bacillus of Morgan and the bacillus of Shiga, gave no agglutination reaction with a dilution of 1 in 20. But an extremely well-marked reaction was obtained with a dilution of 1 in 20, 1 in 50, and 1 in 100, and a slight reaction in a dilution of 1 in 1,000 with this bacillus and the bacillus of Flexner. The rabbit's serum was saturated with the bacillus of Flexner and the bacillus used for the immunization of the rabbit, with the result that this bacillus was found to be specifically identical with the bacillus of Flexner."

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, March 27th, 1909.

THE ALLEGED HETEROGENESIS IN ANKYLOSTOMA DUODENALE.

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IN the reports of the Belfast meeting of the British Medical Association Dr. A. T. Ozzard, of British Guiana, publishes a paper on the "Life-history of *Ankylostoma duodenale*,"¹ reaffirming his previously published conclusions that under certain suitable conditions the ankylostome embryo can develop outside the body into sexually mature forms. As the President of the Section before which the paper was read pointed out in his remarks, the question raised is one of great importance, "because prophylactic measures that would be of value if no heterogenesis occurred would be useless if it took place." It is of equal importance also to the zoologist and systematist. Dr. Ozzard's statements deserve, therefore, careful consideration and scrutiny.

1. Dr. Ozzard quotes the recent writings of Manson and Brookes to show that "there is considerable diversity of opinion on the subject," but in both these instances the authors are merely quoting Giles's work, and are far from adopting his views. No one who has read Giles's papers on the life-cycles of parasitic nematodes is likely to give credence to his conclusions. He entirely fails to recognize the existence of free-living nematodes, and passes with astonishing rapidity from the ovum and newly-hatched embryo as it appears in the faeces of the host to sexually mature "rhabdites" on the rank vegetation around.

2. In Dr. Ozzard's description of his experiments several important desiderata are lacking.

A small quantity of dejecta, known to contain only the ova of *Ankylostoma duodenale*, is mixed with about three or four times its bulk of water and poured on the surface of some sterilized river sand in a suitable vessel.

The embryos developed into free sexually mature worms in from eight to ten days.

No mention is made of the manner in which the sterilization of the river sand or of the water was ensured, nor of the keeping of controls. It is open to doubt whether the sterilization was efficiently carried out, for the author later remarks that, "To endeavour to cultivate them in sterilized vessels and on sterilized sand, is practically asking them to survive and reproduce their species on almost nothing at all." It is noteworthy that Giles, in his "Observations on the Life-history of *Sclerostomum tetra-canthum*,"² was unable to develop the embryos of this allied form on "moist sand," although he claimed to have found advanced forms later "on the cotyledonary leaves of some chance seedlings" near by. When we remember that free-living nematodes abound in all soil and vegetation, that their eggs and larvae are able to withstand a considerable degree of drying, and that they multiply exceedingly in the course of a few days, we should be very loth to accept results of experiments that do not rigorously exclude the possibility of their presence.

Two recent experiences of my own may be related in this connexion. Whilst pursuing certain investigations into the life-history of the *Trichostrongylus pergracilis* for the committee of the Grouse Disease Inquiry, a specimen tube was forwarded to me from the experimental station containing the dropping that had been collected from a clean board floor under one of the infected birds. On examining this a few days later, I found it to contain rhabditiform worms of small size but sexually mature. These worms continued to reproduce with amazing rapidity. The suggestion was afforded that these might

be "heterogenetic" forms of the *Tr. pergracilis*, but on carefully examining the whole content of the tube, I found a small stick of heather which had undoubtedly contaminated the faeces with a rapidly multiplying free-living nematode. If dry heather be soaked in water for twenty-four hours, numerous species of free-living worms will be found wriggling in the bottom of the vessel.

The other illustration is still more striking, but is less easily explained. It is the rule for the faeces of patients in the Seamen's Hospital, Albert Dock, to be placed in flat, covered, glass receptacles when sent to the London School of Tropical Medicine for examination. These dishes are used for no other purpose, and are invariably sterilized after use. In such a vessel the stool of a foreign sailor was received, and was found to contain *Strongyloides intestinalis* in considerable numbers. It was then transferred by one of the junior laboratory attendants to a large glass bottle that had lain in the school store for several years, and had originally contained pathological specimens in spirit. Some weeks later this stool was examined again, and was then found to contain very many sexually mature forms closely resembling the free adults of *Strongyloides intestinalis*. For a time they were so considered by myself. The preparation was examined daily for several weeks, and it soon became evident that many generations were succeeding one another although the embryos of the free-living *Strongyloides intestinalis* do not again develop into adult forms until they gain access to the human body. Thinking that I was dealing possibly with some unobserved phenomena in the life-cycle of this parasite I then engaged upon a detailed study of the structure of the free-living adults and closely compared them with those of undoubted *S. intestinalis* that I had obtained whilst in Egypt with Professor Looss, with the result that I was forced to the conclusion that the two forms differed in several constant features. Apparently the stool had become infected in some unknown manner with an ovum or larva of a free-living nematode. Most likely the bottle itself had become infected during its prolonged sojourn in the store, or with much less probability the origin of the infection had passed through the alimentary canal of the patient.

3. Turning now to the description of the free-living forms in Dr. Ozzard's cultures we unhappily find practically nothing to enable us to ascertain their structural similarity to other forms of free-living or parasitic nature. The possibility that they are *Strongyloides intestinalis* he himself emphatically rejects. Great stress is placed, so far as I can see with no reason whatsoever, on the similarity of the ova in the mature females in the cultures to those of ankylostome eggs in faeces, but the characters of the ankylostome egg, whilst distinctive enough for diagnostic purposes when seen in human faeces, present no such pathognomonic peculiarities as should distinguish it from the ova of all other nematodes.

4. Lastly, Dr. Ozzard makes the important statement that he kept his culture for months and "could at any time (after their first free-stage generation) obtain specimens at all stages of their growth from the eggs to the adult forms." This clearly shows that the supposed "heterogenesis" of *Ankylostoma duodenale* differs in an essential feature from that occurring in other forms, yet it is exactly what one would expect to find if so rich a food medium had become infected with a free-living nematode.

REFERENCES.

¹ Ozzard: Life-history of *Ankylostoma duodenale*, BRITISH MEDICAL JOURNAL, 1909, vol. ii, p. 779. ² Giles: Scientific Memoirs by Medical Officers of the Army of India, Part VII.

THE first meeting of the Italian National Committee for the Suppression of Endemic Cretinism was held at Milan on October 5th. Among those present were Professors Tamburini, Devoto, and Mangiagalli, the latter of whom occupied the presidential chair. The Minister of the Interior, the Minister of Public Instruction, and the Minister of Agriculture, together with a number of provincial and communal authorities connected with the infected zone, as well as a number of men of science, intimated their approval of the objects of the congress. Professor Tamburini read a report on the present state of knowledge in regard to endemic cretinism, and Dr. Cerletti read the proposed scheme for the study, prophylaxis, and cure of the disease, which was unanimously approved.