the centrifuge is used than when the ordinary plain smear method alone is relied upon for diagnosis.

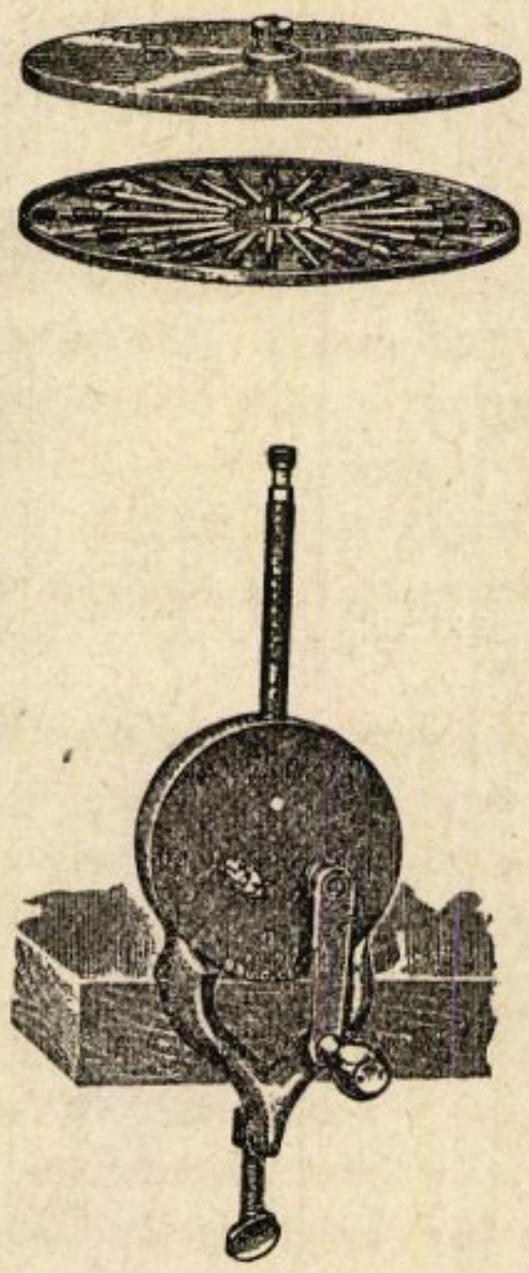

Fig. 24.—Special type of hand centrifuge used in examining specimens.

(Top) Stewart panhead, with specimen tubes in position
(Bottom) Shaft, showing manner of clamping to table

Accuracy of Centrifuge Method. The accuracy of the centrifuge method, like that of the plain smear method, depends primarily upon a fecal sample that is too small to yield entirely trustworthy results. The Board's Uncinariasis Commission to the Orient found, in the Federated Malay States and in Fiji, that when the same groups of persons were examined first by the centrifuge method and

later by administering a vermifuge and straining the stools for worms, the microscope showed only from 75 to 85 per cent of the persons examined to be infected, while diagnosis by vermifuge revealed from 97 to 100 per cent. It seems well within conservative bounds to estimate that in examinations both before and after treatment, diagnosis by microscopic examination, aided by the centrifuge, yields evidence of infection varying from 4 to 25 per cent less than actually exists. In support of this statement the evidence afforded by experiments made in Brazil during 1918 may be cited.

Summary of Experiments in Brazil during 1918. One hundred two among the total of 280 test cases treated in Brazil during 1918 were reported negative on original microscopic examination, giving a percentage of infection of 63.9. All 102 of the negative cases were later treated and fifty-six of them expelled worms, thus indicating that the actual rate of infection was not less than 83.6. All of the original examinations were made by trained microscopists with the aid of the centrifuge, yet the result shows a difference of 19.7 per cent in favor of diagnosis by vermifuge. The fifty-six cases incorrectly diagnosed yielded 716 worms, or thirteen per infected case. One of the cases declared negative on microscopic examination expelled as many as 115 worms.

GLYCERINE-SALT PROCESS OF EXAMINATION

It seems that infections which escape detection by the combined plain smear and centrifuge methods represent cases which harbor comparatively few worms. Nevertheless it is of considerable importance that these mild infections should be correctly diagnosed.

Two special techniques of examination have lately been developed to meet this need: the glycerine-salt and the brine flotation-loop methods. Both make use of specific gravity as an aid in correct diagnosis. The former was developed by Dr. M. A. Barber in his work in the Federated Malay States and was used by the medical officer in charge of the work in Siam in examining 31,298 specimens in that country up to December 31, 1918. The results obtained from its use are reported to be extremely satisfactory.

Process of Examining by Glycerine-Salt Method. In using the glycerine-salt technique, a diluting fluid composed of equal parts of a saturated solution of magnesium sulphate and glycerine is prepared. This fluid is dropped from a large dropping-bottle into the small tin box which contains the specimen. The fecal mass is thoroughly stirred and broken up with a toothpick, which releases the ova and causes them to rise to the surface. The upper part of the fluid in each container is poured upon a two-by-three-inch glass microscope slide which has been rimmed with paraffin or grease, and

Fig. 25.—Boys of Kampong Bharu, Federated Malay States. Hookworm incidence by ova examination, 86.6 per cent; by vermifuge, 100 per cent

Fig. 26.—Collection of feces from Javanese patients prior to counting of worms. Dutch Guiana

the surface of the slide is searched for eggs. The entire contents of a container may be examined by preparing three or four of these slides. The process regularly followed is to examine two slides before and two after centrifuging the specimen. The glycerine-salt diluting fluid is used in preparing all four of the slides, including those made before as well as after centrifuging.

Advantages of the Glycerine-Salt Method. The number of ova brought upon the slide by the glycerine-salt method is so greatly increased that the eggs may be much more easily found than when the plain smear method is used. This reduces the number of specimens that have to be run through the more time-consuming process of centrifuging and results in a great saving of time. This is an especially important consideration in regions like Siam, where the individual infection is so mild that when the plain smear method is used it is often necessary to prepare from ten to twelve slides from a single specimen and to spend from twenty to thirty minutes in order to make a diagnosis.

Comparative Accuracy of Plain Smear and Glycerine-Salt Methods. Forty-five test specimens were examined personally by the director of the work in Siam, using first the plain smear and then the glycerine-salt method. Two slides from each specimen were examined by both methods; in neither case was the centrifuge used as an aid. The percentage of persons found infected in examinations by the plain smear method was 23.3 on the first and 12.2 on the second slide, or 35.5 for the two slides combined. By the glycerine-salt method it was 84.4 on the first and 2.2 on the second, or 86.6 for both slides. With the plain slide technique a total of thirty-six ova were found on all ninety of the slides examined; with the glycerine-salt technique, a total of 4.48.

A later series of forty-three specimens was examined by the two methods, but a second slide was prepared only when the first proved negative and no record was kept of the number of eggs discovered. In this series the percentage found positive by the plain slide method was 37.2, as compared with 67.4 by the glycerine-salt method. For both series, embracing eighty-eight specimens in all, the percentage of positive findings by the two methods was 27.5 and 77.2, respectively.

Accuracy of the Plain Slide, Centrifuge, and Glycerine-Salt Methods Compared. Twenty-seven of the eighty-eight specimens just mentioned were examined in rotation by the plain slide, centrifuge, and glycerine-salt methods. In this series, record of the number of ova discovered was omitted and a second slide was not prepared if the first proved positive. The results showed that the glycerine-salt was the most accurate of the three methods. The findings were as follows: 40.7 per cent positive by the plain slide, 55.5 by the centrifuge, and 70.2 by the glycerine-salt method.

BRINE FLOTATION-LOOP METHOD OF EXAMINATION

During 1918 Majors Kofoid and Barber developed a special technique known as the "brine flotation-loop method," and employed it in examining for hookworm disease the soldiers in the Southern Department of the United States Army.[1] This method is in part an outgrowth of experience with the glycerine-salt method just described, and in this respect may be accepted as an improvement over that technique. In the army medical work it was used by about seventy-five examiners in making more than 100,000 examinations under field conditions, and was found to be rapid, efficient, practicable, and especially valuable in diagnosing light infections.

Technique of Examination with Brine Flotation-Loop Method. The process followed in making examinations by this method is to mix a large fecal sample thoroughly in concentrated brine in a paraffin paper container of from 50 to 75 mils (two to three ounces) capacity. The coarse float is forced below the surface by means of a disk of No. 9 steel wool and the container is allowed to stand one hour for the ova to ascend. The surface film is then wiped off with wire loops one-half inch in diameter and examined on a slide without a cover glass. The ova of hookworm and of other parasites are floated up by the brine into the surface layer of the pool without distortion or noticeable change in appearance.

Advantage of Flotation-Loop Process. The great advantage of this method is believed to lie in its easy utilization of large samples. With containers of sufficient size, receptacles for mixing the entire stool may be employed. This eliminates the element of random sampling except in so far as this may be due to irregular egg-laying by the female worms or to an unequal discharge of eggs in successive stools. It insures also a sufficient number of ova to make detection possible in light infections which may be overlooked by other methods using smaller samples. It is for this reason a more accurate means of diagnosis. In addition, it is reported to be about 50 per cent more rapid than the centrifuge method.

Accuracy of Flotation-Loop Process. The accuracy of this method depends on a number of variables, including the size and consistency of the specimen, the thoroughness of stirring, the amount of steel wool used, the care in looping, the opacity of the fluid, and the extent and thoroughness of the search made of the material on the slide. Eight lots of fifty specimens each, which had been examined once, were set aside and subsequently re-examined for the purpose of ascertaining what proportion of light infections had escaped detection. The specimens were all from companies of soldiers in

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[1] For full particulars, see article entitled "Rapid Method for Detection of Ova of Intestinal Parasites in Human Stools," by Charles A. Kofoid and Marshall A. Barber, Journal American Medical Association, vol. 71, No. 19, p. 1557.

which there was light and therefore presumably easily-overlooked infection, and all had been found negative on the first examination. The top float of each lot of fifty cans was drawn off into a tall cylindric liter graduate, and the surface film of this column examined. The cans had stood, after stirring, for not less than two or three hours. In order to avoid entangling any ova that might be present, no brine from thick or viscous stools was used. Only one specimen among all eight lots, or one in four hundred negatives, was found positive on second examination. From this it appears that the number of positives escaping detection by this method is practically negligible.

IMPRACTICABILITY OF SCIENTIFICALLY EXACT DIAGNOSIS

When a person is declared free of infection on microscopic examination, the term is used in a relative sense to indicate that the number of worms in the intestines is so low that no ova can be discovered in the feces. This does not necessarily mean that there is not a single hookworm present. Male worms may still be harbored, as there is no possible way of knowing that there are none of these except by administering repeated treatments and washing the stools after each treatment. Nor is it possible to say that not a single female worm inhabits the intestinal tract unless specimens of stool are examined every day for many days. But it can be stated definitely that if careful examination by the methods in use fails to show the presence of ova, the number of worms remaining is very small. If patients were willing to submit two or three specimens for examination, the removal of every parasite could be more definitely predicated, but this would entail a large amount of additional work and present many difficulties if attempted under field conditions.

IV

METHODS OF TREATING HOOKWORM DISEASE

The treatment of hookworm disease is gradually becoming standardized. It is now generally agreed that a purgative and a vermifuge are required. The purgative is usually administered in two portions, the first being given before and the second after the vermifuge has been taken, though some authors do not regard the preliminary purge as necessary. Most authorities state, however, that the first purgative dose is useful in eliminating the mucous and other substances which surround the worms in the intestines and protect them from the action of the vermifuge. The latter is supposed to kill or poison the worms and cause them to release their hold on the intestinal wall. A second dose of the purgative is then administered to sweep the worms and the vermifuge from the intestines.

Drugs Used in Treatment. The principal remedies used are chloroform, eucalyptus, beta-naphthol, thymol, and oil of chenopodium. A new drug known as *carvacrol* was tried during 1918, but the results attending its use were reported as unsatisfactory. Of the five drugs most extensively employed, thymol and oil of chenopodium have proved themselves superior to all the others under field conditions. Chenopodium during recent years has been gaining steadily in favor as a remedy for hookworm disease.

Properties of Chenopodium Not Fully Understood. It seems, however, that there are on the market a number of varieties of this drug which differ greatly in their strength and toxicity. The variations in different samples are especially noticeable in the chemical composition of the oil, and are exhibited in its appearance, taste, smell, specific gravity, and volatility. A better pharmacopeial standard seems highly desirable. Thorough investigation of the cultivation of the plants from which the oil is distilled, of the pharmaceutical preparation of the oil, and of its properties after distillation, is required to assure a uniform and standard product and a safe routine of administration. The tests should also include, among other things, a careful and detailed investigation of the effect of the drug not merely on animals but on adults and children of different ages and in varying states of health. Although during 1918 scarcely any untoward results were reported by the United States army medical service or in the Board's work, yet it is believed desirable to repeat the earlier caution, that in giving the oil to children the dose should be made smaller than is indicated by Young's rule, and that medical officers should exercise careful supervision over the administration of the oil in the field.

STANDARD TECHNIQUE OF THYMOL ADMINISTRATION

The routine dosage of thymol recommended by Stiles, Dock, Howard, Bass, and others of wide experience in the treatment of hookworm disease, is the one most commonly employed in the countries where thymol is used. It is based upon sixty grains as the maximum for an adult, preceded and followed by an active saline purgative. Children from one to five years of age receive from 3 to 5 grains of the thymol; those from six to ten, from 10 to 15 grains; and those from eleven to fifteen, from 15 to 30 grains. Persons between sixteen and twenty years of age receive from 30 to 40 grains; those between twenty-one and fifty years, from 45 to 60 grains; and those more than fifty years, from 30 to 45 grains. The drug is administered in two equally divided portions, and apparent (not actual) age determines the dosage. Competent physicians examine all patients who are to take the drug, prescribe the proper dosage for each, and supervise the important phases of the treatment.

Conditions Governing Administration of Thymol. Food is not allowed from the time of the first purgative until after the final dose of salts has acted. Inasmuch as alcohol and oils, and gravy, butter, milk, or other fatty foods, are especially dangerous, the patient is cautioned against taking them at any time during the period of treatment. Under field conditions it is also necessary to withhold thymol from persons suffering from acute diseases such as malaria in the febrile stage or fevers of any other type; those having chronic dysentery or diarrhea, organic cardiac or renal disease, pulmonary tuberculosis beyond the incipient stage, or general anasarca; those who are extremely weak or feeble from old age or from other cause; and pregnant women, or women with serious hemorrhagic diseases of the uterus. Thymol may be administered to persons suffering from any of these diseases only when the circumstances will permit rigid control of all features connected with the treatment.

USE OF CHENOPODIUM AS AN ANTHELMINTIC

Oil of chenopodium is now used more extensively than thymol in all countries with which the Board co-operates except Panama, British Guiana, Trinidad, and Saint Lucia. Its comparatively low cost and the relative scarcity of thymol brought about by the World War have doubtless been factors in some measure leading to its widespread use. Following the reduction in dosage recommended by the Board's Uncinariasis Commission to the Orient, the drug was employed in administering 437,166 treatments to 191,377 persons during 1918, and gave exceptionally favorable results.

STANDARD METHOD OF ADMINISTERING CHENOPODIUM

The standard method of administering chenopodium as used by the Board during 1918 was that recommended by Darling, Barber, and Hacker as a result of their experiences with various vermicidal drugs in the Orient and published in their article entitled "The Treatment of Hookworm Infection."[1] It consists of an adult dose of 1½ mils (by weight),[2] divided into three equal parts and administered the first portion at 7:00 a.m., the second at 8:00 a.m., and the third at 9:00 a.m. A light evening meal followed by a purgative dose of magnesium sulphate is usually given on the evening preceding treatment, and a very light breakfast, consisting of milk or thin rice gruel, on the morning of treatment. Two hours after the last portion of chenopodium is taken, a second purgative dose of magnesium sulphate is administered. Effective post-treatment purgation is thought to be essential to eliminate the dead or stunned worms and the unabsorbed oil. A second post-treatment purgative should be given if the first fails to act freely and promptly.

Schedule of Dosage for Children and Adults. The directors of the work in Ceylon, who have made extensive use of the drug in small doses, have worked out a dosage table for children and adults. Children who *appear* to be between the ages of two and twelve years receive 1 minim for each year of age, minus 1 minim. This means that a child of seven receives 6 minims, a child of six 5 minims, and so on. Persons from thirteen to fourteen years of age receive 13 minims; those from fifteen to sixteen, 16 minims; from seventeen to eighteen, 20 minims; and from nineteen to twenty, 24 minims. It will be noted that especially small doses are administered to children under twelve. The oil is dropped from a dropping-bottle into simple sugar syrup. In Ceylon this has proved the most satisfactory of all the vehicles in which the oil has been administered. The directors of the work in this country also report that in addition to the contraindications to thymol treatment mentioned on page 139, the use of chenopodium is contraindicated when the patient has peptic ulcers or gonorrhea.

Efficiency of Standard Chenopodium Treatment. The director and the assistant director of the newly established Department of Hygiene at the University of Sao Paulo, assisted by the staff engaged in hookworm control measures in Brazil, made considerable progress during the year toward establishing the probable average efficiency of the foregoing dosage under field conditions. In the original experiments, made in the Orient under laboratory conditions,

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[1] The Journal of the American Medical Association, February 23, 1918, Vol. 70, pp. 449–507.

[2] Special attention is directed to the fact that a minim by weight equals approximately 2 drops by measure.

two standard chenopodium treatments, separated by an interval of ten days, removed 99 per cent of all the hookworms harbored by a group of thirty-nine adults. One hundred fifty-six cases were similarly treated in Brazil during 1918, except that the work was done largely under field conditions, and 97 per cent of the worms they harbored were removed. Thus the Brazilian experiments confirmed, in so far as the smallness of the numbers involved may be accepted as confirming, the tests made in the Orient. A large amount of additional field experience will need to be gained, however, before the entire practicability and efficiency of the routine treatment may be regarded as definitely established. One of the factors remaining for further investigation is the apparent difference in power of resisting treatment between the *Ancylostome* and the *Necator americanus*, and between persons who harbor large numbers of worms and those who harbor only a few.

a. Experiments with standard technique among Brazilian vagabonds. Eighty-two vagabonds more than fourteen years of age, who lived at an institution in Pinheiro, in the State of Rio de Janeiro, were treated three times with chenopodium. The first two treatments consisted of 1½ mils each and the third of 3 mils.[1] These treatments expelled a total of 10,895 worms. Fig. 27 shows the efficiency of each treatment as based on two factors: the percentage of worms expelled and the percentage of cases cured. In this group there were only nine relative failures of the treatment, or cases which harbored ten or more worms after two 1½ mils treatments had been taken. The conditions of this experiment, however, permitted a rigid control of the patients and approached the exactness of a laboratory test. The results, therefore, may not be accepted as altogether representative of those to be expected when the remedy is administered in the field.

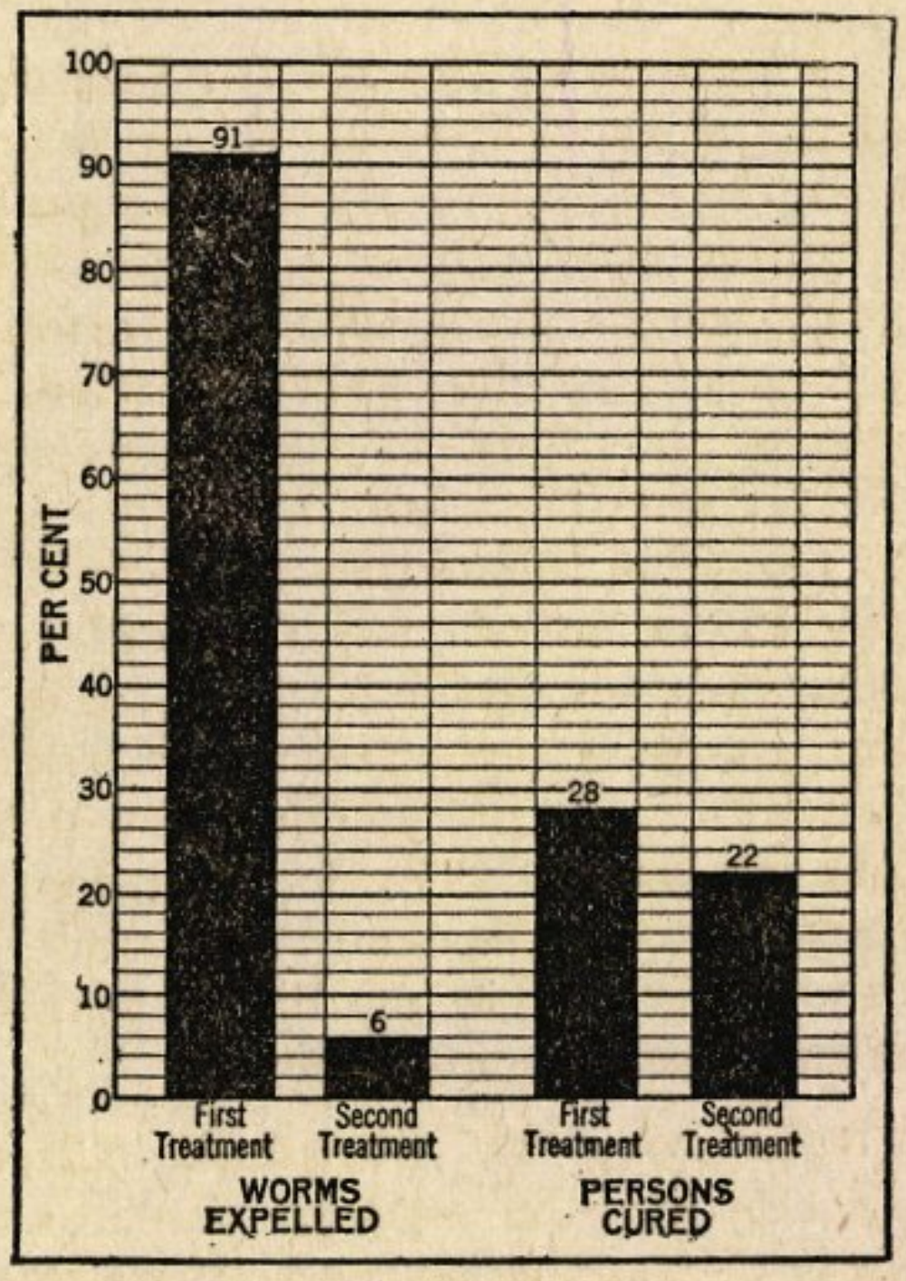

Fig. 27.—Worms expelled and cases cured by two treatments of chenopodium. Eighty-two Brazilian vagabonds.

[1] The third treatment (consisting of 3 mils) is not, of course, a part of the routine chenopodium administration. It was given to assure the quick recovery of all the hookworms harbored. Under ordinary conditions a dose of this size is not without its dangers.

b. Tests on heavily infected farm and in lightly infected village. Two trials were made in Atibaia, Brazil, to determine the efficacy of the standard treatment as administered under field conditions by regular campaign dispensers. In the first test, two localities were chosen: a severely infected farm and a mildly infected village. Ten persons in each locality were selected for the test. All received two routine treatments of chenopodium from the dispensers. Two weeks after they had taken the last of these two treatments, they were given a large 3 mils test dose of chenopodium. In the farm group there still remained 134 worms, or 13 per case, after the first two 1½ mils treatments had acted; in the city group, 7, or .7 per case. There were 50 per cent of relative failures among the farm residents. The number of worms harbored by this group before treatment was undoubtedly high, however, as two controls on the same farm who, before receiving the 3 mils dose, had been treated only once with 1½ mils, expelled as a result of the second treatment an average of 148 worms apiece.

c. Experiments on typical coffee farm. In the third experiment fifty-six persons living on a large, typical coffee plantation in the State of Sao Paulo, Brazil, who had already been treated twice in the routine way by campaign dispensers, were given, twelve days later, a single large dose of chenopodium. These cases were found to harbor, on the average, 5.8 worms per case after they had taken the first two treatments, while four control cases treated for the first time averaged 176 worms per case. In 41 per cent of the cases every worm was expelled by the first two treatments; in 21 per cent there was relative failure of the drug.

Interval Between Treatment with Chenopodium and Re-examination. Chenopodium has a distinctly inhibitory effect upon the egg-bearing functions of the female hookworm. A series of test cases conducted during 1918 by a special nurse in the city hospital of Sao Paulo showed that after treatment with chenopodium the ova disappeared from the feces and, if the cases were not cured, re-appeared the eighth to thirteenth day. This confirmed the findings of earlier investigators. All who have studied the subject agree that re-examination should be made in not less than fourteen days after the vermifuge has been taken. This is the period customarily allowed in the countries where chenopodium is used.

Need of Satisfactory Purgative for Use with Oil of Chenopodium. None of the purgatives which have been employed in connection with chenopodium treatment have given entirely satisfactory results. Of those which have been tried, magnesium sulphate is the one which has been reported upon most favorably.

Omission of Preliminary Purge. Better results are apparently obtained if the pre-treatment purgative is given; and in hospital practice, where the patient can rest and is under constant observa-

tion, it seems best to give it. But when it is given in field work, many of the patients, after it has acted, become weak and in some instances are unfit for work next day, with the result that they lodge complaints against the treatment. The original experiments of Darling, Barber, and Hacker, although dealing with a number of cases too small to enable trustworthy conclusions to be drawn from them, nevertheless showed that when this purge was omitted and the other factors were kept the same as in routine treatment, two standard doses of 1½ mils of chenopodium cured 80 per cent of the cases and removed 95 per cent of the total worms. This suggested that with an interval of twelve hours between eating and the administration of the vermifuge, the preliminary purge might be omitted.

CHENOPODIUM-CROTON OIL TREATMENT AS DEVELOPED IN CEYLON

In Ceylon a special form of treatment which omits the preliminary purge, has been developed and is now being extensively employed in estate and village work. It is unquestionably more acceptable to the patients. Some of its best features are that smaller doses of salts are required to secure effective post-treatment purgation, there is less exhaustion, the after-effects—consisting of rheumatoid pains, tinnitus, etc.—are much less in evidence, and in almost all cases the patients are able to work the following day.

Routine Administration of Chenopodium-Croton Oil. When this method is employed, a light meal of rice gruel is allowed the evening before treatment. At 6:00 o'clock next morning a small cup of konje is taken. At 6:30 a.m. the vermifuge (a mixture of chenopodium 40 parts and croton oil 1 part) is given in the standard dosage prescribed for chenopodium (see page 140), graduated according to the apparent and not the stated age of each person. The dose is usually given in two equal parts with an interval of one hour between. Two hours after the whole of the vermicide has been taken, the patient receives a purgative dose of magnesium sulphate.

Conditions Governing Chenopodium-Croton Oil Treatment. All patients are kept under observation by the dispenser from the time of giving the first portion of the vermicide until the medical officer in charge is satisfied that the post-treatment purgative has acted freely. Meanwhile, the patients are allowed to rest in a sheltered place. Temporary sheltered latrines for men and women are provided near the resting-place, and an apothecary or dispenser sees that the latrines are properly used. Before the patients are discharged, they are strongly counselled not to eat raw fruit or vegetables for a day or two after treatment, but to take chiefly rice and rice gruel.

ADMINISTRATION OF CHENOPODIUM IN UNDIVIDED DOSES

In an experiment conducted by the Uncinariasis Commission to the Orient, 2 mils of chenopodium administered in two equally divided doses removed 96.2 per cent of the worms harbored by eight cases, while the same amount of the drug administered in a single massive dose expelled 95.8 per cent of the worms in twenty-five other cases. The similarity of these figures suggested that it was probably unnecessary to divide the dose. Experiments to determine this point were made by the directors of the work in several countries during 1918.

Experience in Seychelles Islands and in Ceylon. The medical officer in charge of the work in the Seychelles Islands administered to a limited number of cases the full daily dose of chenopodium at 6:00 a.m., without preliminary purgation, but the results obtained were not so good as when the regular routine of chenopodium treatment was followed. In Ceylon, similarly, the entire amount of chenopodium in one dose was administered experimentally on a number of estates. The method is still under trial, but the directors report that it does not appear suitable for use where there is heavy infection.

Experience in China. The director in China, on the other hand, has made extensive use of a single 2 mil dose, and in a group of experimental cases obtained satisfactory results, the percentage of cures after one treatment being approximately 87.0. The experience in that country indicates that chenopodium in this dosage is seldom contraindicated. Persons with active tuberculosis, moderate heart lesions, and acute bronchitis have been treated and have shown no ill-effects. It should be pointed out, however, that all the patients dealt with are male adults between eighteen and fifty years of age, and that the doses of salts used are larger than are customarily administered in other countries.

EFFECT OF PURGATIVE ON EFFICIENCY OF REMEDY

Tests made in China during 1918 suggest that the rôle played by the purgative in removing the worms from the intestines, and the full effect of chenopodium on hookworms, considered from the therapeutical standpoint, are two extremely important phases of treatment which have perhaps not been sufficiently investigated. It was noticed that the percentage of living worms expelled was increased if the salts acted quickly. This meant either that longer

contact with chenopodium kills a larger percentage of worms, or that in many cases the drug temporarily loosens the hold of the worm on the intestinal wall so that a strong purgative may expel many living worms. A series of observations was then made to ascertain what effect an increase in the dose of magnesium sulphate had on the percentage of cures.

Increased Efficiency of Chenopodium with Free Purgation. The amount of chenopodium used was an undivided dose of 2 mils. At first 25 mils (one ounce) of magnesium sulphate was administered the evening before treatment, and 50 mils two hours after the chenopodium had been taken. Of 395 infected persons treated by this method, 286, or 72.4 per cent, were found negative after one treatment. The results were so good that the amount of salts was increased to 50 mils instead of 25 on the evening before treatment, and to 141 mils (four and two-thirds ounces) instead of fifty after the taking of the chenopodium. The salts given after the vermifuge were divided into two portions, one-half being administered at the end of two hours and the other half at the end of four. Of 620 persons treated in this way, 499, or 80.5 per cent, were found negative after one treatment. With the increase in the amount of salts given, there was not one case which showed any symptoms of chenopodium absorption. There were nausea and vomiting at times, but there were no ill effects due to the action of chenopodium.

USE OF CHENOPODIUM IN TREATMENT OF AMEBIC DYSENTERY

In a number of countries oil of chenopodium is now being regularly employed in the treatment of dysentery. It is reported to remove encysted ameba, to cause the disappearance of blood and mucus from the feces, and to give prompt relief to the patient.

Routine Chenopodium Treatment for Relief of Dysentery. In Siam the treatment is used as follows: 37 mils (one and one-half ounces) of magnesium sulphate are first given. Two hours later 1 mil of oil of chenopodium follows. One hour later a similar dose of the oil is administered, followed in another hour by 37 mils (one and one-half ounces) of castor oil. For more severe cases either the preliminary purgative is omitted and 2 mils of chenopodium in 37 mils of castor oil are given in a single dose, or 1 mil of oil of chenopodium, emulsified with gum acacia, is administered by way of the rectum. In the latter mode of treatment the anal mucosa is protected by petrolatum and the injections are terminated with 50 mils (two ounces) of an inert oil. The buttocks are elevated, and the enema—the first dose of which does not exceed 200 mils (eight ounces) for an adult—is given slowly.

MANNER OF DETERMINING RELATIVE EFFICIENCY OF DRUGS

The proportion of infected persons cured by two treatments does not always convey an adequate idea of how efficient a remedy is. Two treatments of a powerful vermicide may remove from a large proportion of cases all but two or three per cent of the worms they harbor, and still fail to effect the complete cure of any considerable number of the patients. Thus, in a series of experimental cases, two treatments of chenopodium, each consisting of 1½ mils, have expelled more than 95 per cent of the hookworms harbored and yet cured only from 40 to 50 per cent of the cases. To effect the complete cure of all infected persons required, on the average, four treatments of the drug. This meant that the additional two treatments were used to expel less than 5 per cent of the worms originally harbored.

Efficiency as Estimated by Percentage of Worms Removed. For judging the efficacy of a drug the percentage of worms expelled is a better criterion than the percentage of cures obtained. It affords a satisfactory measure of efficiency in districts where there is moderate or severe infection distributed with a fair degree of uniformity among various classes of the population. But where the infection is mild and there are a few carriers with a disproportionately large number of worms to dominate the results, its value is not so great. One of the chief advantages of the method lies in the fact that the

CASE NO	WORMS HARBORED	WORMS REMOVED BY TWO TREATMENTS	PERCENTAGE OF WORMS REMOVED BY TWO TREATMENTS
1	64	48	75.0
2	195	193	99.0
3	873	461	52.8
4	1227	498	73.2
5	439	439	100.0
6	93	27	29.0
7	291	120	41.2
8	686	678	98.8
TOTAL	3868	2864	74.0

Percentage of Worms Removed from Group ---------- $\frac{2864}{3868} = 74.0$

Average Percentage of Worms Removed from Each Individual* $\frac{569.0}{8} = 71.1$

Knowlton's Index of Efficiency ---------- $\frac{74.0+71.1}{2} = 72.6$

* *Addition of Figures in column headed Percentage of Worms Removed by Two Treatments, divided by the number of cases treated.*

Fig. 28.—Method of computing Knowlton's index of efficiency

worm count is a positive finding, all errors tending to decrease the apparent efficiency of the drug; while in estimating efficiency by cures, all errors of omission, due to faults inherent in the methods of diagnosis followed, tend to enhance the apparent value of the remedy by fictitiously increasing the number of cases registered as cured.

Knowlton's Method of Determining Efficiency. By adding the percentages of worms removed from each member of a group of infected individuals and dividing the total of these percentages by the number of individuals comprising the group, a fairly good index may be obtained. This is open to the objection, however, that the case with one worm counts for as much as the one with a thousand. Knowlton therefore recommends combining this method with the one whereby efficiency is determined on the basis of the percentage of worms removed from the group. The two percentage figures thus derived are averaged, and a figure obtained that is believed to give the most satisfactory index of efficiency of any method yet evolved. Fig. 28, page 146, illustrates this method of obtaining the efficiency index as applied to a supposititious group of eight cases.

V

HOOKWORM INFECTION SURVEYS

The Board's participation in measures against hookworm disease in any state or country is contingent upon official invitation from Government. As a preliminary step to the arrangement of a definite program, it is customary for an infection survey to be made of the territory. This survey defines the geographical prevalence and distribution of the disease and the practicability of its control, makes available data concerning the insanitary conditions which are responsible for the presence and spread of the infection, and furnishes information relative to the public health or other agencies through which systematic efforts against the disease may be begun with greatest promise of success. Thus it gives to Government and to the Board definite information upon which a satisfactory working agreement may be based. This information is also of much assistance when the measures designed to reduce the incidence and severity of the disease are put into operation.

Infection Surveys Completed or Authorized. During 1918, three complete infection surveys were concluded. One of these was in the State of Sao Paulo, Brazil, another in Jamaica, and the third in the United States Pacific possession, Guam. A fourth survey, begun in June in Minas Geraes, one of the largest states in Brazil, had not been completed by the end of the year. Other surveys were authorized but not begun during the year in the Brazilian States of Bahia, Parana, and Maranhao, and in the Province of Madras, in India.

INFECTION SURVEY OF JAMAICA

The infection survey of the Cayman Islands (a dependency of Jamaica) made during the spring of 1917, resulted in the Government's appropriating approximately $12,000 for carrying out a cooperative campaign against the disease in Jamaica proper. As an initial step in the measures of control an infection survey of the Island was made during June and July of 1918.

Findings of the Survey. The survey indicated that probably two of every three inhabitants of Jamaica have hookworm disease. The distribution of the infection by parishes is roughly indicated by the accompanying map (Fig. 29). High infection rates were also recorded for round-worms and thread-worms, the former being found in 67.2 per cent of the 10,926 persons examined and the latter in 35.9 per cent. In the larger towns and cities, which are located on

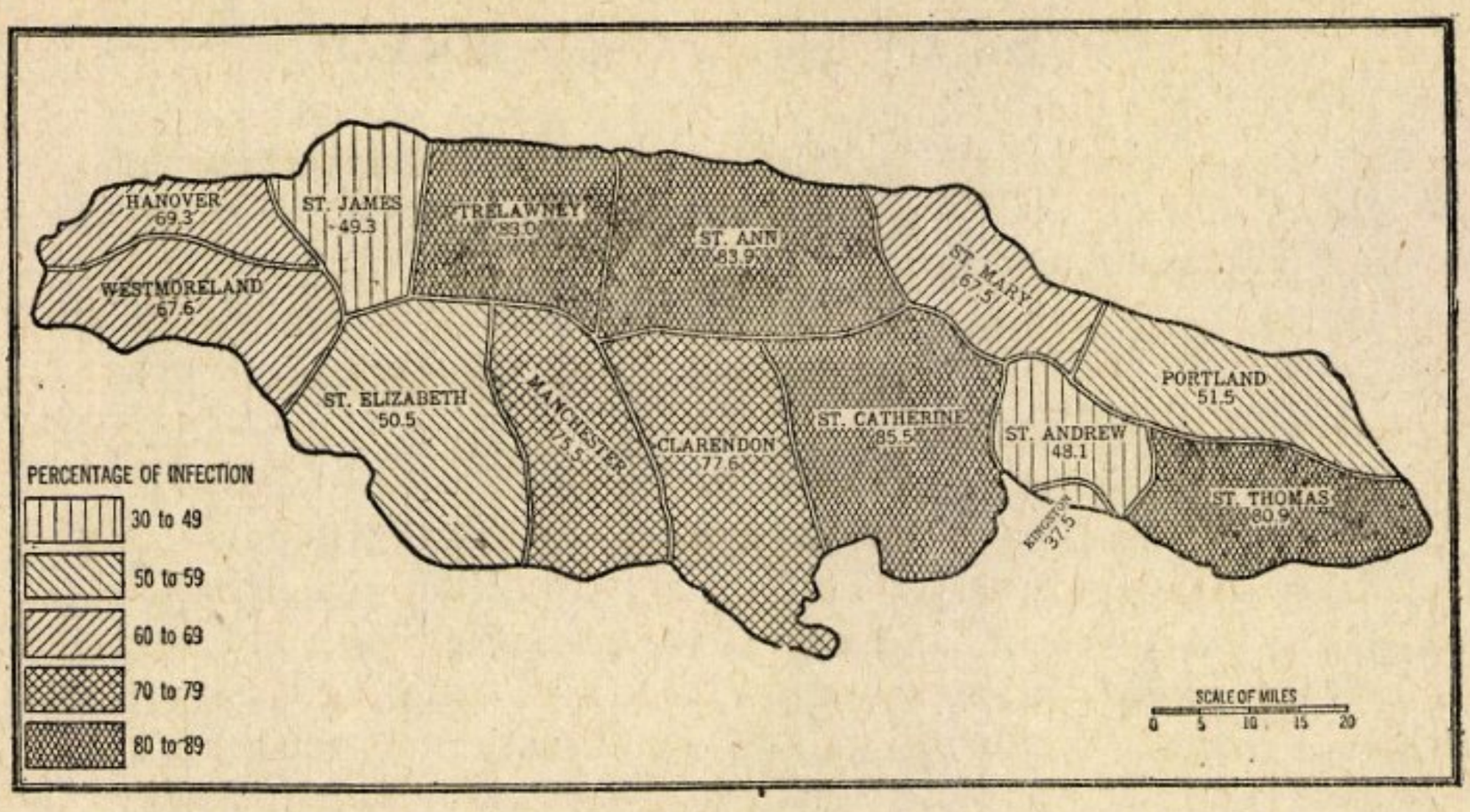

Fig. 29.—Hookworm infection survey map of Jamaica

the coast, a beginning has been made toward the proper disposal of excrement, but in the rural districts soil contamination is practically universal. There are laws requiring a latrine at every home, but no serious attempt has been made to enforce them.

Inauguration of Control Measures. The survey is to be followed by a series of demonstrations in control measures. The working arrangement provides that Government is to share the expense of the initial field posts and to have suitable latrines installed in all areas in advance of examination and treatment. Government has made available approximately $7,500 as a first appropriation for this purpose.

PREVALENCE OF HOOKWORM DISEASE IN GUAM

At the request of the Surgeon General of the Navy, a hookworm infection survey of Guam was made in May, 1918. Microscopic examination of 857 natives resident in various parts of the Island, representing 7 per cent of its total population, showed 71 per cent to be infected. The disease is relatively mild in type. No cases were found in which the infection was severe enough to cause retardation of growth, edema, or ulceration.

Soil pollution is not prevalent throughout the Island. Where it exists it can be prevented through the use of a simple type of latrine well within the resources of the natives. The Navy has sufficient personnel, drugs, and other facilities available for treating parasitic infections and for carrying out thoroughgoing measures of control with practically no outlay beyond the routine expenditures now being incurred.

SURVEY OF SAO PAULO, BRAZIL

An infection survey of the State of Sao Paulo was made between December 1, 1917, and February 28, 1918. Eleven towns and two coffee plantations in representative parts of the State were selected as centers for carrying out the survey. The number of persons examined was 8,751, and 58.9 per cent were found to be infected. Four of every five persons harbored either hookworm or another type of intestinal parasite.

Relationship of Soil to Percentage of Infection. The character of soil in different regions was found to have an important bearing on the percentage of hookworm infection: the less sandy and absorbent the soil, the lower was the rate of infection recorded. In three towns built on compact red clay, the average percentage of infection was only 43.7, as compared with an average of 63.8 per cent for four towns built on slightly sandy soil, and of 75.0 for two coffee plantations where the soil was the most sandy and most porous of all the areas surveyed.

Fig. 30.—Hookworm infection map, State of Sao Paulo, Brazil

Effect of Use of Latrines on Infection Rates. Classification of the persons examined with respect to the latrine accommodations at their homes showed that the highest rate of hookworm infection was among 6,631 persons who stated that they had no latrine accommo-

dation whatsoever. In this group the rate was 62 per cent. Compared with this, the average rate for those who had latrine accommodations, whether good or bad, was 48 per cent. The rate among those who used septic tanks or had sewer connections was only 37 per cent, the lowest recorded for any of the groups.

Inauguration of Comprehensive Program for Control. At the close of the survey, or on March 9, 1918, intensive operations for the control of the disease were begun at Guarulhos, a rural area located near the capital city of Sao Paulo. Meanwhile the Director of the Public Health Service offered, on behalf of the State, to organize and maintain five posts for the control of the disease if the Board would maintain two. A second post was thereupon established at Atibaia on July 9, and the State opened one of its five posts in June, two in August, and two in September. At the close of 1918 seven posts, each with its own staff of physicians, dispensers, and sanitary inspectors, were attacking the disease simultaneously from strategic centers throughout the State. The five posts established by the State were maintained during 1918 at a cost of approximately $60,000.

INFECTION SURVEY BASED ON WORM COUNTS

A new type of infection survey, making worm counts its central feature, was developed by the Board's Uncinariasis Commission to the Orient. This was employed in carrying out the survey of Java in 1916 and has since come into extensive use in Brazil. The customary microscopic examination of fecal specimens is dispensed with, and the counting of worms expelled as the result of treatment by representative groups of persons is substituted.

