in 1902, of a living trypanosome in the stomach of an *Anopheles* mosquito have to be borne in mind. Much of the wealth of native tribes in the Southern Soudan is represented by cattle, and it will be a very serious matter if bovine trypanosomiasis is found to exist to any extent, and in a severe form, amongst the Nuer, Dinka, and Shilluk herds. Portions of the spleen and liver referred to, and a few slides of blood smears have been forwarded to the London and Liverpool Schools of Tropical Medicine. The form of trypanosome present can thus be compared with the varieties already known from Uganda, East and South Africa, Nigeria, Senegambia, the Congo Free State, and other parts of Africa.

Had it not been for Bimbashi Head's knowledge of the subject, and his enthusiasm for the work, the disease would have been missed. As illustrating his interest in the subject, and the difficulties of research in such a country as the Soudan, I may mention that he had to ride thirty miles on several occasions, for the most part in blazing heat, and had to carry the portions of diseased organs, etc., fifteen miles on horseback for purposes of examination.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, June 20th, 1903. ² *Veterinarian*, vol. lxxii, p. 648. ³ BRITISH MEDICAL JOURNAL, March 14th, 1903. ⁴ BRITISH MEDICAL JOURNAL, July 2nd, 1904; and *Indian Medical Gazette*, October, 1904. ⁵ BRITISH MEDICAL JOURNAL, May 28th, 1904; and *Laboratories Report*, 1903. ⁶ *Jour. Trop. Med.*, June 1st, 1904, et seq. (translation).

SLEEPING SICKNESS (TRYPANOSOMIASIS):

THE PREVENTION OF ITS SPREAD, AND THE PROPHYLAXIS.

By CUTHBERT CHRISTY, M.B., C.M.EDIN.

Liverpool School of Tropical Medicine.

AN opportunity was recently afforded me of perusing a copy of some rules for the prevention of the spread of sleeping sickness, issued by His Majesty's Commissioner for East Africa. In brief, the rules direct that no native of Uganda or of Kavirondo shall be allowed to travel in an easterly direction from the infected area, which for the operation of the rules is declared to be all land within 25 miles of the shore of Lake Victoria; that no native of Africa other than personal servants of Europeans shall travel out of the infected area in an easterly direction unless furnished with a medical certificate. This is valid for two days only from date of issue, and must state that the traveller has no obvious signs of sleeping sickness; further, that an authorized medical officer at an advertised time and place shall examine intending travellers, and detain in hospital or observation camp any whom he suspects to be suffering from sleeping sickness.

These regulations would be all very well if the disease were plague; but it is not, and it is extremely doubtful if any rules based on the Bombay plague "measures" could possibly be successfully carried out in tropical Africa, either for plague or any other disease. In India the traveller goes by road, rail, or boat, and there are ample facilities for each method. During the "measures" régime observation stations were established at places on the roads and at certain stations on each system of railways, as well as at the Bombay landing stages. All other avenues were stopped. Now, bubonic plague has a very short incubation period, after which there may be high fever for a day or two, or perhaps only a few hours, before physical signs develop. The doctor at an observation station is able with practice to detect, by palpation of the body, any traveller with a temperature above normal. Such persons would be detained in an isolation camp for subsequent examination and observation. If the case were plague, within a few hours buboes or other obvious symptoms appeared, rendering the diagnosis clear. By the adoption of such means only an occasional case in the early incubation period, before the temperature had risen, was likely to pass the cordon.

With regard to restrictions against spreading African sleeping sickness the conditions widely differ. For example, the single railway in British East Africa is scarcely used as yet by the natives, while there are practically no roads. An observation station on the railway could of course be arranged, but the guarding of the numerous native pathways which branch out from the affected area would be next to impossible. Africa is a network of pathways. Apart from this there are technical difficulties with regard to diagnosis which make it quite hopeless to expect more than a minimum of benefit from any segregation measures based on the above lines.

Sleeping sickness has a very long incubation period—from a few months to several years probably—during which trypanosomes are to be found in the peripheral blood in the majority of cases either daily, occasionally, or periodically before the temperature becomes affected.¹ Consequently the individual all this time is a source of danger to his neighbours as long as he remains within the infective area, that is, where *Glossina palpalis*, the species of tsetse fly known to be the transmitter of the disease, is prevalent. Outside the fly area he is practically harmless so far as we know at present, unless his blood is used for inoculation. When the incubation period has ceased there is still a period of weeks or even months during which the temperature, normal during the morning, rises several degrees every afternoon, and this occurs before any other symptoms can be detected by others than the immediate associates of the patient.

