

## TRYPANOSOMIASIS.

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THIS paper is a brief review of the problems which animal trypanosomiasis present to the administrators of Tanganyika Territory and of the lines along which we look for solution.

2. Tanganyika Territory is a warm, forest country essentially suited to tsetse flies, and more than half of its surface is covered by tsetse-infested forest. This opening remark does not mean that I look upon all forms of African trypanosomiasis as "tsetse fly diseases" which disappear with the eradication of *glossina*—to do so is to ignore the existence of many areas where trypanosomiasis are maintained in enzootic form in the absence of tsetse—but it does mean that as far as Tanganyika Territory is concerned the maintenance in health of domestic animals is practically impossible in the presence of these flies, and that local control of tsetse is the greatest single step that can be taken towards suppressing the diseases. The realization of this led to the formation of an independent *Department of Tsetse Research*, consisting of entomologists, botanists, and zoologists, with Mr. Twynnerton as chief, who are studying the relations of tsetse flies to every portion of their environment. The immediate object of the researches of this Department is to find out how much of the environment of the tsetse is *absolutely essential* to their existence; then, once this is known, the next object will be the determination of what portion of the absolutely essential environment can be most economically removed to bring about the complete destruction of the flies. At present, knowledge on these points is not detailed enough. It is known, for example, that shade and blood form large portions of the absolutely essential environment of tsetse, and under certain local conditions it has been found necessary to advocate complete destruction of all trees or of all game within a certain area to bring about the disappearance of tsetse. Such drastic measures are necessary where they can be successfully applied to drive back tsetse which are encroaching on fly-free land, but as *general* measures of reclamation they are repugnant; for it is far from the desire of any cultured man to hand on to posterity an Africa freed from tsetse indeed, but at the same time shorn of all her natural beauty.

3. For general measures of reclamation, then, we of Tanganyika must perforce wait until the Department of Tsetse Research has had time to carry out the research necessary for their formulation. For holding back tsetse from further encroachment on land occupied by a fairly dense population of husbandmen we can successfully apply the crude measures of game and/or forest destruction. When, however, fly encroachment occur, in the country of *Masai*, who are only stock-owners we know of no practicable way of helping these natives except by soliciting the help of the Geological Department—to open up new areas of grazing by discovering available underground water

in fly-free country at present closed to stock on account of the absence of surface water; in other words, by running away from the fly and making better use of the remaining fly-free land?

4. This matter of fly encroachment in Masai land constitutes the only side of the tsetse fly problem which is in *urgent* need of solution, since for some considerable time the growth in stock requirements of the rest of the Territory can be met by improvement in the methods of utilizing the existing fly-free areas. This improvement is being slowly effected under the guidance of the Veterinary, Administrative, Geological, and Agricultural Departments.

5. The Veterinary Department is studying the diseases themselves more with the aim of clearing them up in the absence of tsetse than with the aim of attempting to immunize stock for use in fly belts; for we hope that by the time the existing fly-free grazing lands are fully and evenly stocked, satisfactory measures for extending these areas will have been advised.

6. An account of the work on trypanosomiasis of the Veterinary Department is given in the Report for 1928. To bring this account up to date I shall refer very briefly to two or three interesting points which have arisen during this year's work.

The first points are in connection with the distribution of *T. congolense* in an animal's body.

7. If a bloodsmear is taken from any superficial vessel of a bovine affected with *T. congolense* and an estimate is made of the number of trypanosomes present—for convenience in terms of so many per 100 fields—and if, then after an injection of antimosan, a series of similar smears from the same or adjoining vessels are made at five-minute intervals, a characteristic curve can be plotted from the figures so obtained. A single example will suffice.

Ox 2403 was given 40 c.c. of 10 per cent antimosan intravenously.

At 0 min after inj.	there were	7	tryps.	per	100	fields.
At 5	„	52	„	„		
At 10	„	88	„	„		
At 15	„	114	„	„		
At 20	„	70	„	„		
At 25	„	30	„	„		
At 30	„	22	„	„		
At 40	„	4	„	„		
At 50	„	2	„	„		
At 60	„	0	„	„		

8. A similar curve had previously been found by Hall to follow the injection of the drug Harlarsine, but no explanation of its occurrence has yet been published. I sought, but failed to find, an explanation of parasites in the ear veins in the early morning than in the due to constriction or dilatation of certain groups of capillaries forcing or flushing out the trypanosomes contained in the affected vessels.

9. The clue to what I believe to be the simple explanation was furnished when I was engaged in studying the diurnal variation in the concentration of *T. congolense* in superficial vessels. I found that in chronically affected bovines there tends to be a greater concentration of parasites in the ear veins in the early morning than in the afternoon, and that this diminution does not occur when the animal is kept in the dark. To take a single example:—

A chronically affected ox (No. 2435) was examined on five days during April and May. On four of these days he was running in a paddock; on the fifth day he remained in a pitch dark shed.

TRYPANOSOMES PER 100 FIELDS.

Date.	7 a.m.	11 a.m.	2 p.m.	6 p.m.
7th April, 1929.....	4	1	1	—
8th April, 1929.....	36	7	5	10
9th May, 1929.....	36	5	1	2
14th May, 1929.....	9	7	9	—
3rd June, 1929.....	11	—	—	—

The date on which he was kept in the dark was 14/5/29.

10. The conveying point of the two sets of observations and the conclusion to which they lead is this: *T. congolense* are not evenly distributed throughout the whole of the blood and carried passively round like erythrocytes. If they are carried into a vessel of small size they tend to attach themselves and lie quietly there while they feed and multiply. In the ordinary way only a small proportion are being hurtled along the great blood channels. If disturbed by any noxious influence the trypanosomes release their hold, and are carried into the main circulation where they remain until destroyed or until they encounter another attractive resting place.

11. One such noxious influence is sunlight, the more penetrating rays of which reach the parasites in the ear and cause those which had settled there during the night to release their hold.

12. A much more general disturbance is created when Antimosan is injected; trypanosomes all over the body release their hold, and are swept into the general circulation to produce such figures as I have given.

13. There is one other point in connection with pathology. Not only are *T. congolense* practically confined to the closed haemo-lymph system, but the damage they do consists in an almost pure anaemia. A study of red-cell counts following injection brings out one point very forcibly, and that is the enormous reserve of blood possessed by an ordinary healthy male animal. A young healthy ox with us has a red-cell count of 9-12 millions per cm. although, provided external conditions are favourable, he can manage quite well with less than half that number. Consequently if, as often occurs, an animal becomes mechanically infected at Christmas time—when he is fat, the weather is warm, and there is abundance of grass—he will forthwith develop an anaemia, but he will not show any symptoms of illness until he is exposed to the adverse conditions of winter.

14 To conclude: With many diseases, application of results of research lays far behind the research itself. With trypanosomiasis this is not so; for the simple reason that research is not very advanced. We have not yet enough knowledge to permit us to combat these diseases satisfactorily, and that is why I lay such emphasis on research.