Methods of Conducting Worm-Count Survey. The patients to be treated are carefully selected from the different localities to be included in the survey. Effort is made at all times to secure groups whose state of health closely approximates the average for their communities. Not less than twenty-five nor more than thirty persons are usually chosen for each locality, adults comprising two-thirds of the group. Different activities and occupations find proportionate representation, and the number of males and females—of boys and girls as well as of men and women—is equalized wherever possible. The subjects to be examined are treated with a vermifuge, and all stools which they pass for three days are retained, washed, and searched for worms. The worms passed by each person are then counted and identified as to species. Treatment is usually repeated at ten-day intervals until three treatments in all have been taken.

Advantages of New Type of Survey. The principal advantage of this method of conducting a survey lies in the fact that it yields

more accurate information as to the severity of the infection than does the ordinary microscopic search for eggs in the feces. It is especially valuable for determining not only the extent but the severity of hookworm infection in different localities, and the effects of occupation, age, etc., upon the number of worms harbored. By thus indicating more accurately the relative severity of the infection in different localities and among different groups, it enables control measures to be undertaken with greater assurance that the disease is being attacked first in those areas where it assumes its most serious aspect.

VI

HOOKWORM CONTROL OPERATIONS

Nothing could be simpler in theory than the few measures necessary for the control of hookworm infection. The cycle of the worm from the moment the egg is deposited on the ground until it has reached the small intestine of its human host and developed to its adult stage, is well understood, as are also the details of its life-story and environment; and there are at least two drugs which are most potent in freeing the human system of the parasites. It should therefore be relatively simple to locate and to cure those who have the disease, to prevent others from contracting it, and thus to bring about, within limited areas at least, its complete eradication.

Complete Control Never Accomplished. Although the problem of complete eradication is simple when stated on paper, it is not so in practice. The Board has been engaged in work against hookworm disease since 1910, similar work was undertaken in Porto Rico in 1904, and the attack on the disease in the mines of Belgium, Holland, and Germany began as early as 1902, yet it is impossible to point to any one mine or area from which the infection has been completely eradicated. In the mines of Germany it was reduced from 16.8 per cent in 1903 to .18 per cent in 1912; in those of the Netherlands, from 25 per cent in 1903 to .32 per cent in 1913; and in those of the Liege district of Belgium, from 22.8 per cent in 1902 to 1.2 per cent in 1913. These are the nearest recorded approaches to complete control.

Difficulty of Completely Eradicating the Infection. Many obstacles stand in the way of complete eradication, even in isolated areas having no immigration and with natural conditions that either limit or preclude intercourse with the outside world. It is seldom possible to examine every individual in an area or to treat until cured all who are found infected; when latrines of a proper type are installed in sufficient numbers to prevent soil pollution, it is still necessary to accustom the people to the use of them—and this is a task that usually requires a long period of education and enlightenment; and even when both the foregoing conditions are fulfilled, there still remains for a time the danger of re-infection from hookworm larvae already in the soil.

RE-INFECTION IN TREATED AREAS

The failure to achieve *complete* control of the infection in any area is probably due in the main to three reasons: first, that in most of the areas of operation effective excrement disposal has not preceded

the curative work by more than ten months; secondly, that there has been an error of greater or less degree in microscopic diagnosis; and, thirdly, that there is at present a lack of data on certain points concerning which definite knowledge is essential for control. In six countries during the period under review, a large number of persons who had previously been treated and presumably cured were re-examined in order to ascertain whether infection was recurring in the areas in which they lived, and if so to what extent.

Low Rate of Re-Infection on Costa Rican Plantations. The lowest re-infection percentage recorded was in Costa Rica, where on Aquiares estate only 4.0 per cent infection was found on re-examination of 223 laborers who had been cured eighteen months earlier. On another estate in this country—Rodeo—a rate of 14.4 per cent was found among 191 persons who had been cured from five to eighteen months earlier. On neither estate was every home provided with a latrine: Aquiares had but half and Rodeo but one fourth its homes provided with this convenience at the close of the curative campaign. The re-infection rates for these estates are in striking contrast to those reported for areas in other countries where similar re-examinations were made.

Re-Infection Rates among Treated Patients in St. Vincent. In St. Vincent three dispensers spent their entire time during the period from May 13 to June 18, 1918, in collecting specimens from persons who had been cured in Calliaqua, Belair, and Sion Hill, the three first areas of this colony in which systematic measures for the control of hookworm infection were completed. The original work in the Calliaqua area ended on September 30, 1915, in Belair on December 31, 1915, and in Sion Hill on April 5, 1916; in each area, therefore, more than two years elapsed between treatment and re-examination. In all, 1,525 of the 2,257 persons treated and reported cured in the original campaigns were re-examined and 67.6 per cent of them were found to be infected. The re-infection rates were 46.9 per cent in the Belair district, 64.8 per cent in Calliaqua, and 68.2 per cent in Sion Hill, being lowest in Belair, where the greatest amount of sanitary work was done.

Re-Examination of Treated Patients in Seychelles, Nicaragua, and Trinidad. In the Seychelles Islands, among 267 persons known to have been cured six months or more previous to re-examination, an infection rate of approximately 30 per cent is reported. Here the homes are now provided with latrines and there is but little evidence of soil pollution. The director for Nicaragua states that at the end of a year there was a re-infection rate of 65 per cent in the town of Nandasmo, where every home had been provided with an approved latrine during the progress of the curative campaign; and the director for Trinidad reports re-infection rates varying from 18 to 84 per cent for certain districts of that colony in which the people were treated more than a year ago. The extent

of re-infection in Trinidad was found to vary with the sanitary condition of the districts. Areas with very poor sanitation invariably had more than 60 per cent re-infection, and those in good sanitary condition had relatively high rates of re-infection if poorly sanitated districts surrounded them. (See Fig. 33, page 157.)

High Re-Infection Rates on Estates in Ceylon. It is from Ceylon, however, that the highest rates of re-infection have been reported. On the thirty-three estates of the Matale area whose laboring force was partially re-examined during 1918, after the lapse of at least a year, the average percentage of re-infection was 88 among a total of approximately 3,000 persons examined. The rate ranged from as low as 45 on one estate to as high as 100 on ten. Nineteen of the estates had re-infection percentages between 91 and 100; six between 81 and 90; three between 71 and 80; and only five less than 70. (See Fig. 31.)

In the Bogawantalawa and Dickoya areas—the two other estate areas completed at practically the same time as Matale—systematic re-examinations have not yet been made on a large number of estates, but the information received from Bogawantalawa shows that on the three estates for which reports have been received, the re-infection rates at the end of twelve months or more were 70, 88, and 100 per cent.

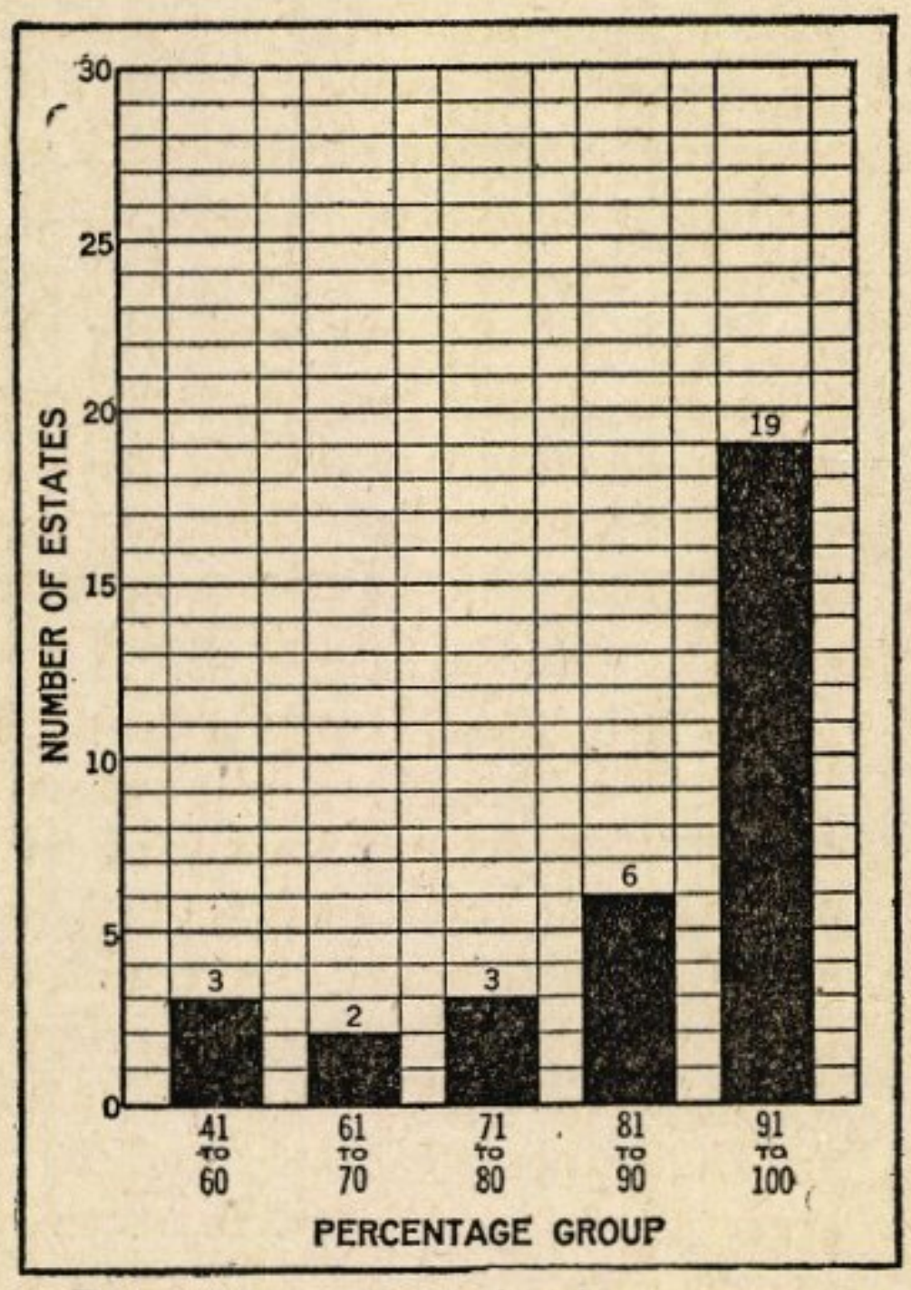

Fig. 31.—Re-infection rates at end of one year or more. Thirty-three treated estates of Matale area, Ceylon. Persons examined, approximately 3,000

Re-Examinations on Ceylon Estates Completed during 1918. A limited number of re-examinations were made in the estate-areas of Ceylon in which operations were terminated during 1918. Three months after completing work on the estates in the Upper Maskeliya area, specimens were re-examined from 348 laborers who had been reported cured, and 13 per cent were found to be infected. On nine estates in the Elpitiya area a proportion of the inhabitants were re-examined from six to eight months after the close of the campaign. Here the infection percentages ranged from 6 to 47, the average being 31. In the Koslanda-Haputale area, among seven estates a number of whose residents were re-examined at the end of four months, the rates ran from 2 to 13, the average being only 7. It should be

pointed out, however, that in the case of all three of the estate areas last mentioned the re-examinations were made too soon after the completion of the original campaign. It is to be expected that other re-examinations which will follow at the end of twelve months or more will establish re-infection percentages more closely approaching those recorded for Matale and Bogawantalawa. (See Fig. 32.)

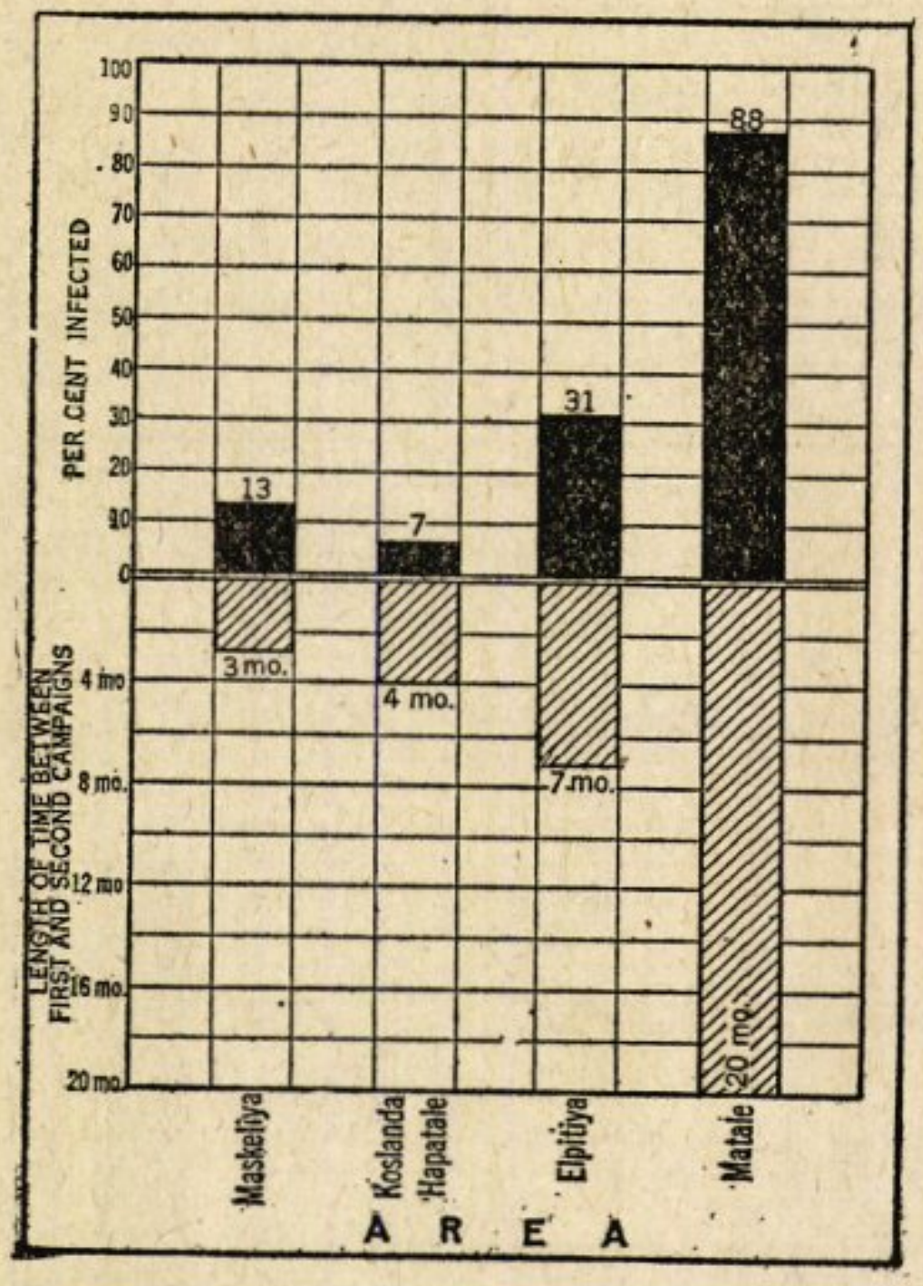

Fig. 32.—Re-infection rates in Ceylon. Relationship between length of time elapsing between treatment and re-examination, and rates of infection recorded

Reduction of Mass Infection First Essential to Control. These high rates of re-infection should not be accepted as indicating that no considerable progress has been made toward bringing the disease under control. It should be remembered that the problem of hookworm control is primarily one of reducing mass infection. The practical phase of the task is concerned with the removal of the largest possible number of worms from the largest possible number of infected persons. Upon this basis the best criterion for judging the effectiveness of a curative campaign in any area is not the percentage of infected persons who are cured or who remain cured, but the proportion, expelled and destroyed, of the total worms harbored by the population.

Factors Determining Percentages of Re-Infection. Even though in certain of the areas mentioned, from 50 to 100 per cent of the persons formerly cured of the disease have since become re-infected, there can be little doubt that as a result of treatment the average number of worms harbored by each infected person has been very materially reduced. Conditions extremely favorable for the prevalence and persistence of the infection exist practically throughout all countries in which the work has been conducted; there is at present lack of definite knowledge as to how long larvae remain infective in the soil; the latrine accommodations provided in many areas have been defective or inadequate, the habits of the people grossly insanitary, and in addition war conditions have interfered seriously with due and effective sanitary supervision and reasonable regimentation. Under these circumstances re-infection was bound to occur in

greater or less degree, but it will unquestionably diminish as effective sanitation is introduced and the curative measures are extended.

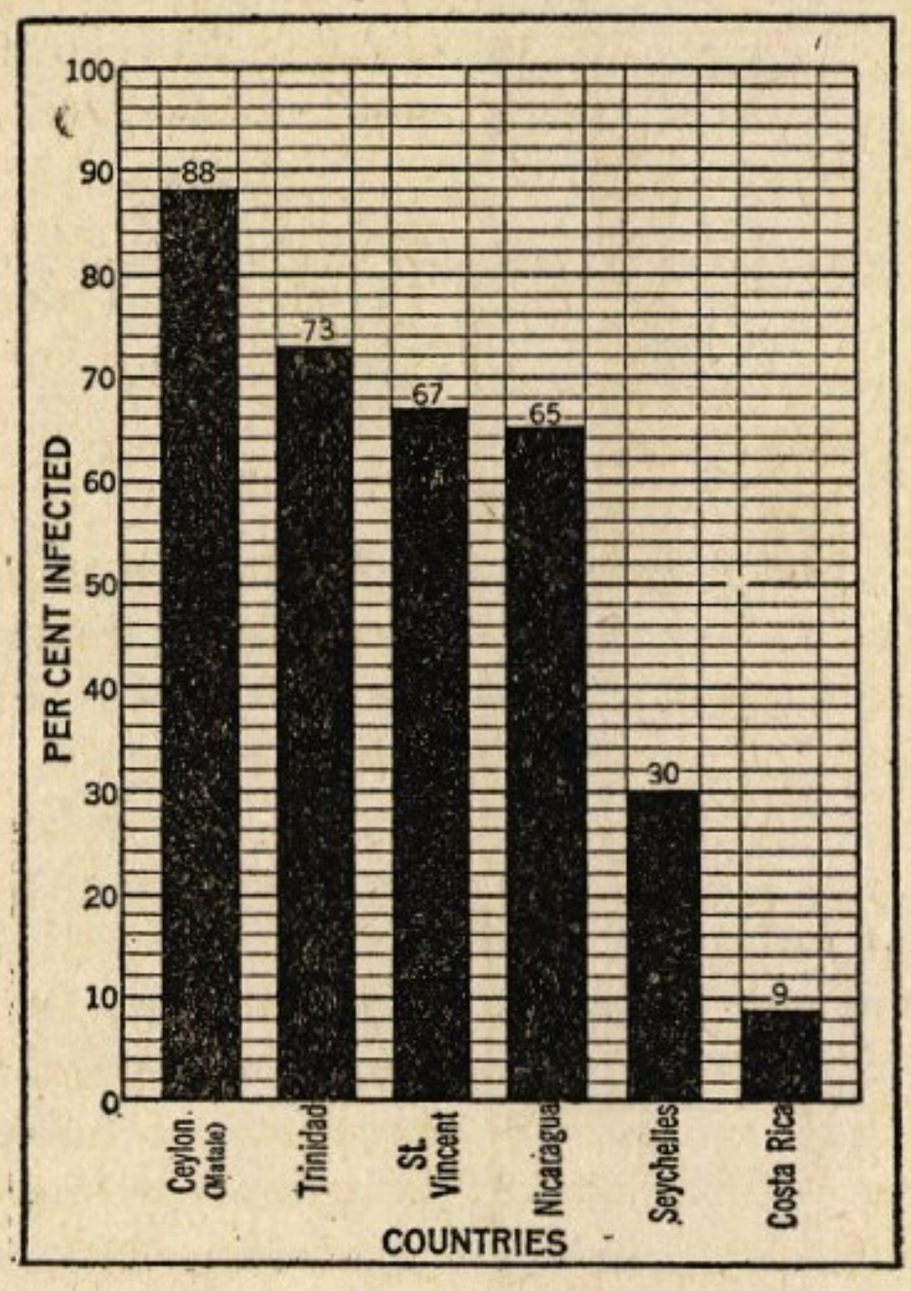

Fig. 33.—Re-infection rates among persons previously treated for hookworm disease, by countries. Interval of twelve or more months between treatment and re-examination

NEED OF SCIENTIFIC KNOWLEDGE ON FACTS ESSENTIAL FOR CONTROL

The fact that after a series of efforts at control in different parts of the globe extending over a period of more than fifteen years it is still impossible to point to any single area from which the disease has been completely eradicated, suggests that perhaps the work is being carried out with a lack of scientific information on certain points concerning which definite knowledge is indispensable if complete control is to be achieved. It is hoped that a series of studies may soon be made which will supply definite experimental proof on the phases of hookworm control which still require further investigation.

Viability of Hookworm Larvae in Soil and Feces. One of the most important factors in need of further study is that relating to the viability of hookworm larvae in soil and feces. In the past it has been commonly supposed that after a period of from six to ten months the soil would become sterile and the disease would gradually die out, but the evidence now at hand seems to indicate that soil once heavily infected—particularly in tropical countries where the

temperature seldom or never drops to the freezing point—must remain infected for a considerable time even after sanitary conditions have been improved. Thus, Kofoid has recently reported that in the soil of California the larvae remained alive for twelve months, and it is probable that in more tropical climates they persist for even longer periods.

a. Life of larvae in garden soil of China. There was opportunity for limited investigation of this question in China during 1918. In this country, much of the soil is under cultivation the year round, assisted by intensive fertilization with human excreta. In the middle of August a plot of land in which no larvae could be demonstrated was fenced off. This plot was then divided into three sections. In (A) the ground was dug up in the manner that is followed in planting a Chinese vegetable garden, and feces that were known to contain hookworm eggs and larvae were mixed with the soil. In (B) infected feces were merely sprinkled over the top. In (C) the ground was left undisturbed and uncontaminated. The plot of ground selected for the experiment was 1000 ft. above sea level and during the period of five months that had elapsed up to December 31, 1918, had been subjected to temperatures, varying from 38° centigrade to 4° centigrade. The soil in the meantime had been directly exposed to the summer sun and to the winter ice and snow.

For the entire five months' period plot (C) gave negative results. On the other hand, until the cold weather set in in December, larvae could always be found in (A) and (B) on the first slide examined. Afterwards it was necessary to pour water on the culture to draw the larvae out, and the last time the test was made three slides had to be prepared before a larva was found. The larvae were always actively motile in (A) and (B) and in December were still present in enormous numbers.

In other experiments conducted during the month of September and again at the end of December, fifteen fields were indiscriminately chosen and samples of soil obtained and cultivated. All were positive for hookworm larvae.

b. Investigation of larvae viability in storage pits. It is customary for Chinese farmers to store excreta in storage pits after purchasing it for use as fertilizer. An investigation was made during 1918 of the probable duration of life of hookworm ova and larvae in these pits. For economical reasons none of the farms visited had feces that had been in storage for more than two and one-half months, despite the fact that the farmers claim that the older the excreta the more valuable it is for fertilizing purposes. On one occasion thirteen pits were visited and on another twelve, and samples of feces were obtained from all. The age of the feces from which the samples were taken ranged from three to seventy-two days. All specimens contained both hookworm and ascaris ova, but larvae were not numerous except on cultivation.

c. Penetration of larvae through sand. Dr. Dershimer investigated this question in connection with his work at the Onderneeming Industrial School in British Guiana. In spite of the fact that pail latrines had been in use in this institution for some time, an unusually high percentage (95.8) of the 142 boys living there were found infected. On investigation it was discovered that the contents of the latrines were buried around lime trees to fertilize them, and that a large proportion of the boys who worked round these trees when the ground was wet subsequently developed ground-itch. A pound or more of sand taken from the surface near the trees was examined microscopically and numerous larvae were discovered. All had worked through two feet or more of sand to gain the surface.

Transmission of Infection by Flies and Dust. Some data from Arkansas and Texas brought together by means of the laboratory car *Metchnikoff*, during the treatment of infected soldiers in the Southern States, suggest that there is a possibility of the infection being transmitted by dust. This subject is worthy of further study. The rôle played by insects, particularly flies, in transmitting the infection, also remains to be thoroughly investigated. The latter problem was studied to a limited extent in China during 1918. On two occasions several hundred flies of the "blue-bottle" species were taken from several native latrines. Those from each latrine were placed in separate bottles and thoroughly washed. The water was then centrifuged and microscopic examinations made. All the specimens gathered from the seven latrines visited on the first occasion showed ascaris and one showed hookworm ova, while those from all five latrines visited on the second occasion again showed ascaris and one showed hookworm ova. The water in which the flies were washed was then cultured by the charcoal method, but no additional hookworm larvae were demonstrated. No explanation can be offered as to why the eggs of one parasite should be found more frequently than those of another, as the percentage of the population infected with both parasites is about the same. The end of the fly season prevented further investigation being made of this interesting subject.

MODIFIED WORKING METHODS TO REDUCE MASS INFECTION

It has long been evident that if treatment is to be extended to the hundreds of millions of East Indians, Egyptians, and Chinese, to say nothing of the dense masses of humanity inhabiting other tropical and subtropical lands, a means must be found of lowering the cost of the work without seriously impairing its efficiency. The great bulk of the people in these lands are agriculturists, and practically one hundred per cent of the adolescents and adults among them are in-

fected. Two means exist of making treatment more readily available for them: (1) preliminary microscopic examination may be omitted in regions of heavy infection, and the time and personnel now engaged in this phase of activity may be utilized for actual curative or preventive work; and (2) since it seems neither necessary nor feasible to attempt the immediate removal of the very last hookworm which these persons harbor, a quickly efficient and reliable method of treatment may be developed which can be administered as a routine, with the expectation that effective sanitation and post-campaign treatment will eliminate whatever light infection remains.

Impracticability of Insisting upon Absolute Cure. To strive for the cure of each infected person often involves a long series of treatments and re-examinations, and besides is in certain other respects an impracticable standard. In present practice by this plan it is not usual for all the worms to be expelled. Instead, they are reduced to a minimum. When microscopic examination aided by the centrifuge is the method of diagnosis employed, there is a material error in first examinations as well as in re-examinations after treatment has been taken,—an error which may be conservatively estimated as exceeding 15 per cent. Thus there is considerable unreliability in the very standard upon which cure is based. Then, too, infected cases not detected by the present method of diagnosis not only are given no opportunity to receive treatment for hookworm or for other parasites, but these, as well as the cases inaccurately pronounced cured after treatment, are given the impression they are free and as a result they continue to spread the disease. There are also large numbers of persons who cannot be cured because of refusal or for medical or other reasons. This group commonly represents about 20 per cent of those infected. While striving for cures in four-fifths of the infected population, this group escapes and continues to seed its environment.

Mass Treatment Without Preliminary Diagnosis by Microscope. After all, it is not the few worms left after treatment, but the average of 150 or more worms harbored by the great mass of infected and untreated humanity in tropical and subtropical lands, that is the important factor in hookworm control. Communities in which the adults have an average of fifty or less worms obviously do not require treatment so urgently as more heavily infected localities. Where there is a high rate of infection and the average number of worms per person exceeds fifty, it would seem that the people might be treated *en masse* without preliminary microscopic examination, every person in the group except the very young and very old receiving treatment. Even though in a few instances more than 10 per cent of the worms remained after routine treatment, this would be offset by the error in microscopic diagnosis under the present plan of work. Therefore, though the modified plan when considered

Fig. 34.—Staff for the relief and control of hookworm disease in State of Rio de Janeiro, Brazil. (Unit No. 1)

Fig. 35.—Hookworm cavalry in State of Rio de Janeiro, Brazil. Director, sanitary inspector, and nurses ready to attack strongholds of the disease

theoretically may seem to lack a certain degree of thoroughness, in actual operations by this plan it would seem that but little thoroughness should be lost.

Experimental Plan of Control for Ceylon Estates. Ceylon was the first country in which the modified intensive plan of control was attempted. More than 99 per cent of the Tamil laboring population of this country is infected with hookworm disease. Preliminary fecal examination was therefore omitted for all except ten or twenty per cent of the laborers on each estate. If the specimens obtained showed over 80 per cent infection, the whole labor force, except persons less than a year old, those physically unfit for treatment, and pregnant women beyond the third month, were given one or two medium doses of chenopodium with an interval of one week between.[1] All were examined clinically to see if they were fit to take treatment and also to impress them. Ten days after the first or second treatment, fecal specimens were obtained from all those who had been treated, and as a rule it was found that about 70 per cent of those who had had two treatments had been cured.

Modification of Intensive Plan Tentatively Adopted for Brazil. In Brazil, too, the enormous extent, high rate of infection, and sparseness of the population in many regions, have led to a similar effort to accelerate the rate of treatment by conservative modification of the plan originally followed. In certain of the posts in this country it is now customary to take a census of every individual and to examine all once, and once only, microscopically. Every individual found infected with hookworm disease is treated twice with oil of chenopodium, with an interval of ten days between treatments. Individuals with hemoglobin below 50 per cent are treated three times without additional microscopic examination, unless malaria is a controlling factor in the anemia. In addition, all persons suffering from any form of intestinal helminthiasis whatever are treated once, as well as *all* the members of any family which contains even one infected individual. It is believed that this plan of work will succeed in reaching all infected individuals and succeed in eliminating from them at least 95 per cent of the intestinal parasites they harbor. If at the same time the construction of latrines at all the homes is secured, the community will be permanently protected and the remaining worms will probably disappear. Summed up in few words the system means: a latrine at every house, education sufficient to assure its proper use, and every infected individual treated at least twice.

Study of Relative Efficiency of Regular and Modified Intensive Plans. The Board is not yet prepared to commit itself definitely to the new plan of work. Before doing this it will have to test experi-

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[1] For discussion of the efficiency of standard chenopodium treatment, see pages 140 to 143.

ence under a wide variety of conditions and in a number of different fields. An initial step in this direction is under way in the State of Sao Paulo. In one of the two posts which the Board is maintaining in this State, the standard has been set of treating every infected individual to a cure. In the other, every infected individual is being given one miscroscopic examination and two treatments of chenopodium. The conditions of race, infection, and laboratory efficiency are practically the same for both posts. All details of the work are to be closely observed. Worm counts will be used as a means of checking the findings and of verifying the conclusions reached.

POST-CAMPAIGN MEASURES ON CEYLON ESTATES

Arrangements by which post-campaign measures will be conducted on all estates on which the regular work of treatment has been completed, were made with the Government and planters of Ceylon during 1917. It is planned to have these measures continue for a period of eighteen months following the close of the initial demonstration in the different estate areas. They will be under the supervision of Government medical officers, assisted by microscopist-dispensers trained in regular campaign work. At the end of the eighteen months' period of organized post-campaign measures, the estate dispensers will be expected to handle the situation, which will consist mainly of the treatment of small groups of new laborers coming to the estates from time to time.

Extent of Post-Campaign Work to End of 1918. In January, 1918, post-campaign measures were begun on the estates in the Matale area, where the original treatment campaign had been completed during 1917. More than 3,000 laborers received post-campaign treatment up to the end of the year. It was hoped that thoroughgoing post-campaign measures might also be carried out in the Bogawantalawa and Dickoya areas, as the demonstration campaigns there had also been concluded during 1917, but in these areas the work had scarcely begun when it had to be interrupted and later suspended because of the influenza epidemic.

Methods Followed in Post-Campaign Work During 1918. In carrying out the post-campaign work in Ceylon, the plan followed during 1918 was to take a complete census of each estate and to distribute tins to at least fifty coolies taken indiscriminately from men, women, and children who had been treated in the original demonstration campaign. This served to indicate roughly what percentage of re-infection had occurred. The medical officer clinically examined every person and prescribed for those who were to be treated. Two treatments, separated by an interval of ten days, were administered, and the staff vacated the estate.

Proposed Modification of Post-Campaign Methods for 1919. During 1919 it is proposed to modify the plan in the case of those estates on which the post-campaign medical officer, after careful survey of the latrines and of a zone within a radius of seventy-five yards around each of the lines or groups of lines, finds that the latrines are in general use and are being properly kept, and that the zones around the lines are free, and are being kept free, from visible soil pollution. On such estates a third treatment is to be given to all found to be still positive on microscopic examination after the second treatment. This will complete the work on such estates if arrangements are made for the treatment of all new coolies immediately upon their arrival. On all other estates, additional treatments, after the first series, are to be deferred until eighteen months after the close of the original demonstration campaign, by which time specific soil pollution should be controlled.

VII

SOIL SANITATION AS A MEANS OF CONTROL

The crux of the hookworm problem lies largely in the contamination of the hands and feet of the people with fecal matter. This occurs mostly under rural conditions. The most important undertaking in all efforts to stamp out the disease is therefore to prevent the deposit of ova-impregnated feces on the surface of the ground. This may be accomplished by securing the provision and use of properly built and adequate latrines to serve as receptacles for the contaminated matter. To assure the installation, maintenance, and use of sufficient and satisfactory latrines is, however, a formidable undertaking. It involves the task of inducing hundreds of millions of people in the infected regions to abandon habits ingrained by centuries of usage and often dictated by the religions to which they adhere, and to accustom themselves to new and in some respects difficult habits, the necessity for which they must in some manner be brought to appreciate.

Defining the Problem by Sanitary Surveys. The original sanitary problem of each area of operations is defined by a house-to-house canvass during which the facilities that exist at each house for safely disposing of human excrement are carefully noted. This initial sanitary inspection is generally carried out in advance of the curative work. During the past year, statistics have been gathered as to the latrine conditions at 95,706 homes in 236 rural or semi-rural areas in various tropical and subtropical lands. Classing as satisfactory any type of latrine that effectually prevents soil pollution and is fly-proof, only 9,381, or 9.8 per cent, of the homes in these areas were reported to have satisfactory accommodations, while 50,749, or 53.0 per cent, had no accommodations whatever when the curative work was undertaken. The situation on first inspection in a number of widely-separated but typical rural localities is instanced below to show the need of thoroughgoing sanitary reform if soil contamination is to be prevented and hookworm disease eventually controlled. The conditions in the areas mentioned are not unusual, but repeat themselves with greater or less fidelity in the different countries in which control measures are being undertaken.

a. Lack of latrines on Sao Paulo plantations. The survey of Sao Paulo completed during 1918 showed that on the coffee plantations of this State the owners' and managers' houses are generally the only ones provided with latrines. As a result the soil around the coffee plants is infected with larvae and the workers constantly re-infect themselves. The soil is porous and is kept moist by the shade of the

coffee trees, and for the greater part of the year the temperature is fairly high. Conditions are therefore ideal for the eggs to hatch and for the larvae to develop.

b. Sanitary situation in selected areas of Southern States. In the entire rural area of Hart County, Georgia, not a single sanitary latrine was found at the time of first inspection. In South Carolina, among 5,703 homes in three counties, 3,334, or 58.5 per cent, were found to be provided with insanitary latrines of the open-back, open-seat variety. An additional 1,518, or 26.6 per cent, were without facilities of any sort for disposing of their excrement. In Texas, only 13.7 per cent of 4,758 homes located in eight counties, had satisfactory conveniences when the work began. Two hundred eighty-five, or 6.0 per cent, had no conveniences at all.

c. Facilities for fecal disposal in Queensland and Trinidad. In the infected regions of Queensland, Australia, the pail system, with burial of the contents, was in general use on first inspection, but the latrines were mostly of the open-back, open-seat variety, inadequate for preventing soil contamination. In the Caroni, Maracas, and Laventille areas of Trinidad, the sanitary conditions were reported to be very bad. In the Caroni area there were a number of heavily-infected villages in which not a single latrine could be found.

Methods Followed in Securing Sanitary Improvement. Practically all the states and countries which are carrying on measures against hookworm disease have adopted one or more types of latrines, and have made provision for a more or less complete system of inspection to assure the erection and use of these latrines in sufficient numbers to guard against soil pollution. The staff engaged in the curative work endeavors through its educational activities to bring all the people to appreciate the necessity of providing themselves with some form of latrine that will permit the safe disposal of excrement, and in each instance recommends the type or types of latrines adopted by the Board of Health of the state or country in which the work is being conducted.

Types of Latrines Recommended. In general, any means of disposal is acceptable if it provides against dissemination of infected material by flies, against pollution of the ground in places accessible to bare feet, and against the contamination of drinking water. There are six main methods that do this: (1) the fly-proof pail latrine, where the ultimate disposal of the night soil is under careful supervision and is satisfactory; (2) the pit latrine, when fly-proof and so located as not to pollute the drinking-water supply; (3) septic tanks properly constructed; (4) sewerage; (5) treatment of the feces with an effective chemical; and (6) incineration plants. There are practical considerations touching upon the relative merits of each of these methods, and in many countries, where the choice lies between two or more forms of disposal, it is only the cheapest that

the people in large numbers can be induced to use. This goes far toward explaining the present popularity of the pit privy, which, though not ideal, has come into use on a large scale mainly because it is inexpensive and requires but little effort to maintain.

INVESTIGATION OF SEWAGE DISPOSAL IN SOUTHERN STATES

The diversity of opinion among public health officials as to the best method of disposing of human excrement in rural communities with limited means, led the National Conference of State and Provincial Health Officers, at its meeting in Washington, D. C., on June 3 and 4, 1918, to urge the Surgeon General of the United States Public Health Service to appoint a special commission to study the subject and make recommendations. Prior to this, in January, 1916, the Board, recognizing that definite information on the subject would be of considerable assistance to local health authorities, had made provision for carrying out, under the direction of the Rockefeller Institute for Medical Research, a study of the types of latrines commonly used for disposing of feces in unsewered localities. It was hoped that from the facts brought to light it would be possible to evolve a method, or various methods, of disposal that would be safe and practicable under prevailing conditions.

Method of Approaching the Problem. The work was placed in charge of Dr. I. J. Kligler, of the Rockefeller Institute, whose studies, conducted over a period of two years, have sought to test experience under a variety of conditions. The problem was approached from both the field and experimental points of view. In the laboratory, repeated tests were made to determine the viability of typhoid and dysentery bacilli in soil and in excrement under different conditions, their ability to penetrate columns of soil of different degrees of porosity, their viability in septic fluids and effluents, and the nature of the antagonistic factors in soil and in septic material which influence their viability. In the field work, particular attention was paid to the extent of pollution of the soil surrounding privies and the relationship that privies bear to the pollution of wells. The pit and the septic tank were the types of privies mainly studied, though other varieties, including the pail privy and the chemical toilet, came in for a limited share of attention.

Method of Conducting Studies in the Field. The studies of the septic tank centered on field investigations of thirty Kentucky sanitary privies, which had been in use for periods ranging from four months to three years. The L. R. S. type was investigated only in the laboratory. Practically all the Kentucky privies examined were of the rural type.

The pit privy was tested in five widely separated communities in the State of South Carolina. These communities presented practically all soil formations common to that State. The soil in the first was hard, red clay; in the second and third, sand-clay; in the fourth, sand on a sandstone bed, with a water-table eight to ten feet below the surface; in the fifth, sand and sand-clay. The privies, more than fifty in number, had been used from one to three years, and were studied during both the dry and rainy seasons.

In investigating the pit privy, specimens of soil were taken at different depths and at different distances from the pit, to learn the source and direction of any seepage that might be occurring. The effluent from septic tanks was also collected and examined, the soil samples being taken in the same manner as for pit privies.

Results of the Investigations. The main findings of the survey, subject to confirmation by more extended investigations, are: (1) that typhoid and dysentery bacilli succumb rapidly upon being exposed to unnatural environment, consisting either of the effluent from septic tanks, of solid feces, or of soil; (2) that the spread of pollution from a focal point is limited in scope; and (3) that pollution of the wells, when it occurs, is usually derived from the surface. The experiments indicated that the vertical distance between the source of pollution and the ground water level, as well as the character of the soil, are the important factors for consideration in choosing the method to be employed in disposing of sewage. The horizontal distance between the polluted area and the well was found to be of relatively slight importance except where there are underground channels or cracks in the soil.

In moderately compact clay, sand clay, or sandy soil, free from cracks, the possibility of subsoil pollution of the ground water from pits and septic tanks seems to be negligible if a vertical distance of at least ten feet is allowed between the fecal deposits and the ground water level. The pit privy is not considered safe in limestone regions or in soil where the ground water level is near the surface. For such localities the Kentucky sanitary privy or a privy of similar design, with sufficient storage capacity to allow time for the destruction of pathogenic bacilli, and with the drain placed from three to five feet above the ground water level, is thought to be best.

Need of Additional Inquiry to Establish Preliminary Deductions. It is recognized that these experiments and tests are only preliminary in character and that they have not yet been carried far enough for definite conclusions to be drawn from them. Conditions growing out of the war made it necessary to await favorable opportunity for a more extended study of the problem. The further study to be undertaken should include, among other subjects, a thorough investigation of the viability of the eggs of intestinal parasites.

SOIL SANITATION IN ADVANCE OF TREATMENT

There is a growing tendency for governments to arrange for the proper disposal of excrement in advance of the examination and treatment of the people. Ceylon led the way in this movement. Government regulations enacted in that colony during 1916 required all estates to erect adequate latrines for their laborers before the expiration of one year. As a result, the new estate areas undertaken during 1917 and 1918 were provided with latrine accommodations before the curative work was inaugurated. This situation will hold true with respect to all other estate areas that are selected for work in this colony. A similar movement is reported from Brazil, Queensland, the Seychelles Islands, China, Siam, Nicaragua, Salvador, and British Guiana, and the agreements entered into with Jamaica and Barbados, where measures against hookworm disease are shortly to be inaugurated, specify that effective sanitation shall precede examination and treatment by at least six months. The Australian authorities also are reported to be favorably disposed toward making the installation and use of latrines a prerequisite to the opening of work for hookworm control on the estates of Papua.

Advance Sanitation in Brazil and Seychelles Islands. In Brazil, the State of Parana has already undertaken active sanitary operations in anticipation of the opening of curative work, and reports a beginning through the installation of latrines in the town of Jaguariahyva. Other states of that country are expected to adopt a similar program. Similarly, in China, no new miners have been examined at the Pinghsiang Colliery since August, 1918, unless the areas they worked in were provided with adequate latrines. In the Seychelles Islands, careful sanitary inspection of about half the area in which curative work remains to be carried out was made during 1918. This revealed that an excellent start toward eradicating the disease had been made through the installation of latrine accommodations for all the residents. Though soil pollution has not been entirely stopped, it has been greatly reduced, and there is every indication that in this area a situation has been brought about that will permit the fullest realization being made of the benefits of the curative work.

LEGAL ASSISTANCE IN LATRINE PROVISION

During 1918 the States of Sao Paulo, Minas Geraes, Parana, and Bahia, in Brazil, adopted and put into execution rural sanitary codes which make obligatory the provision of latrine accommodations at every home within their jurisdictions. The State of Rio de Janeiro, of the same country, had already adopted such a law in 1917.