During the long period of incubation before this fever stage commences there is at present no means of arriving at a diagnosis without microscopically examining the blood or cerebro-spinal or other fluids for trypanosomes, except indeed by the discovery of enlarged cervical glands, the presence of which may ultimately prove to be an early and sure sign, for in 1903, in Uganda, I showed that their area of distribution agreed very closely with that of sleeping sickness.²

After the fever stage has set in the detection of the case is less difficult, for if the examination is carried out during the afternoon a rise of temperature and quick pulse will draw attention to it. Even then the medical officer has no light task before him to establish a diagnosis, since the examination of each fresh bloodslide for trypanosomes by the ordinary coverslip method takes twenty minutes or more to complete, and the parasites are generally so scanty that daily examinations for a month or more may fail to reveal them.

If ordinary coverslip examinations yield negative results, then half a cubic centimetre of blood has to be drawn, centrifugized and examined, daily or oftener, till the parasites are discovered. When blood examinations are repeatedly negative the cerebro-spinal fluid should be examined, particularly if any excitement or other head symptoms are present, for, as I have pointed out elsewhere,³ trypanosomes may frequently be found in the cerebro-spinal fluid of these cases, and not in the blood. So also in the case of hydrocele, trypanosomes may be found in the fluid, and not in the blood or the cerebro-spinal fluid. Even if the parasites are never observed at all, the case may still be one of sleeping sickness.

Useful information pointing to the nature of the case may be gained by practice from the very first glance at the fresh blood preparation, even without using the microscope, by noting the condition of the red cells. Normally, these are evenly distributed if the slide is clean, or in rouleau, but in trypanosomiasis there is generally some agglutination: irregular clumps of cells are seen with large spaces between them, and in these trypanosomes, if present, may be detected. More or less agglutination is fairly constant, but how early in the case is doubtful.

Apart from the question of enlarged cervical glands, the early diagnosis of sleeping sickness is difficult; it requires considerable technical skill, and it entails much labour. Hence the difficulty of initiating measures for preventing its spread which are based on the examination and segregation of travellers.

What other preventive measures are there? It would, of course, be impossible to completely evacuate the whole of the affected area—namely, those districts in which sleeping sickness cases are to be met with, stretching may be for twenty-five miles from the lake shores. Judging from observations on the banks of the Congo and the Niger, I have good reason to believe that the distribution of *G. palpalis* along the shores of the Victoria Nyanza is much less extensive than that originally mapped out by me as the infective area of sleeping sickness in 1902-3, at a time when both the cause and mode of transmission of the disease were unknown.⁴ Probably the fly, and therefore the infective area, does not extend beyond a distance of one mile or so from the water, and in places possibly not more than a few hundred yards from it.

It would under these circumstances be quite unnecessary to evacuate the whole of the sleeping sickness affected regions, for where the tsetse is not found the transmission of the disease is not probable. On the other hand, the compulsory evacuation of the presumably narrow fly area on the mainland, as well as the complete evacuation of the islands in the lake, might not only prevent the spread of the

disease, but might eradicate it altogether if the persons evicted were sent sufficiently far inland to be out of reach of the tsetse, and prevented from returning for a period of seven years at least, by which time all those with sleeping sickness would probably have died off.

This measure, however, could not be carried out until all the areas of distribution of the different species of tsetse flies in the two Protectorates had been precisely mapped. The mapping of these areas I believe to be the first step in combating the spread of sleeping sickness. With such a map before one, it would be easy to determine the direction of spread most likely to occur from any given infective area, and what measures of prevention, such as the closing of certain routes, or the evacuation of certain districts, promised the best hope of success.

If two or three competent inspectors were appointed by the Governments of the Protectorates to investigate and report upon the exact distribution of the "fly,"—a work which could be completed in a few months—a great step in advance would be made, and if evacuation were not insisted upon prophylactic measures within the dangerous zones might then be elaborated with a prospect of success. Habitations, rest-houses, or even stations might be moved to more healthy sites; watering and washing places might be screened, or cleared of all forest and bush; horses and cattle, supposing these to be a possible source of danger to human beings, might be protected when obliged to pass through the areas; crews and passengers of steamers on rivers and lakes might be safeguarded in some way when stopping at dangerous wood posts; white men obliged to live at those posts might be provided with wire net verandahs; and any case of sleeping sickness that was detected would, of course, be carefully segregated or deported inland. Inspectors could study the habits of the "flies," of which at present we know comparatively little. They would investigate the question of whether the fly areas were permanent, or tended to vary in position, and whether the flies were dangerous all the year round, or bit only during two or three months in the year, which is probable. They would soon be in a position to suggest means for the protection of the natives from bites by the use of some ammoniacal or other strong smelling substance smeared on their bodies, or to devise methods which would enable the flies themselves or their pupae to be effectually destroyed. Prevention is better than cure, and it seems to me that the former is not receiving the attention that it deserves in view of the gravity of the disease and the great probability of its breaking out in other "fly" infested regions.

REFERENCES.

¹ Reports of the Trypanosomiasis Expedition to the Congo, 1903-4. Liverpool School of Tropical Medicine, Memoir xlii. ² Royal Society Reports of Sleeping Sickness Commission, No. iii, p. 30. ³ Reports of the Trypanosomiasis Expedition to the Congo, 1903-4. L. S. T. M., Memoir xlii, p. 57. ⁴ Royal Society Reports of Sleeping Sickness Commission, No. iii, p. 13.

