

research and instruction naturally have not developed courses from the historical side, although the individual instructors may be quite well versed in the subject. Then again, the answers received indicate that even among these men the distinction between so-called "popular" science and fundamental science is by no means clear.

Lest offence be taken by teachers of political and social history, it should be emphasized that no consideration has been given here to their admirable work in tracing the development of human thought and of their growing appreciation of the influence of scientific progress on all history. Their cooperation is needed at every turn—in developing the special methods of historical research suitable for scientific work—in creating a greater demand for such history, and in producing the literature which may satisfy the new needs.

The various suggestions here made are given for what they are worth. Few points of procedure have been indicated as wholly preferable. They are all the testimony of the men and women whose vision has led them into the struggle to add this true side of history—and of science—to those already in the schools, for it is human history, as well as history of science.

My sincere thanks are extended to all who have submitted their views on any phases of this question. Certain aspects of the investigation will constitute material for reports elsewhere.

E. H. JOHNSON

KENYON COLLEGE,
GAMBIER, OHIO

THE EXPEDITION TO TRINIDAD FOR THE STUDY OF HOOK- WORM DISEASE¹

AN expedition for the study of the life of hookworm eggs and larvæ in the soil was sent out by the department of medical zoology of the School of Hygiene and Public

¹ A full account of the results of the work of this expedition will appear in a series of articles in the *American Journal of Hygiene*.

Health of the Johns Hopkins University to carry on investigations in Trinidad, British West Indies, during the summer of 1921. The expenses of the expedition were paid by the International Health Board of the Rockefeller Foundation. The International Health Board through the Trinidad Ankylostomiasis Commission and the Trinidad government cooperated with work of the expedition. The party from the United States sailed from New York on May 5 and returned on September 17. The expedition was under the direction of Dr. William W. Cort of Johns Hopkins University, and worked in cooperation with Dr. George C. Payne, the director for Trinidad of the International Health Board, who also took an active part in the investigations. The others who took part in the investigations were Dr. James E. Ackert, of the Kansas State Agricultural College, Dr. Florence King Payne, of Trinidad, and Mr. Donald L. Augustine, of Johns Hopkins University. Much of the scientific equipment was shipped from the United States and some was borrowed from the Trinidad Ankylostomiasis Commission. The work was carried out at Princes Town, which is in the south central part of the island, in an area where sugar-cane cultivation predominates. Over seventy per cent. of the people of this region are infested with hookworms. This high incidence of hookworm disease and the close coordination with the control campaign served to suggest problems for work and to give an abundance of material. A private residence was rented for a laboratory and fitted out with the necessary equipment. A large space under this house was utilized for animal pens and laboratory space. The yard surrounding the house was also used in a number of the outdoor experiments.

The investigations of the Trinidad expedition were centered around the study of the phase of the life of the hookworm which is passed outside the human body. An effective attack on the problems of the life of the larvæ in the soil was made possible by the utilization of an apparatus invented by Baermann, which makes it possible to iso-

late the larvæ from considerable quantities of soil. Both field and laboratory studies were included in the program. The field investigations consisted of intensive epidemiologic studies of the factors involved in the spread of hookworm disease in two limited areas, one on a sugar estate and the other on a cacao estate. The laboratory investigations included a study of the following points, viz.: (1) the relation of the chicken and pig to the spread of hookworm disease, (2) some of the factors influencing the hatching of the eggs, (3) the migrations both vertical and lateral of the infective hookworm larvæ and (4) the length of life of the infective hookworm larvæ.

A summary of the most important results obtained will be given here.²

1. SOURCES OF HUMAN INFESTATION

In the two field areas studied a comparison of the distribution of soil infestation and the habits of the people revealed that almost the exclusive sources of human infestation in these two areas were the places in a cane field and a cacao grove which were constantly visited for the purpose of defecation.

2. REDUCTION OF SOIL POLLUTION BY THE INTRODUCTION OF LATRINES AND AN EDUCATIONAL CAMPAIGN

It was found by a study of the distribution of soil pollution in the cane area that the building of an adequate number of la-

² These results are taken from the work of all the members of the expedition. The epidemiologic studies in the field were made by Doctors Cort and G. C. Payne. The work on the relations of the chickens and pigs to the spread of hookworm disease and on the conditions influencing the hatching of hookworm eggs was done by Dr. Ackert. Drs. Florence K. Payne and Ackert collaborated on the work on the new species of pig hookworm from Trinidad, and Dr. Florence K. Payne made the studies on vertical migrations of the infective hookworm larvæ. The laboratory experiments on the horizontal migrations and length of life of the infective hookworm larvæ were made by Mr. Augustine.

trines and the carrying through of the regular educational campaign against hookworm disease resulted in a very great reduction of soil pollution in a period of about three weeks.