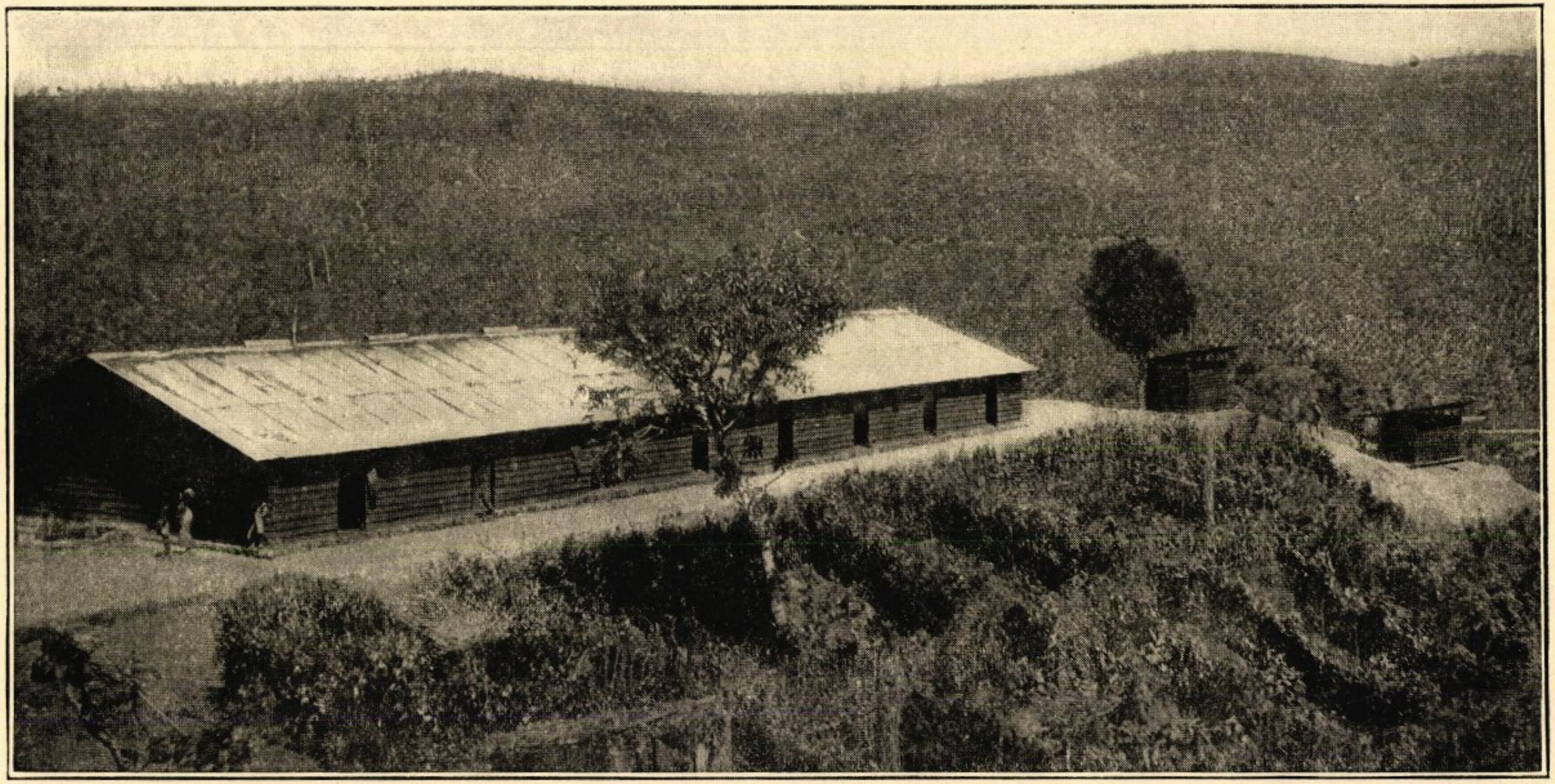

Fig. 36.—Ceylon tea estate, showing laborers' quarters in good condition Latrines appear at right of photograph

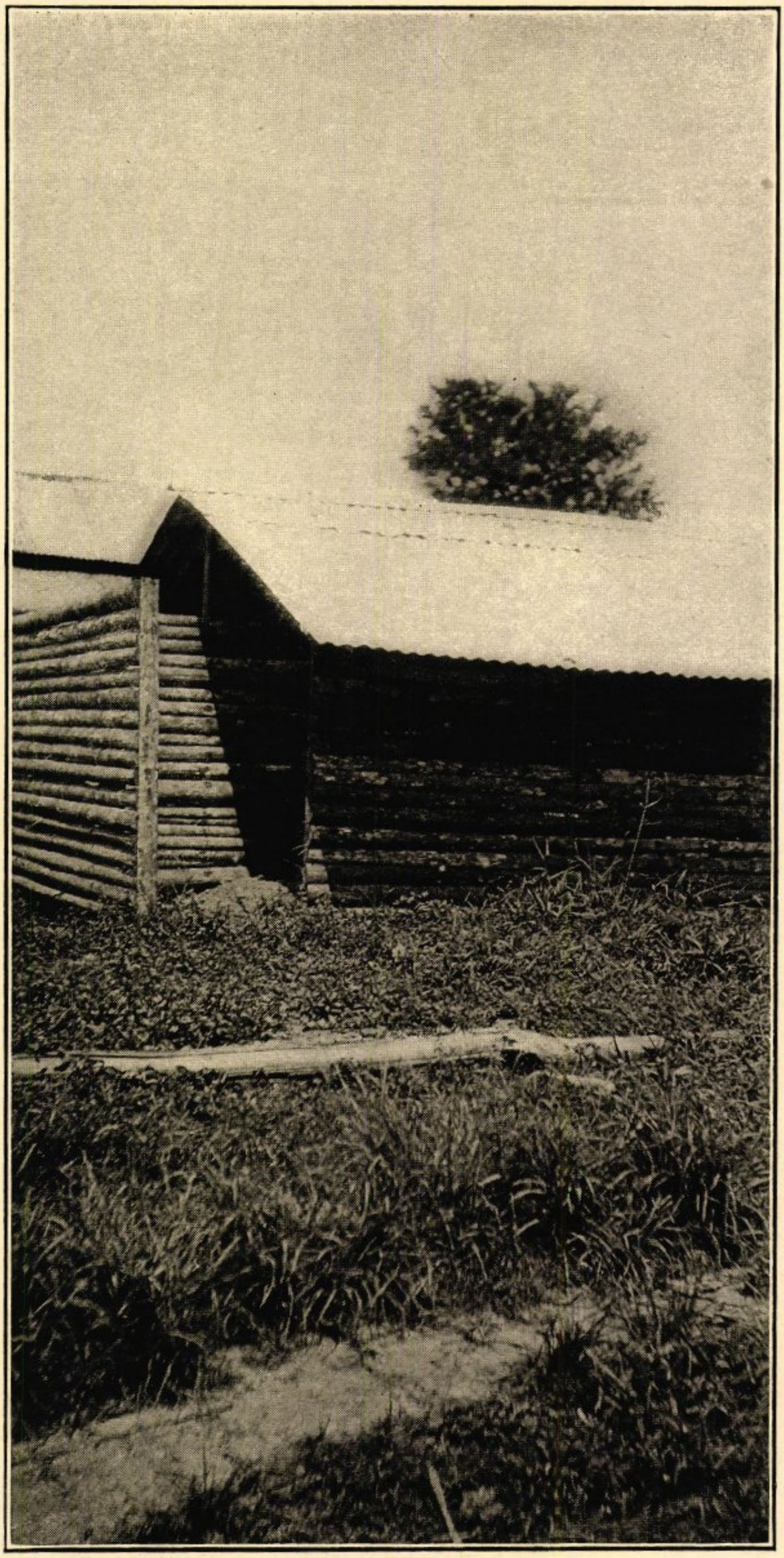

Fig. 37.—Pit latrine for use of forty laborers.
Plantation, Dutch Guiana

Shortly after the close of 1918, the General Assembly of North Carolina adopted a similar state-wide law, and numerous towns and counties in other Southern States have adopted ordinances requiring latrines at all homes within their incorporated limits.

Latrine Ordinances Enacted in Queensland. The health act of Queensland, Australia, clothes the local authorities of each shire or township with full authority for securing effective excrement disposal. During 1918 an ordinance for enforcing the improvement of all latrines was adopted by Cooktown, Port-Douglass-Mossman, Cairns, and Cairns Shire,—all embraced within the territory in which measures against hookworm disease were being carried out. These ordinances gave the owners a limited time for making repairs, and provided that after the expiration of that period the alterations would be made by the local authorities at the expense of the owners.

ESTATE SANITATION IN CEYLON

Before the opening of work against hookworm disease in Ceylon, few estates had latrine accommodations for their labor, and the houses in the villages were seldom equipped with sanitary conveniences. Now practically all estates have adequate latrines. This means that since the work was undertaken in January, 1916, approximately 50,000 latrine compartments, sufficient to provide accommodations to 700,000 persons, have been installed. Now the great problem is to bring about the use of the latrines that have been built.

Difficulty of Enforcing Use of Latrines on Estates. On all the estates the latrines are used to greater or less extent, but there is still considerable evidence that the soil is being polluted. This commonly occurs about laborers' quarters and along bridle paths. The efforts to improve sanitary conditions being made by the estate superintendents will require time to yield results, as the laborers are indifferent about using latrines. Nevertheless it is encouraging to report that the number who do use them is steadily increasing.

Adequate System of Latrine Inspection Needed for Estate Areas. The definitive recognition of soil pollution as an offense punishable by law, and the establishment of a regular system of inspection, may be required to guarantee that the estate latrines are properly used. The Senior Sanitary Officer now has a competent body of trained sanitary inspectors, but their activities are confined in the main to sanitary board areas and to special districts where conditions are very unsatisfactory. The extension of this work to reach all of Ceylon is to be the next step.

VILLAGE SANITATION IN CEYLON

Much of the infection and re-infection on estate areas is probably acquired in the villages and bazaars included within the boundaries of these areas or situated closely adjacent to them. Until recently no latrines had been erected in these localities, but the Government, recognizing the futility of treating and curing the estate laborers only to have them re-acquire the infection on their visits to the villages or to the largely-patronized bazaars, has lately issued orders to the village headmen and other authorities to have latrines constructed for village and bazaar communities. In the Matale area the sanitary department has had from two to four qualified inspectors at work for more than two years, extending the latrine and privy system throughout the villages. Nearly 2,500 village latrines were erected in this area during 1917, and, although no figures for final results are yet available, the work went steadily forward during 1918. In the village communities in or near other estate areas in which treatment campaigns were conducted up to December 31, 1918, many additional latrines have been installed, but the absence of an adequate system of inspection has sometimes resulted in these latrines being of an inferior type.

Installation of Latrines in Southern and Western Provinces. It is estimated that in villages located in other parts of the colony, between 40,000 and 50,000 latrines have been built since the beginning of 1916, nearly all of them by the villagers themselves. Of these, 480 were installed in 1916 and 25,215 in 1917. Exact figures for 1918 are not yet available. In the rural parts of Weligama-Korale, in the Southern province, with a population of about 200,000, privies to the number of 21,419 have been erected during the past eighteen months or two years, more than 19,000 of them during the past seven months. These are sufficient to provide accommodations to at least 100,000 persons.[1] The villagers built all of these latrines without prosecution and are using them without reluctance. By special tax and with a Government grant and loan, 40,000 rupees will be available for the erection of latrines in two towns of this province—Matara and Weligama—during the coming year. Extensive sanitary improvements have also been made at Minuwagonda and surrounding villages in Western Province. Here the whole township, with a population of about 9,000, and the villages within a two-mile radius, having a combined population of 3,000 or 4,000, have been provided with sufficient latrines. Sanitary surveillance is to be maintained by qualified inspectors, who will also carry on educational work, including lantern talks, on health subjects.

Latrine Building as Means of Interesting Villagers in Hookworm Relief Measures. Paradoxically, the installation and use

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[1] These figures take no account of local board or sanitary board activities.

of latrines affords the best entering wedge for work among the Singhalese villagers who form the permanent population of Ceylon. Lantern talks by native dispensers gain the sympathy and interest of the villagers, lead to extensive privy building, and later to a request for the establishment of dispensaries to extend to the villagers the opportunity of being treated. If treatment is held out to them as a preliminary first step, they refuse; but after they have been brought to install latrines in large numbers and to realize the benefits attending their use, effective curative work may readily be conducted among them.

SANITATION IN THE MINES OF CHINA

In December, 1917, a demonstration in the control of hookworm disease was undertaken in a large mine in China. An infection survey of the Pinghsiang colliery and the immediate mining community, in Kiangsi Province, was the first step in carrying out this demonstration. As a result of conditions revealed by the survey, the mining corporation set aside $20,000 (Mexican) to be expended in sanitating its mines, and on April 6, 1918, the systematic examination and treatment of the employes was begun.

Organization of Permanent Sanitary Department. Part of the $20,000 appropriated by the mining corporation will be used to establish a permanent sanitary department. This department will take over the work against hookworm disease as soon as the initial demonstration has been completed. A well-trained Chinese sanitary engineer is to be appointed to direct the new department. The company has three assistants also attending the office regularly to learn all details of the campaign, and has employed a special attendant to look after latrines.

Provision of Sanitary Conveniences. Before the demonstration measures are completed, there will be sufficient sanitary toilets, both above and below ground, to provide accommodations for all surface and underground workers. In the mines the pail system of latrine, with careful inspection and frequent emptying of the contents of the pails, is being employed. On the surface the open latrines previously used at the four boarding-houses where the company's employes live, have been filled in and replaced by new latrines of the pit type, each costing between $800 and $1,000 (Mexican), and other smaller latrines are under construction where needed. The large latrines at the boarding-houses will provide accommodations for approximately 2,000 persons.

Installation of Pits for Storage of Feces. Eleven pits have been erected in the company's vegetable gardens, where it is proposed to store feces for such time as may be required to render them innocuous. In China the commercial value and wide-spread use of

feces for fertilizing purposes complicates the problem of hookworm control and makes it especially difficult to prevent soil contamination. The eleven pits in the vegetable gardens will provide opportunity for studying the viability of hookworm ova and larvae in feces and for determining whether storage for a sufficient length of time to kill the eggs and embryos will lower or destroy the commercial value of the feces. The Chinese farmers have a maxim that the older the feces the greater its potential fertilizing value, and it may be that this precept, coupled with facilities for storage, will provide the solution of the problem.

Control Regulations as Part of Future Mining Concessions. The sanitation of working conditions and the examination and treatment of applicants before employment, are fundamental factors in permanently ridding the mines of China of their hookworm infection. If the Government should decide to insert in all future mining concessions granted by its central and provincial mining bureaus, a clause requiring proper sanitation and provision for the treatment and cure of infected employes before the mines are opened, such provision would go a long way toward the eventual control of the disease. One of the objects of the work at Pinghsiang is to demonstrate the need for such action.

SOIL SANITATION IN BRAZIL

The campaign on Governor's Island, in Brazil, resulted in providing latrine accommodations for more than 7,000 people. The co-operation of the Federal Health Service was all that could be desired. Of 1,140 homes, 911, or 80 per cent, were without any kind of latrines on first inspection, and only 206, or 18 per cent, had acceptable latrines. On last inspection 99.4 per cent of the houses had latrines either already erected or in course of construction. This means that every house in the area except seven belonging to public departments—on which notices to install latrines could not legally be served—were either provided with latrines or had them under construction. Steps are already under way to secure the erection of latrines at the seven public buildings. A sanitary inspector appointed and paid by Government will remain permanently in this area to superintend completion of the work, and to see that the provisions of the sanitary code for the Federal District are properly observed in future.

Erection and Use of Latrines in Rio Bonito. There was also considerable sanitary improvement during the year in the typical rural community of Rio Bonito, located in the State of Rio de Janeiro. In the town proper there are 2,500 inhabitants. Here, at the close of the year, two-chamber septic tanks with subsoil effluents had either been installed or were under construction at

practically all the homes. On the larger farms the proprietors had built pit latrines, and similar latrines had also been installed at a large number of private homes throughout the remainder of the rural area. All this was accomplished without recourse to legal process and entirely at the expense of the proprietors. In this area, however, there are many temporary habitations which will make it impossible to report the erection of latrines at 100 per cent of the homes.

PROVISION OF CARPENTERS TO BUILD LATRINES

Initial inspection in the North Queensland district of Australia showed that 96 per cent of the 3,023 homes were provided with unsafe latrines, or with no latrines at all. Corps of carpenters were employed to undertake the task of systematically remodeling all the latrines in the area. For this purpose an initial expenditure of approximately $7,500 has been made by the householders. A second inspection of the same premises several months later showed 1,310, or 45.0 per cent, of the latrines to be safe. Alterations were in progress on all the others. In addition, several towns have let contracts for incinerators for night soil disposal, to cost approximately $5,000 each.

INSTALLATION OF LATRINES IN THE SEYCHELLES

A recent survey of Mahe, Praslin, and LaDigue, the three largest islands of the Seychelles group, indicated that excellent progress was being made toward the provision of latrine accommodations for all the homes. Of 513 homes located on the island of Praslin, 481, or 93.8 per cent, had unusually well-constructed latrines, and all thirty-two of the houses recorded as not having latrines really had latrine accommodation. Many of the houses are so close together that it is unnecessary for each to have a separate latrine.

Sanitation of the Soil in Advance of Treatment. On Praslin and LaDigue, where curative work had not been attempted up to the close of the year, 98 per cent of the homes had good pit latrines. The majority of these were built as a result of Government regulations enacted in 1917, requiring latrine accommodations at all the homes. Thus, practically complete sanitation has been provided on these Islands in *advance of the treatment campaign*. Furthermore, the Government of Mauritius has recently given $32,400 to the Seychelles Government, and the Governor has sanctioned the use of as much of this as may be necessary for the installation of public latrines at the most convenient locations throughout the Seychelles.

LATRINE BUILDING IN SIAMESE VILLAGES

In Siam, up to December 31, 1918, three liquefaction tanks and 224 protected pit latrines had been installed in the city of Chiengmai, and 977 pit latrines in neighboring villages. These figures include only the latrines that were inspected and found satisfactory; they take no account of large numbers of additional latrines erected in localities so remote from the regular headquarters of the work that it was not possible to arrange for their inspection.

Outlook for Advance Sanitation in Siam. The rivalry between the Siamese villages to secure the benefits of examination and treatment for hookworm disease sometimes makes it possible to insist, as a prerequisite, that adequate latrine accommodation shall be provided before curative measures are undertaken. The Viceroy and the Commissioner of Chiengmai called in July a conference of mayors of the entire province to discuss the question of sanitation. This led the mayor of Muang Prao to order latrines installed at every home within this village, and the mayor of Payang to issue a similar order to the householders of an entire township. Much progress has been made in preparing the way for these sanitary laws by the work of education.

SANITARY ADVANCE IN WEST INDIAN COLONIES

In the West Indies the Government of Dutch Guiana has enacted a code of sanitary laws, is organizing a sanitary force with clearly defined authority to control soil pollution, and has proceeded with its sanitary program during the period that the curative work has been in suspension. The Government of Grenada is making satisfactory progress in having a uniform type of latrine installed in rural areas. Jamaica is organizing a sanitary department and arranging to carry out advance sanitation in the areas where the people are to be examined and treated. The Governor of Trinidad has appointed the Board's director an honorary member of the Central Board of Health of the Island, and has also assigned to the Department of Ancylostomiasis an unusually competent inspector who will carry out advance sanitation in the areas where work is to be undertaken. A committee of the Central Board of Health is making a study of the most satisfactory types of latrines for use in rural and semi-urban districts, and this committee will make a special report on the subject to the Island government. In the Santa Cruz area of this Island practically all the homes have been provided with latrines, and the majority of the people have formed the habit of using them. The sanitary campaign started before the curative work was under way, and continued actively and efficiently as long as the area was under treatment.

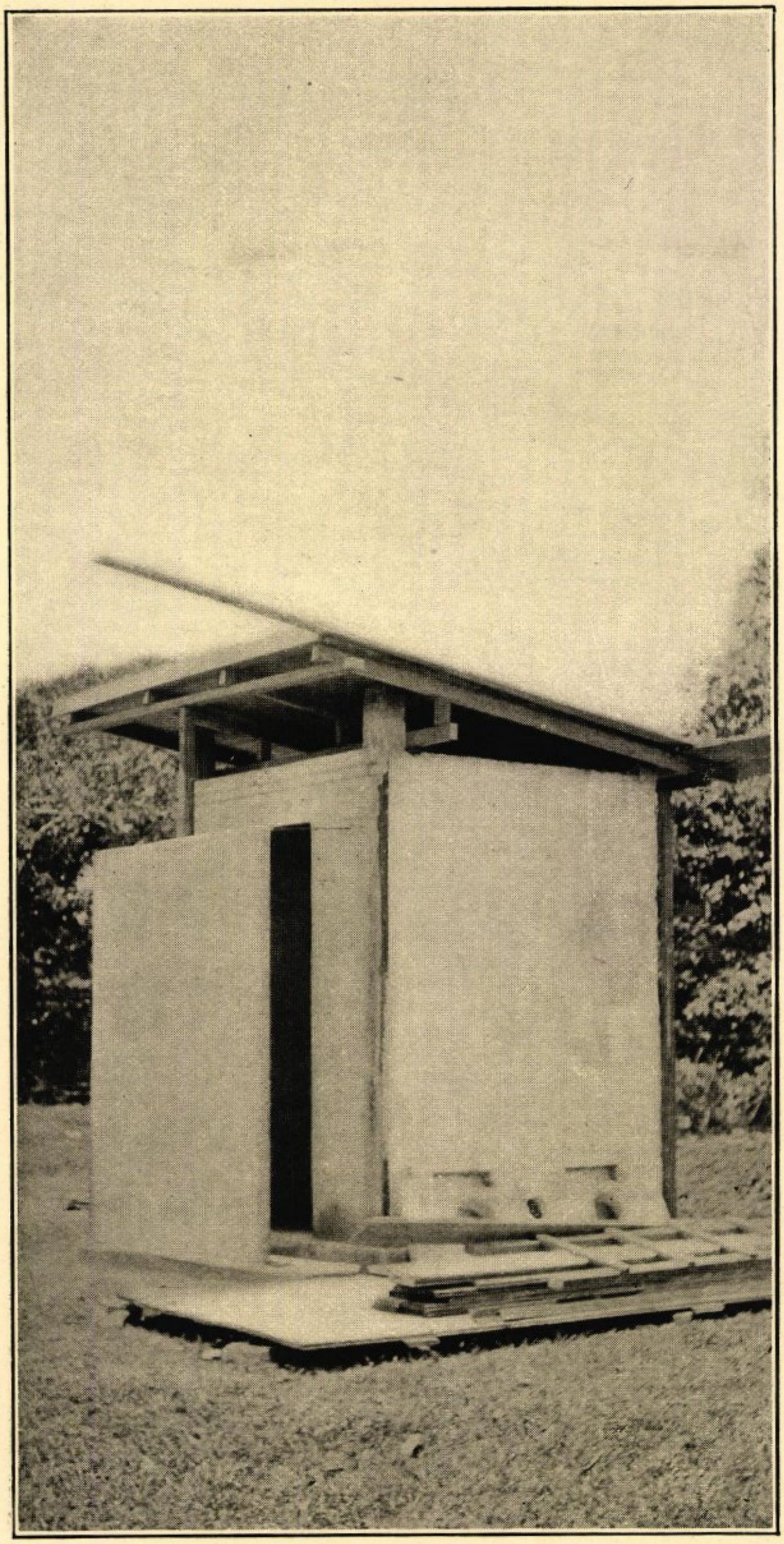

Fig. 38.—New concrete latrine for public use.
Panama

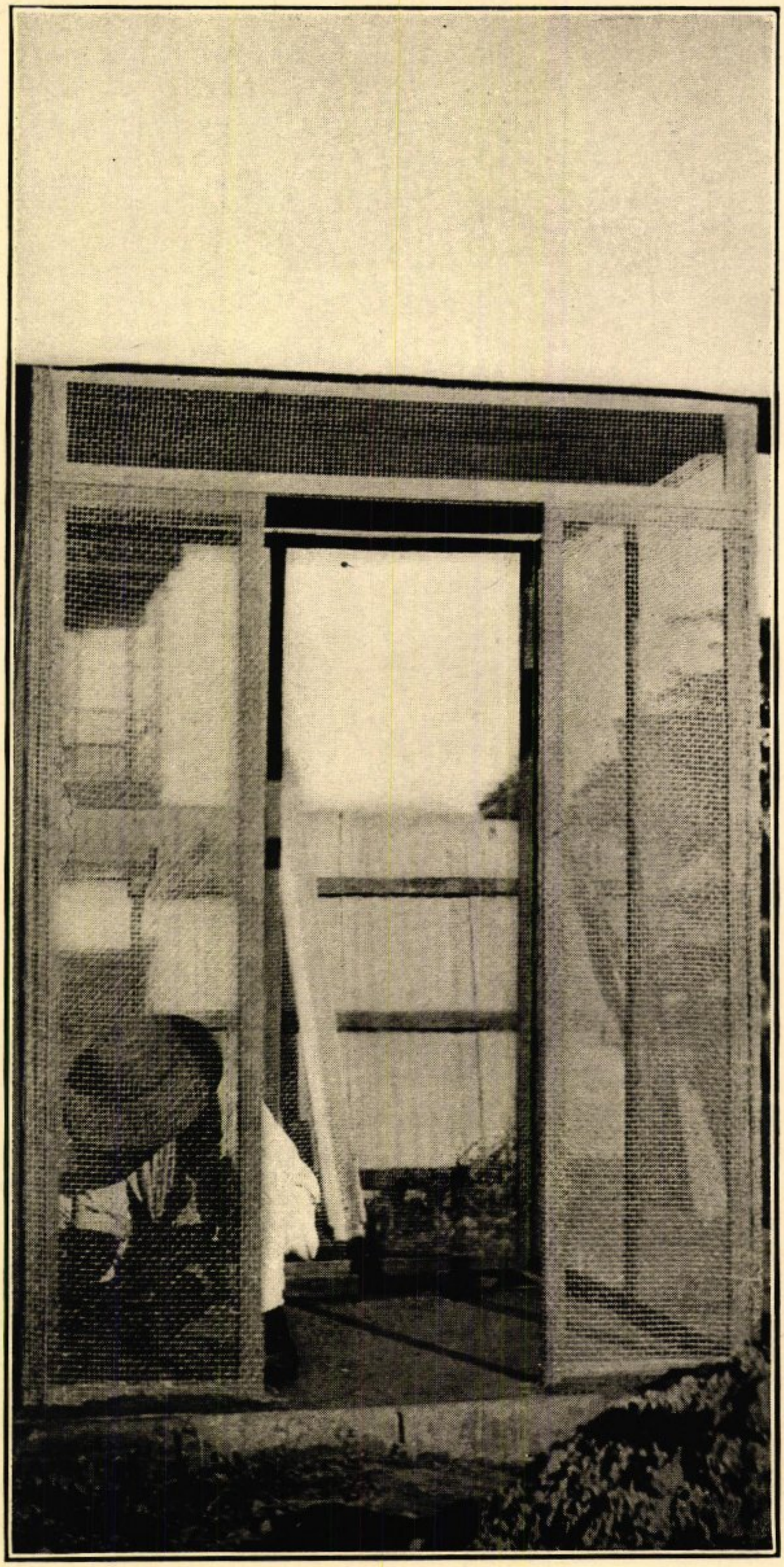

Fig. 39.—Placing frames with wire mesh in new type of concrete latrine. Panama

LATRINE BUILDING IN CENTRAL AMERICA

In Central America, exceptional difficulties stand in the way of all privy work undertaken. Most of the people are so poor that they find it difficult to sustain existence, and the construction of latrines, when required by Government ordinance, imposes upon them a financial hardship that in many cases cannot be borne. Of the five Central American republics in which work has been conducted, Nicaragua, Costa Rica, and to a lesser extent Guatemala, are the only ones that have been able to report substantial accomplishments in sanitary improvement. In Costa Rica, latrines were erected or improved at 5,134 homes during 1918. In the same country the number of public schools provided with sanitary latrines was increased from ninety-five in 1915 to 132 in 1917. In a few instances in Nicaragua, too, thoroughgoing sanitary reform has accompanied the curative work. On the coffee plantations of Guatemala, latrines sufficient to provide accommodations for more than 80 per cent of the laboring population were installed, but it is doubtful if all these are regularly used. The Indian laborers are not accustomed to the sitting posture and are inclined to revert to their primitive habit of fouling the ground. The plantation owners, too, after going to the expense of erecting latrines, frequently do not bring about their use.

Sanitary Progress Through Educational Efforts. In Salvador a few latrines have been installed as a result of urging by staff members and decrees issued by mayors, and the Government has recently provided a corps of mounted sanitary police to assist in the campaign for improved sanitation. In general, however, the situation with respect to sanitation has been unsatisfactory. In Panama there are no laws requiring latrines, the officials sometimes appear to be indifferent, and the people are prejudiced against latrines. Effort here has centered on the construction of at least two concrete latrines of the pit type at each school in the Republic, and of similar public latrines in localities where they will serve the largest number of persons. For this purpose the Panamanian Government has set aside the sum of $4,000 and has promised to supply an additional appropriation of like amount during 1919. There can be little doubt that the installation of these public and school latrines, taken with the educational efforts of staff members and the benefits resulting from the curative work, are sowing seed that will bear fruit in the future, though it may be necessary to await the rising generations before the full harvest can be reaped.

SANITATION OF THE SOIL IN SOUTHERN STATES

The outstanding features of the rural health work conducted in the Southern States during 1918 were (1) the demonstration that the

special plan of work being followed in North Carolina yields gratifying results in different fields of county health activity and at the same time makes definite progress toward the prevention of soil contamination throughout whole counties; and (2) the installation in Stone and Harrison counties, Mississippi, of an improved privy at every one of their 2,344 rural homes. Harrison was the first county in the South to achieve this enviable distinction: here the work afforded practical illustration of what can be accomplished in health protection and stood out as one of the prominent movements of the year in both the county and the State.

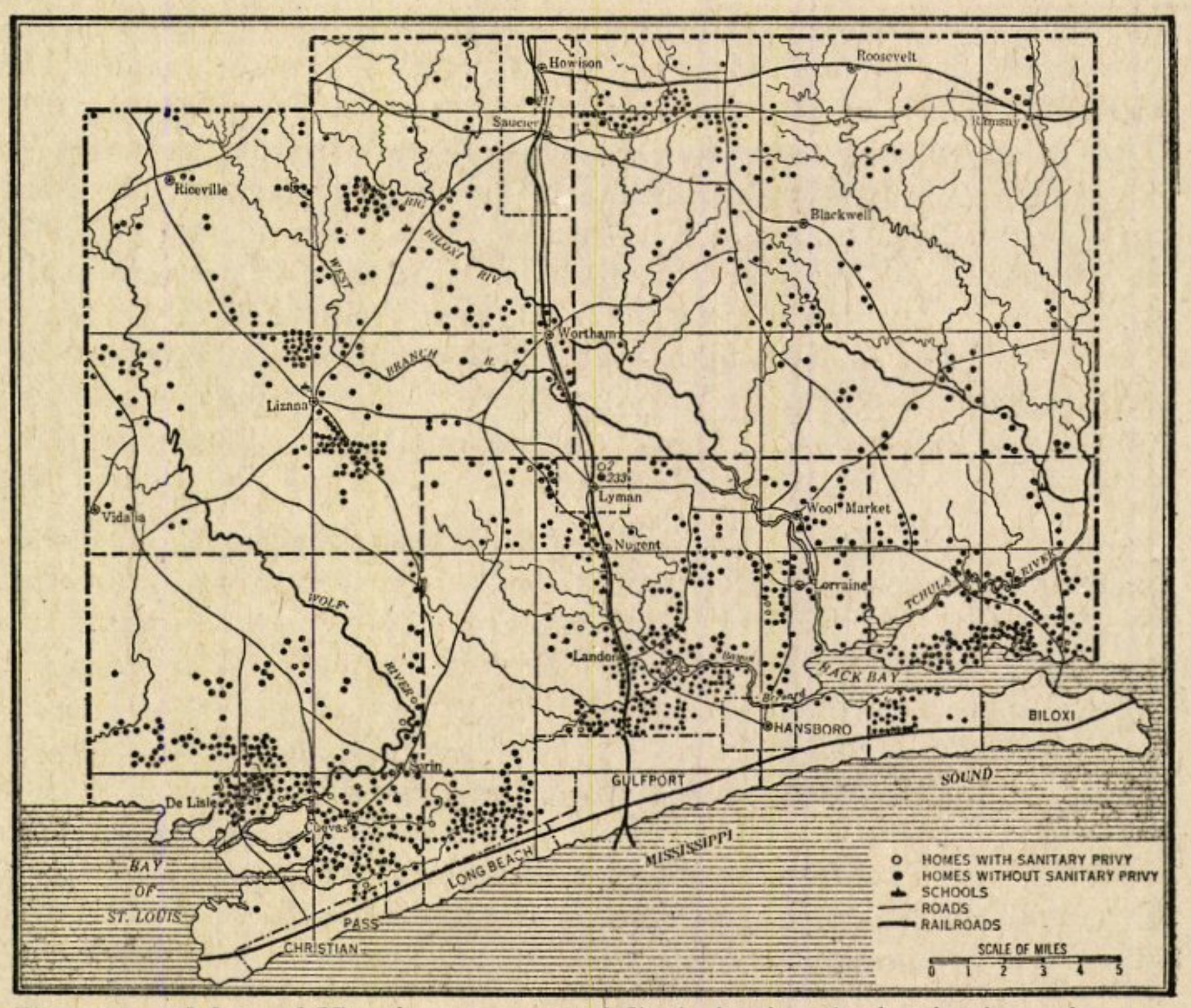

Fig. 40.—Map of Harrison county, Mississippi. At beginning of campaign against soil pollution diseases. Black dots indicate homes with insanitary latrines

Development of Community Sentiment for Adequate Latrines. In ten Southern States, a total of 4,586 new privies were erected and 15,568 old privies improved during the year. In one-fifth of the areas in which work was conducted, a complete record of 100 per cent sanitary installation was obtained. In addition, there was a gratifying development of privy pride in many rural regions of the South, which found expression in the construction not of the cheapest type of privy that would serve the purpose, but of a well-housed, durable structure to form a permanent adjunct of the home. In one community of Tarrant county, Texas, the residents of 180 of the 200 homes voluntarily erected concrete privies which cost

$35 apiece; not less than 15 per cent of the 441 improved privies constructed in McLennan county, Texas, were of this type; and in Greenwood and Orangeburg counties, South Carolina, there was a distinct leaning toward the septic tank and other more costly, but also more permanent, forms of construction. The development of this individual and community pride was largely fostered by publishing lists of names in local papers or by marking homes on maps posted in public places to indicate that their occupants or owners had made the necessary sanitary improvements. This served as an honor roll and soon brought recalcitrants into line.

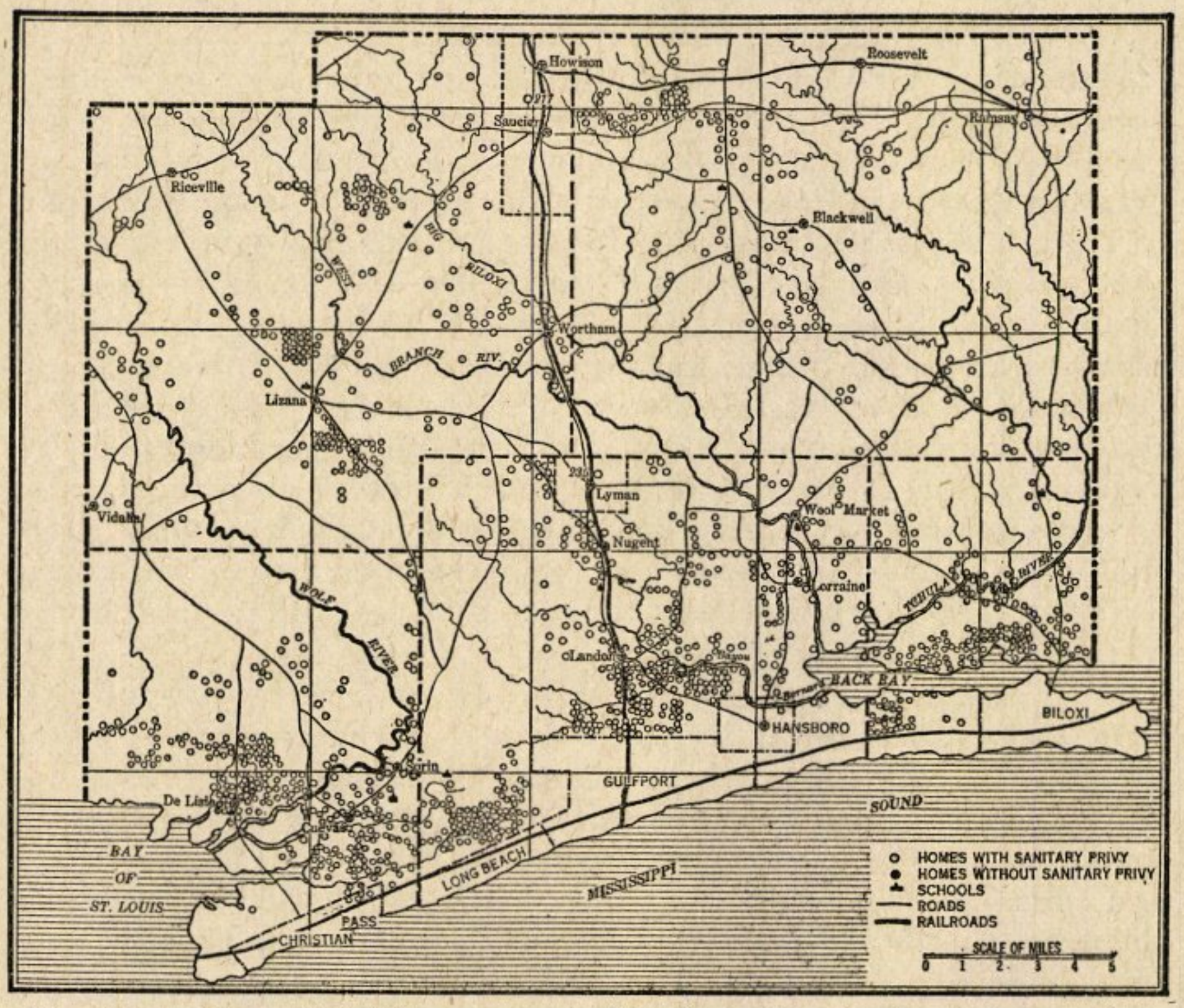

Fig. 41.—Map of Harrison county, Mississippi. At close of campaign against soil pollution diseases. Note entire absence of insanitary latrines

Results of County Health Work in North Carolina. In North Carolina the work of the past fourteen months resulted in the installation of 7,364 sanitary closets in the rural areas of ten counties, to say nothing of extensive sanitary reform in towns and other urban localities. The people were brought to appreciate the value of public health measures in general, and a sustaining public sentiment toward these measures was developed. One result was the enactment at the recent session of the General Assembly of a state-wide sanitary-privy law which requires all privies located within 300 yards of a neighboring home to be constructed and maintained in a

manner satisfactory to the State Board of Health. The law applies to approximately 85,000 privies in the State, and places an annual inspection tax of forty cents on each privy. The funds thus collected will be used to defray the salaries and expenses of from ten to twelve State sanitary inspectors, whose duty it will be to inspect each privy in the State from two to five times a year, to see that the provisions of the law are enforced.

HEALTH IMPROVEMENT FOLLOWING SOIL SANITATION

Data dealing with field conditions can seldom have the scientific accuracy of the laboratory. Nevertheless, results following soil sanitation in widely separated areas are significant.

In Georgia, an intensive campaign against soil pollution was begun in Troup county on January 1, 1918. Prior to this date, there had never been a sanitary pit privy in the entire rural area of the county. In the course of the year, 1,341 of these were installed, and 62 per cent of the people were thus protected from the dangers of soil pollution. A house-to-house survey of the entire county revealed the fact that before the work of sanitation had been undertaken, an average of 496 cases of dysentery and 177 cases of typhoid fever occurred annually. During the year 1918, there were only fifty-eight cases of dysentery, or 12 per cent of the previous average annual incidence, and thirty-two cases of typhoid fever, or 18 per cent of the former yearly average of cases.

In Wicomico county, Maryland, from January 1 to October 1, 1916, the typhoid fever incidence totaled seventy-eight cases; for the same period in 1917, there is a record of seventy-six cases. Investigation indicated that the infection was fly-borne and that its source was the prevalent open privy. In January, 1918, a sanitary and educational campaign, in which special emphasis was laid upon the necessity for the erection of fly-proof latrines, was begun. As a result, one hundred homes a month, on an average, were supplied with sanitary privies during the course of the year. There were but twenty-six typhoid fever cases reported in the county for the period from January 1 to October 1, 1918,—a reduction of 66.2 per cent from the average rate for the two previous years.

In nine counties of North Carolina, during the four-year period from 1914 to 1917, the total number of deaths from typhoid fever was 478. This was a yearly average of 119.5 deaths, or 35.3 deaths per hundred thousand. During 1918, as a result of a crusade against soil pollution in these nine counties, a total of 6,480 fly-proof privies were erected. Typhoid fever statistics for the year 1918 show that out of an aggregate population of 305,016 in these counties, there were only twenty-four deaths from this disease, a rate of 7.8 per hundred thousand.

Reports from these same counties indicate that the reduction in the number of cases of diarrheal diseases among children and in fatalities from these diseases, has been even greater than in the case of typhoid fever. In the town of Lexington, which has a population of about 5,000, the average number of cases of diarrhea among children for the years 1914 to 1917 was approximately 115 yearly. During 1918 the health officer reported only five cases.

A study of the birth and death rates of recent years in Costa Rica furnishes interesting data. During the year 1910, before the work of hookworm eradication and soil sanitation had been begun in that country, the death rate was 26.36 per thousand. Since then, the rate has gradually dropped to 22.52 per thousand for the year 1917. On this basis it may be estimated that the lives saved during the period from 1911 to 1917 number 10,169, or two and one-half per cent of the existing population. In 1910, an average of 201.7 deaths out of 1,000 births occurred among children under the age of one year, while the rate for 1917 was 175.9 deaths per thousand births. The death rate of children under five years was reduced from 328.6 for every thousand births in 1910 to 275 per thousand in 1917.

VIII

MALARIA CONTROL

Demonstrations which have been carried out in a number of different localities within the last three years tend to show that in the average community in the heavily infected regions of the Southern States, malaria can be controlled for less money than it is costing the communities to have it. Thus far, the field experiments undertaken have been of four types, consisting of efforts at malaria control by anti-mosquito measures, by the screening of houses, by the administration of immunizing quinine, and by direct attack upon the parasite in the blood of the human carrier. In conducting these first experiments, no attempt has been made to put into operation a full program of malaria control, but rather to try out the possibilities of some of the more important elements which would enter into such a program.

CONTROL BY ANTI-MOSQUITO MEASURES

The work in malaria control by anti-mosquito measures has been guided by two main purposes: (1) to ascertain to what degree the infection may be reduced in the average small town of the Southern States by applying the simpler measures of malaria control; and (2) to ascertain whether a satisfactory result may be achieved within limits of expenditure which these towns may well afford. In the experimental demonstrations the habits of the three mosquitoes—*A. quadrimaculatus Say*, *A. punctipennis Say*, and *A. cruzians Wiedermann*—which are responsible for the infection, have been made the subject of constant study with a view to eliminating all unnecessary effort and thereby reducing cost.