SCIENTIFIC GRANTS COMMITTEE

OF THE

British Medical Association.

REPORT LXXXVIII.

THE BACTERIOLOGY OF CERTAIN PARTS OF THE HUMAN ALIMENTARY CANAL AND OF THE INFLAMMATORY PROCESSES ARISING THEREFROM.

By JOHN T. HEWETSON, M.D., M.Ch., F.R.C.S.,

Research Scholar of the British Medical Association; Surgical Curator, Pathological Museum, University of Birmingham.

THE following abstract represents the basis of my results up to date. As it is my intention to continue the research for another two years, I have drawn only such conclusions as this early stage of the investigation will warrant. The literature of the subject has been purposely avoided, owing to the fact that it will be more convenient to deal with it at the end of my research.

In view of the great importance attached to anaërobic growths by many French bacteriologists—notably, Rist, Veillon, Faber, Cortret, Halle, Tresser, and others—I deter-

mined from the outset to make both aerobic and anaërobic cultivations from each specimen of pus or other substance examined. The anaërobic inoculations were made in deep glucose agar, deep glucose gelatine, and similar stabs kept in Buchner's tubes in atmospheres of nitrogen. The pathogenicity of organisms has been ascertained only since the beginning of the present year, owing to the fact that the University of Birmingham has possessed licensed premises only during that time.

APPENDIX AND APPENDICITIS.

In cases of non-suppurative appendicitis aerobic and anaërobic cultivations were made from the proximal end of the excised appendix, and also from the cavity of the appendix near the tip. The appendix was then carefully investigated to determine whether its lumen was at any point interrupted or completely stenosed. In cases of suppurative appendicitis the pus was collected into sterile pipettes, from which films and aerobic and anaërobic cultivations were made.

Appendix in Non-suppurative Appendicitis.—In 44 cases the appendix was completely stenosed in 25, and was open throughout its entire length in 19. Of the 25 cases of stenosis, the contents of the distal chamber were sterile in 11 and gave a growth in 14. In the 14 giving a growth the following organisms were found:

Bacillus coli alone in 11.
Bacillus coli and a torula in 1.
Staphylococcus pyogenes aureus in 1.
A streptobacillus in 1.

The proximal side of the stenosis was examined in 4 cases. Of these, bacillus coli was found in 3 and 1 was sterile. Of the 19 cases showing no stenosis, 18 gave a growth and one was sterile. In the 18 showing a growth the following organisms were found:

Bacillus coli alone in 16.
Bacillus coli and staphylococcus albus in 1.
Streptococcus pyogenes in 1.

On eight occasions a pure growth of bacillus coli found in the appendix was injected into the peritoneal cavity of rats, and was very pathogenic in 6 cases, and produced little or no effect in 2. In the 44 appendices 4 concretions were found.

Appendix in Suppurative Appendicitis.—It is quite impossible to form any idea of the nature of the organisms present by means of films of the pus alone. Streptococci, micrococci, and even staphylococci are very prone to appear in pus films as almost pure diplococci, and may even appear to be encapsulated. The value of films, though considerably limited, generally tells you whether you are dealing with a pure or a mixed infection. You can, as a rule, readily distinguish between cocci and bacilli. One of the objects of my research has been to see how far the appearances, as shown by films, are borne out by the revelation of the cultivation methods. This leads me to speak of the importance attached to anaërobic cultures by the French bacteriologists. Rist, in a paper published in the BRITISH MEDICAL JOURNAL of October 12th, 1901, claims that many organisms in suppurative appendicitis are overlooked if aerobic cultivations alone are made. He draws attention to the fact that many varieties of organisms are seen in the films of pus which cannot be grown on aerobic cultures, and he concludes that these can only be obtained by anaërobic methods. My investigations lead me to a very different conclusion. In all my 44 cases of suppurative appendicitis I only once found the anaërobic cultures to reveal organisms that the aerobic cultures did not; that was in Case VI, where a diplococcus was found in the glucose agar stab along with bacillus coli, whereas the aerobic culture showed bacillus coli only. This one instance might easily be explained by supposing that the bacillus coli had overgrown the diplococcus in the aerobic cultivations. There can be little doubt that bacillus coli grows much more vigorously aerobically than anaërobically; for this reason, if a film is made from an anaërobic stab, or if subcultures are made on agar slopes from such a stab, there is much less likelihood of missing the mixed growth than if the aerobic cultures only are used.

During the whole of my investigation upon suppuration I have been profoundly disappointed that the results of Rist, Veillon, and others have not been confirmed in my hands. I had hoped for great results from the anaërobic cultures, but, after a careful trial, I have come to the conclusion that the great majority of organisms found in suppuration or in the human body are facultative anaërobes, and that if a sufficient number of strokes are made there will be little difficulty in