3. RELATION BETWEEN THE DISTRIBUTION OF SOIL POLLUTION AND SOIL INFESTATION

In both the cane and cacao areas gross soil pollution by infested individuals did not always produce soil infestation, especially in unprotected places near houses, latrines or at the edge of the cane field. The conclusion was drawn that in the heavy clay loam soil of these areas the conditions are unfavorable for the development or continued life of the hookworm larvæ, unless there is protection by shade and vegetation.

4. THE RELATION OF CHICKENS TO THE SPREAD OF HOOKWORM DISEASE

When chickens ingested human feces containing hookworm eggs only a very small percentage of such eggs produced infective hookworm larvæ. Chickens fed on human feces containing hookworm eggs were found to produce limited areas of soil infestation at their drinking places, or under their roosts. The conclusion is drawn, however, that in view of the great reduction of infective larvæ produced by passage through the chickens, they are, under the conditions in Trinidad, a factor favorable rather than unfavorable to hookworm control.

5. THE RELATION OF THE PIG TO THE SPREAD OF HOOKWORM LARVÆ

Eggs of the human hookworm which had passed through the digestive tract of the pig developed as readily in pig as in human feces, thus making pigs a factor in the dissemination of hookworm larvæ whenever they have the opportunity of ingesting human feces containing hookworm eggs. In connection with this work a new species of *Necator* closely resembling *Necator americanus* was found to be prevalent in the pigs in Trinidad, and its morphology and distribution studied.

6. CONDITIONS INFLUENCING THE HATCHING OF
HOOKWORM EGGS

Hookworm eggs hatch as readily in ashes as in soil. Hookworm eggs in feces buried to a depth of from 1/2 of an inch to 2 inches hatch and the larvæ develop in numbers, there being only a slight retardation in development. When eggs were buried from 4 to 5 1/2 inches in a clay loam soil, only a few larvæ were able to develop. The invasion of the stools by numbers of fly larvæ was found to be detrimental to the development of hookworm larvæ to the infective stage.

7. THE FINDING OF UNSHEATHED HOOKWORM
LARVÆ IN THE SOIL

The finding, both in field and laboratory studies, of a large percentage of mature hookworm larvæ without their protective sheaths, led to the conclusion that a large proportion of such larvæ in the soil complete their second larval moult and continue to live in the un-sheathed condition.

8. VERTICAL MIGRATIONS OF INFECTIVE HOOK-
WORM LARVÆ

It was found that under certain conditions mature hookworm larvæ when buried to a depth as great as 5 1/2 inches can migrate to the surface. In such a migration the larvæ used up most of their reserve food supply, so that after reaching the surface they were relatively inactive and the cells of the intestine had become almost transparent.

9. HORIZONTAL MIGRATIONS OF INFECTIVE HOOK-
WORM LARVÆ

From laboratory experiments and field observations it was found that mature hookworm larvæ do not migrate actively from their place of development, although they may be carried to considerable distances by the action of water or on the feet of man. These observations showed that the present idea that the soil of considerable areas can be infested by the migrations of the larvæ from limited centers is untenable.

10. LENGTH OF LIFE OF INFECTIVE HOOKWORM
LARVÆ IN THE SOIL

Under the conditions in Trinidad the length of life of infective hookworm larvæ in the soil is short, almost never exceeding six or seven weeks. In an area of a cane field where there was intense soil infestation there was a reduction of over 90 per cent. in the numbers of larvæ in about three weeks after the practical elimination of soil pollution. After six weeks only a very few larvæ were left. In a large series of laboratory experiments carried out with different soils and under different conditions, there was a great reduction in numbers of larvæ after from two to three weeks and an almost complete dying out in six weeks. These findings which are contrary to the present conception of the length of life of infective hookworm larvæ indicate that under tropical conditions, the larvæ will die out quickly in the soil after the elimination of soil pollution by infested individuals.

WILLIAM W. CORT

JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MD.

THE AMERICAN ASSOCIATION FOR
THE ADVANCEMENT OF SCIENCE:
THE TORONTO MEETING

THE second Toronto meeting of the American Association and associated societies will be very conveniently arranged in all its details and promises to be one of the most satisfactory meetings in the history of the Association. The preliminary announcement of the meeting has recently been sent from the Washington office to all members, and the permanent secretary will send copies to all who request them.

The announcement, a 47-page booklet, gives the personnel of the local committee for the meeting (Dr. J. C. Fields, chairman; 198 College St., Toronto) and the list of the chairmen of the twelve subcommittees that have charge of local details, also the list of the Toronto representatives of the various sections. Many features of the meeting are mentioned or described. The usual lists of