Experiment at Crossett, Arkansas, 1916. The first of the tests was undertaken at Crossett, a lumber town of 2,129 inhabitants, situated in Ashley County in southeastern Arkansas, about twelve miles north of the Louisiana line. It lies at the edge of the so-called "uplands," in a level, low-lying region (elevation 165 feet) with sufficient undulation to provide reasonably good natural drainage. Climatic conditions and abundant breeding places favor the propagation of anopheles. Malaria in its severe form is widely prevalent as an endemic infection, and according to the estimate of local physicians is the cause of about 60 per cent of all illness throughout the region. Within the town itself the malaria rate was high and was recognized by the lumber corporation and the people as a serious menace to health and working efficiency.

The initial step in the experiment was a survey of the community to determine the malaria incidence, to ascertain the species of mos-

quitoes responsible for the spread of the infection, and to locate the breeding places of these mosquitoes. Breeding places were exhibited on a community map, and organized effort was centered on their destruction or control. The program of simple measures excluded all major drainage. Borrow pits and shallow ponds were filled or drained; streams were cleared of undergrowth where necessary to let the sunlight in; their margins and beds were cleared of vegetation and obstructions; and they were trained to a narrow channel providing an unobstructed off-flow. Artificial containers were removed from premises; water barrels on bridges were treated with nitre cake. All remaining breeding places were regularly treated by removing vegetation, opening up shallow margins to give free access to small fish, and spraying once a week with road oil by means of automatic drips or a knapsack sprayer. All operations were under the supervision of a trained lay inspector. Care was exercised to avoid all unnecessary effort, and to secure, not the elimination of the last mosquito, but a reasonably high degree of control at a minimum cost.

The first conspicuous result apparent to every person living in the community was the practical elimination of the mosquito as a pest. The reduction in malaria as shown by a parasite index taken in May, 1916, and again in December of the same year, was 72.33 per cent. The reduction in physicians' calls for malaria in 1916 as compared with the number of calls for the previous year (company's records) was 70.36 per cent. The per capita cost of the work—omitting overhead—was $1.24. During the year the Crossett Lumber Company had repeated these measures at two of its large logging camps with results which were convincing as to the soundness of the investment.

At the end of 1916 the community took over the work and for two years has maintained it at its own expense and under its own direction. The measures have been continued under the supervision of a trained native lay inspector. Figure 42, page 188, exhibits in graphic form the results for the three years.

Physicians' Calls for Malaria

Population	2,029	
1915 calls	2,500	(company's records)
1916 "	741	
1917 "	200	
1918 "	73	
Reduction for the three years	97.1 %	

Per Capita Cost

1916 (omitting overhead)	$1.24
1917 (total cost)	.63
1918 (total cost)	.53

Results Confirmed at Hamburg—1917. After the work at Crossett had been turned over to the community, operations were transferred to the neighboring town of Hamburg, with a view to putting the practicability of anti-mosquito measures to test under

somewhat more difficult conditions. Hamburg was not governed and financed by a wealthy corporation; it had no hospital; it depended for medical service upon private practitioners who were deriving about 60 per cent of their income from malaria; the town was less compact, and with only 1,285 inhabitants had a higher malaria rate and more abundant breeding places for mosquitoes than had Crossett.

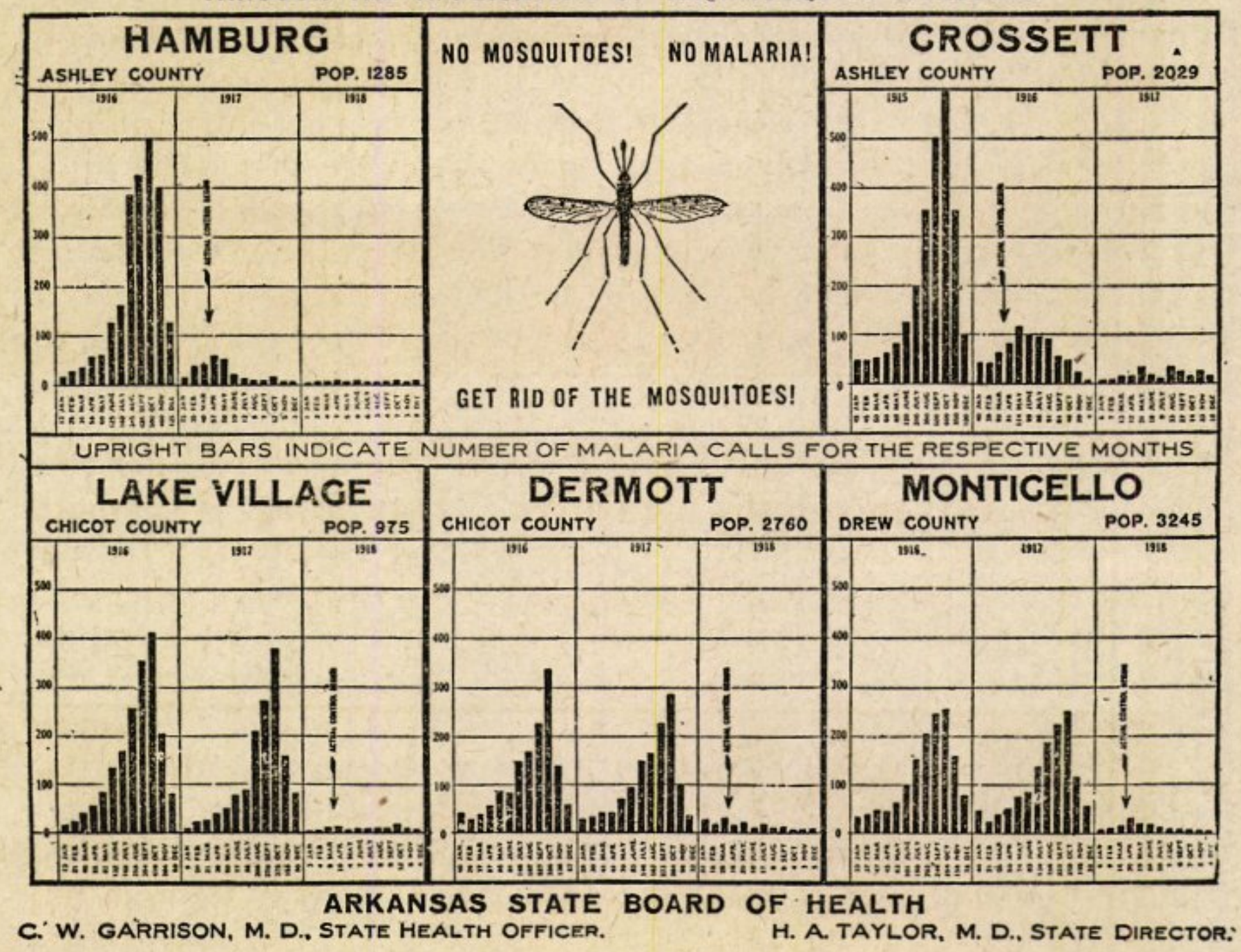

Fig. 42.—Record of malaria control in five Arkansas towns, 1916–1918

The measures which had stood the test of the previous year at Crossett, with the introduction of certain economies which experience had suggested, were repeated here. Physicians' calls were reduced from 2,312 in 1916 to 259 in 1917—a reduction of 88.8 per cent. For the latter half of the year—July to December inclusive—there were only forty-three calls for malaria in 1917 as compared with 1,995 calls for the same period the previous year—a reduction of 97.8 per cent. The per capita cost—omitting overhead—was $1.45.[1]

[1] The overhead omitted comprises, in addition to general supervision, expenditures for outside surveys, for blood examinations, etc., which are desirable as affording useful information but are not properly a part of the cost of control operations in the given community. The costs as given include all capital expenditures and the complete local organization necessary to the conduct of the work.

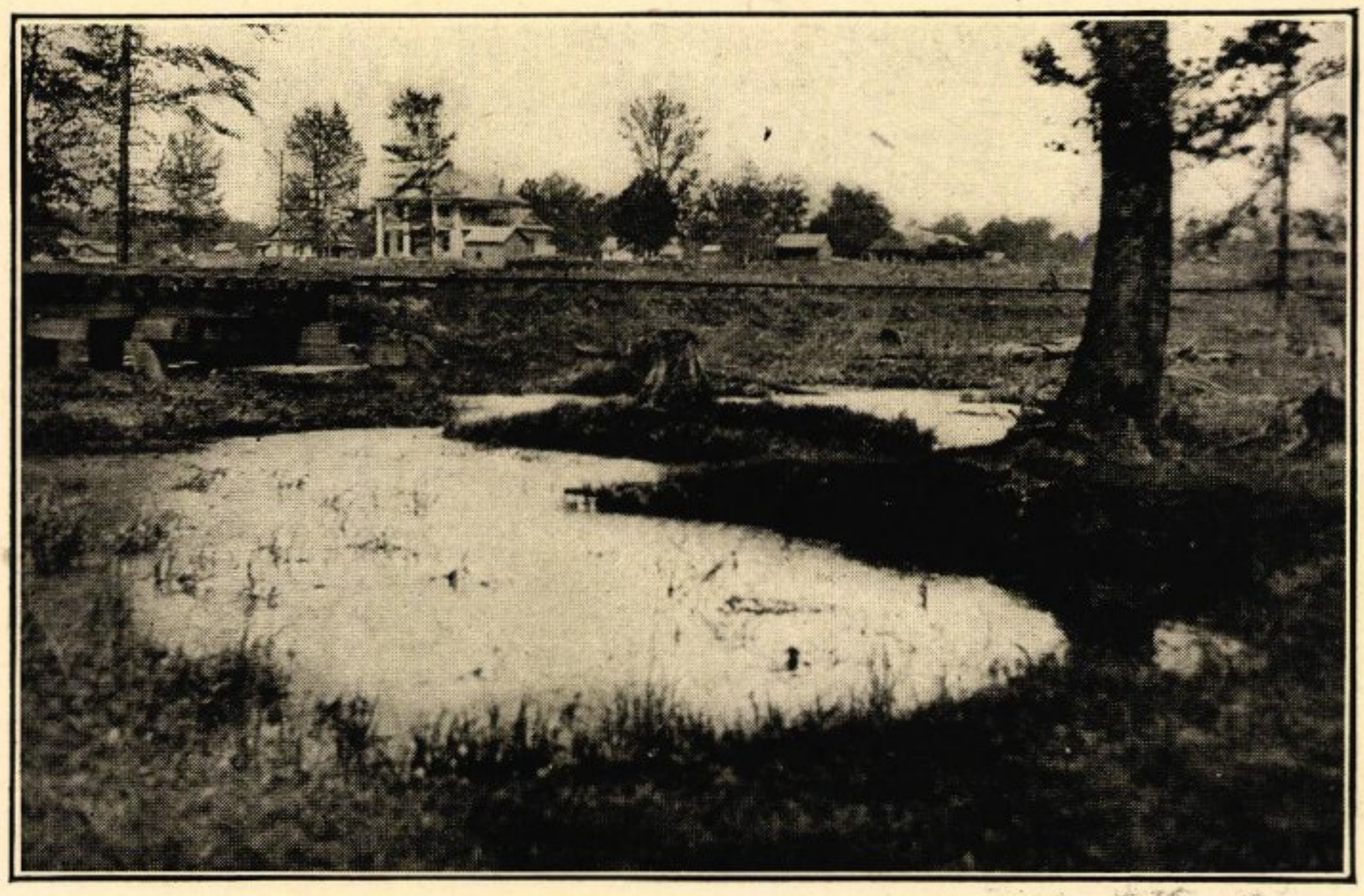

Fig. 43.—Borrow pit before draining. Malaria control by anti-mosquito measures. Hamburg, Arkansas

Fig. 44.—Same borrow pit after draining

Fig. 45.—Drained swamp. Malaria control by anti-mosquito measures

At the end of the year again the community took over the work, assuming entire responsibility for its continued maintenance and direction. Figure 42, page 188, exhibits graphically the results for the two years. As a result of community effort during 1918, the total calls for malaria fell to fifty-nine, and the work was maintained at a per capita cost of forty-four cents.

Physicians' Calls for Malaria

Population	1,285
1916 calls	2,312
1917 "	259
1918 "	59
Reduction 1916–1918	97.4%

Per Capita Cost

1917 (omitting overhead)	$1.45
1918 (total upkeep)	.44

Demonstration in Four Communities—1918. Taking as a basis the plan of operation which had been tried at Crossett and further developed and confirmed at Hamburg, effort was made during 1918 to carry out a demonstration on a somewhat larger scale and under a variety of conditions. For this purpose four small Arkansas towns were selected. They are rural towns ranging in population from 975 to 3,023. Lake Village, county seat of Chicot

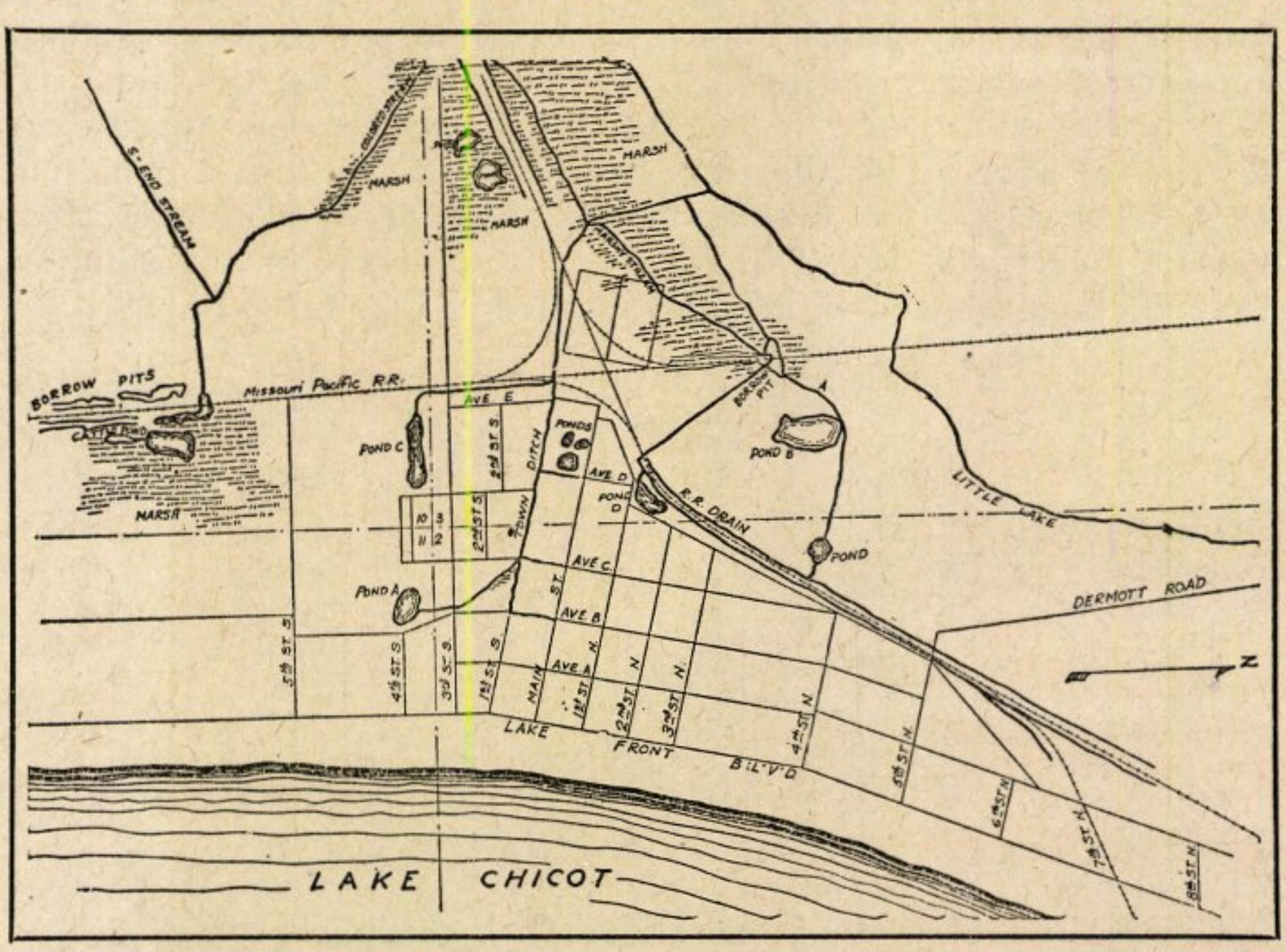

Fig. 46.—Map of Lake Village, Arkansas, showing Lake Chicot and main natural drainage system. Malaria control by anti-mosquito measures

County, presented the problem of a level, low-lying area of buckshot soil with two miles of lake frontage and an extensive area of shallow swamp in the rear. Dermott, about twenty miles away, also in the flat lands of the Mississippi, presented the peculiarity of having abundant anopheles breeding places throughout the municipal area, due chiefly to the utter neglect of the most elementary principles of drainage in the grading of two railroads and the streets of the town. Monticello, county seat of Drew County, is a typical hill-town for which a number of clear streams, with adequate fall over a stiff clay soil, furnished an abundant supply of anopheles. Bauxite, a rambling mining community of about 2,500 inhabitants, presented the difficulties of a large area to be treated, a heavy sand-flow in the beds of its numerous small streams, and extensive hillside seepage areas offering ideal breeding conditions.

A preliminary survey of each community at different seasons during the previous year made it possible to omit from the working plans much that otherwise would have been waste effort. Each community was presented in advance with an estimate of its malaria prevalence, a chart exhibiting its breeding places, a working plan with budget, and an estimate of what might be expected as a result in degree of malaria control. The community in each case provided the funds required save for general supervision, and agreed to assume entire responsibility for the work after the first year.

The plan of operation followed at Crossett and Hamburg, with improvements suggested by experience and adaptations to local conditions, was repeated in each of these towns. For the four communities combined, physicians' calls for malaria were reduced from 5,065—the average for the two previous years—to 554, a reduction of 89.1 per cent. The per capita cost of the entire work—omitting general overhead—was 74¢. Results and costs by communities (except Bauxite) are graphically exhibited in Fig. 42, page 188.

Results and Costs by Communities

	Lake Village	Dermott	Monticello	Bauxite
Population	975	2,760	3,023	2,500
Physicians' calls for malaria:				
1916	1,817	1,399	1,413	862
1917	1,388	1,248	1,274	729
1918	83	162	137	172
Per cent reduction, 1917–1918	94.8	87.8	89.8	78.4
Per capita cost, 1918	$1.25	$0.54	$0.46	$1.11

Comparison of cost of operations with results accomplished in these six towns tends to show that malaria control in such communities, considered merely as a business proposition, pays. At two dollars per physician's call, Crossett has been paying annually more

than four and one-half times as much in doctors' bills alone, for the privilege of having malaria, as it expended in 1918 for the upkeep of the work which kept it practically free from malaria and from the mosquito as a pest. Hamburg's annual doctors' bill for malaria had been eight times the cost of protection in 1918. In the four new communities the annual payment for physicians' calls would cover even the relatively heavy cost of first year operations almost one-and-a-half times over. And the doctors' bill is but an insignificant fraction of malaria's total cost to the community.

CONTROL BY SCREENING

For communities situated as those described above, there seems to be little need of resort to other procedures than those directed against mosquitoes. The control of malaria in towns, however,—even in small towns—does not reach the heart of the matter. Malaria is essentially a rural disease, bearing most heavily on the people and the industries of the farm. There are large rural areas, moreover, where in the light of our present knowledge the control of mosquito breeding is not practicable. Malaria in these localities, if it is to be controlled at all during the pioneer period of settlement, must be attacked from another angle. It has been shown by demonstration that under conditions which make the cost of mosquito control prohibitive, it is still possible to reduce the malaria rate by the screening of houses, by the systematic administration of immunizing quinine, and by detecting the human carriers and destroying the parasites in their blood.

Experiment on Plantations Near Lake Village, Ark. In order to test the efficiency and the cost of screening as a control measure, a field experiment was conducted in 1916 on a group of cotton plantations near Lake Village, Arkansas. The community, which lay along the shore of Chicot Lake, had an abundant supply of anopheles and a high malaria incidence. The houses on these plantations were typical negro cabins, many of them loosely constructed and therefore difficult to protect against entrance by mosquitoes. All selected houses were screened with galvanized wire cloth, 16 mesh, the work being carefully done by carpenters and without cost to the tenants. The people were taught by house-to-house visits the importance of keeping the screens in good condition and the dangers of exposure after dark to mosquitoes on the outside of their homes. Each home was inspected at regular intervals throughout the season. No other measure was employed.

The estimate of result was based on parasite index. An index taken in May, 1916, when the work began, showed an infection of 11.97 per cent; a second index taken in December of the same year showed an infection of 3.52 per cent, a reduction of 70.6 per cent.

Unfortunately, the index for May, 1917, which would have afforded a more instructive comparison, is wanting. On a visit during the season of the following year it was found that the screens were still in good repair and that the people—mainly typical plantation negroes—were convinced of their value. The average cost of screening for the community was $14.59 per house. Estimating the life of the screen at two years, the average annual cost would be $7.29. On this basis the annual per capita cost of the screening alone was $1.75.

CONTROL BY IMMUNIZING WITH QUININE

In another plantation community, immunizing quinine as a control measure was put to similar test. This second community lay along the bank of a sluggish bayou, from which it derived its supply of anopheles. Under the direct supervision of the physician in charge, quinine was administered to all persons in the community in doses of five grains morning and evening—making ten grains a day—for two successive days each week. For children under fifteen years of age the dosage was reckoned at one grain for each three years and was administered in the same way. A parasite index taken in May, 1916, at the beginning of the work, and again in December of the same year, showed a reduction of 64.45 per cent. Again the omission of the index for May, 1917, must be regretted. The per capita cost of the work, omitting the overhead, was fifty-seven cents.

These tests in malaria control by screening and by the administration of immunizing quinine are to be regarded as preliminary and their results as suggestive only. Generalization may be attempted only when they have been carried out on a much larger scale under a variety of conditions and with a more reliable measure of results.

CONTROL BY TREATING THE CARRIERS

Since all infected mosquitoes have derived their infection from the blood of infected persons, it is theoretically possible to prevent the infection of mosquitoes and thereby prevent the spread of malaria in a community by destroying the parasites in the blood of the human carrier. Robert Koch first suggested the possibility of controlling malaria by the treatment of carriers during a visit to Italy in 1898, and in 1900 demonstrated his theory by a definite reduction of the malaria rate in a small community of 734 persons at Stephansort, German New Guinea. The measure has been rather widely employed in German colonies and with varying degrees of success. Malaria has been reduced, but in no community does the method seem to have been put to an adequate test and with sufficient attention to measure of results and to counting of costs.

Fig. 47.—Laborers at work filling borrow pit. Anti-mosquito operations. Hamburg, Arkansas

Fig. 48.—Wide ditch for heavy rains, with "V"-shaped center for normal flow. Anti-mosquito measures. Monticello, Arkansas

Initial Experiment in Bolivar County, Mississippi, 1916–1917. As a preliminary study, a two-year field experiment—in which more than 30,000 persons were registered—was conducted in Bolivar County, Mississippi, during 1916 and 1917. The large number of blood examinations confirmed with emphasis the importance of the malaria carrier. Persons who have had clinical attacks are apt to carry the parasites in the blood for months after the clinical symptoms have disappeared. The examinations showed also that the usual doctor's treatment of malaria, although breaking the chill and sending the patient back to his work, does not, in most cases, sterilize his blood. The results of the chill tonics upon which so many people depend, are still less satisfactory. A very large percentage of malaria cases treated by physicians or by the use of chill tonics continue to carry the parasites for months after apparent cure, and to be therefore subject to relapse and a possible source of infection to others. These tests furthermore established the fact that ten grains of quinine a day for eight weeks sterilized the blood of about 90 per cent of the carriers to whom it was administered.[1]

With this standard course of treatment established, effort was made during 1918 to carry out a test demonstration in malaria control by treating the carriers.

Test Demonstration in Sunflower County, Mississippi, 1918. For purposes of the demonstration a typical rural area was selected in Sunflower County, Mississippi. This area, like the delta region in the heart of which it lies, is level, low-lying, and covered at frequent intervals with a net-and-patchwork of sluggish streams, bayous, and swamps. Mosquito breeding is abundant throughout the season and the cost of its control under present conditions is prohibitive. The area contains about 100 square miles and a population of about 9,000, about 1,000 of these living in the town of Ruleville and about 8,000 on cotton plantations under typical delta conditions. The blacks outnumber the whites by about four to one. Most of the negroes can read, but as compared with a white population living under similar conditions the grade of intelligence is relatively low. The dominant industry of the region is the growing of cotton; and the life of the community centers in and revolves about the cotton plantation. There are relatively few small farms operated by their owners, the prevailing type being the large plantation operated with negro tenant labor under the supervision of a resident manager.

The disabling disease of the region is malaria. At cotton cultivating and picking time, when labor is in greatest demand and when delay means direct money loss, malaria is most severe. It is estimated that from one-third to three-fourths of the people on these plantations have one or more attacks of malaria each year, and that

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[1] There is reason to believe that this result does not hold for all conditions. It seems to be much more difficult, for example, to sterilize the blood of carriers in certain tropical regions.

70 per cent or more of all sickness disability in the community is due to this cause. On one plantation, for example, having a tenant population of about 600, the average annual doctors' bill for the last ten years has been approximately $4,000. Of this sum about $3,000, or $5.00 per capita, is attributed by the manager to malaria. The loss to the tenant and to the landlord in crop returns is much larger. And since the landlord must look to the tenant's crop both for return on his capital investment in land and equipment and for reimbursement for his large current advances to his tenant families, he is most deeply concerned in any condition which impairs the health and efficiency of the workers on his plantation.

The first step in the demonstration was to map the area, locating roads, streams, and homes; to take a census of the population; and to make a survey involving a record of each person on the census roll. This survey showed that of the rural population 40 per cent had had clinical malaria within twelve months; and that of the remaining 60 per cent who had not had a clinical attack, 22 per cent had the parasites in their blood. All persons giving a history of clinical malaria within twelve months, and those who were found by blood examination to be carrying the parasites, were given sterilizing treatment—namely, ten grains a day for eight weeks. Effort was made by personal instruction and by repeated house-to-house visits to have the prescribed course of treatment followed to the end. Irregularities occurred and are under such conditions inevitable, but in general the instructions were followed. In the rural area no other measures were employed.

In the town of Ruleville malaria control was based in the main on anti-mosquito measures. Here inspection disclosed the fact that mosquito breeding, which was abundant, was due almost exclusively to running hydrants and leaking pipes supplied by flowing artesian wells. The problem was extremely simple. The enactment of an ordinance followed by the imposition of a number of fines resulted in the destruction of breeding places and the consequent extermination of mosquitoes in the town.

Results. Unfortunately no reliable record is available of the number of physicians' calls within the area before the work began, and the second parasite index will not be taken until next season. The results of the test, in so far as they may be estimated in advance of the final report, may be summarized as follows:

1. There has been no transmission of malaria within the town of Ruleville during the year, and the town has been free from the mosquito as a pest.

2. The degree of malaria control resulting from the measures carried out in the rural area is estimated by the director in charge at approximately 80 per cent. This estimate is based on the record of malaria histories, intimate observation during the season, informal reports by tenants and plantation managers, and regular monthly reports submitted by physicians.

3. Physicians practicing within the area report a marked decline in malaria cases.

4. Plantation owners and managers operating within the area are of one accord in reporting an obvious decrease in malaria as compared with previous years. One manager, for example, operates a large plantation within the demonstration area and a smaller one outside the area. The plantation under control has a tenant population of about 600, the one not under control about 180. The doctor's bill for the year on the smaller plantation has been greater than on the large one. This difference he attributes altogether to the malaria control on the larger plantation.

5. These reports and estimates were checked by personal inspection on a recent house-to-house visit among tenant families on the plantations and among families in a community of small landed proprietors. The following record of the first ten families visited typifies the result:

Order of Visit	Number in Family	Positive Malaria History	Negative History but Parasites in Blood	Malaria This Year
1	12	10	0	3
2	6	4	0	0
3	4	0	1	0
4	2	0	0	0
5	8	0	2	0
6	7	1	5	0
7	4	3	0	0
8	9	9	0	0
9	1	1	0	1
10	5	4	0	0
TOTAL	58	32	8	4

PERCENTAGE OF REDUCTION, 87½

Summary

Population rural area	8,000
Estimated degree of control	80 %
Per capita cost	$1.08
Per capita cost for Ruleville	$ .41

Neighboring counties in Mississippi have asked that the work be extended to them and have indicated a willingness to provide the funds. The demonstration, however, is only begun. It is suggestive but far from complete. No conclusion will be attempted until the test has been continued over a period of years within the same area, has been tried under a variety of conditions, and has been submitted to a more definite measure of results.

SUMMARY OF RESULTS AND CONCLUSION

By way of summary it may be said:

1. That for the average town in our Southern States having a thousand or more inhabitants and a reasonably high infection rate, malaria control by anti-mosquito measures is economically feasible; that it is, in fact, a sound business investment.

2. That in heavily infected regions where the cost of mosquito control would be prohibitive, the amount of malaria may be greatly reduced by resort to screening, to immunizing quinine, or to destroying the parasites in the blood of the human carriers. The indications would seem, in fact, to justify the hope that by the systematic application of these measures the malaria in a community may be held within reasonable bounds and that this result may be accomplished within limits of cost which the average community may well afford.

3. That the people in these communities are prepared to provide the funds by public taxation for malaria control when they have been shown by demonstration that the program proposed will accomplish definite results which justify the expenditure.

4. The results thus far accomplished would seem to justify continuing these field experiments until the principal procedures which have been found useful in controlling malaria have been pretty thoroughly tested separately and thus evaluated. It will then be possible to operate intelligently a combination program in which each control measure will be given its place and will receive varying emphasis from time to time according to the local conditions which have to be met. This freedom in the use of our tools will in turn contribute toward the object which we have in view; namely, the highest degree of malaria control consistent with a reasonably low per capita cost.

IX

TUBERCULOSIS IN FRANCE

During 1918 the work of the Commission for the Prevention of Tuberculosis in France was continued under four departments or divisions: the Educational Division, the Medical Division, the Department of Nursing, and the Department of Extension. The main activities of each of these departments are summarized below:

EDUCATIONAL DIVISION

The educational division carried on four types of activity during the year: (1) traveling exhibits; (2) the distribution of literature; (3) publicity in newspapers and magazines; and (4) miscellaneous.

Traveling Exhibits. Three traveling exhibits were active during the year, and at the close of the year a fourth and fifth were being prepared for operation. The further development of this particular activity will depend upon the general conditions in France, and the feasibility of extending this work under the mechanical and other difficulties which now exist.

During 1918 the traveling exhibits visited ten departments. In seven of these their work was completed. The plan has been to hold meetings and campaigns in all communities with a population of over 3,000. In the departments already visited 141 such towns have been reached, and 875 lectures with demonstrations and exhibits have been given. So far as possible this work is followed up in each department and community with a view to the organization by the French people of permanent activity in the several centers.

Literature. From time to time, posters, pamphlets, and other material dealing with tuberculosis, of which there is now a fairly comprehensive series, have been published. This printed matter has been distributed widely throughout the whole of France. During the year, 2,115,708 pieces of printed matter were distributed.

General Publicity. The co-operation of the French press has been gratifying. A series of twenty-four articles on tuberculosis, furnished by the Commission, has been published by thirty-three important provincial newspapers, and a large amount of additional space has also been obtained in these and various other departmental journals.

Miscellaneous. The Commission also co-operated with the Children's Bureau of the American Red Cross in the large exhibits held by the latter organization in Lyons, Marseilles, St. Etienne, and Toulouse. A tuberculosis exhibit was placed in the larger exhibit

of the Children's Bureau and a fairly complete series of educational panels and some models thus presented. A large amount of literature was also distributed. In the four towns mentioned there was an attendance of over 300,000 people.

MEDICAL DIVISION

Following the plans adopted in 1917, the medical activities carried out during 1918 were largely concentrated upon the two demonstrations, one in the 19th arrondissement of Paris and the other in the Department of Eure-et-Loir. In the 19th arrondissement three model dispensaries with full personnel were operating at the close of the year, and a fourth, which will be the central dispensary, was about to open. Four central dispensaries, one in each arrondissement, were in active operation in the Department of Eure-et-Loir, and six secondary dispensaries had been established and were in operation.

Opening of Additional Branch Dispensaries. Six additional secondary dispensaries for the Department of Eure-et-Loir had been nearly completed and were to commence operations early in 1919. Seven other secondary dispensaries had been determined upon and the sites for their installation obtained, although actual construction had not begun. When these have been established the Department of Eure-et-Loir will have twenty-three dispensaries well distributed, and with the addition of one or two others the equipment of that Department, in so far as dispensaries are concerned, will be complete. The cost of establishing these dispensaries is very slight and is for the most part provided by funds obtained from the French themselves, or, as was the case in certain instances in the past, from the American Red Cross.

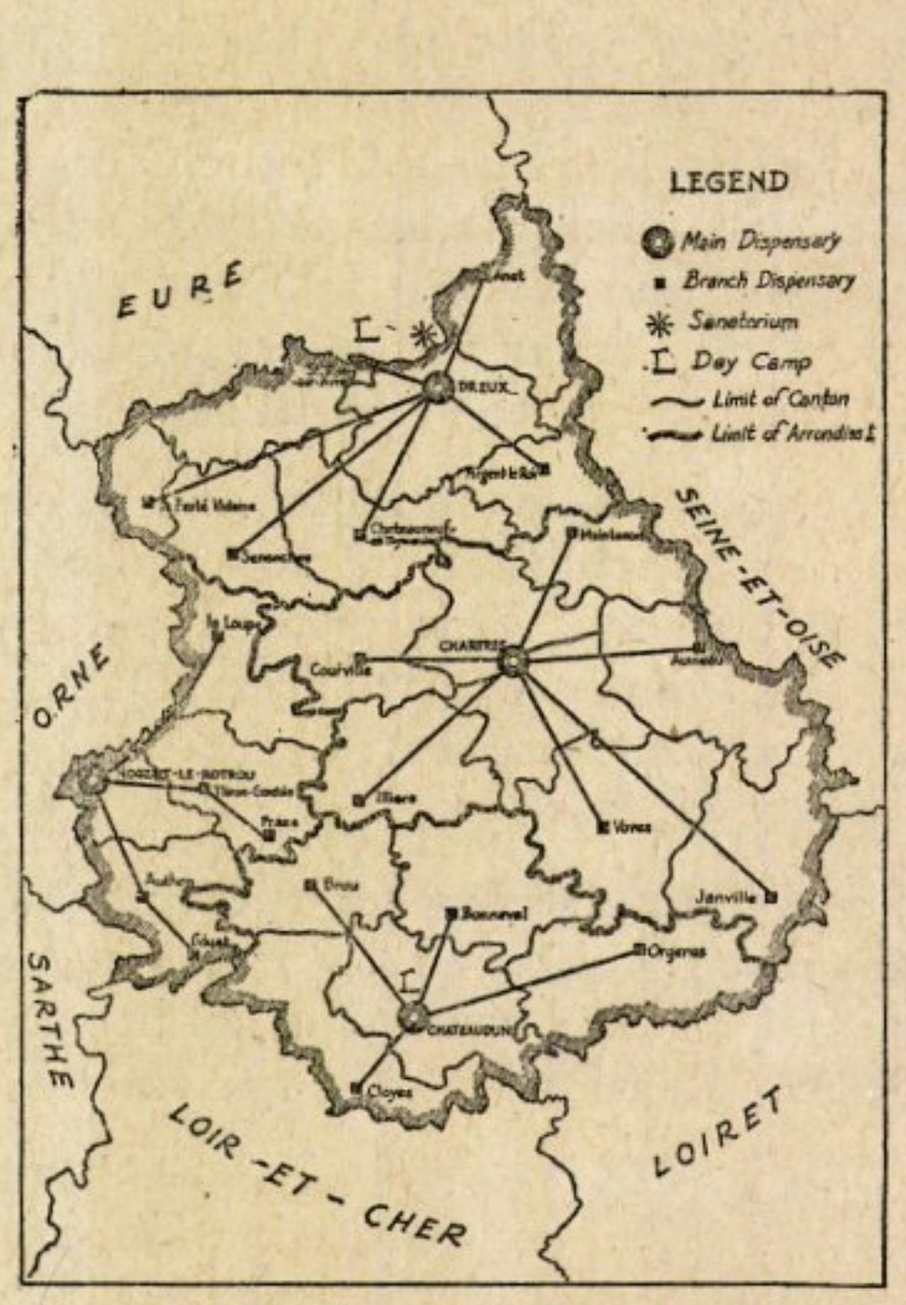

Fig. 49.—Tuberculosis dispensary organization in Department of Eure-et-Loir. France

Hospital Beds and Sanatorium for Early Cases. The French have already provided or given definite assurance of providing additional hospital beds in the four chief towns of the Department. The Department has also taken the initial steps toward the estab-

Fig. 50.—Improvising open-air treatment of tuberculosis. Chartres, France

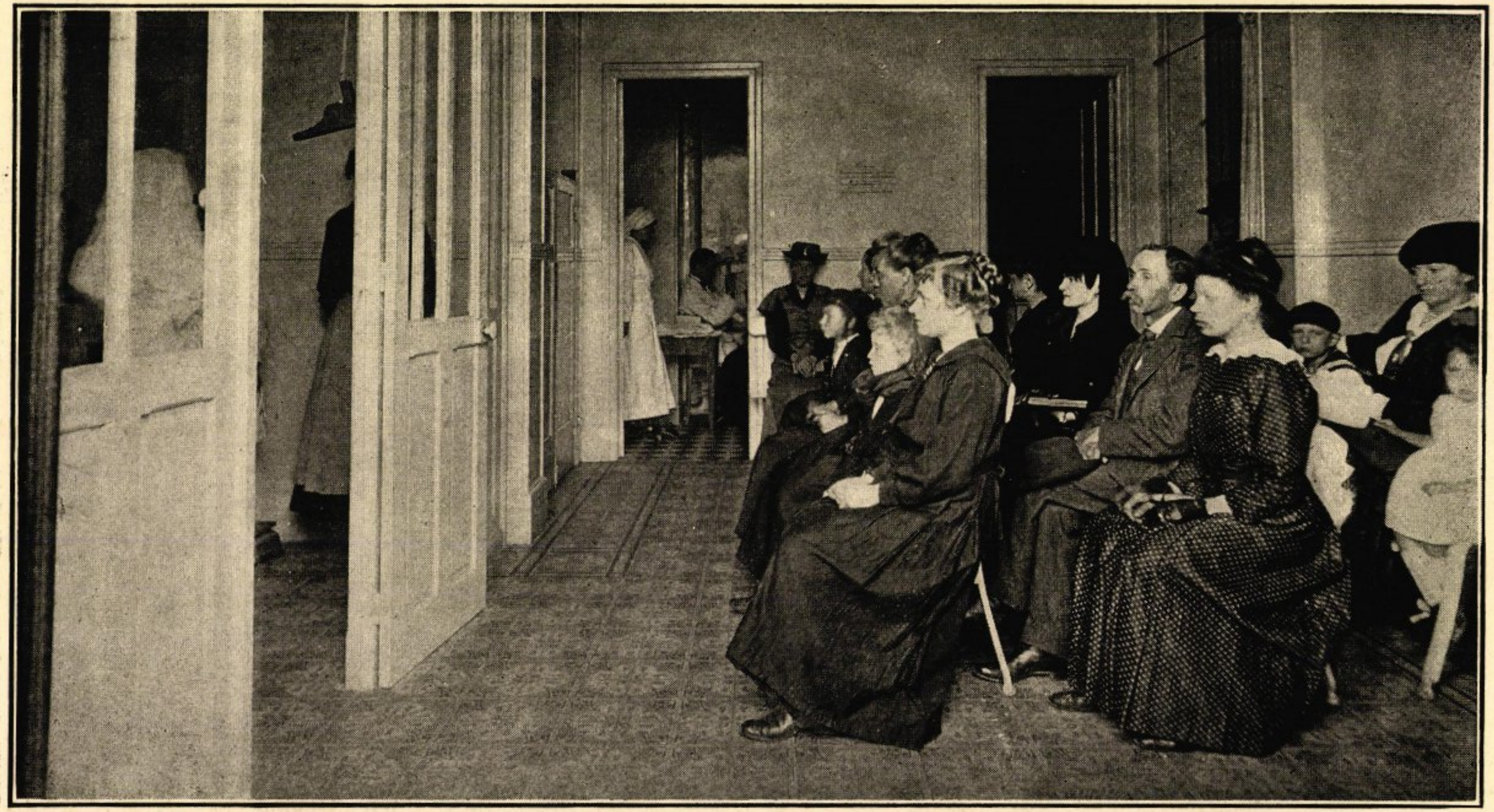

Fig. 51.—Waiting-room of tuberculosis clinic at Chartres, France

lishment of a sanatorium for early cases of tuberculosis, and there is little doubt that this project will be brought to a successful issue. The general equipment of the Department of Eure-et-Loir, from the point of view of the tuberculosis problem, may therefore be regarded as approximately complete. It is particularly gratifying, too, that each of the communities in which dispensaries are situated has organized French committees to provide the necessary material relief that was formerly obtained through funds from the American Red Cross.

DEPARTMENT OF NURSING

Forty-five visiting nurses, or *Visiteuses d'Hygiene*, as they are technically termed, were in active service for the Commission on December 31, 1918. Of these, twenty-two were in Paris and one in Versailles; fifteen were working in connection with the dispensaries in the Department of Eure-et-Loir; and seven were situated in other

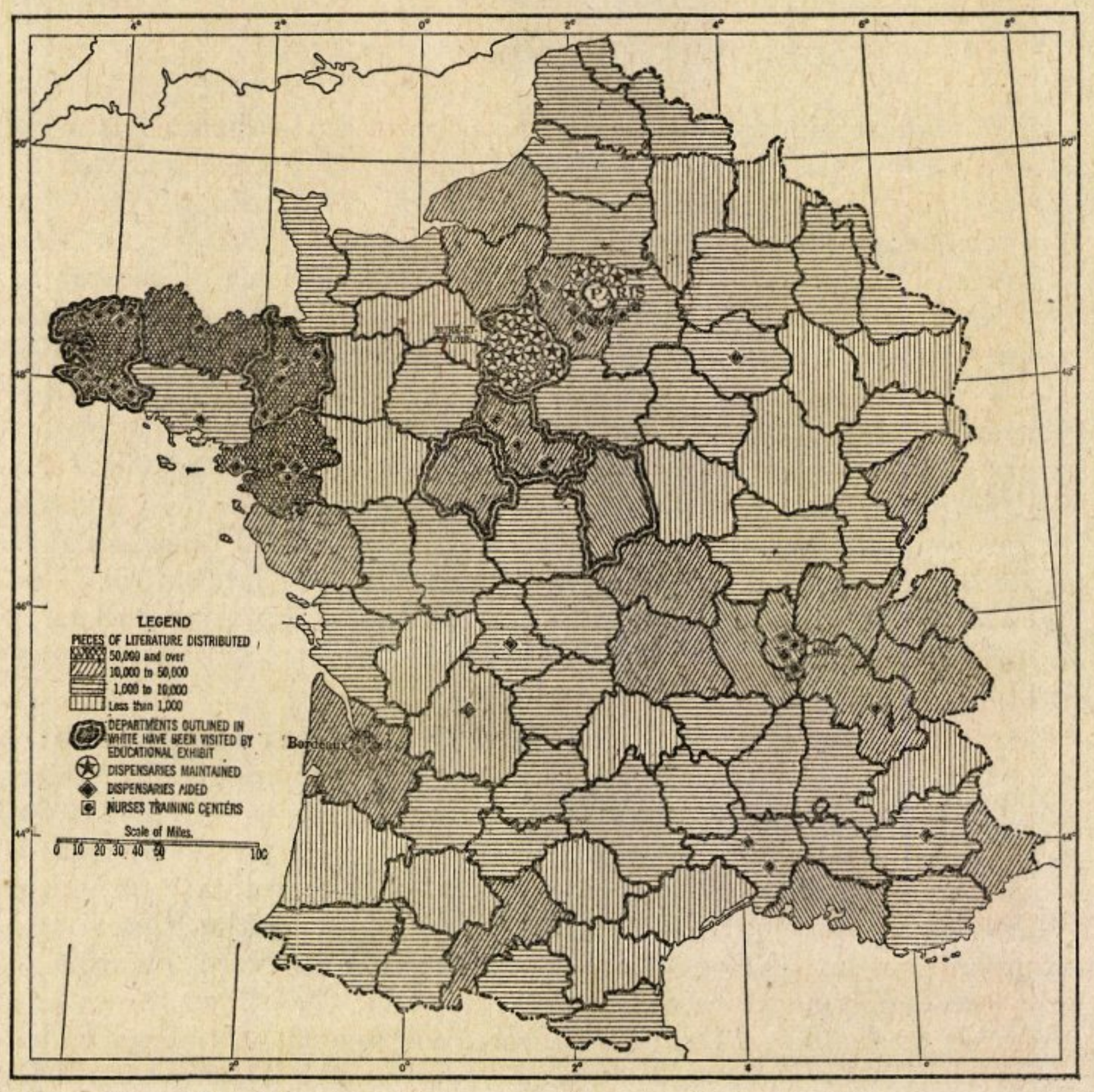

Fig. 52.—Work of Tuberculosis Commission in France, to December 31, 1918

parts of France in dispensaries operating entirely under French auspices. Two *Visiteuses d'Hygiene*, trained in the Commission's dispensaries but paid by local French organizations, were also working in co-operating dispensaries in Paris. Similarly, two others were in Bordeaux, working in dispensaries operated by that municipality and acting as supervisors in a training center which has been organized in that city.

Training Schools for Nurses. At the close of the year, there were three training schools for *Visiteuses d'Hygiene* in Paris, attended by thirty-three pupils for whom scholarships had been provided. In addition, twelve pupils who had been furnished scholarships were completing their training in dispensaries located in the 19th arrondissement of Paris; seven other pupil nurses were in the training center at Bordeaux; and four scholarships had been granted to pupils in a training school at Lyons organized in co-operation with the Commission. An additional training center had been opened in Nantes, but enrolment figures were not at hand.

DEPARTMENT OF EXTENSION

The task of stimulating the organization of anti-tuberculosis work in the various departments and communities of France was met as far as adequate personnel was available. The response by the French people has indeed been gratifying. The American Red Cross and the Commission have carried on activities of greater or less extent in twenty-seven departments of France. In these twenty-seven departments, twenty-one dispensaries were in existence at the time of the first visits. During the year fifty-seven new dispensaries were organized and were functioning at the end of the year. There were also twenty dispensaries definitely provided for and in process of installation; and forty-nine other dispensaries definitely planned for, the installation of which could be reasonably regarded as assured for the near future. Fifteen laboratories had been established or arranged for; thirty-eight new nurses had been installed; and forty-two new and active committees had been organized.

Organization of Dispensary System in Other Departments. The bulk of the expense, not only in the establishment and installation but in the maintenance of these activities, is provided from French sources. This field activity, which is after all the main object of the work, is now moving with extraordinary rapidity. Plans are being completed for the establishment by the French of a complete system of dispensaries in the Region du Nord, comprising the five departments recently re-occupied by the Allied forces and restored to France. Demands from numerous departments which have not yet been reached are also under consideration and will be taken up as soon as facilities permit.

TABULAR SUMMARY

TABLE 4: *All Countries—Persons Enumerated in Census, Microscopically Examined, Found Infected, Given First Treatment, and Cured of Hookworm Disease in Areas Completed During 1918, by Geographical Regions. Figures Excluded for Areas in Which Work Was Still in Progress*

Geographical Region	Census	Microscopically Examined		Found Infected		Given First Treatment		Cured	
	Number	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total	..	..	..	..	..	**215,484**	..	**126,194**	**58.6**
Southern States[1]	306,267	44,241	14.4	8,074	18.3	7,636	94.6	1,206	15.8
West Indies	31,685	31,314	98.8	23,636	75.5	22,057	93.3	17,551	79.6
Central America[2]	..	169,531	..	107,449	63.4	94,176	87.6	42,889	45.5
South America (Brazil)	11,150	10,490	94.1	6,922	66.0	5,984	85.1	4,107	69.7
The East[3]	..	..	..	..	..	85,631	..	60,441	70.6

[1] During 1918, in the Southern States, the main emphasis was placed on the building and improving of latrines.

[2] In Central America the bulk of the work is by the dispensary plan. This does not afford opportunity for frequent re-examinations to determine cure. Consequently the percentage of persons known to be cured is low in comparison with other regions.

[3] In Ceylon, throughout a large part of 1918, estate laborers were assumed to be infected, and accordingly were given first treatment without preliminary microscopic diagnosis. This explains the blank spaces for "Census," "Microscopically Examined," and "Found Infected" in the lines for "The East" and "Total."

TABLE 5: *Southern States—Persons Enumerated in Census, Microscopically Examined, Found Infected, Given First Treatment, and Cured of Hookworm Disease in Areas Completed During 1918, by States. Figures Excluded for Areas in Which Work Was Still in Progress*[1]

State	Census	Microscopically Examined		Found Infected		Given First Treatment		Cured	
	Number	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total	**306,267**	**44,241**	**14.4**	**8,074**	**18.3**	**7,636**	**94.6**	**1,206**	**15.8**
Alabama	3,713	675	18.2	79	11.7	79	100.0	79	100.0
Arkansas	3,573	500	14.0	3	.6	3	100.0	..	..
Louisiana	5,854	1,161	19.8	208	17.9	55	26.4	..	..
Maryland	9,912	..	..	..	..	..	..	..	..
Mississippi	12,487	8,468	67.8	4,084	48.2	4,069	99.6	84	2.1
North Carolina	212,936	18,431	8.7	3,503	19.0	3,272	93.4	987	30.2
South Carolina	22,825	931	4.1	24	2.6	..	..	..	..
Tennessee	6,904	127	1.8	3	2.4	3	100.0	2	66.7
Texas	19,959	11,025	55.2	81	.7	70	86.4	33	47.1
Virginia	8,104	2,923	36.1	89	3.0	85	95.5	21	24.7

[1] During 1918, in the Southern States, the main emphasis was placed on the building and improving of latrines.

TABLE 6: *West Indies—Persons Enumerated in Census, Microscopically Examined, Found Infected, Given First Treatment, and Cured of Hookworm Disease in Areas Completed During 1918, by Countries. Figures Excluded for Areas in which Work Was Still in Progress*

Country	Census	Microscopically Examined		Found Infected		Given First Treatment		Cured	
	Number	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total	**31,685**	**31,314**	**98.8**	**23,636**	**75.5**	**22,057**	**93.3**	**17,551**	**79.6**
British Guiana	11,856	11,719	98.8	8,727	74.5	8,175	93.7	6,871	84.0
Saint Lucia	5,036	5,004	99.4	3,126	62.5	2,892	92.5	2,068	71.5
Saint Vincent	1,121	1,117	99.6	955	85.5	884	92.6	766	86.7
Trinidad	13,672	13,474	98.6	10,828	80.4	10,106	93.3	7,846	77.6

TABLE 7: *Central America—Persons Enumerated in Census, Microscopically Examined, Found Infected, Given First Treatment, and Cured of Hookworm Disease in Areas Completed During 1918, by Countries. Figures Excluded for Areas in Which Work Was Still in Progress*[1]

Country	Census	Microscopically Examined		Found Infected		Given First Treatment		Cured	
	Number	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total	..	**169,531**	..	**107,449**	**63.4**	**94,176**	**87.6**	**42,889**	**45.5**
Costa Rica	66,219	56,371	85.1	29,898	53.0	27,487	91.9	12,504	45.5
Guatemala	36,151	32,861	90.9	22,299	67.9	19,950	89.5	14,684	73.6
Nicaragua	..	19,786	..	15,016	75.9	13,679	91.1	5,773	42.2
Panama	..	16,185	..	13,656	84.4	11,966	87.6	4,286	35.8
Salvador	49,564	44,328	89.4	26,580	60.0	21,094	79.4	5,642	26.7

[1] In Central America the bulk of the work is by the dispensary plan. This does not afford opportunity for frequent re-examinations to determine cure. Consequently the percentage of persons known to be cured is low in comparison with other regions.

TABLE 8: *The East—Persons Enumerated in Census, Microscopically Examined, Found Infected, Given First Treatment, and Cured of Hookworm Disease in Areas Completed During 1918, by Countries. Figures Excluded for Areas in Which Work Was Still in Progress*

Country	Census	Microscopically Examined		Found Infected		Given First Treatment		Cured	
	Number	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total	..	..	..	..	..	**85,631**	..	**60,441**	**70.6**
Ceylon[1]	61,698	..	..	..	..	50,374	..	44,812	89.0
China	..	12,504	..	7,556	60.4	5,694	75.4	2,519	44.2
Fiji	3,222	3,190	99.0	2,887	90.5	2,770	95.9	2,514	90.8
Seychelles	10,524	10,475	99.5	9,113	87.0	8,671	95.1	7,413	85.5
Siam	..	31,298	..	24,018	76.7	18,122	75.5	3,183	17.6

[1] In Ceylon, throughout a large part of 1918, estate laborers were assumed to be infected, and accordingly were given first treatment without preliminary microscopic diagnosis. This explains the blank spaces for "Census," "Microscopically Examined," and "Found Infected" in the lines for "Ceylon" and "Total."

FINANCIAL STATEMENT

FINANCIAL STATEMENT

The statement on the following pages shows that in the work of the International Health Board during the year 1918, a total of $1,121,-585.11 was expended. This statement is based on expenditures actually made during the calendar year 1918, regardless of when financial reports were received at the New York office. It will be seen that the figures differ from those given in the Treasurer's statement on pages 281 to 355. The Treasurer's Report includes amounts paid in the field during the first three quarters of 1918, to which in many instances have been added amounts paid during the fourth quarter of 1917, but not recorded until early in 1918. This discrepancy between the two reports is caused by the necessity of closing the Treasurer's books shortly after the first of the calendar year, before detailed financial reports can be received from the foreign countries in which a large part of the work of the Board is conducted.

TABLE 9 : *Expenditures of International Health Board During the Year 1918*

Fields of Activity	Amount Expended
Grand Total	**$1,121,585.11**
Relief and Control of Hookworm Disease	455,810.75
Malaria Control	26,489.29
Yellow Fever Control	46,639.17
Tuberculosis in France	433,030.43
Public Health Education	36,642.82
Philippine Hospital Ship	12,500.00
Investigation of Sewage Disposal at Rural Homes	4,288.01
Field Staff Salaries, Expenses, Automobiles, etc., not Prorated to Specific Budgets	5,143.32
Miscellaneous	27,596.64
Administration	73,444.68
Itemization by States and Countries	
Relief and Control of Hookworm Disease	455,810.75
Southern States	89,501.36
West Indies	57,800.06
Central America	113,545.86
South America	97,031.00
The East	97,932.47
Southern States	$89,501.36
Administration	8,749.79
Alabama	5,922.09
Arkansas	2,784.41
Georgia	5,418.95
Kentucky	2,064.97
Louisiana	1,317.93
Maryland	2,494.53
Mississippi	9,427.52
North Carolina	15,775.89
South Carolina	13,592.37
Tennessee	6,642.20
Texas	9,362.85
Virginia	5,947.86
West Indies	57,800.06
Administration	4,298.24
British Guiana*	16,504.11
Dutch Guiana*	4,389.11
Grenada	1,833.74
Jamaica—Survey	3,937.85
St. Lucia	8,152.28
St. Vincent	6,383.25
Trinidad	12,301.48

* For administrative reasons, British and Dutch Guiana, although on the mainland of South America, are considered West Indian Colonies.

TABLE 9: *Expenditures of International Health Board During the Year 1918—Continued*

Fields of Activity		Amount Expended
Relief and Control of Hookworm Disease—*Continued*		
Central America	$113,545.86	
Administration	7,058.73	
Costa Rica	21,330.40	
Guatemala	20,816.27	
Nicaragua	22,454.30	
Panama	24,312.26	
Salvador	17,573.90	
South America—Brazil	97,031.00	
The East	97,932.47	
Administration	4,145.61	
Ceylon	36,041.44	
China	12,400.87	
Fiji	5,579.84	
Papua	2,009.41	
Queensland	16,624.09	
Seychelles Islands	8,089.06	
Siam	13,042.15	
Malaria Control		$26,489.29
Arkansas		4,749.02
Mississippi		21,740.27
Yellow Fever Control		46,639.17
East Coast of Brazil and Southern Littoral of the Caribbean		2,897.97
Ecuador—Investigation		22,878.02
Ecuador—Control		6,595.96
Guatemala—Control		14,267.22
Tuberculosis in France		433,030.43
Central Administration		80,037.65
Medical Division		267,237.59
Educational Division		85,755.19
Public Health Education		36,642.82
Department of Hygiene—Faculdade de Medicina e Cirurgia de Sao Paulo:		
Equipment	$13,085.46	
Operating Expenses	17,578.31	
Fellowships	2,125.07	32,788.84
Bello Horizonte Medical School—Fellowship		2,353.98
Advisor in Medical Education		1,500.00

TABLE 9: *Expenditures of International Health Board During the Year 1918—Continued*

Fields of Activity	Amount Expended
Miscellaneous	$27,596.64
Drugs for Conserving Health of Field Staff	202.50
Field Equipment and Supplies	3,000.00
Surveys and Exhibits	14,970.85
Pamphlets and Charts	3,999.49
Lecture Charts	17.40
Conference of Health Officers of the Southern States	2,990.76
Portable House for Salvador	945.35
Express, Freight and Exchange	1,063.83
Dr. A. M. Struse—Personal Loss from Earthquake	406.46

CHINA MEDICAL BOARD

Report of the General Director

To the President of the Rockefeller Foundation:

Sir:—

I have the honor to submit herewith my report as General Director of the China Medical Board for the period January 1, 1918, to December 31, 1918.

Respectfully yours,

WALLACE BUTTRICK,
General Director.

CHINA MEDICAL BOARD

OFFICERS AND MEMBERS
1918

Chairman
GEORGE E. VINCENT

General Director
WALLACE BUTTRICK

Resident Director in China
ROGER S. GREENE

Secretary
EDWIN R. EMBREE

Members

*Wallace Buttrick
*Simon Flexner
Frederick L. Gates
Frank J. Goodnow
Roger S. Greene
Harry Pratt Judson
John R. Mott
*Starr J. Murphy
Francis W. Peabody
John D. Rockefeller, Jr.
*Wickliffe Rose
*George E. Vincent
William H. Welch

---

* Member of Executive Committee.

CHINA MEDICAL BOARD

OFFICERS AND MEMBERS
1919

Chairman and General Director
GEORGE E. VINCENT

Resident Director in China
ROGER S. GREENE

Secretary
EDWIN R. EMBREE

Members

*Wallace Buttrick
*Simon Flexner
Frederick L. Gates
Frank J. Goodnow
Roger S. Greene
Harry Pratt Judson
John R. Mott
*Starr J. Murphy
Francis W. Peabody
John D. Rockefeller, Jr.
*Wickliffe Rose
*George E. Vincent
William H. Welch

* Member of Executive Committee.

TRUSTEES OF THE PEKING UNION MEDICAL COLLEGE

OFFICERS, MEMBERS, AND EXECUTIVE COMMITTEE

1918

Chairman

JOHN R. MOTT

Vice-Chairman

JAMES L. BARTON

Secretary

WALLACE BUTTRICK

Executive Committee

George E. Vincent, *Chairman*

Arthur J. Brown
Wallace Buttrick
Simon Flexner
Frank Mason North

Members

To Serve Until the Annual Meeting of 1921

J. Auriol Armitage
James L. Barton
Simon Flexner
Robert H. Kirk
John R. Mott

To Serve Until the Annual Meeting of 1920

Arthur J. Brown
Wallace Buttrick
James Christie Reid
George E. Vincent

To Serve Until the Annual Meeting of 1919

F. H. Hawkins
Frank Mason North
Wickliffe Rose
William H. Welch

These members have been elected as follows:

By the Rockefeller Foundation

Wallace Buttrick
Simon Flexner
Robert H. Kirk
John R. Mott
Wickliffe Rose
George E. Vincent
William H. Welch

By the London Missionary Society
F. H. Hawkins

By the Medical Missionary Association of London
James Christie Reid

By the American Board of Commissioners for Foreign Missions
James L. Barton

By the Society for the Propagation of the Gospel in Foreign Parts
J. Auriol Armitage

By the Board of Foreign Missions of the Methodist Episcopal Church
Frank Mason North

By the Board of Foreign Missions of the Presbyterian Church in the United States of America
Arthur J. Brown

TRUSTEES OF THE PEKING UNION MEDICAL COLLEGE

OFFICERS, MEMBERS, AND EXECUTIVE COMMITTEE

1919

Chairman

JOHN R. MOTT

Vice-Chairman

ARTHUR J. BROWN

Secretary

EDWIN R. EMBREE

Executive Committee

George E. Vincent, *Chairman*

Arthur J. Brown
Wallace Buttrick
Simon Flexner
Frank Mason North

Members

To Serve Until the Annual Meeting of 1922

F. H. Hawkins
Paul Monroe
Frank Mason North
William H. Welch

To Serve Until the Annual Meeting of 1921

J. Auriol Armitage
James L. Barton
Simon Flexner
Robert H. Kirk
John R. Mott

To Serve Until the Annual Meeting of 1920

Arthur J. Brown
Wallace Buttrick
James Christie Reid
George E. Vincent

These members have been elected as follows:

By the Rockefeller Foundation

Wallace Buttrick
Simon Flexner
Robert H. Kirk
John R. Mott
Paul Monroe
George E. Vincent
William H. Welch

By the London Missionary Society
F. H. Hawkins

By the Medical Missionary Association of London
James Christie Reid

By the American Board of Commissioners for Foreign Missions
James L. Barton

By the Society for the Propagation of the Gospel in Foreign Parts
J. Auriol Armitage

By the Board of Foreign Missions of the Methodist Episcopal Church
Frank Mason North

By the Board of Foreign Missions of the Presbyterian Church in the United States of America
Arthur J. Brown

TRUSTEES OF THE SHANGHAI MEDICAL SCHOOL OF THE ROCKEFELLER FOUNDATION

OFFICERS AND MEMBERS
1918

Chairman
GEORGE E. VINCENT

Vice-Chairman
JOHN W. WOOD

Secretary
WALLACE BUTTRICK

Executive Committee

George E. Vincent, *Chairman*

Wallace Buttrick
Simon Flexner
Starr J. Murphy
Robert E. Speer

Members

To Serve Until the Annual Meeting of 1921

Robert E. Speer
George E. Vincent
William H. Welch
John W. Wood

To Serve Until the Annual Meeting of 1920

Simon Flexner
Frederick L. Gates
Starr J. Murphy
Francis W. Peabody

To Serve Until the Annual Meeting of 1919

Fletcher S. Brockman
Wallace Buttrick
Walter B. Cannon

TRUSTEES OF THE SHANGHAI MEDICAL SCHOOL OF THE ROCKEFELLER FOUNDATION

OFFICERS AND MEMBERS
1919

Chairman
GEORGE E. VINCENT

Vice-Chairman
JOHN W. WOOD

Secretary
EDWIN R. EMBREE

Executive Committee

George E. Vincent, *Chairman*

Fletcher S. Brockman
Wallace Buttrick
Simon Flexner
Robert E. Speer

Members

To Serve Until the Annual Meeting of 1922

Fletcher S. Brockman
Wallace Buttrick
Walter B. Cannon

To Serve Until the Annual Meeting of 1921

Robert E. Speer
George E. Vincent
William H. Welch
John W. Wood

To Serve Until the Annual Meeting of 1920

Simon Flexner
Frederick L. Gates
Starr J. Murphy
Francis W. Peabody

CHINA MEDICAL BOARD

During the year, construction work on the buildings of the Peking Union Medical College went forward. The total number of members of the faculty proper was increased to thirty-four, and a large number of other persons were appointed to less important positions in connection with the school. Contributions were paid to nineteen hospitals, three medical schools, and sixty-five fellows and scholars.

I. THE PEKING UNION MEDICAL COLLEGE

The attention of the China Medical Board during the past year has been centered on the construction of the Peking Union Medical College and the securing of a competent faculty.

Many obstacles have been encountered in the construction work, including export and transportation embargoes, high cost of materials during war-time, and the very unfavorable rate of exchange. Through the mediation of Minister Reinsch, the building materials were exempted from taxation. The construction work which has proceeded throughout the year has involved more expense than was originally expected. The present estimate on the land, the completed buildings, and the equipment calls for about five million dollars.

At the request of the Board, Mr. Robert H. Kirk, Comptroller of the Rockefeller Foundation, went to Peking during the summer to study and report on the building operations there. He and Mr. Greene, acting under the authorization of the Board, drew up new contracts with Mr. Harry H. Hussey, who was to act thereafter as

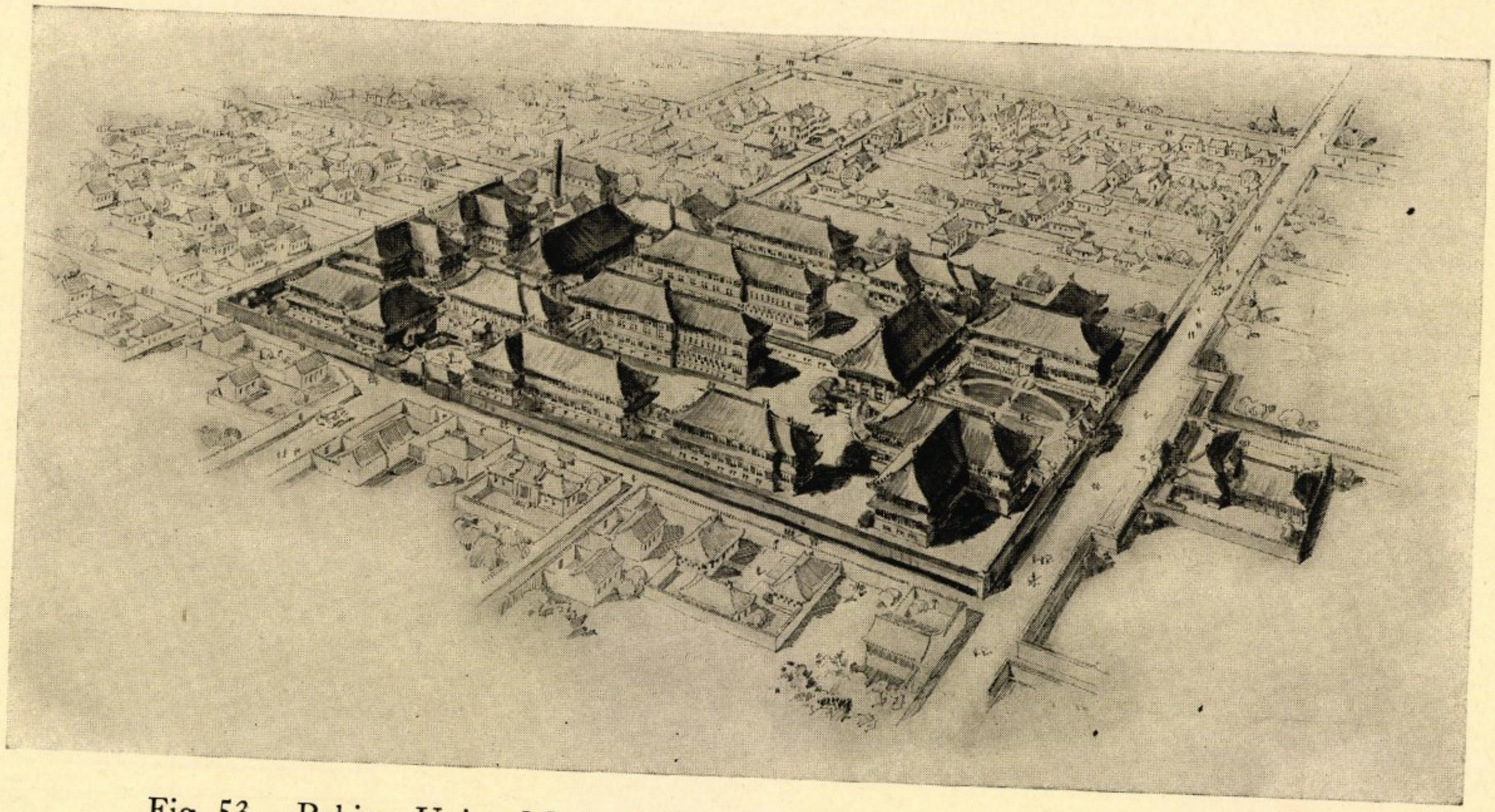

Fig. 53.—Peking Union Medical College. Now in Course of Construction

architect only. Mr. B. Frank Bennett, formerly superintendent of construction, is now in full charge of the building operations, on salary from the Board, and Mr. Charles E. Lane, of the architectural firm of Murphy and Dana, has been engaged as adviser.

Progress has been made towards securing a faculty, although Dr. McLean, the Director, has been serving with the U. S. Army and has therefore been unable to give as much attention as he wished to this work. During the earlier part of the year Dr. McLean was in Washington and was able to go to Baltimore or New York occasionally for conference; during the latter part he was in France.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

The faculty members and administrative officers, including certain appointments made since the close of 1918 (indicated by footnote) are as follows:

THE MEDICAL SCHOOL

Franklin C. McLean, Ph.D., M.D., Director, professor, and head of the department of medicine. Age 31. University of Chicago, B.S., 1907, M.S., 1912, Ph.D., 1915. Rush Medical College, M.D., 1910. Assistant Resident Physician, Hospital of the Rockefeller Institute, 1914–1916.

Henry Spencer Houghton, Ph.B., M.D., Acting Director. Age 39. Ohio State University, Ph.B. Johns Hopkins Medical School, M.D. Formerly Dean and Professor of Tropical Medicine, Harvard Medical School of China.

Edmund V. Cowdry, Ph.D., Professor and head of the department of anatomy. Age 31. University of Toronto, B.A., 1909. University of Chicago, Ph.D., 1912. Associate in anatomy, Johns Hopkins University, 1913–1917.

Harvey James Howard, M.D., D.Oph., Professor and head of the department of ophthalmology. Age 39. University of Michigan, B.A., 1904. University of Pennsylvania, M.D., 1908. Formerly in charge of the eye, ear, and nose department, Canton Christian College.

**J. Preston Maxwell, M.D.*, Professor and head of the department of obstetrics and gynecology. Age 48. London University, B.S., M.B., 1898, M.D., 1910. Formerly in charge of Yungchun Hospital, Fukien.

Ralph Garfield Mills, M.D., Professor and head of the department of pathology. Age 38. University of Illinois, B.A., 1903. Northwestern Medical College, M.D., 1907. Director of department of research, Severance Union Medical College, Seoul, Korea.

Adrian Stevenson Taylor, M.D., Professor and head of the department of surgery. Age 36. Universities of Alabama and Virginia. University of Virginia, M.D.,1905. In charge of the hospital of the Southern Baptist Convention at Yangchow, China.

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* Appointed since December 31, 1918.

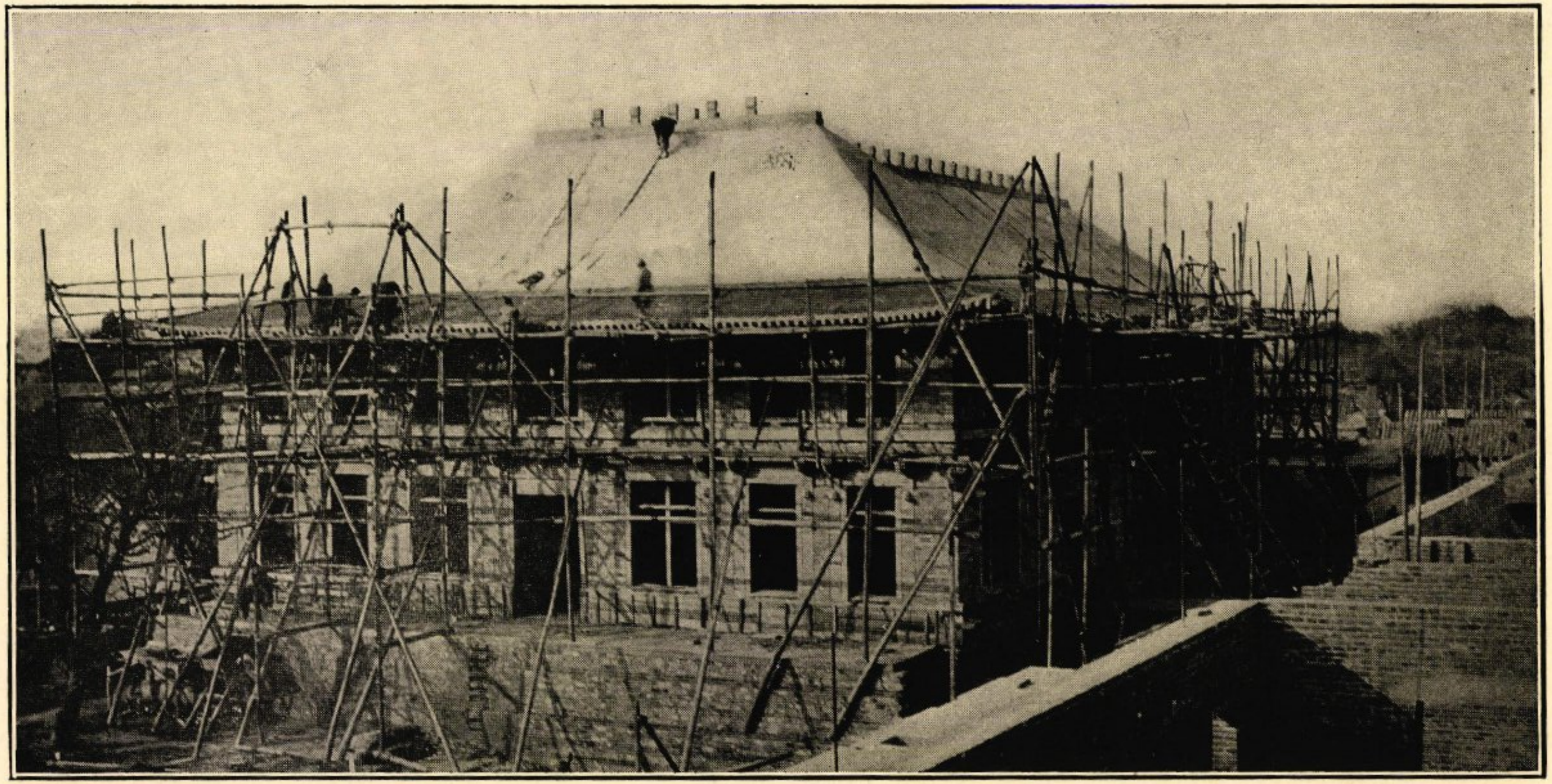

Fig. 54.—A unit of the Peking Union Medical College. One of the fifteen buildings being erected by the China Medical Board

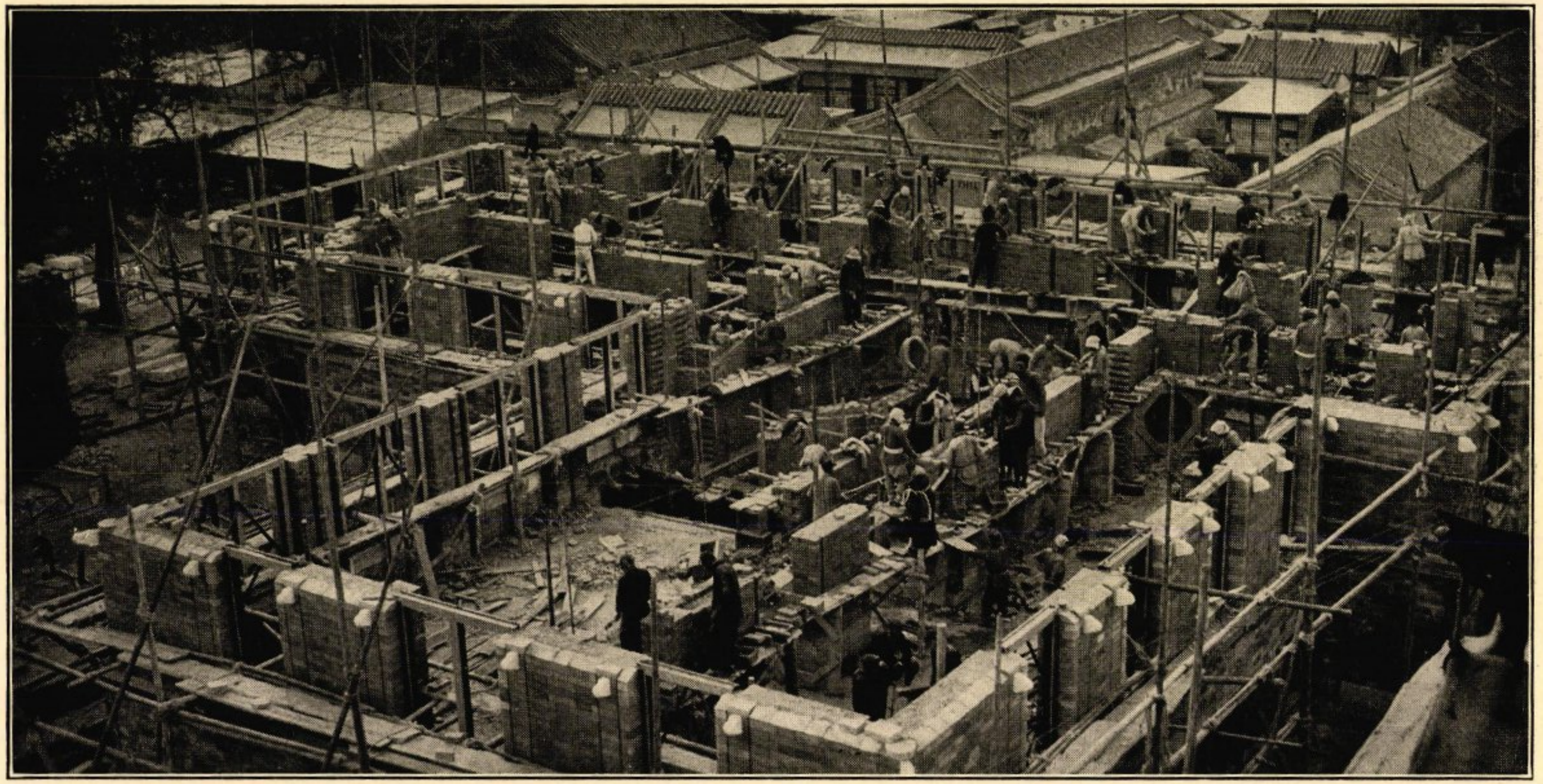

Fig. 55.—Construction staff at work on a building of the Peking Union Medical College

Davidson Black, B.A., M.B., Professor of embryology and neurology. University of Toronto, M.D., 1906, B.A., 1911. Assistant professor of anatomy, Western Reserve Medical School. Canadian Army Medical Corps.

†*Ernest G. Grey, M.D.*, Professor of surgery. Graduate, University of Wisconsin. Johns Hopkins Medical School, M.D., 1911.

Albert Menzo Dunlap, B.A., M.D., Associate professor of otology, rhinology, and laryngology. Age 35. University of Illinois, B.A., 1906. Harvard Medical School, M.D. Professor of otology, rhinology, and laryngology, and chief of outpatient department, Harvard Medical School of China.

Bernard E. Read, Ph.C., M.S., Associate professor of physiological chemistry. Age 31. Yale, M.S., 1918. Connected with the Union Medical College, Peking, 1909–1916.

**Oswald H. Robertson, M.S., M.D.*, Associate professor of medicine. Age 33. University of California, B.S., 1910, M.S., 1911. Harvard Medical School, M.D., 1915. Assistant in pathology and bacteriology, Rockefeller Institute for Medical Research.

**Andrew H. Woods, M.D.*, Associate professor of neurology and psychiatry. Age 47. Washington and Lee University, B.A., 1893. University of Pennsylvania, M.D., 1899. Canton Hospital, 1900–1907. University of Pennsylvania, assistant neurologist, 1908–1911. Canton Christian College, acting president, 1912–1916. Major in Army Medical Corps, 1918–1919.

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* Appointed since December 31, 1918.
† Died October 11, 1918.

Frederick E. Dilley, M.D., Associate in surgery. Age 42. Western Reserve University. Acting head of department of surgery in the Union Medical College and hospital, and superintendent of hospital.

**Miss Hartley C. Embrey, M.S.*, Associate in physiological chemistry, with particular attention to food chemistry. Age 32. University of Nashville, B.A., 1907, University of Chicago, M.S., 1915. Two years' graduate study at Sorbonne, Paris. Head of department of science, Central High School, Chattanooga, Tennessee, 1917–1918. Experimental work with DuPont Company, 1918–1919.

**Ernest C. Faust, Ph.D.*, Associate in parasitology. Age 29. Oberlin College, B.A., 1912. University of Illinois, M.A., 1914, Ph.D., 1917. Instructor in zoology, University of Illinois, 1917–1919.

**Paul C. Hodges, M.D.*, Associate in roentgenology. Age 26. Collegiate work at University of Wisconsin. Washington University School of Medicine, M.D., 1918. Photomicroscopist to department of surgery, Washington University School of Medicine.

John H. Korns, M.D., Associate in medicine. Age 35. Ohio Wesleyan University, B.A., 1904. Rush Medical College, M.D., 1909. Taianfu Men's Hospital, Taianfu, Shantung, 1911–1915. Appointed to Union Medical College faculty, 1915.

William G. Lennox, B.A., M.D., Associate in medicine. Colorado College, B.A. Harvard Medical School, M.D. Instructor in medicine and assistant physician, Union Medical College, Peking (old School).

Tsing-meu Li, M.D., Associate in ophthalmology. Age 35. Oahu College, Honolulu, H. I. St. John's

*Appointed since December 31, 1918.

University, Shanghai, graduated from School of Medicine. University of Pennsylvania, M.D., 1909. On staff of University of Pennsylvania Medical School at Canton, 1909–1913, and on staff Hunan-Yale Hospital, 1913–1914.

H. Jocelyn Smyly, M.A., M.D., F.R.C.S., I., Associate in medicine. Age 36. Trinity College of Dublin University, undergraduate and medical work. Appointed to Union Medical College faculty under former management in 1913.

Edgar T. H. Tsen, M.D., Associate in bacteriology. Age 25. Boone University, Wuchang, and Harvard Medical School of China. Postgraduate work at Harvard Medical School, Boston, and College of Physicians and Surgeons of Columbia University.

Charles W. Young, B.S., M.D., Associate in medicine. Age 44. University of Illinois, B.S., 1897. Johns Hopkins Medical School, M.D., 1903. Connected with the Union Medical College under former management from 1906, for several years as Dean.

**En-tseng Hsieh, M.D., D.P.H.*, Assistant in anatomy. Age 35. Graduated Union Medical College, Peking, 1911. Harvard Medical School, D.P.H., 1917. Postgraduate work, University of Pennsylvania Medical School.

**Jui-hua Liu, M.D.*, Assistant in otology, rhinology, and laryngology. Age 27. Anglo-Chinese College, Tientsin. Pei-yang Medical College, Tientsin, M.D., 1915. Postgraduate work at Harvard Medical School, 1917–1918. Service Red Cross Hospital, Shanghai, 1915–1917. Special interne New York Eye and Ear Infirmary, 1918–1919.

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* Appointed since December 31, 1918.

Way Sung New, M.D., Assistant in surgery. Age 26. Harvard Medical School, M.D., 1914. In charge of department of anatomy, Harvard Medical School of China, 1915–1916.

Laurence M. Sears, Assistant in Modern European Languages. Princeton College, B.A., 1917. Teaching in several schools and giving part time to Peking Union Medical College.

**Robert Spencer Stone*, Assistant in anatomy. Age 24. Completing seven-year course in biology and physiology, University of Toronto, June, 1919, including first two years of medical course. Seventeen months' army service.

S. Y. Wong, M.S., Assistant in physiological chemistry. Age 26. University of Chicago, B.S., 1916, M.S., 1917. Research work in drying oils.

**Arthur Waitah Woo, M.R.C.S., L.R.C.P.*, Assistant in obstetrics and gynecology. Age 30. University College, London, M.R.C.S., L.R.C.P., 1913. Formerly senior house surgeon and resident medical officer, East Suffolk and Ipswich Hospital. Obstetric and gynecological house surgeon, Middlesex Hospital, England.

C. M. Yü, Assistant in Chinese.

Y. T. Ch'ü, M.D., Resident Surgeon.

**Richard H. P. Sia, M.D.*, Assistant resident physician. Age 24. Boone University, Wuchang, China, B.S. Western Reserve University, M.D., 1918. House and admitting officer, Cleveland City Hospital.

C. H. Chang, M.D., Clinical assistant in surgery.

K. M. Ma, Hsiu-ts'ai, Instructor in Chinese. Formerly

* Appointed since December 31, 1918.

taught in preparatory department of Government University at Peking.

Adolf Eduard Zucker, *M.A.*, *Ph.D.*, Instructor in English and German. Age 29. University of Illinois, B.A., 1912, M.A., 1913. University of Pennsylvania, Ph.D., 1917. Formerly teacher of French and German, Tsing Hua College, Peking.

Donald E. Baxter, *M.D.*, Superintendent. Age 37. Hiram College. University of Louisville, M.D. Wide engineering and administrative experience. Director of New York Committee on After Care of Infantile Paralysis Cases. Worked under Red Cross in France on organization of hospitals.

Philip Allen Swartz, *B.A.*, *B.D.*, Director of Religious Work. Age 30. Lafayette College, B.A., 1910. Union Theological Seminary. Ordained by Presbytery of Newark, 1917. Formerly Pastor of Church of Forest Hills, Long Island (union, undenominational).

A. J. D. Britland, *M.P.S.*, Pharmacist.

George G. Wilson, Secretary and Treasurer (on leave). Mr. Wilson was on the staff of the former Union Medical College, and has been for several years on leave in war service.

A. J. Skinn, *M.P.S.*, Acting Treasurer.

Emily Gilfillan, *B.A.*, Librarian. Age 27. University of Michigan, B.A., 1914. Two and a half years assistant librarian of the Rockefeller Foundation.

**Miss E. Grace McCullough*, Dietitian. Age 50. Studied at Washington School of Cookery and Southern

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* Appointed since December 31, 1918.

Homeopathic Medical College. Dietitian, Massachusetts General Hospital, Boston, 1907–1911. Dietitian, Peter Bent Brigham Hospital, Boston, 1912–1919. In 1913 investigated and reported on von Noorden Clinic, Vienna, Austria.

H. C. Mao, Bookkeeper

Miss Harriet Barchet, B.A., Secretary to the Director.

Miss J. Dorothy Gordon, B.A., Secretary and technician.

Internes, 1918–1919.

Liu Ju-kang	Li Pao-an
Pi Hua-te	Yuan Te-mao
Pa Ta-chih	Kung Hsien-wu
Pai Tzu-ming	Wang Chun-ling

THE PRE-MEDICAL SCHOOL

William Warren Stifler, Ph.D., Dean and instructor in physics. Age 35. Shurtleff College, B.A., 1902. University of Illinois, M.A., 1908, Ph.D., 1911. Instructor in physics at Columbia University, 1911–1916.

K. M. Ma, Hsiu-ts'ai, Instructor in Chinese. Formerly taught in preparatory department of Government University at Peking.

Charles W. Packard, Ph.D., Instructor in biology. Age 33. Syracuse University, B.S., 1907, M.S., 1908. Columbia University, Ph.D., 1914. Instructor in biology at Columbia University, 1914–1918.

**Bird R. Stephenson, M.S.*, Instructor in physics. Age 29. Albion College, Michigan, B.A., 1914. University of Illinois, M.S., 1917. Assistant in physics, University of Illinois, 1917–1918.

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* Appointed since December 31, 1918.

Stanley D. Wilson, Ph.D., Instructor in chemistry. Age 36. Wesleyan University, B.A., 1909, M.A., 1910. University of Chicago, Ph.D., 1916. Instructor in organic chemistry, Rice Institute, Houston, Texas, 1916–1917.

Adolf Eduard Zucker, M.A., Ph.D., Instructor in English and German. Age 29. University of Illinois, B.A., 1912, M.A., 1913. University of Pennsylvania, Ph.D., 1917. Formerly teacher of French and German, Tsing Hua College, Peking.

Miss Alice Middleton Boring, Ph.D., Assistant in biology. Age 36. Bryn Mawr, B.A., 1904, M.A., 1905, Ph.D., 1910. University of Pennsylvania, fellow in zoology, 1905–1906. Wurzburg and Stazione Zoologica, Naples, 1908–1909. Associate professor of biology, University of Maine, 1913–1918.

C. T. Feng, Assistant in chemistry. Assistant in chemistry at the Union Medical College, 1915–1916. Post-graduate course in chemistry at Weihsien, 1916–1917.

Ming-hai Ma, M.A., Assistant in Physics.

**Miss Alice Ryder*, Assistant in English. Employed on the field with approval of Trustees.

Laurence M. Sears, Assistant in Modern European Languages. Princeton College, B.A., 1917. Teaching in several schools and giving part time to Peking Union Medical College.

C. M. Yü, Assistant in Chinese.

Mrs. I. K. Loeber, Secretary to the Dean.

P. L. Shih, Secretary to the Dean of the Pre-Medical School.

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*Appointed since December 31, 1918.

THE TRAINING SCHOOL FOR NURSES

**Miss Anna Dryden Wolf, M.A., R. N.*, Superintendent of Nurses. Age 29. Goucher College, B.A., 1911. Teachers College, Columbia University, M.A., 1916. Assistant Superintendent of the Johns Hopkins Hospital Training School since 1916.

Miss Edith J. Haward, Acting Superintendent of Nurses. Ipswich Nursing Home, one year. Guy's Hospital, London, five years. Appointed to Peking, 1913.

**Miss Mary Louise Beaty, B.S.*, Age 42. Graduate, Presbyterian Hospital, Philadelphia, 1904. Teachers College, Columbia University, B.S., 1916. Presbyterian Hospital, San Juan, Porto Rico, head nurse, 1907–1910; Superintendent of Nurses, 1910–1917. Instructor in Army School of Nursing since 1918.

**Miss Florence Bridgman Brown*, Age 25. Graduate New Britain Normal School and Johns Hopkins Hospital, 1918.

Miss Jo Carr, graduate of Touro Infirmary, New Orleans.

**Miss Kathleen Caulfield*, Age 26. Graduate, Bishop Bethune College, Canada, and Johns Hopkins Hospital, 1918.

Miss Susan H. Connelly.

**Miss Florence Kelly Goodman*, Age 28. Graduate Johns Hopkins Hospital, 1915. Head nurse, Johns Hopkins Convalescent Home.

Miss Ruth Ingram.

**Miss Mary McCoy*, Age 41. Graduate, St. Luke's Training School, Chicago, 1899. Chief nurse, dis-

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* Appointed since December 31, 1918.

pensary Indiana University School of Medicine. Army service one year. Private nursing five years.

**Mrs. Sophia Packer*, Age 28. Graduate, Johns Hopkins Hospital, 1918.

Pai Hsiu-lan, Graduate, West Philadelphia Hospital for Women. Postgraduate work, Presbyterian Hospital, New York. Henry Street Settlement, New York, one year.

**Miss Martha Schaur*, Age 25. Graduate, Johns Hopkins Hospital, 1917.

Miss Joan Swann.

**Miss Lula Sweet*, Formerly in charge of nursing at the Red Cross General Hospital, Shanghai. Postgraduate work at Johns Hopkins Hospital, 1918–1919.

A number of the members of the faculty have spent the year in the United States in further graduate study and research, preparatory to taking up their duties at Peking when the buildings are completed and the school is opened for students.

An announcement of the work of the Peking School has been printed and sent to four or five thousand persons interested in medical education in China.

For the sake of the members of the staff who, on coming to China, will wish to learn the Chinese language, the Board has joined the North China Language School Union and has

* Appointed since December 31, 1918.

appointed Dr. Houghton and Dr. Stifler as its representatives on the school's board of management.

Two preparatory schools, the Peking Primary School and Kindergarten, and the North China American School at Tungchow, are receiving small sums from the Board, for it is expected that members of the faculty will send their children to these schools. They are supported by the societies whose representatives use them.

II. SHANGHAI MEDICAL SCHOOL

The very unfavorable rates of exchange, and the increased cost of building materials which resulted from the war, made the construction work at Peking so expensive that it has been thought best to postpone building activities at Shanghai pending the completion of the Peking School. A careful survey and study of the whole situation from architectural, engineering, and building standpoints, to cover one and a half or two years, has been recommended before any construction is begun. As the completion of the buildings at Peking will require at least one and a half years longer, and as the new survey probably should not be begun until the work on the Peking buildings has been finished, it seems likely that building operations in Shanghai will not be begun for at least three or four years.

A gift amounting to $5,500 has been received from the Harvard Medical School of China, to be used toward the endowment of the Shanghai Medical School.

III. OTHER MEDICAL WORK AIDED

No new appropriations have been made for medical or pre-medical education. Payments have been continued on former appropriations to the medical schools of Yale, St. John's University, and the Shantung Christian University (Tsinanfu Union Medical College).

Fukien Christian University and St. John's University have not yet found themselves in position to make use of the grants of the China Medical Board for pre-medical work, beyond a single fellowship for a Chinese member of their scientific department which St. John's University has asked for and received.

In accordance with the Board's policy of reducing its expenditures for work other than that of the Peking Union Medical College, fewer appropriations have been made for missionary hospitals than in former years, and in general these were small additions to appropriations already made rather than new undertakings. The largest appropriation to a new hospital was that to St. James Hospital at Anking, which has been granted funds toward buildings, equipment, and salaries. The only other considerable appropriations were made for the Foreign Christian

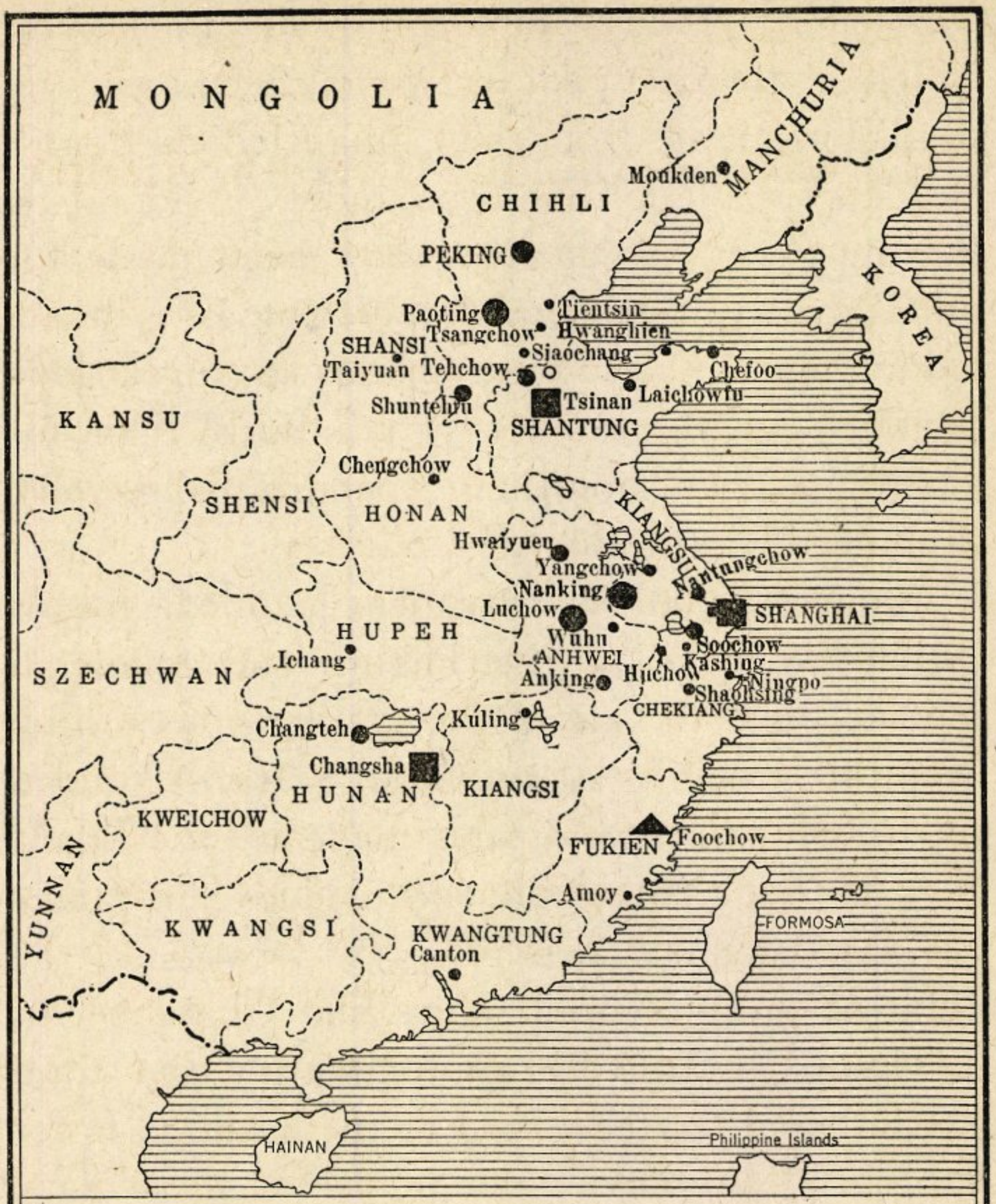

Fig. 56.—Medical institutions aided by China Medical Board (in addition to the medical school at Peking supported in full)

Missionary Society's hospital at Luchowfu, which for the past year or two has been receiving funds for salaries from the China Medical Board, and has for a long time been under consideration for the grants which have now been made for buildings, equipment, and operating expenses.

Payments have been made to missionary societies during the year, to reimburse them for losses in exchange on their expenditures for work supported by the Board.

About $90,000 was also spent for medical education exclusive of the Peking and Shanghai schools, and about $100,000 for missionary hospitals. Table 10 and Fig. 57 (pp. 262 and 253) show the expenditures made by the Board from 1915 to 1918, and the pledges for future years. Fig. 56 (p. 251) gives the location of the different hospitals aided by the China Medical Board, indicating approximately the total amounts paid and pledged to the hospitals.

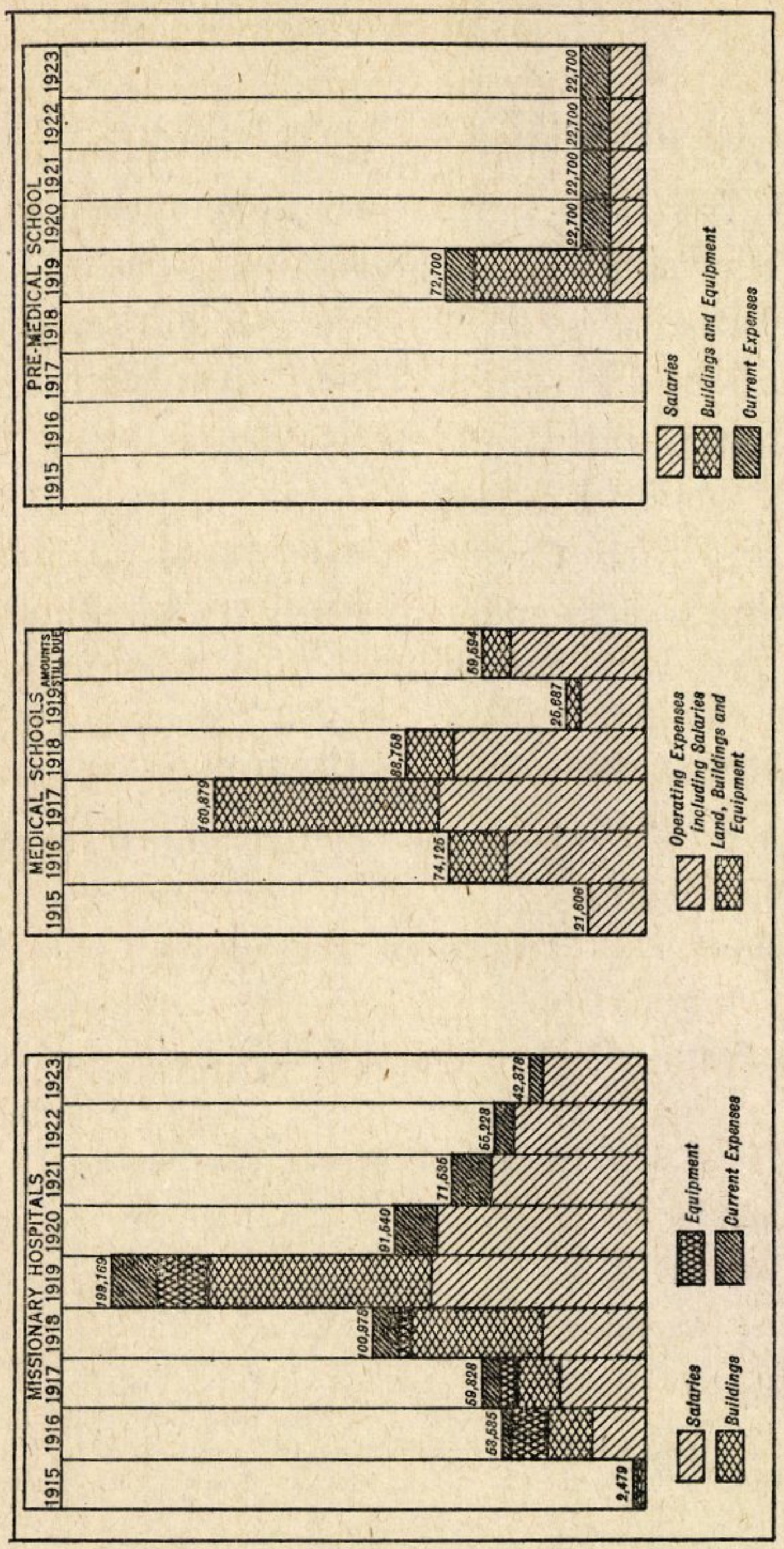

Fig. 57.—Actual expenditures through 1918 and pledges for future years, for missionary hospitals, medical, and pre-medical schools. China Medical Board

IV. FELLOWSHIPS AND SCHOLARSHIPS

Study has been carried on during the year, under fellowships and scholarships of the China Medical Board, by thirty-five medical missionaries and nurses on furlough, eleven Chinese doctors, ten undergraduate students (from the Harvard Medical School of China), six Chinese nurses, and three Chinese pharmacists.

The names of the persons studying here during the year are as follows:[1]

MEDICAL MISSIONARIES ON FURLOUGH[2]

T. W. Ayers, M.D., Southern Baptist Hospital, Hwanghien.

H. W. Boyd, M.D., American Presbyterian Mission, Canton.

N. Worth Brown, M.D., Nanking Union Hospital, Nanking.

Grace Crandall, M.D., Liu-ho Hospital, Liu-ho.

A. M. Dunlap, M.D., Peking Union Medical College, Peking.

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[1] The three pharmacists, who have been here for several years, continued their work during the early part of the year. Mr. George K. How and Mr. Charles T. Cheng then returned to China and are now working as graduate pharmacists at the Hunan-Yale Medical School and the Shantung Christian University, respectively. Mr. Y. D. Hsi went to France in the Y. M. C. A. service with the Chinese troops.

[2] This list includes several persons who have been appointed to, or are under consideration for, positions in the Peking or Shanghai schools of the China Medical Board.

Helen Robertson Gage, M.D., Hunan-Yale Medical School, Changsha.

Nina D. Gage, Nurse, Hunan-Yale Medical School, Changsha.

F. P. Gaunt, M.D., Wuhu General Hospital, Wuhu.

F. W. Goddard, M.D., American Baptist Hospital, Shaohsing.

J. S. Grant, M.D., American Baptist Hospital, Ningpo.

Paul V. Hellwell, M.D., Canadian Episcopal Mission, Kweiteh.

Harvey J. Howard, M.D., D.Oph., Peking Union Medical College, Peking.

J. Charles Humphreys, M.D., Ningyuenfu Hospital, Ningyuenfu.

Mary L. James, M.D., Church General Hospital, Wuchang.

E. M. Johnstone, M.D., American Methodist Mission, Peking.

John M. Korns, M.D., Peking Union Medical College, Peking.

C. B. Lesher, M.D., American Baptist Hospital, Chaoyang.

S. C. Lewis, M.D., American Presbyterian Hospital, Chenchow.

C. S. F. Lincoln, M.D., St. John's University, Shanghai.

O. Houghton Love, M.D., Tungchow Hospital, Tungchow.

Mabel Manderson, M.D., Methodist Mission, Peking.

J. Preston Maxwell, M.D., Yungchun Hospital, Yungchun.

W. H. Park, M.D., Southern Methodist Hospital, Soochow.

Ethel Polk, M.D., Southern Methodist Hospital (for women), Soochow.

Charles A. Powell, *M.D.*, Chaohsien General Hospital, Chaohsien.

Bernard E. Read, *M.S.*, Peking Union Medical College, Peking.

Emma E. Robbins, *M.D.*, Methodist Mission Hospital, Chinkiang.

Florence Sayles, *Nurse*, Women's Methodist Hospital, Tientsin.

Lula Sweet, *Nurse*, Red Cross General Hospital, Shanghai.

Adrian S. Taylor, *M.D.*, Peking Union Medical College, Peking.

Harry B. Taylor, *M.D.*, St. James Hospital, Anking.

J. Oscar Thomson, *M.D.*, Canton Hospital, Canton.

Paul J. Wakefield, *M.D.*, Luchowfu Hospital, Luchowfu.

Andrew H. Woods, *M.D.*, Canton Christian College, Canton.

Charles W. Young, *M.D.*, Peking Union Medical College, Peking.

CHINESE GRADUATE PHYSICIANS

George Y. Char, *M.D.*, Wuchang General Hospital, Wuchang.

Hung Pih Chu, *M.D.*, Red Cross General Hospital, Shanghai.

Edward Young Kau, *M.D.*, Red Cross General Hospital, Shanghai.

C. C. Liau, *M.D.*, University Hospital, University of Pennsylvania, Philadelphia.

C. C. Liu, *M.D.*, Union Medical College, Peking (interne).

Jui Hua Liu, *M.D.*, Red Cross General Hospital, Shanghai.

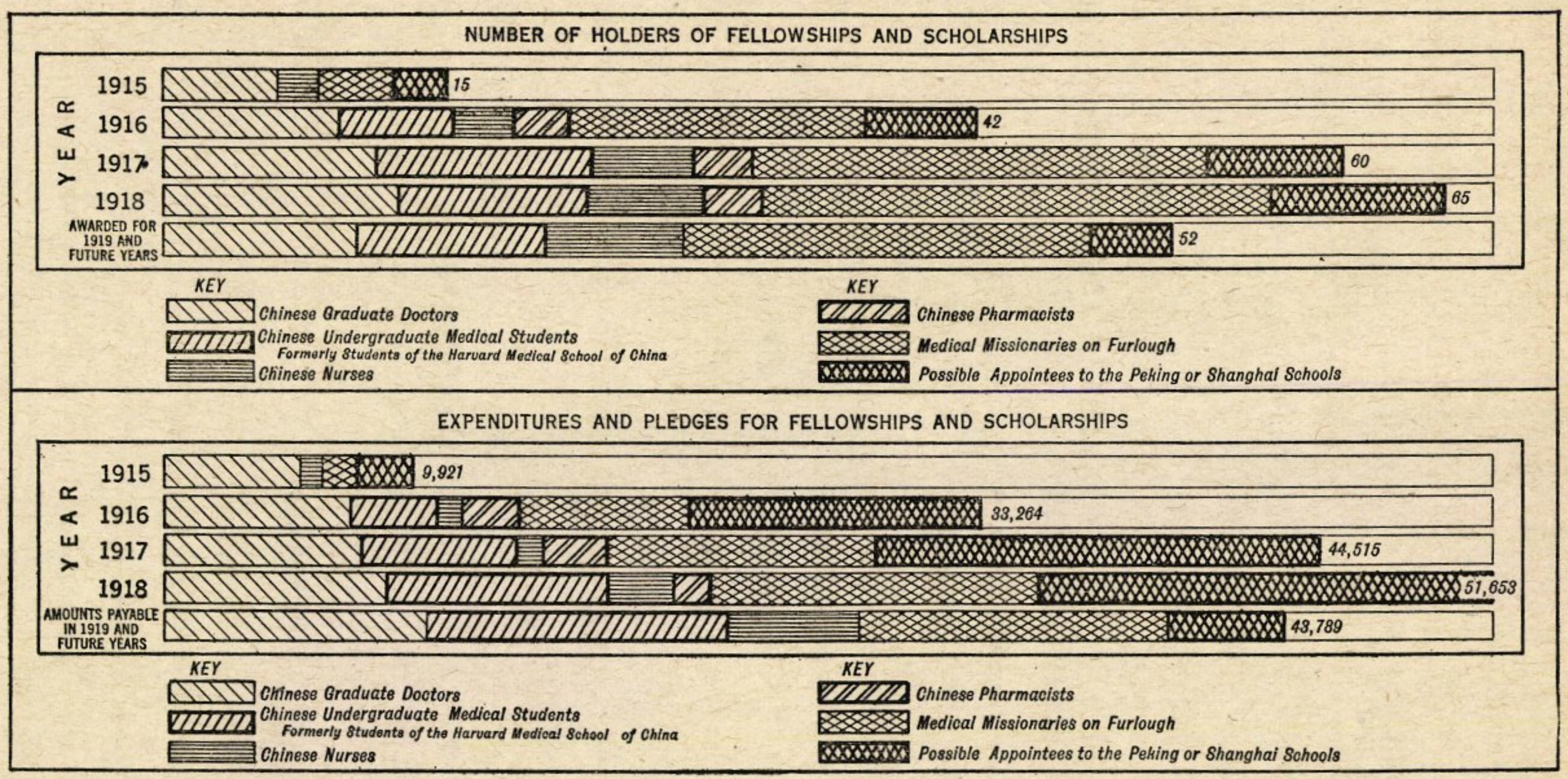

Fig. 58.—Number of scholarship and fellowship holders, by years, since creation of China Medical Board

Way Sung New, *M.D.*, Red Cross General Hospital, Shanghai.

Edgar T. H. Tsen, *M.D.*, Hunan-Yale Medical School and Hospital, Changsha.

Lan Sung Woo, *M.D.*, St. Luke's Hospital, Shanghai.

Grace Yoh, *M.D.*, St. James Hospital, Anking.

Zung-dau Zau, *M.D.*, Red Cross General Hospital, Shanghai.

UNDERGRADUATE MEDICAL STUDENTS FROM THE HARVARD MEDICAL SCHOOL OF CHINA[1]

Sheo-nan Cheer
Cheng-hsiang Hu
Ven-tsao Loh
Tse King
Wen-ping Ling
Ernest Tso
Shu-tai Woo

CHINESE NURSES

Miss Mabel Mooney, Red Cross General Hospital, Shanghai.

Miss Winifred Mooney, Red Cross General Hospital, Shanghai.

Miss Elizabeth Sze, Southern Methodist Hospital, Soochow.

Miss Loo Sung Woo, Johns Hopkins Nursing School, Baltimore.

Miss Lillian Wu, Danforth Memorial Hospital, Kiukiang.

Miss Wei-li Yih, Red Cross General Hospital, Shanghai.

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[1] The students from the Harvard Medical School of China who have been in this country for the past two years have continued their work toward the degree of Doctor of Medicine, Mr. Cheer at the Johns Hopkins and the others at the Harvard Medical School in Boston. Dr. A. M. Dunlap, who has himself held a fellowship of the China Medical Board, has given their work his careful supervi-

Statistics have been prepared for the several years of the Board's existence on the basis of the number of persons actually studying. Tables 11 and 12 and Fig. 58 (pp. 263 and 257) show by years the number of fellowships and scholarships that have been used, and the total payments that have been made on these accounts, together with pledges for future years.

MISCELLANEOUS

Small grants have been made for several years to the Nurses' Association of China and the Publication Committee of the China Medical Missionary Association for work in translation. These have not been intended to commit the Board to any system of translation, but merely to help along temporarily a worthy work. The appropriation this year for the Publication Committee amounted to $5,500 and included part stipend for Dr. Cousland, who is in charge

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sion. After the completion of their courses, which some of them are nearing, they will remain in the United States for an interneship, and possibly for further graduate study, and then return to China for service under one of the missionary societies or this Board.

Two other men from the Harvard Medical School of China, Mr. Zau-yoong Zee and Mr. Mur-sung Ting, have been studying at St. John's University in Shanghai under small grants from the China Medical Board.

Mr. Cheuk-shang Mei, another undergraduate medical student, holds a small fellowship for work at Columbia University leading towards the degrees of Doctor of Medicine and Master of Arts.

of the work, and salaries for five Chinese assistants.

Three eminent Chinese educators, Mr. Fan Yuan-lien, recently Minister of Education, Mr. Yen Hsiu, a Hanlin scholar of the old regime, and Mr. F. T. Sun, President of the School of Fisheries at Tientsin, spent several months in the United States. The Board was able to assist them in getting in touch with the leading authorities on education in this country.

OFFICERS OF THE BOARD

At the December meeting of the Board, the General Director, Dr. Wallace Buttrick, stated that owing to his many duties as President of the General Education Board, he was obliged to resign from the directorship of the China Medical Board. His resignation was accepted and Dr. George E. Vincent was appointed to succeed him. Mr. Edwin R. Embree, Secretary of the Rockefeller Foundation, is Secretary of the China Medical Board, and also of the Boards of Trustees of the Peking Union Medical College and of the Shanghai Medical School of the Rockefeller Foundation.

Summary of Expenditures of China Medical Board for the Year 1918.

I. ADMINISTRATION	
Home office	$20,828
Peking office	24,849
II. PEKING UNION MEDICAL COLLEGE	
Land, buildings and equipment	1,619,666
Administration	116,317
III. SHANGHAI MEDICAL SCHOOL	
Land, buildings and equipment	73,427
Administration	5,596
Maintenance of hospital	35,338
IV. CONTRIBUTIONS TO MISSIONARY HOSPITALS	123,686
V. CONTRIBUTIONS TO MISSIONARY MEDICAL SCHOOLS	57,549
VI. FELLOWSHIPS AND SCHOLARSHIPS	51,575
VII. MISCELLANEOUS	2,757
TOTAL FOR THE YEAR 1918	$2,131,588

TABLE 10 : *Expenditures and Pledges for Missionary Hospitals, Medical, and Pre-Medical Schools By Years*[1]

1. MISSIONARY HOSPITALS

	1915	1916	1917	1918	1919	1920	1921	1922	1923
Salaries	$1,054	$19,850	$31,350	$37,239	$79,418	$76,414	$57,403	$48,128	$37,528
Buildings	.....	17,000	16,000	49,125	83,350	.....	.....	.....	.....
Equipment	1,000	13,609	6,277	3,938	19,350	.....	.....	.....	.....
Current Expenses	425	3,076	6,201	10,676	17,051	15,126	14,350	7,100	4,850
TOTALS	$2,479	$53,535	$59,828	$100,978	$199,169	$91,540	$71,753	$55,228	$42,378

2. MISSIONARY MEDICAL SCHOOLS

	1915	1916	1917	1918	1919	AMOUNTS STILL DUE	TOTALS
Operating Expenses, including Salaries	$21,606	$51,950	$77,551	$70,758	$20,450	$49,594	$291,909
Land, buildings and equipment	.....	22,175	83,328	18,000	5,237	10,000	138,740
TOTALS	$21,606	$74,125	$160,879	$88,758	$25,687	$59,594	$430,649

3. MISSIONARY PRE-MEDICAL SCHOOLS

	1919	1920	1921	1922	1923	TOTALS
Salaries	$12,700	$12,700	$12,700	$12,700	$12,700	$63,500
Buildings and equipment	50,000	.....	.....	.....	.....	50,000
Current Expenses	10,000	10,000	10,000	10,000	10,000	50,000
TOTALS	$72,700	$22,700	$22,700	$22,700	$22,700	$163,500

[1]These figures are compiled from the standpoint of the amounts paid to the missionary societies for use during the designated years. An exact statement of the amount paid during the year, for use either then or at some other time, will be found in the Treasurer's Report, pp. 314–334.

TABLE 11: *Number of Holders of Scholarships and Fellowships Since Creation of China Medical Board, By Years*

	Fellowships on Which Payments Have Been Made				Fellowships Awarded For	Total Number of
	1915	1916	1917	1918	1919 and Future Years	Individuals
Chinese graduate doctors	6	9	11	11	10	20
Chinese undergraduate medical students (formerly students of the Harvard Medical School of China)	—	6	11	10	10	13
Chinese nurses	2	3	5	6	7	9
Chinese pharmacists	—	3	3	3	—	3
Medical missionaries on furlough	4	15	23	26	21	55
Possible appointees to the Peking or Shanghai Schools	3	6	7	9	4	10
Total Individuals per Year	15	42	60	65	52	110

TABLE 12: *Expenditures and Pledges for Fellowships and Scholarships Since Creation of China Medical Board, By Years*[1]

	Payments				Amounts Payable in	
	1915	1916	1917	1918	1919 and Future Years	Totals
Chinese graduate doctors	$5,486	$7,283	$7,526	$8,756	$10,105	$39,156
Chinese undergraduate medical students (formerly students of the Harvard Medical School of China)	—	3,627	6,263	8,651	11,943	30,484
Chinese nurses	950	950	750	2,659	5,268	10,577
Chinese pharmacists	—	2,301	2,754	1,800	—	6,855
Medical missionaries on furlough	1,235	7,428	10,211	12,575	11,725	43,174
Possible appointees to the Peking or Shanghai Schools	2,250	11,675	17,011	17,212	4,748	52,896
Total	$9,921	33,264	44,515	51,653	43,789	183,142

[1] See footnote, page 262.

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

SPECIAL WAR ACTIVITIES

Report of the Director of Laboratories

To the President of the Rockefeller Foundation:

Sir:—

I have the honor to submit herewith my report of the special war activities of the Rockefeller Institute for Medical Research, which have been supported by the Rockefeller Foundation for the period January 1, 1918, to December 31, 1918.

Respectfully yours,

SIMON FLEXNER,
Director of Laboratories.

WAR WORK OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

During 1918 the Rockefeller Foundation continued its special appropriations to the Rockefeller Institute for the support of war activities outside the precise scope of the normal work of the Institute, which is to promote medical discovery through research. Upon the entrance of the United States into the war, the Institute adjusted its activities to a war basis and equipped its several laboratories so that they would supplement the various research laboratories at the command of Government. In scientific research looking toward the prevention and the curative treatment of disease, it had already made contributions which offered immediate application to the medical problems likely to arise in connection with the greatly enlarged personnel of the Army and Navy: among these were the curative serums which it had developed for epidemic meningitis and for one of the forms of pneumonia—diseases which have always appeared with great force in large military organizations,—and the method of treating infected surgical wounds which Doctors Carrel and Dakin had perfected and which had come to have wide

applicability in practice. Inasmuch as it was evident that other medical and allied problems would call for investigation, the entire resources of the Institute were placed freely at the disposal of the Surgeons General and other government officials.

INSTRUCTION AT WAR DEMONSTRATION HOSPITAL

In order to carry out on a large scale the teaching of the Carrel-Dakin treatment for infected wounds, the Rockefeller Foundation built on the grounds of the Institute a portable military base hospital. Completed in the summer of 1917, the hospital continued in active operation throughout 1918. Instruction was given during the year to medical officers and enlisted men of the United States Army and Navy, to civilian surgeons, and to nurses of the Red Cross and of civil hospitals. The total number of persons receiving instruction during the year was 998.

The staff consists of surgeons assigned by the Surgeon General of the United States Army, of French military surgeons lent by the French Sanitary Service, and of bacteriologists and chemists in part assigned by the Surgeon General of the United States Army. Most of the instruction has been given to the men in classes conducted in the laboratories, in the wards, and in the operating room, and by lectures with lan-

tern slides and moving pictures. Class work has been arranged in the following manner:

Surgical Course: Two weeks' instruction in the treatment of infected wounds. Twenty-seven courses given.

Chemistry Course: Organized April 1, 1918. Three days' instruction in the chemistry of antiseptics. Six courses given.

Laboratory Course: Course organized July 1, 1918. One week's instruction in laboratory methods used in conjunction with wound treatment. Three courses given.

Special Instruction: At various times special instruction has been given to individual medical officers, doctors, nurses, and enlisted men. Special demonstrations have also been arranged or groups of doctors, nurses, etc., and for medical officers under instruction elsewhere in New York or from base hospitals.

A detailed report of the number of persons receiving instruction is as follows:

Surgical Class:

Medical Officers of the Army	503
Medical Officers of the Navy	78
Civilians	40
Total	621

Chemistry Class:

Medical Officers and Enlisted Men of the Army	129
Medical Officers and Enlisted Men of the Navy	2
Civilians	3
Total	134

Laboratory Class:

Medical Officers and Enlisted Men of the Army	78
Total Number Receiving Instruction in Classes	833

Special Instruction:

Medical Officers of the Army	30
Medical Officers of the Navy	10
Enlisted Men of the Army	25
Enlisted Men of the Navy	35
Female Nurses	15
Civilians	50
Total	165
TOTAL RECEIVING INSTRUCTION	998

Special Demonstrations Given:

Groups of Surgeons of Base Hospitals	10
Surgical Classes Attending Other Schools of Instruction in New York	9
Groups of Nurses of Base Hospitals	25
Total	44

Lectures and Demonstrations Given by Members of the Staff at Various Institutions and Before Various Medical Societies:

Lt. George Loewy	35
Capt. Geo. Dehelly	10
Major Geo. Stewart	15
Capt. Glenn Cullen	5
Capt. T. F. Sullivan	2
Lt. A. H. Ebeling	4
TOTAL	71

TREATMENT AT WAR DEMONSTRATION HOSPITAL

During the year, 237 patients received treatment in the hospital. On August 31 the first returned soldier was admitted to the hospital. Since that time most of the patients admitted have been men returned from France. Volunteer reconstruction aides have been working in the wards since August 1.

With the going into effect of the armistice, the work of the War Demonstration Hospital did not cease. In the first place, the patients still under treatment required care until they were ready to be transferred to other hospitals or to be returned to their commands. Next, the Surgeon General requested the courses of instruction to be continued for another period of three months in order that regular army surgeons who had not

attended the classes might receive the benefit of the training. The Foundation made a special appropriation of $55,000 to enable the hospital to continue in active operation until April 1, 1919.

COURSES IN BACTERIOLOGY, ETC.

The classes in bacteriology, chemistry, and technical instruction were continued throughout the year except for a break during the height of the influenza epidemic in October and November.

	Number Attended
Bacteriological Class	364
Chemical Class	133
Technical Class	45
TOTAL	542

The instruction in these several subjects ceased with the signing of the armistice, except that the classes under way were carried to the completion of the courses.

PRODUCTION OF SERUM

The preparation of serums by the Institute, and the distribution of these to Government hospitals, have constituted another Foundation-supported contribution to the war. At the time

of the signing of the armistice, the serum production for the treatment of meningitis, pneumonia, and dysentery was at its height. The number of doses supplied increased from 3,000 in 1917 to 25,000 in 1918. It is estimated that the output for the first three months of 1919 will far exceed the entire output for 1918.

The following summary shows the amounts of different kinds of serums which were distributed during 1918:

Meningitis Serum:	Liters
Army Medical School, Washington	290.20
Army Camps	54.22
Naval Medical School, Washington	2.00
Naval Stations and Camps	16.48
American Expeditionary Force, Units Going Abroad	6.48
Rockefeller Institute Hospital, for Army	1.32
Hygienic Laboratory, U. S. Public Health Service, Health Departments	1.00
Royal Naval College, London	32.00
Capt. Hussey, England	1.00
	404.70
For diagnostic purposes, Army and Navy	2.18
TOTAL	406.88

This serum is put up in bottles of 20 mils

each. Hence the number of bottles of the serum issued equals 2,035.

The serum was obtained from twenty-seven horses under immunization for this purpose at the Department of Animal Pathology at Princeton, N. J.

Antipneumococcus Serum:

	(Liters)		
	Army	Navy	Total
Type I.....	38.93	3.05	41.98
Type II.....	13.59	2.01	15.60
Type III.....	5.21	2.00	7.21
TOTAL.....	57.73	7.06	64.79

In addition to the above amounts, twenty-eight liters of antipneumococcus serum were used for instruction purposes in the sixteen bacteriological courses, making a total of 92.79 liters of antipneumococcus serum supplied in 1918.

Of the 41.98 liters of Type I serum supplied, 27.9 liters were for therapeutic use and the remaining 14.08 liters for diagnostic purposes.

The above serum was obtained from seventeen horses under immunization for this purpose at the Department of Animal Pathology at Princeton, N. J.

Antidysenteric Serum:

	Liters
Army Medical School, Washington	10.00
Army Camps	.24
American Expeditionary Force, Units Going Abroad	25.00
American Red Cross, France	20.00
U. S. Persian Expedition	.48
	55.72
For Diagnostic Purposes, Army and Navy	.28
TOTAL	56.00

This serum is put up in bottles of twenty mils each. Hence the number of bottles of the serum issued equals 280.

The above serum was obtained from two horses under immunization for this purpose at the Department of Animal Pathology at Princeton, N. J.

Attention is directed to the fact that in the case of the serums for pneumonia a distinction is drawn between what is called "therapeutic" and "diagnostic" uses. While several kinds of serums can be produced for the purpose of determining the particular or specific type of pneumococcus causing given cases of pneumonia, only one kind of serum, namely that directed against so-called Pneumococcus Type I, is practically effective in the treatment of the

disease. Hence it becomes necessary in every case of pneumonia to determine promptly the type of pneumococcus responsible for the disease. This is done by means of the diagnostic serum. If the pneumococcus discovered is a Type I organism, then the Type I serum should be administered; otherwise not, as it has no effect on cases of pneumonia caused by other types of pneumococcus, of which several are known.

ANTIGASEOUS GANGRENE SERUM

At the time of the cessation of hostilities the control of gaseous gangrene appeared near at hand. The investigation carried out at the Institute on that subject, under the appropriation from the Foundation for war research, opened the way for the production of an antiserum not only for the gas bacillus (*B. welchii*) but also for other anaerobic bacteria occurring in cultivated soils, which often accompanied the gas bacillus in wounds and intensified its destructive action. Experiments to enlarge the therapeutic properties of the antigaseous gangrene serum so as to include the other bacterial species mentioned are so well advanced that it is safe to conclude that a permanent addition has been made to the measures now available for preventing gaseous gangrene, or for curing it when

it arises in connection with the industrial and other accidents of civil life.

TREATMENT OF SYPHILIS

The new drug which has been prepared for the treatment of syphilis has been administered in the Hospital of the Rockefeller Institute to 126 patients belonging to the armed forces of the nation,—seventy-nine from the Army and forty-seven from the Navy. As one result of the precise tests thus carried out, the drug has been issued to a small number of general hospitals in which syphilis is treated. It is hoped soon to collate all the records based on the cases treated with the drug in different institutions, so as to arrive at a decision as to the limitations of its usefulness, if there are any such limitations, and also as to the best manner of its administration. Until this is done, the drug will not be offered for general employment.

CONTINUATION OF WAR-TIME MEDICAL INVESTIGATIONS

The investigations which were taken up under war circumstances can in many instances be continued with advantage and applied to the conditions arising in times of peace. The close of hostilities has permitted the laboratory erected at St. Cloud to be discontinued, and Doctor

Carrel and his staff are now in New York, where, under far more favorable physical conditions, they can continue the investigations upon which they were at work. In the Hospital of the Rockefeller Institute the researches on streptococci, taken up during the epidemics of pneumonia following measles and influenza in the Army camps, will be carried to a conclusion because of their intrinsic importance and the menace which streptococcic infections present in civil life.

THE ROCKEFELLER FOUNDATION

Report of the Treasurer

To the President of the Rockefeller Foundation:

Sir:—

I have the honor to submit herewith my report of the financial operations of The Rockefeller Foundation and its subsidiary organizations for the period January 1, 1918, to December 31, 1918.

Respectfully yours,

L. G. MYERS,
Treasurer.

TREASURER'S REPORT

Income available for appropriation during the year was as follows:

Income from principal funds (not including special funds) and from invested income and reserve.....	$7,609,710.68
Gifts from Mr. John D. Rockefeller..	1,000,000.00
Total.....	$8,609,710.68

The undisbursed balance carried over from 1917, after adding sundry refunds, was $11,630,164.68. This, added to income as above, made a total of $20,239,875.36 available for disbursement. Of this sum $15,050,202.16 was disbursed, leaving a balance of $5,189,673.20, applicable to the following uses:

Amount due on appropriations made in 1918 and prior years, not yet called for.....	$2,138,524.33
Amount available for appropriation—not taking into account pledges due in 1919, referred to below	3,051,148.87
Total.....	$5,189,673.20

The pledges that become effective in 1919 amount to $7,934,641.70. This sum is considered a charge against income for 1919. If treated as a present liability it follows that income as of December 31, 1918, is exceeded by appropriations to the extent of $4,883,492.83.

Additional appropriations which become effective in 1920 and subsequent years, amounting to $2,271,395.00, are considered as charges against the income for the years in which they become payable.

The $1,000,000.00 given by Mr. Rockefeller, mentioned above, was in payment of his pledges of $500,000.00 each toward the Foundation's contributions to the American Red Cross and United War Work Campaign.

On January 30, 1918, the Harvard Medical School of China transferred to the Foundation, under a trust agreement, the sum of $25,000, which is to be known as the Henry Sturgis Grew Memorial Fund.

On July 23, 1918, the Harvard Medical School of China gave to the Foundation the sum of $5,500. This gift is to be known as the Arthur Theodore Lyman Endowment, and the income applied to the uses of the Shanghai Medical School.

There have been no other changes in principal funds during the year, excepting a gain in the reserve fund amounting to $42,123.47, as shown in Exhibit P.

Land, buildings and equipment acquired during the year, by the expenditure of income, cost $1,704,059.74, as shown in Exhibit O. The amount carried in this account as an asset is thus increased from last year's figure of $809,612.80 to $2,513,672.54.

The financial condition and operations are set forth in the appended exhibits listed below:

Balance Sheet	Exhibit A
Statements of Receipts and Disbursements of Income	Exhibit B
Foundation's Appropriations:	
War Work	Exhibit C

After Care of Infantile Paralysis Cases	Exhibit D
Mental Hygiene	Exhibit E
Rockefeller Institute and Medical Education	Exhibit F
School of Hygiene and Public Health	Exhibit G
Miscellaneous	Exhibit H
International Health Board Appropriations	Exhibit I
China Medical Board Appropriations	Exhibit J
Summary of Appropriations and Payments	Exhibit K
Additional Appropriations for Future Years	Exhibit L
Appropriations and Payments of Special Funds	Exhibit M
Statements of Principal Funds	Exhibit N
Land, Buildings and Equipment Funds	Exhibit O
Transactions Relating to Invested Funds	Exhibit P
Schedule of Securities in General Funds	Exhibit Q
Schedule of Securities in Special Funds	Exhibit R

EXHIBIT A

BALANCE SHEET, DECEMBER 31, 1918

ASSETS

I. INVESTMENTS		
General Schedule (Exhibit Q) . .	$125,994,175.94	
Less amount of income investments (see below)	3,817,550.62	
		$122,176,625.32
Special Funds (Exhibit R)		111,300.00
		$122,287,925.32
Special Fund cash on deposit awaiting investment (Exhibit N)		5,500.00
		$122,293,425.32
II. LAND, BUILDINGS AND EQUIPMENT (Exhibit O)		$2,513,672.54
III. INCOME ACCOUNTS		
Income invested temporarily (Exhibit B)		$3,817,550.62
Funds in the hands of agents, to be accounted for, and sundry accounts receivable	$1,262,380.83	
Less accounts payable	111,678.09	
		1,150,702.74
Cash on deposit		261,294.69
		$5,229,548.05
GRAND TOTAL		$130,036,645.91

EXHIBIT A

BALANCE SHEET, DECEMBER 31, 1918

FUNDS AND OBLIGATIONS

I. Funds		
General Fund (Exhibit N)		$120,765,856.00
Estate Laura S. Rockefeller Fund (Exhibit N)	152,733.00	
Reserve Fund (Exhibit N)	1,258,036.32	
		$122,176,625.32
Special Funds (Exhibit N)		
Gift of John D. Rockefeller..	$37,000.00	
Gift of Laura S. Rockefeller..	49,300.00	
Henry Sturgis Grew Memorial Fund.....	25,000.00	
Shanghai Medical School Fund.....	5,500.00	
		116,800.00
		$122,293,425.32
II. Land, Buildings and Equipment Fund		
Appropriations from income (Exhibit O).....		$2,513,672.54
III. Income Accounts		
Estate of Laura S. Rockefeller Fund Income (Exhibit B)...		$39,022.36
Henry Sturgis Grew Memorial Fund Income (Exhibit B)...		787.08
Shanghai Medical School Fund Income (Exhibit B).....		65.41
Balance payable on appropriations (Exhibit K).....	$2,138,524.33	
*Unappropriated income.....	3,051,148.87	
		5,189,673.20
		$5,229,548.05
Grand Total.....		$130,036,645.91

*It should be noted that these figures do not take into account appropriations and pledges payable in 1919 amounting to $7,934,641.70. If allowance be made for this sum, it follows that appropriations will exceed funds in hand by $4,883,-492.83. Nor are additional appropriations and pledges, amounting to $2,271,-395.00, which become effective in 1920 and subsequent years, included in the balance sheet. Both of these liabilities are, for the purposes of this report, considered as charges against the income for the years in which they become payable.

EXHIBIT B

STATEMENT OF RECEIPTS AND DISBURSEMENTS OF INCOME AND OF OTHER FUNDS AVAILABLE FOR APPROPRIATION

GENERAL FUNDS

Receipts

Balance, January 1, 1918		$11,629,048.11	
China Medical Board refunds:			
Peking Union Medical College property	$859.02		
Fellowship and Scholarships	257.55		
		1,116.57	
			$11,630,164.68
Income from principal funds and funds temporarily invested		$7,609,710.68	
Gifts from Mr. John D. Rockefeller		1,000,000.00	
			8,609,710.68
Total amount available			$20,239,875.36

Disbursements

International Health Board (Exhibit I):			
Hookworm, Malaria and Yellow Fever work	$514,503.87		
Tuberculosis work in France	447,573.69		
Medical Education	18,880.75		
Miscellaneous	108,335.61		
			$1,089,293.92
China Medical Board (Exhibit J):			
Missionary Societies—Hospitals	$123,685.98		
Fellowships and Scholarships	51,575.39		
Medical Schools:			
Unaffiliated	57,549.10		
Affiliated	1,850,342.73		
Miscellaneous	48,435.08		
			2,131,588.28
War Work (Exhibit C):			
Well being of Soldiers, Sailors and Prisoners-of-war	$6,202,734.44		
Medical work	349,557.86		
Humanitarian work	4,552,933.88		
		11,105,226.18	
Carried forward		$14,326,108.38	$20,239,875.36

EXHIBIT B—*Continued*

STATEMENT OF RECEIPTS AND DISBURSEMENTS OF INCOME AND OF OTHER FUNDS AVAILABLE FOR APPROPRIATION

GENERAL FUNDS

Brought forward	$14,326,108.38	$20,239,875.36
After Care of Infantile Paralysis Cases (Exhibit D)	38,956.95	
Mental Hygiene (Exhibit E)	17,050.00	
Rockefeller Institute and Medical Education (Exhibit F)	288,277.84	
School of Hygiene and Public Health (Exhibit G)	91,959.97	
Miscellaneous (Exhibit H)	150,135.96	
Administration (Exhibit H)	137,713.06	
	$15,050,202.16	
Balance:		
Securities (Exhibit Q)	$3,817,550.62	
Cash on deposit	221,419.84	
Funds in the hands of agents, to be accounted for, and sundry accounts receivable	1,262,380.83	
	$5,301,351.29	
Less accounts payable	111,678.09	
	5,189,673.20	
	$20,239,875.36	$20,239,875.36

Balance as Above is Apportioned as Follows:

Payable on appropriations and pledges for 1918 and previous years	$2,138,524.33
Amount available for appropriation	3,051,148.87
	$5,189,673.20

EXHIBIT B—(*Continued*)

STATEMENT OF RECEIPTS AND DISBURSEMENTS OF INCOME AND OF OTHER FUNDS AVAILABLE FOR APPROPRIATION

SPECIAL FUNDS

LAURA S. ROCKEFELLER FUNDS INCOME

Income collected during the year		$3,000.00
Amounts paid to the several societies designated by Mrs. Rockefeller (Exhibit M)	$3,000.00	

JOHN D. ROCKEFELLER FUND INCOME

Income collected during the year		$1,850.00
Amounts paid to the society designated by Mr. Rockefeller (Exhibit M)	$1,850.00	

ESTATE LAURA S. ROCKEFELLER FUND INCOME

Balance, January 1, 1918	$28,039.07
Income collected during the year	10,983.29
Balance accounted for in cash on deposit	$39,022.36

JOINT ACCOUNT BELGIAN CHILDREN IN SWITZERLAND

Balance, January 1, 1918	$1,847.28
Credits adjusting account	562.68
Interest, July 18, 1916 to November 1, 1918 credited to account	1,918.71
Total paid to American Red Cross	$4,328.67

HENRY STURGIS GREW MEMORIAL FUND

Income collected during the year		$787.08
Accounted for in cash on deposit	$787.08	

ARTHUR THEODORE LYMAN ENDOWMENT

Bank interest from date of receipt of fund, July 23, 1918, to December 31, 1918		$65.41
Accounted for in cash on deposit	$65.41	

EXHIBIT C

1918 FOUNDATION APPROPRIATIONS,

Unpaid Balances of Appropriations Made in Previous Years, and Payments Thereon Made in 1918

WAR WORK

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
WELL-BEING OF SOLDIERS, SAILORS, AND PRISONERS-OF-WAR			
American Social Hygiene Association, (R.F. 2256) For the support of workers serving under the direction of the Commission on Training Camp Activities	$2,623.29	. . . . .	$2,623.29
(R.F. 2307) For its work during the period January 1st to June 30th, 1918.	. . . . .	$100,000.00	99,467.14
(R.F. 2330) For demonstration of Social Hygiene program in War Camp Community	. . . . .	25,000.00	. . . . .
(R.F. 2345) Law Enforcement and Social Hygiene budgets of Commission	. . . . .	50,000.00	50,000.00
(R.F. 2353) Law Enforcement and Social Hygiene	. . . . .	110,000.00	18,025.09
Knights of Columbus (R.F. 2304, 2326) For war work during 1918	. . . . .	200,000.00	200,000.00
Playground and Recreation Association of America (R.F. 2266) For administrative expenses of its work in the American Army Training Camps	75,000.00	. . . . .	75,000.00
Carried Forward	$77,623.29	$485,000.00	$445,115.52

EXHIBIT C—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$77,623.29	$485,000.00	$445,115.52
WELL-BEING OF SOLDIERS, SAILORS, AND PRISONERS-OF-WAR (*Cont'd*)			
Playground and Recreation Association of America (*Cont'd*)			
(R.F. 2342) Loaned for the promotion of War Camp Community with the understanding that so much as may have been called for will be repaid to the Treasury of the Rockefeller Foundation on or before November 30, 1918	.....	900,000.00	.....
Training Camp Auxiliary Fund Committee			
(R.F. 2306) For its work for the period from January 1st to June 30, 1918 ..	.....	50,000.00	38,893.05
Teaching of Hygiene to United States Troops			
(R.F. 2346) For demonstration at Camp Meade	.....	1,500.00	1,000.00
United War Work Fund			
(R.F. 2352) For war work of the seven co-operating agencies	.....	2,500,000.00	2,500,000.00
(R.F. 2354) Special dividend declared by the National Lead Company . . .	.....	14,700.00	14,700.00
War Camp Community Service			
(R.F. 2332) For a demonstration during 1918 in adequate care of negro troops	.....	25,000.00	25,000.00
Carried Forward	$77,623.29	$3,976,200.00	$3,024,708.57

EXHIBIT C—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$77,623.29	$3,976,200.00	$3,024,708.57
WELL-BEING OF SOLDIERS, SAILORS AND PRISONERS-OF-WAR (*Cont'd*)			
Young Men's Christian Association, International Committee (R.F. 2232) For work in prisoners-of-war and training camps abroad	75,000.00	. . . . .	75,000.00
National War Work Council, Y. M. C. A. (R.F. 2305) Toward its general budget for the period January 1st to June 30, 1918	. . . . .	2,500,000.00	2,500,000.00
Young Women's Christian Association, War Work Council (R.F. 2270) For work in connection with the American Army training camps . . .	253,025.87	. . . . .	253,025.87
(R.F. 2335) For its war work in America during the period from July 1, 1917 to July 1, 1918	. . . . .	350,000.00	350,000.00
MEDICAL WORK			
National Committee for Mental Hygiene (R.F. 2234) To provide buildings for a Naval Psychiatric Unit	15,000.00	. . . . .	. . . . .
(R.F. 2289) For work in connection with the American Army and Navy during the year 1918	. . . . .	25,000.00	25,000.00
Carried Forward	$420,649.16	$6,851,200.00	$6,227,734.44

EXHIBIT C—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$420,649.16	$6,851,200.00	$6,227,734.44
MEDICAL WORK (*Cont'd*)			
National Research Council (R.F. 2319) For the support of its Division of Medicine and Related Sciences during the period March 1st to December 31, 1918 . .	. . . . .	50,000.00	13,856.82
Rockefeller Institute for Medical Research (R.F. 2246) For support of hospital under control of Dr. Carrel for teaching military and other surgeons new methods of surgical treatment of infected wounds	100,000.00	. . . . .	100,000.00
(R.F. 2317) For the operation of its War Demonstration Hospital during the year 1918	. . . . .	125,000.00	75,000.00
(R.F. 2230) For additional equipment for teaching military and naval surgeons	10,000.00	. . . . .	7,364.03
(R.F. 2302, 2338) For instruction of military and naval surgeons during the year 1918	. . . . .	15,000.00	15,000.00
(R.F. 2228, 2318) For war research and relief during the year 1917	25,000.00	7,403.52	31,853.52
(R.F. 2300, 2327) For war research and relief during the year 1918	. . . . .	35,000.00	26,104.44
Carried Forward	$555,649.16	$7,083,603.52	$6,496,913.25

EXHIBIT C—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$555,649.16	$7,083,603.52	$6,496,913.25
MEDICAL WORK (*Cont'd*)			
Rockefeller Institute for Medical Research (*Cont'd*)			
(R.F. 2229, 2313) For additional equipment, assistance and materials at the Princeton Farm for the preparation of serums during the year 1917	25,000.00	4,877.41	29,877.41
(R.F. 2301) For the preparation of serums at the Princeton Farm during the year 1918	. . . . .	25,000.00	25,000.00
(R.F. 2343) For the maintenance of special war activities to December 31, 1918	. . . . .	33,202.00	501.64
HUMANITARIAN WORK			
American Red Cross			
(R.F. 2247) For the war fund of the American Red Cross	*1,500,000.00	. . . . .	1,500,000.00
(R.F. 2336) For the maintenance and care of the Belgian children in Switzerland during the period from July 1, 1917 to December 31, 1918	. . . . .	75,000.00	22,196.33
(R.F. 2340) Special dividend declared by the National Lead Company . . .	. . . . .	29,400.00	29,400.00
(R.F. 2337) For the second war fund of the American Red Cross	. . . . .	3,000,000.00	3,000,000.00
Carried Forward	$2,080,649.16	$10,251,082.93	$11,103,888.63

* A portion of the principal fund of the Foundation was made available for this appropriation.

EXHIBIT C—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward....	$2,080,649.16	$10,251,082.93	$11,103,888.63
HUMANITARIAN WORK (*Cont'd*)			
Belgium (R.F. 2192) Stipends for Belgian professors in England...	2,517.57	.....	2,500.00
Poland, Serbia, Montenegro and Albania (R.F. 2165) For relief work.....	103,218.63	.....	.....
General Relief Work (R.F. 2157) To be expended at the discretion of the Director of the War Relief Commission	15,419.26	.....	.....
Dr. Vincent's Trip to Europe (R.F. 2286) For salaries and expenses.	.....	18,000.00	1,395.00
War Relief Commission (R.F. 2216) Administration—1917 ...	19,567.07	.....	.....
TOTALS.....	$2,221,371.69	$10,269,082.93	$11,107,783.63
Credit adjusting R.F. 2216—War Relief Commission Administration.....	.....	.....	2,557.45
Unexpended balances of appropriations allowed to lapse			
R.F. 2157.. $15,419.26			
2192.. 17.57			
2165.. 103,218.63			
2216.. 18,789.95			
	137,445.41	.....	.....
R.F. 2286.. $16,605.00			
2307.. 532.86			
2317.. 47,835.62			
2327.. 4,276.41			
2342.. 900,000.00			
2343.. 17,129.49			
	.....	986,379.38	.....
NET TOTALS	$2,083,926.28	$9,282,703.55	$11,105,226.18

EXHIBIT D

AFTER CARE OF INFANTILE PARALYSIS CASES

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
After Care of Infantile Paralysis Cases			
(R.F. 2253, 2334) For administrative expenses....	$10,463.78	$16,000.00	$23,517.81
State Charities Aid Association			
(R.F. 2290) For work during the year 1918 in cooperation with the New York State Department of Health in providing for the after care of infantile paralysis cases.....	.....	15,000.00	10,939.14
(R.F. 2314) For the conduct of clinics by Dr. Robert W. Lovett during the years 1916 and 1917.....	.....	4,500.00	4,500.00
(R.F. 2315) For the conduct of clinics by Dr. Robert W. Lovett during the year 1918.....	.....	2,000.00	.....
TOTALS.....	$10,463.78	$37,500.00	$38,956.95

EXHIBIT E

MENTAL HYGIENE

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
National Committee for Mental Hygiene			
(R.F. 2259) For the work of the committee in aiding state commissions on provision for the mentally defective during the year ending July 31, 1918.....	$8,500.00	.....	.....
(R.F. 2309) For the work of the committee in aiding state commissions on provision for the mentally defective during the year 1918.....	.....	$11,750.00	.....
(R.F. 2260, 2311) For studies in the psycho-pathology of crime.....	6,000.00	7,500.00	$2,000.00
(R.F. 2277) For administration expenses	.....	7,000.00	7,000.00
(R.F. 2308) For carrying out its surveys of the care and treatment of mental diseases during the year 1918.....	.....	10,000.00	1,000.00
(R.F. 2310) For the support of the Psychiatric Clinic at Sing Sing Prison during the year 1918.....	.....	5,000.00	2,500.00
(R.F. 2312) For the committee's work during 1918 in the establishment of uniform statistics on mental diseases.....	.....	2,750.00	2,750.00
(R.F. 2344) For the purpose of enabling a subcommittee of the New York State Commission of Prisons to make an inquiry and report looking to the adoption of the psychiatric examination of prisoners.	.....	1,800.00	1,800.00
TOTALS.....	$14,500.00	$45,800.00	$17,050.00

EXHIBIT F

ROCKEFELLER INSTITUTE AND MEDICAL EDUCATION

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Rockefeller Institute for Medical Research			
(R.F. 2173) For alteration of buildings	$80,303.72	.....	$80,303.72
(R.F. 2245) For the construction of coal pockets	30,000.00	.....	26,475.06
(R.F. 2303) For buildings and equipment	.....	$24,000.00	24,000.00
(R.F. 2350) To cover deficit of the Institute	.....	33,925.14	33,925.14
(R.F. 2299) For its corporate purposes	50,000.00	.....	40,094.50
(R.F. 2347) Special fund of the Director	.....	7,500.00	7,500.00
(R.F. 2385) Additional Compensation to Employees	.....	85,000.00	53,000.00
University of Chicago			
(R.F. 2287) For interest on pledge of $1,000,000.00 for the establishment of a Medical School	.....	25,000.00	22,979.42
TOTALS	$160,303.72	$175,425.14	$288,277.84
Unexpended balance of appropriations allowed to lapse			
(R.F. 2245) $3,524.94			
(R.F. 2299) 9,905.50			
	13,430.44		
NET TOTALS	$146,873.28	$175,425.14	$288,277.84

EXHIBIT G

SCHOOL OF HYGIENE AND PUBLIC HEALTH

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Johns Hopkins University			
(R.F. 2170) For the establishment and maintenance of a school of hygiene and public health	$228,180.30	.....	$10,967.80
(R.F. 2242) For the administration and equipment during the year 1917–1918	50,290.00	.....	40,838.70
(R.F. 2284) For operating expenses during the period July 1st to December 31, 1918	.....	$57,017.00	13,462.02
(R.F. 2281) For renovation of physics laboratory	.....	18,000.00	14,952.22
(R.F. 2283) For additional apparatus for the physics laboratory	.....	23,600.00	243.00
(R.F. 2282) For furniture	.....	12,000.00	11,496.23
TOTALS	$278,470.30	$110,617.00	$91,959.97

EXHIBIT H

MISCELLANEOUS

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
American Academy in Rome			
(R.F. 215) For general purposes, $10,000.00 per year for ten years beginning with 1914. (Installment due 1918)	.....	$10,000.00	$10,000.00
Bureau of Municipal Research			
(R.F. 265) For constructive studies in Government of State of New York $10,000.00 per year for five years beginning with 1915. (Installment due 1918)	.....	10,000.00	10,000.00
(R.F. 2102) For its New York City work. $15,000.-00 per year for four years beginning with 1916. (Installment due 1918)	.....	15,000.00	15,000.00
Committee on Scientific Research in Governmental Problems			
(R.F. 2183) For cost of publication of scientific studies	$8,000.00	.....	8,000.00
Committee of Reference and Counsel of the Annual Foreign Mission Conference of North America			
(R.F. 228) For carrying out its program of co-operation and co-ordination in foreign missionary work of the principal American Mission Boards. Total pledge of $425,000.00 extending over a period of ten years beginning with 1914. (Installment due 1918)	.....	50,000.00	50,000.00
Investigation of Industrial Relations			
(R.F. 2206) Administration 1917	6,131.02	.....	.....
(R.F. 2276) Administration 1918	.....	3,333.00	2,439.60
Carried Forward	$14,131.02	$88,333.00	$95,439.60

EXHIBIT H—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$14,131.02	$88,333.00	$95,439.60
National Committee for the Prevention of Blindness (R.F. 233) $5,000.00 per year for five years beginning with 1914. (Installment due 1918)	. . . . .	5,000.00	5,000.00
National Organization for Public Health Nursing (R.F. 2288) Toward the budget of the organization for the year 1918	. . . . .	15,000.00	15,000.00
New York Association for Improving the Condition of the Poor (R.F. 239) For the purpose of providing pensions for dependent widows with families. $20,000.00 per year for ten years beginning with 1914. (Balance of installment due 1917) . .	15,000.00	. . . . .	15,000.00
(Installment due 1918)	. . . . .	20,000.00	5,000.00
Public Health Committee of the New York Academy of Medicine (R.F. 2333) For a study of New York City dispensaries	. . . . .	10,000.00	3,729.16
ASSET ACCOUNTS			
(R.F. 2275) Books for the Library	. . . . .	700.00	218.90
(R.F. 2274, 2341) Furniture and Fixtures	. . . . .	3,000.00	2,876.59
(R.F. 2252, 2285) Grand Chenier Tract, Taxes and Expenses	1,380.48	3,000.00	4,031.71
(R.F. 2351) Purchase of land	. . . . .	3,840.00	3,840.00
Totals Carried Forward	$30,511.50	$148,873.00	$150,135.96

EXHIBIT H—*Continued*

		PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Totals Brought Forward		$30,511.50	$148,873.00	$150,135.96
Unexpended balances of appropriations allowed to lapse.				
(R.F. 2206)		6,131.02	.....	.....
(R.F. 2275)	$481.10			
(R.F. 2276)	893.40			
(R.F. 2285)	348.77			
(R.F. 2341)	123.41			
		.....	1,846.68	.....
NET TOTALS		$24,380.48	$147,026.32	$150,135.96
ADMINISTRATION				
(R.F. 2272, 2291A, 2384, 2387) Executive Offices.		$5,312.38	$123,067.07	$119,547.53
(R.F. 2273, 2291A, 2316, 2339, 2384) Treasurer's Office		857.52	17,823.96	18,165.53
TOTALS		$6,169.90	$140,891.03	$137,713.06
Unexpended balances of appropriations allowed to lapse				
(R.F. 2291A)		509.69	.....	.....
(R.F. 2339)	$515.95			
(R.F. 2387)	2,311.89			
		.....	2,827.84	
NET TOTALS		$5,660.21	$138,063.19	$137,713.06

EXHIBIT I

1918 INTERNATIONAL HEALTH BOARD[1] APPROPRIATIONS,

Unpaid Balances of Appropriations Made in Previous Years, and Payments Thereon Made in 1918

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Hookworm Work			
Southern States			
Alabama			
1917—I.H. 2252 ..	$1,070.99	.....	$1,070.99
1918—I.H. 2319, 2320, 2321	.....	$6,500.00	4,621.53
Arkansas			
1917—I.H. 2275, 2287	781.86	.....	781.86
1918—I.H. 2322, 2427	.....	2,900.00	675.50
Georgia			
1917—I.H. 2307, 2308	1,650.00	.....	189.94
1918—I.H. 2323, 2324, 2325, 2325.	.....	10,700.00	1,473.87
Kentucky			
1917—I.H. 2271 ..	417.65	.....	417.65
1918—I.H. 2327 ..	.....	3,300.00	.....
Louisiana			
1917—I.H. 2186 ..	1,618.36	.....	397.02
1918—I.H. 2328–2330	.....	7,200.00	842.06
Maryland			
1917—I.H. 2305 ..	495.40	.....	55.75
1918—I.H. 2331 ..	.....	2,400.00	.....
Mississippi			
1917—I.H. 2228–2230	3,199.23	.....	2,972.62
1918—I.H. 2332–2338	.....	14,500.00	920.30
North Carolina			
1917—I.H. 2288–2292, 2297–2300, 2317, 2413	4,992.50	.....	4,992.50
1918—I.H. 2339–2348, 2407–2409, 2420–2422	.....	13,215.88	7,533.58
Carried Forward	$14,225.99	$60,715.88	$26,947.17

[1] The Foundation provides for the cost of work carried on by the International Health Board by making to the Board one or more appropriations to cover its work for the year. From these large grants the Board then makes its own appropriations for specific objects.

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$14,225.99	$60,715.88	$26,947.17
HOOKWORM WORK (*Cont'd*)			
Southern States (*Cont'd*)			
South Carolina			
1917—I.H. 2188–2190, 2253, 2254.	2,123.89	. . . . .	2,123.89
1918—I.H. 2349–2353	. . . . .	14,150.00	10,019.25
Tennessee			
1917—I.H. 2255–2259	3,689.52	. . . . .	2,007.69
1918—I.H. 2354–2358	. . . . .	10,000.00	. . . . .
Texas			
1918—I.H. 2359–2364	. . . . .	9,866.68	. . . . .
Virginia			
1917—I.H. 2199–2203	2,435.32	. . . . .	2,435.32
1918—I.H. 2365–2370	. . . . .	12,500.00	5,062.79
Central America			
Costa Rica			
1917—I.H. 2205 . .	12,661.89	. . . . .	12,661.89
1918—I.H. 2371 . .	. . . . .	20,240.00	13,121.82
Guatemala			
1917—I.H. 2206 . .	2,189.17	. . . . .	2,189.17
1918—I.H. 2372 . .	. . . . .	18,186.46	12,203.21
Nicaragua			
1917—I.H. 2207 . .	2,725.72	. . . . .	2,725.72
1918—I.H. 2373 . .	. . . . .	21,500.00	12,439.20
Panama			
1917—I.H. 2208 . .	4,103.68	. . . . .	4,103.68
1918—I.H. 2374 . .	. . . . .	20,645.00	9,747.25
Salvador			
1917—I.H. 2209 . .	3,300.71	. . . . .	2,036.69
1918—I.H. 2375, 2559	. . . . .	10,070.00	7,440.94
Carried Forward	$47,455.89	$197,874.02	$127,263.68

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$47,455.89	$197,874.02	$127,263.68
HOOKWORM WORK (*Cont'd*)			
South America			
Brazil			
1917—I.H. 2235, 2279, 2280, 2294–2296	9,467.20	. . . . .	9,134.05
1918—I.H. 2376–81, 2404, 2423, 2432, 2440, 2460, 2451, 2457, 2444	. . . . .	103,217.50	37,048.79
British Guiana			
1917—I.H. 2211, 2237	5,534.18	. . . . .	3,367.90
1918—I.H. 2382 . .	. . . . .	14,386.82	9,614.19
Dutch Guiana			
1917—I.H. 2213 . .	1,820.65	. . . . .	1,820.65
1918—I.H. 2383 . .	. . . . .	12,460.00	1,992.42
British West Indies			
Antigua			
1917—I.H. 2210 . .	4,133.45	. . . . .	885.55
Grenada			
1917—I.H. 2214 . .	114.85	. . . . .	114.85
1918—I.H. 2384 . .	. . . . .	6,614.00	936.30
Jamaica			
1918—I.H. 2445, 2466	. . . . .	7,641.00	1,671.82
St. Lucia			
1917—I.H. 2215 . .	1,749.98	. . . . .	1,749.98
1918—I.H. 2385 . .	. . . . .	8,288.60	5,759.35
St. Vincent			
1917—I.H. 2216 . .	3,777.67	. . . . .	942.86
1918—I.H. 2386 . .	. . . . .	7,703.60	1,986.84
Trinidad			
1917—I.H. 2218 . .	1,595.27	. . . . .	1,595.27
1918—I.H. 2387, 2560	. . . . .	8,870.00	5,656.85
The East			
Ceylon			
1917—I.H. 2219 . .	4,667.37	. . . . .	Cr. 9,477.59
1918—I.H. 2426, 2388	. . . . .	12,116.00	7,531.95
China			
1917—I.H. 2282 . .	2,126.72	. . . . .	252.31
1918—I.H. 2438 . .	. . . . .	11,400.00	1,243.88
Carried Forward	$82,443.23	$390,571.54	$211,091.90

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$82,443.23	$390,571.54	$211,091.90
HOOKWORM WORK (*Cont'd*)			
The East (*Cont'd*)			
Egypt			
1915—I.H. 237 . . .	15,891.88	. . . . .	. . . . .
Federated Malay States			
Hookworm Commission			
1917—I.H. 2220 . .	8,997.17	. . . . .	. . . . .
Fiji Islands			
1917—I.H. 2243, 2249	432.40	. . . . .	432.40
1918—I.H. 2389 . .	. . . . .	5,395.96	1,880.59
Papua and Queensland—Survey . .			
1917—I.H. 2238 . .	1,926.13	. . . . .	333.14
Papua			
1918—I.H. 2430 . .	. . . . .	2,100.00	2,009.41
Philippine Hospital Ship			
1917—I.H. 2221 . .	12,500.00	. . . . .	. . . . .
1918—I.H. 2428 . .	. . . . .	12,500.00	6,000.00
Queensland			
1918—I.H. 2431, 2561	. . . . .	6,300.00	6,128.46
Seychelles Islands			
1917—I.H. 2245, 2277	1,624.48	. . . . .	514.77
1918—I.H. 2419 . .	. . . . .	6,500.00	3,014.24
Siam			
1917—I.H. 2244 . .	309.39	. . . . .	309.39
1918—I.H. 2390 . .	. . . . .	9,317.08	7,029.61
Field Expenses not Covered by Budgets			
Salaries of Field Staff			
1918—I.H. 2396 . .	. . . . .	180,000.00	138,204.30
Traveling Expenses of Field Staff			
1917—I.H. 2183 . .	26,690.97	. . . . .	7,114.00
1918—I.H. 2398 . .	. . . . .	60,000.00	25,890.38
Commutation of Field Staff			
1918—I.H. 2397 . .	. . . . .	25,000.00	9,048.07
Study Leave for members of the staff			
1918—I.H. 2468 . .	. . . . .	500.00	. . . . .
Carried Forward	$150,815.65	$698,184.58	$419,000.66

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$150,815.65	$698,184.58	$419,000.66
HOOKWORM WORK (*Cont'd*)			
Field Expenses not Covered by Budgets (*Cont'd*)			
Traveling Expenses of Families of Field Staff			
1917—I.H. 2278 . .	300.97	. . . . .	300.97
1918—I.H. 2399, 2446	. . . . .	8,000.00	6,621.49
Drugs for conserving health of members of the Field Staff			
1918—I.H. 2403 . .	. . . . .	500.00	202.50
Medical examination of applicants for membership on the Field Staff			
1918—I.H. 2429 . .	. . . . .	250.00	. . . . .
Purchase of automobiles for use of directors in training			
1918—I.H. 2402 . .	. . . . .	3,000.00	320.97
Field equipment and supplies . . .			
1918—I.H. 2400 . .	. . . . .	3,000.00	3,000.00
Miscellaneous			
Conference of health officers of the southern states—I.H. 2310	. . . . .	3,500.00	2,990.76
Investigation of sewage disposal in rural homes—I.H. 2284, 2309	5,359.11	10,000.00	8,868.52
Lecture charts on hookworm disease —I.H. 2248	225.80	. . . . .	17.40
School charts on hookworm disease—I.H. 2270	929.73	. . . . .	. . . . .
Pamphlets and charts —I.H. 2414	. . . . .	4,000.00	3,999.49
Carried Forward	$157,631.26	$730,434.58	$445,322.76

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$157,631.26	$730,434.58	$445,322.76
HOOKWORM WORK (*Cont'd*)			
Miscellaneous (*Cont'd*)			
Motor boat for Dutch Guiana—I.H. 2231	289.35	. . . . .	199.71
Portable house and office for use of director in Salvador—I.H. 2285, 2293, 2411, 2449	2,523.10	1,200.00	3,468.45
MALARIA WORK			
Southern States			
Arkansas			
1917—I.H. 2250 . .	1,134.90	. . . . .	1,134.90
1918—I.H. 2433 . .	. . . . .	1,350.00	539.24
Mississippi			
1917—I.H. 2204 . .	15,255.98	. . . . .	9,713.83
1918—I.H. 2424, 2450, 2455, 2425	. . . . .	17,365.00	12,159.73
YELLOW FEVER WORK			
Yellow Fever Commission 1918—I.H. 2439	. . . . .	2,849.15	2,849.15
Yellow Fever Commission—Ecuador 1918—I.H. 2452	. . . . .	26,750.00	21,891.28
Yellow Fever Control—			
Guayaquil, Ecuador—I.H. 2239, 2459 . . .	. . . . .	20,000.00	10.00
East Coast of Brazil—I.H. 2240	3,390.58	. . . . .	6.87
Coro, Venezuela—I.H. 2418	. . . . .	5,000.00	. . . . .
Guatemala—I.H. 2458	. . . . .	25,000.00	10,026.96
Salaries of Yellow Fever Commission—I.H. 2241	35,000.00	. . . . .	6,200.00
Traveling expenses of Yellow Fever Commission—I.H. 2242	11,496.45	. . . . .	980.99
Carried Forward	$226,721.62	$829,948.73	$514,503.87

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$226,721.62	$829,948.73	$514,503.87
TUBERCULOSIS WORK IN FRANCE			
Inauguration of work —I.H. 2281	6,420.92	. . . . .	92.66
Central Administration			
1917—I.H. 2314	10,142.42	. . . . .	8,466.58
1918—I.H. 2415, 2435, 2436	. . . . .	84,700.00	75,665.98
Educational Division			
1917—I.H. 2316	16,252.00	. . . . .	12,954.08
1918—I.H. 2417, 2437	. . . . .	77,400.00	76,179.41
Medical Division			
1917—I.H. 2315	28,586.29	. . . . .	16,870.90
1918—I.H. 2416, 2436	. . . . .	262,300.00	255,144.08
Dr. L. Farrand—Additional Compensation—I.H. 2453–2454	. . . . .	2,200.00	2,200.00
MEDICAL EDUCATION			
Sao Paulo—Department of Hygiene Equipment—I.H. 2312, 2443	9,820.41	5,000.00	13,085.46
Operation—I.H. 2313	. . . . .	12,500.00	1,316.24
Borgas, Dr. F.—Fellowship—I.H. 2441 . .	. . . . .	1,900.00	1,491.04
Chagas, Dr. C. P.—Fellowship—I.H. 2311, 2442, 2463	1,678.15	3,150.00	2,353.98
Souza, Dr. C. P.—Fellowship—I.H. 2456	. . . . .	1,900.00	634.03
MISCELLANEOUS			
Survey & Exhibits Administration 1918—I.H. 2394, 2448 . . .	. . . . .	16,500.00	14,970.85
Express, Freight & Exchange—I.H. 2401, 2447	. . . . .	13,000.00	11,121.79
Carried Forward	$299,621.81	$1,310,498.73	$1,007,050.95

EXHIBIT I—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$299,621.81	$1,310,498.73	$1,007,050.95
ADMINISTRATION			
Home Office—I.H. 2395, 2412, 2562	6,883.90	84,146.28	82,242.97
TOTALS	$306,505.71	$1,394,645.01	$1,089,293.92
Balance of funds appropriated by the Rockefeller Foundation for the Board's work during 1918 remaining unappropriated by the International Health Board on December 31, 1918.	. . . . .	105,354.99	. . . . .
		1,500,000.00	
Unexpended balances of appropriations and unappropriated balance allowed to elapse	127,454.37	158,956.46	. . . . .
NET TOTALS . . .	$179,051.34	$1,341,043.54	$1,089,293.92

EXHIBIT J*

1918 CHINA MEDICAL BOARD APPROPRIATIONS,

Unpaid Balances of Appropriations Made in Previous Years, and Payments Thereon Made in 1918

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
MISSIONARY SOCIETIES —HOSPITALS			
American Baptist Foreign Mission Society			
(C.M. 276) Ningpo Hospital — For salaries of doctor and nurse, $2,250.00 per year for five years beginning with 1918. (Installment due 1918).	.....	$2,250.00	.....
(C.M. 277) Shaohsing Hospital— For support of foreign nurse, Chinese business manager and foreign doctor, $2,475.00 per year for five years beginning with 1918. (Installment due 1918).....	.....	2,475.00	.....
(C.M. 278) Shaohsing Hospital— Equipment, and residences for Chinese staff, nurse and physician.....	$8,512.50	.....	$2,887.50
(C.M. 2319) Shaohsing Hospital —X-ray Outfit .	.....	1,050.00	1,050.00
Carried Forward	$8,512.50	$5,775.00	$3,937.50

* The Foundation provides for the cost of work carried on by the China Medical Board by making to the Board one or more appropriations to cover its work for the year. From these large grants the Board then makes its own appropriations for specific objects.

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$8,512.50	$5,775.00	$3,937.50
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
American Board of Commissioners for Foreign Missions			
(C.M. 211, 294) Tehchow Hospital — For salary of two doctors, $3,236.00 per year for five years beginning with 1915. (Balance due on previous installments) . . .	7,336.50	. . . . .	1,054.00
(Installment due 1918)	. . . . .	3,236.00	. . . . .
(C.M. 297, 2229) Tehchow Hospital—Employes salaries, $4,152.00 per year for five years beginning with 1916. (Balance due on previous installments	4,942.50	. . . . .	3,018.35
(Installment due 1918)	. . . . .	4,152.00	. . . . .
(C.M. 2332) Tehchow Hospital—For repairs and improvements made necessary by the floods of 1917	. . . . .	1,500.00	. . . . .
(C.M. 2333) Tehchow Hospital—For the construction of a dike . . .	. . . . .	1,800.00	. . . . .
Carried Forward	$20,791.50	$16,463.00	$8,009.85

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$20,791.50	$16,463.00	$8,009.85
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Board of Foreign Missions of the Methodist Episcopal Church			
(C.M. 283, 2176) Wuhu Hospital —For salary and allowance of doctor, $900.00 per year for five years beginning with 1916. (Balance of installment due 1917)	300.00	. . . . .	. . . . .
(Installment due 1918)	. . . . .	900.00	900.00
(C.M. 223, 2102) Peking Hospital —Salary of doctor, $2,400.00 per year for five years beginning with 1916. (Balance of installment due 1917)	1,600.00	. . . . .	. . . . .
(Installment due 1918)	. . . . .	2,400.00	. . . . .
(C.M. 2266) Peking Hospital— For support of dentist, medical practitioner and nurse, $22,500.00 extending over a period of five years beginning with 1918. (Installment due 1918)	. . . . .	6,000.00	. . . . .
Carried Forward	$22,691.50	$25,763.00	$8,909.85

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$22,691.50	$25,763.00	$8,909.85
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Board of Missions of the Methodist Episcopal Church, South— (C.M. 236, 2105) Soochow Hospital—For salary of nurse, $600.00 per year for five years beginning with 1916. (Installment due 1917)	600.00	. . . . .	. . . . .
(Installment due 1918)	. . . . .	600.00	. . . . .
Board of Missions of the Methodist Episcopal Church, South—American Baptist Foreign Mission Society, Jointly (C.M. 2151) New Union Hospital at Huchow—For building and equipment	20,000.00	. . . . .	. . . . .
(C.M. 2152) Hospital at Huchow —For support of a Foreign physician, $5,025.00 extending over a period of five years beginning with 1918. (Installment due 1918)	. . . . .	1,650.00	. . . . .
Carried Forward	$43,291.50	$28,013.00	$8,909.85

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$43,291.50	$28,013.00	$8,909.85
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Board of Missions of the Methodist Episcopal Church, South—American Baptist Foreign Mission Society, Jointly (*Cont'd*) (C.M. 2153) Hospital at Huchow —For support of a foreign nurse, $3,000.00 extending over a period of five years beginning with 1918. (Installment due 1918)	. . . . .	825.00	. . . . .
(C.M. 2154) Hospital at Huchow —For support of a Chinese physician, $2,250.00 extending over a period of five years beginning with 1918. (Installment due 1918)	. . . . .	450.00	. . . . .
Board of Foreign Missions of the Presbyterian Church in the U. S. A. (C.M. 2144) Changteh Hospital— For current expenses, $2,625.00 per year for five years beginning with 1916. (Balance due on previous installments)	4,200.00	. . . . .	1,293.75
(Installment due 1918)	. . . . .	2,625.00	. . . . .
Carried Forward	$47,491.50	$31,913.00	$10,203.60

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$47,491.50	$31,913.00	$10,203.60
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Board of Foreign Missions of the Presbyterian Church in the U. S. A. (*Cont'd*)			
(C.M. 2145) Changteh Hospital—For capital expenditures	13,050.00	. . . . .	13,050.00
(C.M. 2318) Changteh Hospital—For running expenses, $2,250.00 per year for five years beginning with 1918. (Installment due 1918)	. . . . .	2,250.00	2,250.00
(C.M. 284) Chefoo Hospital—For salary and allowance of doctor and nurse, $2,625.00 per year for five years beginning with 1917. (Balance of installment due 1917).	1,800.00	. . . . .	. . . . .
(Installment due 1918)	. . . . .	2,625.00	. . . . .
(C.M. 2243) Chefoo Hospital—For operating expenses $2,250.00 per year for five years beginning with 1918. (Installment due 1918)	. . . . .	2,250.00	2,250.00
Carried Forward	$62,341.50	$39,038.00	$27,753.60

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$62,341.50	$39,038.00	$27,753.60
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Board of Foreign Missions of the Presbyterian Church in the U. S. A. (*Cont'd*)			
(C.M. 285) Hwaiyuen Hospital—For salary and allowance of physician and nurse, and operating expenses, $3,375.00 per year for five years beginning with 1918. (Installment due 1918)	. . . . .	3,375.00	. . . . .
(C.M. 286) Hwaiyuen Hospital—For residence of doctor and equipment	5,250.00	. . . . .	. . . . .
(C.M. 214, 295) Paotingfu—for salaries of doctor and two nurses; Shuntehfu—For salaries of doctor and two nurses, $9,200.00 per year for five years beginning with 1916. (Balance due on previous installments)	13,600.00	. . . . .	9,200.00
(Installment due 1918)	. . . . .	9,200.00	5,075.00
Carried Forward	$81,191.50	$51,613.00	$42,028.60

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$81,191.50	$51,613.00	$42,028.60
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*			
Board of Foreign Missions of the Presbyterian Church in the U. S. A. (*Cont'd*)			
(C.M. 2306) Paotingfu Hospital—For the support of a business manager, $900.00 per year for five years beginning with 1918. (Installment due 1918)	. . . . .	900.00	. . . . .
(C.M. 2142) Shuntehfu Hospital—For maintenance, $750.00 per year for five years beginning with 1916. (Installment due 1917)	750.00	. . . . .	687.50
(Installment due 1918)	. . . . .	750.00	. . . . .
Board of Foreign Missions of the Reformed Church in America			
(C.M. 2282) Hope & Wilhelmina Hospital—For purchase of pump, well and engine and electric light plant	. . . . .	2,025.00	. . . . .
Carried Forward	$81,941.50	$55,288.00	$42,716.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$81,941.50	$55,288.00	$42,716.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Board of Foreign Missions of the Reformed Church in America (*Cont'd*)			
(C.M. 2283) Hope & Wilhelmina Hospital—For support of physician, $1,881.00 per year for five years beginning with 1918. (Installment due 1918)	. . . . .	1,881.00	. . . . .
Canton Christian College			
(C.M. 2139) Canton Hospital—For a business manager and current expenses,$4,-500.00 per year for five years beginning with 1917. (Installment due 1918)	. . . . .	4,500.00	4,500.00
Church of Scotland Foreign Mission Committee			
(C.M. 288) Ichang Hospital—For equipment	375.00	. . . . .	. . . . .
(C.M. 289) Ichang Hospital—For support of a third foreign doctor and nurse, $2,250.00 per year for five years beginning with 1918	. . . . .	2,250.00	. . . . .
Carried Forward	$82,316.50	$63,919.00	$47,216.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$82,316.50	$63,919.00	$47,216.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Domestic & Foreign Mission Society of the Protestant Episcopal Church in the U. S. A. (C.M. 2307) St. James Hospital, Anking—For buildings and equipment	. . . . .	17,625.00	. . . . .
(C.M. 2308) St. James Hospital, Anking — For operating expenses, $4,200.00 per year for five years beginning 1918. (Installment due 1918)	. . . . .	4,200.00	. . . . .
Executive Committee of Foreign Missions of the Presbyterian Church in the U.S., South (C.M. 221, 2101) Soochow—For salary, outfit and travel to field of doctor and foreign nurse; Kashing—For salary, outfit and travel to field of foreign nurse. Salaries $3,600.00 per year for five years beginning with 1915. (Balance due on previous installments)	8,225.00	. . . . .	900.00
(Installment due 1918)	. . . . .	3,600.00	. . . . .
Carried Forward	$90,541.50	$89,344.00	$48,116.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$90,541.50	$89,344.00	$48,116.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Foreign Christian Missionary Society (C.M. 215, 2100) Luchowfu — For salary, allowance and outfit of doctor and nurse; Nantungchow—For salary, allowance and outfit of nurse. Salaries and allowances $4,200.00 per year for five years beginning with 1918. (Installment due 1918)	. . . . .	4,600.00	3,595.00
(C.M. 2218) Nantungchow Hospital—For support of a second physician, $8,400.00 extending over a period of five years beginning with 1918. (Installment due 1918)	. . . . .	1,800.00	. . . . .
(C.M. 2219) Nantungchow Hospital—For doctor's residence	3,000.00	. . . . .	. . . . .
(C.M. 2327) Luchowfu Hospital —For buildings and fixed equipment	. . . . .	18,500.00	. . . . .
(C.M. 2328) Luchowfu Hospital —For movable equipment	. . . . .	4,800.00	. . . . .
Carried Forward	$93,541.50	$119,044.00	$51,711.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$93,541.50	$119,044.00	$51,711.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Foreign Christian Missionary Society (*Cont'd*)			
(C.M. 2329) Luchowfu Hospital —For increased maintenance expenses; $4,100.00 per year for five years beginning 1918. (Installment due 1918).	.....	4,100.00	.....
(C.M. 2330) Luchowfu Hospital —For salary of a second foreign nurse, $1,400.00 per year for five years beginning 1918. (Installment due 1918).	.....	1,400.00	.....
(C.M. 2331) Luchowfu Hospital —For salary of a business manager, $1,400.00 per year for five years beginning 1918. (Installment due 1918)	.....	1,400.00	.....
Foreign Mission Board of the Southern Baptist Convention			
(C.M. 228, 2106) Chengchow Hospital — For salary of doctor, $1,200.00 per year for five years beginning with 1916. (Balance of installment due 1917)	850.00	.....	850.00
(Installment due 1918)	.....	1,200.00	50.00
Carried Forward	$94,391.50	$127,144.00	$52,611.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$94,391.50	$127,144.00	$52,611.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Foreign Mission Board of the Southern Baptist Convention (*Cont'd*)			
(C.M. 281) Hwanghien Hospital—For salary of physician, $900.00 per year for five years beginning with 1918. (Installment due 1918)	.....	900.00	.....
(C.M. 282) Hwanghien Hospital—For outfit and travel of a physician	750.00	.....	.....
(C.M. 225, 2103) Warren Memorial Hospital, Hwanghien — For salary of nurse, $600.00 per year for five years beginning with 1916. (Balance of installment due 1917)	150.00	.....	150.00
(Installment due 1918)	.....	600.00	300.00
(C.M. 280) Laichowfu Hospital—For equipment and outgoing expenses of physician and wife	750.00	.....	.....
(C.M. 279) Laichowfu Hospital —For salary of physician and wife, and nurse, $1,650.00 per year for five years beginning with 1918. (Installment due 1918)	.....	1,650.00	.....
Carried Forward	$96,041.50	$130,294.00	$53,061.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$96,041.50	$130,294.00	$53,061.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Foreign Mission Board of the Southern Baptist Convention (*Cont'd*)			
(C.M. 232, 2104) Yangchow Hospital—For salary of nurse, $600.00 per year for five years beginning with 1916. (Balance of installment due 1917) .	425.00	.....	425.00
(Installment due 1918)	.....	600.00	25.00
(C.M. 2316) Yangchow Hospital—For land, buildings and fixed equipment	.....	30,000.00	28,125.00
(C.M. 2317) Yangchow Hospital—For movable equipment	.....	6,000.00	.....
London Missionary Society			
(C.M. 2167) Siaochang Hospital—For support of nurse, $600.00 per year for five years beginning with 1918. (Installment due 1918) .	.....	600.00	.....
(C.M. 2326) Tsangchow Hospital—For the support of a nurse, $750.00 per year for five years beginning 1918. (Installment due 1918).	.....	750.00	750.00
Carried Forward	$96,466.50	$168,244.00	$82,386.10

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$96,466.50	$168,244.00	$82,386.10
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Medical Mission Auxiliary of London. (C.M. 2201) Tai Yuan Fu Hospital—For improvements and supplies	3,150.00	. . . . .	. . . . .
United Free Church of Scotland (C.M. 2232) Mukden Hospital — For support of nurse $750.00 per year for five years beginning with 1918. (Installment due 1918) .	. . . . .	750.00	. . . . .
(C.M. 2233) Mukden Hospital— For improvements	9,000.00	. . . . .	9,000.00
University of Nanking (C.M. 2137) For current expenses of its hospital, $9,250.00 per year for five years beginning with 1917. (Installment due 1918)	. . . . .	9,250.00	9,250.00
(C.M. 2138) For buildings and equipment	12,000.00	. . . . .	12,000.00
Loss in Exchange (C.M. 2251) To cover loss in exchange on payments to Missionary Societies for their hospitals during 1917	20,000.00	. . . . .	9,297.30
Carried Forward	$140,616.50	$178,244.00	$121,933.40

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$140,616.50	$178,244.00	$121,933.40
MISSIONARY SOCIETIES —HOSPITALS (*Cont'd*)			
Loss in Exchange (*Cont'd*)			
(C.M. 2252) To cover loss in exchange on payment to Missionary Societies, for their hospitals during 1918.	. . . . .	93,000.00	1,752.58
FELLOWSHIPS			
Medical Missionaries and Nurses on Furlough.	14,171.05	23,700.00	24,162.82
Medical Fellowships, Chinese . .	6,793.96	11,467.00	8,755.68
Miscellaneous Fellowships.	11,185.00	1,000.00	5,625.00
SCHOLARSHIPS			
Students of Harvard Medical School in China	7,487.17	6,750.00	8,572.91
Chinese Pharmacists.	2,055.00	300.00	1,800.00
Chinese Nurses . . .	3,450.00	4,400.00	2,658.98
MEDICAL SCHOOLS— UNAFFILIATED			
Fukien Christian University			
(C.M. 2273 For building and equipment for Science Department. . . .	. . . . .	50,000.00	. . . . .
St. John's University of Penn. Medical School			
(C.M. 2310) For the support of Dr. Herman Bryan for the school year 1918–19.	. . . . .	1,500.00	1,500.00
Carried Forward	$185,758.68	$370,361.00	$176,761.37

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$185,758.68	$370,361.00	$176,761.37
MEDICAL SCHOOLS—UNAFFILIATED (*Cont'd*)			
Tsinanfu Union Medical College			
(C.M. 251) For buildings and equipment	3,236.55	. . . . .	3,236.55
(C.M. 252) Expense of educating students, sent to Tsinanfu by the China Medical Board during a period of five years	61,849.10	. . . . .	21,849.10
(C.M. 2217) To cover loss in exchange in connection with appriations C.M. 251 and C.M. 252 . . .	20,000.00	. . . . .	14,763.45
Yale Foreign Missionary Society			
(C.M. 27) For support of Hunan-Yale Medical School, Changsha, $16,200.00 per year for five years beginning with 1915. (Balance of installment due 1917) . .	8,100.00	. . . . .	8,100.00
(Installment due 1918)	. . . . .	16,200.00	8,100.00
(C.M. 2133) For laboratory and equipment at Hunan-Yale Medical School	10,000.00	. . . . .	. . . . .
Carried Forward	$288,944.33	$386,561.00	$232,810.47

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$288,944.33	$386,561.00	$232,810.47
MEDICAL SCHOOLS—UNAFFILIATED (*Cont'd*)			
Yale Foreign Missionary Society (*Cont'd*)			
(C.M. 2230) For extended budget of Hunan-Yale Medical School, $9,000.00 extending over a period of three years beginning with 1917. (Installment due 1918)	. . . . .	3,000.00	. . . . .
(C.M. 2231) For support of a third instructor in the Pre-Medical Department of the Hunan-Yale Medical School $6,200.00 extending over a period of three years beginning with 1917. (Installment due 1918)	. . . . .	2,000.00	. . . . .
MEDICAL SCHOOLS—AFFILIATED			
Peking Union Medical College Assets (C.M. 213, 248, 249, 2170, 2212, 2213, 2290) Purchase of additional property	36,953.02	65.26	3,262.21
(C.M. 2196, 2228, 2267, 2312, 2337) Buildings and fixed equipment.	252,600.00	1,447,400.00	1,575,708.43
(C.M. 2197) Movable equipment.	25,000.00	. . . . .	1,762.54
Carried Forward	$603,497.35	$1,839,026.26	$1,813,543.65

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$603,497.35	$1,839,026.26	$1,813,543.65
MEDICAL SCHOOLS—AFFILIATED (*Cont'd*)			
Peking Union Medical College Assets (*Cont'd*)			
(C.M. 2268, 2334) Library	. . . . .	20,000.00	10,436.34
(C.M. 2198) Accessories	25,000.00	. . . . .	. . . . .
(C.M. 2161) Accessories, Pre-Medical School .	15,000.00	. . . . .	10,231.59
(C.M. 2188, 2214) Repairs and alterations	32,800.00	. . . . .	18,264.75
Operation in China			
(C.M. 2107) Budget 1915–16	9,224.77	. . . . .	9,224.77
(C.M. 273) Budget 1916–17	20,160.09	. . . . .	430.76
(C.M. 2190) Budget 1917–18	92,000.00	. . . . .	92,000.00
(C.M. 2257) Budget 1918–19	. . . . .	112,500.00	2,398.02
(C.M. 2162) Budget 1917–18 Pre-Medical School .	25,000.00	. . . . .	640.59
(C.M. 2262) Outfit and travel of doctor	615.87	. . . . .	615.87
Administration in the U. S. A.			
(C.M. 2191, 2279) Budget 1917–18.	19,960.45	700.00	6,322.10
(C.M. 2258) Budget 1918–19	. . . . .	9,500.00	4,684.84
Red Cross Hospital, Shanghai Operation			
(C.M. 256, 268, 2248) Budget 1917–18	56,349.11	. . . . .	35,337.83
Carried Forward	$899,607.64	$1,981,726.26	$2,004,131.11

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$899,607.64	$1,981,726.26	$2,004,131.11
MEDICAL SCHOOLS—AFFILIATED (*Cont'd*)			
Shanghai Medical School			
Assets			
(C.M. 2199, 2270) Buildings and fixed equipment.	22,000.00	28,000.00	16,848.08
(C.M. 2271) Movable equipment..	.....	5,000.00	.....
(C.M. 2215) Library.....	2,820.14	.....	190.35
(C.M. 2272) Accessories.....	.....	5,000.00	30.10
Shanghai Medical School Operation			
(C.M. 2259) Budget 1918–19....	.....	6,000.00	5,595.41
Purchase of land in China			
(C.M. 2110, 2269).	72,889.00	70,000.00	56,358.15
MISCELLANEOUS.			
Emergency Fund			
(C.M. 2211) For aid of medical work of various kinds in China, at the discretion of the Resident Director.....	3,000.00	.....	1,226.42
North China American School			
(C.M. 2281) For maintenance during the year 1918–19.....	.....	300.00	300.00
Peking Primary School and Kindergarten			
(C.M. 2280) For maintenance during the year 1918–19.....	.....	500.00	500.00
Carried Forward	$1,000,316.78	$2,096,526.26	$2,085,179.62

EXHIBIT J—*Continued*

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Brought Forward	$1,000,316.78	$2,096,526.26	$2,085,179.62
MISCELLANEOUS (*Cont'd*)			
Study of Libraries in Medical Schools (C.M. 2278) For a study of libraries in medical schools of recognized standing	. . . . .	300.00	130.97
Translation Nurses Association of China (C.M. 2185, 2309) For translation of nursing text books	600.00	5,500.00	600.00
Peking Office—Administration (C.M. 274, 2195) Budget—Previous Years	9,775.42	. . . . .	2,840.31
(C.M. 2193, 2261, 2277, 2289) Budget—1918	2,250.00	33,267.00	22,009.02
ADMINISTRATION			
Home Office (C.M. 2260, 2265, 2350) Budget 1918	1,820.40	27,227.00	20,828.36
TOTALS	$1,014,762.60	$2,162,820.26	$2,131,588.28
Balance of funds appropriated by the Rockefeller Foundation for the Board's work during 1917, remaining unappropriated by the China Medical Board on December 31, 1918.	. . . . .	82,836.74	. . . . .
Totals Carried Forward	$1,014,762.60	$2,245,657.00	$2,131,588.28

EXHIBIT J—*Continued*

		PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
Totals Brought Forward		$1,014,762.60	$2,245,657.00	$2,131,588.28
Unexpended portions of appropriations allowed to lapse				
C.M.	2188	$1,446.08		
	2265	461.20		
	2250	6,935.11		
	273	19,729.33		
	2191	13,638.35		
	2126	1,750.33		
	2174	159.91		
	2208	55.00		
		44,175.31	.....	.....
C.M.	2260	$2,301.44		
	2278	169.03		
	2279	700.00		
	2295	750.00		
	2292	100.00		
	2298	167.00		
	2238	1,800.00		
	2288	500.00		
R.F.	2280	40,302.00		
R.F.	2365	2,232.74		
		.....	49,022.21	.....
NET TOTALS .		$970,587.29	$2,196,634.79	$2,131,588.28

EXHIBIT K

SUMMARY OF APPROPRIATIONS AND PAYMENTS

	PRIOR APPROPRIATIONS	1918 APPROPRIATIONS	1918 PAYMENTS
International Health Board.	$179,051.34	$1,341,043.54	$1,089,293.92
China Medical Board.....	970,587.29	2,196,634.79	2,131,588.28
War Work.....	2,083,926.28	9,282,703.55	11,105,226.18
After Care of Infantile Paralysis Cases.....	10,463.78	37,500.00	38,956.95
Mental Hygiene.....	14,500.00	45,800.00	17,050.00
Rockefeller Institute and Medical Education.....	146,873.28	175,425.14	288,277.84
School of Hygiene and Public Health.....	278,470.30	110,617.00	91,959.97
Miscellaneous.....	24,380.48	147,026.32	150,135.96
Administration.....	5,660.21	138,063.19	137,713.06
	$3,713,912.96	$13,474,813.53	$15,050,202.16

Prior Appropriations.....	$3,713,912.96	
1918 Appropriations.....	13,474,813.53	
Total Appropriations.....		$17,188,726.49
1918 Payments.....		15,050,202.16
Balance Payable on Appropriations.....		$2,138,524.33

EXHIBIT L

In addition to the foregoing, the Foundation has made pledges and appropriations which become effective in future years, and will require for payment the following amounts

YEAR 1919:		
INTERNATIONAL HEALTH BOARD...	$2,007,000.00	
CHINA MEDICAL BOARD.....	1,550,000.00	
WAR WORK.....	2,856,000.00	
MENTAL HYGIENE.....	66,000.00	
ROCKEFELLER INSTITUTE AND MEDICAL EDUCATION.....	1,010,000.00	
SCHOOL OF HYGIENE AND PUBLIC HEALTH.....	191,130.00	
MISCELLANEOUS.....	254,511.70	
		$7,934,641.70
YEAR 1920.....		1,583,000.00
YEAR 1921.....		71,000.00
YEAR 1922		64,000.00
YEAR 1923.....		57,000.00
YEAR 1924....		15,000.00
		$9,724,641.70

In addition to the foregoing, the China Medical Board had made pledges and appropriations which become effective in future years, and will require for payment the following accounts

YEAR 1919	$1,393,754.00
YEAR 1920.....	308,708.00
YEAR 1921.....	83,781.00
YEAR 1922.....	66,206.00
YEAR 1923.....	22,700.00
	$1,875,149.00

As the appropriation to the China Medical Board, included in the Foundation's requirements for future years, provides for the 1919 appropriation of the Board, this item is deducted.....	1,393,754.00
	$481,395.00

EXHIBIT M

Statement of Appropriations and Payments from Income of Special Funds

Laura S. Rockefeller

	1918 APPROPRIATIONS	1918 PAYMENTS
(R.F. 2320) Baptist Ministers' Home Society of New York	$500.00	$500.00
(R.F. 2321) Baptist Home of Northern Ohio	500.00	500.00
(R.F 2322) Euclid Avenue Baptist Church of Cleveland, Ohio	1,500.00	1,500.00
(R.F. 2323) Baptist Home for the Aged of New York City	500.00	500.00
	$3,000.00	$3,000.00

John D. Rockefeller

(R.F. 2324-25) Baptist Home for the Aged of New York City	$1,850.00	$1,850.00

EXHIBIT N

STATEMENTS OF PRINCIPAL FUNDS

General Fund

Gifts from Mr. Rockefeller		$120,765,856.00
The total fund is invested in the securities listed in General Schedule, Exhibit Q.	$120,765,856.00	

Estate of Laura S. Rockefeller Fund

Gifts.		$152,733.00
The total fund is invested in the securities listed in General Schedule, Exhibit Q.	$152,733.00	

Reserve

Balance December 31, 1918.		$1,215,912.85
Gain on securities sold and redeemed during the year.		42,123.47
		$1,258,036.32
The total fund is invested in the securities listed in General Schedule, Exhibit Q.	$1,258,036.32	

Laura S. Rockefeller Funds

Gifts comprising four separate Funds.		$49,300.00
The total of these funds is invested in the securities listed in Exhibit R.	$49,300.00	

EXHIBIT N—*Continued*

JOHN D. ROCKEFELLER FUND

Gifts		$37,000.00
The total fund is invested in the securities listed in Exhibit R	$37,000.00	

HENRY STURGIS GREW MEMORIAL FUND

Gift to Harvard Medical School of China transferred to the Foundation in trust		$25,000.00
The total fund is invested in the securities listed in Exhibit R	$25,000.00	

ARTHUR THEODORE LYMAN ENDOWMENT

Amount received from Harvard Medical School of China and held as a principal fund for Shanghai Medical School		$5,500.00
Accounted for in cash on deposit	$5,500.00	

EXHIBIT O

LAND, BUILDINGS AND EQUIPMENT FUNDS

Appropriations to December 31, 1917.....			$812,704.92
Deduct refund on property of Peking Union Medical College.....	$859.02		
Depreciation of Foundation's equipment.....	2,233.10		3,092.12
			$809,612.80
Moneys paid out of income for real and personal property for year ending December 31, 1918:			
The Rockefeller Foundation:			
Furniture and fixtures.....	$2,876.59		
Books for the library.....	218.90		
Grand Chenier Tract, taxes, etc..	7,871.71		
		10,967.20	
China Medical Board:			
Peking Union Medical College:			
Purchase of additional property .	$3,262.21		
Buildings and fixed equipment	1,575,708.43		
Library.....	10,436.34		
Accessories.....	10,231.59		
Improvements and alterations	18,264.75		
Movable equipment	1,762.54		
		1,619,665.86	
Shanghai Medical School:			
Buildings and fixed equipment	16,848.08		
Library.....	190.35		
Accessories.....	30.10		
		17,068.53	
Purchase of land in China.....	56,358.15	1,693,092.54	1,704,059.74
Total Fund Carried Forward...			$2,513,672.54

EXHIBIT O—*Continued*

Total Fund Brought Forward. . . .			$2,513,672.54
This fund is represented by the following property:			
The Rockefeller Foundation:			
Grand Chenier Tract (land, taxes, fees, etc.)	$243,365.70		
Furniture and fixtures	11,881.56		
Library—New York City	1,394.97		
		$256,642.23	
China Medical Board:			
Peking Union Medical College:			
Original purchase .	$178,772.77		
Additional Land . .	167,685.20		
Buildings and fixed equipment	1,575,708.43		
Library	14,469.38		
Movable equipment	1,762.54		
Improvements and alterations	18,264.75		
Accessories	10,231.59		
		1,966,894.66	
Shanghai Medical School:			
Buildings and fixed equipment	16,848.08		
Library	370.21		
Accessories	30.10		
		17,248.39	
Harvard Medical School		28,800.00	
Purchase of land in China		243,469.15	
Equipment—New York		618.11	2,257,030.31
			$2,513,672.54 $2,513,672.54

EXHIBIT P

TRANSACTIONS RELATING TO INVESTED FUNDS

General Fund

Securities Sold and Redeemed

	NAME	RATE %	TOTAL PROCEEDS		
$500,000.	Chicago & Northwestern Ry., participation in loan maturing July 24th, 1918	6	$500,000.00		
500,000.	Do. maturing October 22nd, 1918	6	500,000.00		
716,000.	Euclid Heights Realty Co. bonds: Distribution of $26.00 per bond in, liquidation of assets, added to Reserve		18,616.00	Gain	$18,616.00
36,000.	New York Central Lines Equipment	4½	36,000.00	"	345.85
700,000.	United Kingdom of Great Britain & Ireland Two-year Notes	5	700,000.00	"	3,937.50
1,400,000.	United States Government Certificates of Indebtedness maturing May 28th, 1918	4½	1,400,000.00		
2,100,000.	Do. maturing June 18th, 1918	4½	2,100,000.00		
2,700,000.	Do. maturing July 9th, 1918	4½	2,700,000.00		
500,000.	Do. maturing July 18th, 1918	4½	500,000.00		
700,000.	Do. maturing October 24th, 1918	4½	700,000.00		
1,500,000.	Do. maturing October 24th, 1918, exchanged for Liberty Bonds as shown in following table	4½	1,500,000.00		
500,000.	Do. maturing January 2nd, 1919	4½	500,000.00		
224,700.	United States First Liberty Loan	3½	224,430.36	Loss	89.88
50,000.	Wheeling & Lake Erie R.R. Equipment	5	50,000.00	Gain	125.00
	Carried Forward		$11,429,046.36		$22,934.47

EXHIBIT P (*Continued*)

TRANSACTIONS RELATING TO INVESTED FUNDS

General Fund

Securities Sold and Redeemed

	NAME	RATE %	TOTAL PROCEEDS		
Brought Forward			$11,429,046.36		$22,934.47
220	Shares Chehalis & Pacific Land Co.: Dividends amounting to $3.83 per share, in liquidation, credited to cost of stock		842.60		
619	Shares Colonial Oil Co. Capital Stock: Final dividend (31%) in liquidation of Company's assets, added to Reserve		19,189.00	Gain	19,189.00
20,000	Shares Galena-Signal Oil Co. Common Stock: Right to purchase 4,000 shares new preferred stock sold and proceeds credited to cost of stock		5,936.69		
4,193	Shares Galena-Signal Oil Co. Preferred Stock: Right to purchase 838–3/5 shares new preferred stock sold and proceeds credited to cost of stock		1,244.63		
			$11,456,259.28	Gain	$42,123.47

Securities Given Away

$1,500,000.	United States Fourth Liberty Loan given to American Red Cross on account of an appropriation	4¼	$1,500,000.00		
1,000,000.	United States Third Liberty Loan given to United War Work Campaign on account of an appropriation	4¼	1,000,000.00		

SECURITIES BOUGHT, RECEIVED THROUGH EXCHANGE, ETC.

	NAME	RATE %	COST	PRICE %
$500,000.	Chicago & Northwestern Ry. participation in loan, maturing July 24th, 1918	6	$500,000.00	100.
500,000.	Do. maturing October 22nd, 1918	6	500,000.00	100.
500,000.	Do. maturing January 22nd, 1919	6	500,000.00	100.
1,400,000.	United States Certificates of Indebtedness due May 28th, 1918.	4½	1,400,000.00	100.
2,100,000.	Do. maturing June 18th, 1918	4½	2,100,000.00	100.
2,700,000.	Do. maturing July 9th, 1918	4½	2,700,000.00	100.
500,000.	Do. maturing July 18th, 1918	4½	500,000.00	100.
2,200,000.	Do. maturing October 24th, 1918	4½	2,200,000.00	100.
500,000.	Do. maturing January 2nd, 1919	4½	500,000.00	100.
224,700.	United States First Liberty Loan, received as dividends from American Shipbuilding Co.	3½	224,520.24	99.919
1,500,000.	United States Fourth Liberty Loan, received in exchange for $1,500,000 United States Government Certificates of Indebtedness, 4½	4¼	1,500,000.00	100.
			$12,624,520.24	

SECURITIES RECEIVED AS A GIFT

$1,000,000.	United States Third Liberty Loan, received from Mr. John D. Rockefeller	4¼	$1,000,000.00	100.

HENRY STURGIS GREW MEMORIAL FUND

SECURITIES BOUGHT

25,850.	United States Second Liberty Loan	4	$25,000.00	96.711

SECURITIES DELIVERED FOR EXCHANGE

25,850.	United States Second Liberty Loan	4	$25,000.00

SECURITIES RECEIVED THROUGH EXCHANGE

25,850.	United States Second Liberty Loan Converted	4¼	$25,000.00

EXHIBIT Q

SCHEDULE OF SECURITIES IN GENERAL FUNDS ON DECEMBER 31, 1918, REPRESENTING BOTH PRINCIPAL AND INCOME TEMPORARILY INVESTED

BONDS

Name	Interest Rate Per Cent.	Date of Maturity	Amount	Price Per Cent.	Cash Price
American Agricultural Chemical Co. First Mortgage Convertible	5	Oct. 1928	$485,000	101.	$489,850.00
American Telephone & Telegraph Co. Thirty-Year Collateral Trust	5	Dec. 1946	100,000	97.75	97,750.00
Anglo-French External Loan	5	Oct. 15 '20	600,000	96.0862	576,517.20
Armour & Co. Real Estate First Mortgage	4½	June 1939	1,000,000	93.25	932,500.00
Ashland Power Co. First Mortgage	5	Mar. 1928	8,000	100.	8,000.00
Atlantic & Birmingham Ry. First Mortgage	5	Jan. 1934	677,000	90.	609,300.00
Baltimore & Ohio R.R. Refunding and General Mortgage	5	Dec. 1995	650,000	99.75	648,375.00
Bethlehem Steel Co. Two-Year Secured Notes	5	Feb. 15'19	1,000,000	98.25	982,500.00
Chicago & Alton R.R. Refunding Mortgage	3	Oct. 1949	551,000	65.	358,150.00
Chicago & Alton Ry. First Lien	3½	July 1950	854,000	53.	452,620.00
Chicago City & Connecting Railways Collateral Trust	5	Jan. 1927	1,305,000	85.	1,109,250.00
Chicago & Eastern Illinois R.R. Refunding and Improvement Mortgage	4	July 1955	300,000	63.	189,000.00
Chicago, Milwaukee & St. Paul Ry. General Mortgage Series "A"	4	May 1989	30,000	97.	29,100.00

EXHIBIT Q—*Continued*

SCHEDULE OF SECURITIES—*Continued*

BONDS

Name	Interest Rate Per Cent.	Date of Maturity	Amount	Price Per Cent.	Cash Price
Chicago, Milwaukee & St. Paul Ry. General Mortgage Series "C"	4½	May 1989	500,000	103.	$515,000.00
Chicago, Milwaukee & St. Paul Ry. Debenture	4	July 1934	450,000	88.2838	397,277.50
Chicago, Milwaukee & St. Paul Ry. General and Refunding Mortgage Series "A"	4½	Jan. 2014	500,000	91.0625	455,312.50
Chicago & North Western Ry. Extension	4	Aug. 15'26	50,000	95.	47,500.00
Chicago & North Western Ry. Sinking Fund Debenture	5	May 1933	80,000	102.	81,600.00
Chicago & North Western Ry. Secured Loan	6	Jan. 24'19	500,000	100.	500,000.00
Chicago Railways Co. First Mortgage	5	Feb. 1927	500,000	97.	485,000.00
Cleveland, Cincinnati, Chicago & St. Louis Ry. St. Louis Division., Collateral Trust	4	Nov. 1990	73,000	90.	65,700.00
Cleveland, Cincinnati, Chicago & St. Louis Ry. General	4	June 1993	700,000	83.893	587,250.00
Cleveland Short Line First Mortgage	4½	Apr. 1961	500,000	95.	475,000.00
Colorado Industrial Co. First Mortgage	5	Aug. 1934	2,000,000	80.	1,600,000.00
Consolidated Gas Co. (New York) Convertible Debenture	6	Feb. 1920	500,000	110.	550,000.00
Dominion of Canada, Government of, Fifteen-Year	5	Apr. 1931	500,000	94.565	472,825.00
Erie R.R. General Mortgage Convertible Fifty-Year Series "B"	4	Apr. 1953	1,065,000	74.7175	795,742.30

Illinois Central R.R. Refunding Mortgage	4	Nov. 1955	$300,000	87.	$261,000.00
Interborough Rapid Transit Co. First Mortgage	5	Jan. 1966	1,750,000	96.8571	1,695,000.00
International Mercantile Marine Co. First and Collateral Trust Sinking Fund	6	Oct. 1941	2,848,290	97.5	2,777,082.75
Lake Erie & Western R.R. Second Mortgage	5	July 1941	100,000	100.	100,000.00
Lake Shore & Michigan Southern Ry. First Mortgage	3½	June 1997	926,000	87.	805,620.00
Lake Shore & Michigan Southern Ry. Debenture	4	May 1931	1,673,000	92.	1,539,160.00
Magnolia Petroleum Co. First Mortgage	6	Jan. 1937	1,809,000	100.	1,809,000.00
Missouri, Kansas & Texas Ry. General Mortgage Sinking Fund	4½	Jan. 1936	1,325,000	84.	1,113,000.00
Morris & Essex R.R. First and Refunding Mortgage.	3½	Dec. 2000	175,000	82.75	144,812.50
Mutual Fuel Gas Co. First Mortgage	5	Nov. 1947	250,000	100.	250,000.00
National Railways of Mexico, Prior Lien Fifty-Year Sinking Fund with January 1915 and subsequent coupons attached	4½	July 1957	50,000	59.	29,500.00
Secured 6% Notes for coupon due January 1, 1914		Jan. 1917	1,125	59.	663.75
Guaranty Trust Co. Receipt for July 1, 1914 coupon			1,125	59.	663.75
New Orleans, Texas & Mexico Ry. Non Cumulative Income Series "A"	5	Oct. 1935	180,000	42.	75,600.00
New York Central Lines Equipment Trust of 1913	4½	Jan. '19–'28	360,000	99.039	356,541.51
New York Central & Hudson River R.R. Thirty-Year Debenture	4	May 1934	330,000	88.45	291,885.00
New York, Chicago & St. Louis R.R. First Mortgage	4	Oct. 1937	35,000	95.	33,250.00
New York, Chicago & St. Louis R.R. Debenture	4	May 1931	1,303,000	87.	1,133,610.00
New York City Corporate Stock	4¼	Mar. 1964	100,000	94.5	94,500.00
New York Connecting R.R. First Mortgage	4½	Aug. 1953	500,000	95.69073	478,453.65
Northern Pacific Ry. Refunding and Improvement Mortgage	4½	July 2047	390,000	91.577	357,150.00
Pennsylvania R.R. Consolidated Mortgage Sterling	4	May 1948	£2,400	99.	11,880.00

EXHIBIT Q—*Continued*

SCHEDULE OF SECURITIES—*Continued*

BONDS

Name	Interest Rate Per Cent.	Date of Maturity	Amount	Price Per Cent.	Cash Price
Pennsylvania R.R. General Mortgage	4½	June 1965	$1,500,000	98.25	$1,473,750.00
Philadelphia Co. Convertible Debenture	5	May 1922	1,000,000	97.	970,000.00
Philadelphia Co. Convertible Debenture	5	Aug. 1919	500,000	95.	475,000.00
Pittsburg, Cincinnati, Chicago & St. Louis Ry. Consolidated Mortgage Series "I"	4½	Aug. 1963	500,000	103.	515,000.00
Province of Quebec Five-Year	5	Apr. 1920	500,000	99.75	498,750.00
Reading Co.—Philadelphia & Reading Coal & Iron Co. General Mortgage	4	Jan. 1997	500,000	94.25	471,250.00
Rutland R.R. First Consolidated Mortgage	4½	July 1941	25,000	90.	22,500.00
St. Louis-San Francisco Ry. Prior Lien Series "A"	4	July 1950	1,500,000	72.75	1,091,250.00
St. Louis-San Francisco Ry. Adjustment Mortgage	6	July 1955	500,000	81.975	409,875.00
Seaboard Air Line Ry. Adjustment Mortgage	5	Oct. 1949	455,000	77.	350,350.00
Southern Pacific R.R. First and Refunding Mortgage	4	Jan. 1955	100,000	86.	86,000.00
Sunday Creek Co. Collateral Trust	5	July 1944	81,000	78.	63,180.00
United Kingdom of Great Britain & Ireland Three-Year Notes	5½	Nov. 1919	350,000	99.125	346,937.50
United Kingdom of Great Britain & Ireland Five-Year Notes	5½	Nov. 1921	350,000	98.375	344,312.50
Wabash R.R. Second Mortgage	5	Feb. 1939	120,000	97.8	117,360.00
Washington Ry. & Electric Co. Consolidated Mortgage	4	Dec. 1951	450,000	83.5	375,750.00
Western Maryland R.R. First Mortgage	4	Oct. 1952	1,032,000	78.8913	814,158.76
Wheeling & Lake Erie R.R. Lake Erie Division First Mortgage	5	Oct. 1926	140,000	100.	140,000.00
Wheeling & Lake Erie R.R. Equipment Trust Series "B"	5	Apr.'19–'27	450,000	99.75	448,875.00
Total Bonds					$35,883,791.17

STOCKS

Name	Dividend Rate Per Cent.	Number of Shares	Price Per Share	Cash Price
American Ship Building Co. Preferred	7	9,303	85.	$790,755.00
American Ship Building Co. Common	7	14,982	35.	524,370.00
Atchison, Topeka & Sante Fe Ry. Preferred	5	5,000	98.25	491,250.00
Atchison, Topeka & Santa Fe Ry. Common	6	21,100	95.2563	2,009,908.33
Borne-Scrymser Co. Capital	20	300	295.	88,500.00
The Buckeye Pipe Line Co. Capital (Par $50)	16	49,693	160.	7,950,880.00
Central Nat'l Bank of Cleveland Capital	10	500	159.2222	79,611.10
Chehalis & Pacific Land Co. Capital		220	41.6241	9,157.40
Chesebrough Manufacturing Co. Consolidated Capital	14	2,070	223.333	462,300.00
Chicago City & Connecting Ry. Participation Certificates Preferred		17,530	69.1875	1,212,856.88
Chicago City & Connecting Ry. Participation Certificates Common		10,518	30.	315,540.00
Cleveland Arcade Co. Capital	8	2,500	98.6222	246,555.56
Cleveland Trust Co. Capital	10	286	238.195	68,123.77
Colorado & Southern Ry. First Preferred	4	7,000	54.	378,000.00
Consolidated Gas Co. of N. Y. Capital	7	20,000	127.50	2,550,000.00
The Continental Oil Co. Capital	12	7,000	190.	1,330,000.00
Wm. Cramp & Sons Ship & Engine Building Co. Capital	3	648	15.	9,720.00

EXHIBIT Q—*Continued*

SCHEDULE OF SECURITIES—*Continued*

STOCKS

Name	Dividend Rate Per Cent.	Number of Shares	Price Per Share	Cash Price
The Crescent Pipe Line Co. Capital (Par $50)	6	14,120	60.	$847,200.00
Cumberland Pipe Line Co. Capital	10	3,000	81.333	244,000.00
Erie R.R. First Preferred		21,400	45.8306	980,773.76
Eureka Pipe Line Co. Capital	24	12,357	361.3331	4,464,995.59
Galena-Signal Oil Co. Preferred	8	4,193	139.7	585,779.50
Galena-Signal Oil Co. Common		20,000	189.7031	3,794,059.59
Great Lakes Towing Co. Preferred	7	1,527	88.7361	135,500.05
Great Lakes Towing Co. Common	5	1,200	12.	14,400.00
Indiana Pipe Line Co. Capital (Par $50)	20	24,845	125.111	3,108,385.28
International Agricultural Corporation Preferred	5	6,545	30.	196,350.00
International Agricultural Corporation Common		8,175	5.	40,875.00
Manhattan Ry. Capital	7	10,000	128.775	1,287,750.00
Missouri Pacific R.R. Voting Trust Certificates for Convertible Preferred		21,980	55.	1,219,890.00
National Lead Co. Preferred	7	1,100	104.	114,400.00
National Lead Co. Common	4	29,400	50.	1,470,000.00
National Transit Co. Capital (Par $12.50)	8	126,481	28.5	3,604,708.50
New Orleans, Texas & Mexico Ry. Capital		1,125	16.	18,000.00
New York, Chic. & St. Louis R.R. Second Preferred	4	400	78.70	31,480.00
New York, Chic. & St. Louis R.R. Common		100	55.	5,500.00
New York Transit Co. Capital	24	12,392	300.	3,717,600.00
Northern Pacific Ry. Common	7	700	91.7625	64,233.75
Northern Pipe Line Co. Capital	10	9,000	110.	990,000.00
Otis Steel Co. Preferred	7	140	90.	12,600.00
Otis Steel Co. Common	10	329	20.	6,580.00
Pere Marquette Ry. Preferred		5,740.8	54.56	313,248.00
Provident Loan Society Certificates (Par $5,000)	6	40	100.	200,000.00
Seaboard Air Line Ry. Preferred		4,300	54.	232,200.00
Seaboard Air Line Ry. Common		3,400	21.	71,400.00

Sheffield Farms Co., Incorporated, Preferred	6	150	99.4	$14,910.00
The Solar Refining Co. Capital	10	4,964	185.007	918,375.00
Southern Pipe Line Co. Capital	24	24,845	229.5556	5,703,308.88
South West Pennsylvania Pipe Lines Capital	12	8,000	160.	1,280,000.00
Standard Oil Co. (Indiana) Capital	24	29,718	867.	25,765,506.00
The Standard Oil Co. (Kansas) Capital	24	4,966	275.016	1,365,733.13
Standard Oil Co. (Kentucky) Capital	12	14,868	70.2547	1,044,547.23
Standard Oil Co. (Nebraska) Capital	20	2,482	270.	670,140.00
The Standard Oil Co. (Ohio) Capital	16	17,392	210.	3,652,320.00
Superior Savings & Trust Co. Capital	12	300	297.6333	89,350.00
Tilden Iron Mining Co. Capital	5½	1,780	27.35	48,683.46
Union Tank Line Co. Capital	5	24,000	70.	1,680,000.00
U.S. Cast Iron Pipe & Foundry Co. Preferred	5	1,987	44.444	88,310.89
Washington Oil Co. Capital (Par $10)	40	1,774	30.	53,220.00
Western Maryland Ry. Second Preferred		500	46.	23,000.00
Western Pacific R.R. Corporation Preferred	6	20,195	43.5	878,482.50
Western Pacific R.R. Corporation Common		30,292½	15.25	461,960.62
Wilson Realty Co. Capital		591	100.	59,100.00
Woman's Hotel Co. Capital		300	80.	24,000.00
TOTAL STOCKS	.....	.....	.....	$90,110,384.77

EXHIBIT Q—*Continued*

SCHEDULE OF SECURITIES—*Continued*

SUMMARY

Bonds	$35,883,791.17
Stocks	90,110,384.77
Total book value of investments belonging to General Funds, principal and income	$125,994,175.94

The foregoing investments are apportioned as follows:

General Fund	$120,765,856.00
General Fund Income	3,817,550.62
Estate Laura S. Rockefeller Fund	152,733.00
Reserve	1,258,036.32
TOTAL	$125,994,175.94

EXHIBIT R

SCHEDULE OF SECURITIES IN SPECIAL FUNDS ON DECEMBER 31, 1918

JOHN D. ROCKEFELLER FUND

BONDS

NAME	RATE %	DATE OF MATURITY	AMOUNT	PRICE %	CASH PRICE
Canada Southern Ry. Consolidated Mortgage Series "A"	5	Oct. 1962	$37,000	100.	$37,000.00

LAURA S. ROCKEFELLER FUND

BONDS

Colorado Industrial Co. First Mortgage	5	Aug. 1934	$50,000	80.	$40,000.00
Virginia Carolina Chemical Co. First Mortgage	5	Dec. 1923	10,000	93.	9,300.00

HENRY STURGIS GREW MEMORIAL FUND

BONDS

United States Second Liberty Loan Converted	4¼	Nov. 15'42	$25,850	96.71167	$25,000.00

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