The Development of a Parasite of Earth-worms.

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(From the Laboratories of the John Howard McFadden Research Fund, Lister Institute.)

[Plate 14.]

While carrying out experiments on the artificial induction of cell-division, I had occasion to examine the seminal vesicles of the common earth-worm, when I noticed that certain epithelial cells contained within their cytoplasm structures similar to those known as "Kurloff's bodies" found in the blood-cells of guinea-pigs.

These Kurloff's bodies have recently been shown to be parasites, to which the name of *Lymphocytozoon cobayæ* has been given. In their early stages, they are parasites of the mononuclear cells (lymphocytes) of the blood of the guinea-pig. As described in the paper on the subject (E. H. Ross, 1912), they undergo development in definite stages in the lymphocyte, and ultimately become free-swimming spirochæte-like bodies in the blood-plasma. Having assisted in the investigation of the development of these so-called Kurloff's bodies, I was struck with the similarity between them and the new structures seen in the epithelial cells of the seminal vesicles of the earth-worm, and the matter was further investigated. I am now convinced that these structures in the earth-worm also represent phases in the life-cycle of a new parasite which is very similar in its developmental figures to *Lymphocytozoon cobayæ*.

The cells in the worm which contain these peculiar structures are the large cœlomic epithelial cells which form the walls of the vesiculæ seminales of *Lumbricus terrestris*. The body first observed was a large spherical sac containing a closely woven skein, staining deep blue with azur stain, lying embedded within the cytoplasm of the epithelial cell. The method of examination employed was that devised by H. C. Ross (1910) for the examination of blood-cells *in vitro*, and it is known as the "jelly method." A 2-per-cent. solution of agar in distilled water is boiled, sterilised, and filtered. To 5 c.c. of the filtrate is added 1 c.c. of a 1-per-cent. solution of azur II, and the total bulk of the mixture is made up with water to 10 c.c in a test-tube. When molten, a small quantity of the jelly is allowed to spread itself in a thin film on a microscope slide, where it will set when it cools. A drop of a suspension of the cells of the seminal vesicles in citrated

normal saline solution is placed on a cover-glass, which is then inverted and allowed to fall flat on to the set jelly film. The spermatozoa, the nuclei of the epithelial cells and of the seminal cells all stain deeply. Within the epithelial cells the parasites also stain in sharp contrast with the surrounding cytoplasm, so that their morphology can be readily determined. The first stage of the parasite within the cell consists of a blue dot or granule situated in what looks like a vacuole which colours only faintly (Plate 14, fig. 1). In the next stage observed, the dot has apparently divided, for the vacuole or sac now contains several blue granules (fig. 2). The dots then elongate into rods (fig. 3), and each rod becomes lengthened and splits longitudinally (fig. 4), until the parasite appears like a bunch of painted sticks—a sheaf embedded within the cytoplasm of the epithelial cell, its host. This process of splitting continues and at length there is a series of spiral coils wound up within the sac, which is still enveloped by the protoplasm of the epithelial cell (figs. 6 and 7).

In some specimens observed by the jelly method, the parasite is separated from its host-cell, and is found stained and lying free as in fig. 5. The final stage is that of a free spirochæte (fig. 8). This is the fully developed parasite, having a long slender body, pointed at one end and blunt at the other. It is nearly always found coiled up, but occasionally it is almost straight. Its protoplasm is homogeneous, and contains at irregular intervals in its length small chromatin masses, varying in number from five to twelve, which are characteristic of spirochætes. These spirochætes have not only been seen free, but also swimming actively in the seminal fluid when the latter has been examined by dark ground illumination. They are readily differentiated from spermatozoa by their length, granulation, and peculiar movements, nor can there be any confusion between this parasite and the well-known *Monocystis lumbrici* or the spermatophores. So far as I can ascertain, its existence has not been recorded before. It is interesting to note, however, that intracellular phases of spirochætes have been described in other animals by A. Balfour, H. B. Fantham, E. Hindle, Sir William Leishman, and others. Its resemblance to the parasite of the guinea-pig is very remarkable; the earth-worm parasite is larger however, develops in the fixed epithelial cells of the vesiculæ seminales, and has not been seen in the blood of its host nor in the cœlomic fluid, but it passes through corresponding phases. The parasite is present in about one earth-worm out of five.

Summary.

A description of "bodies" found within some of the epithelial cells of the vesiculæ seminales of the earth-worm. They closely resemble "Kurloff's bodies"

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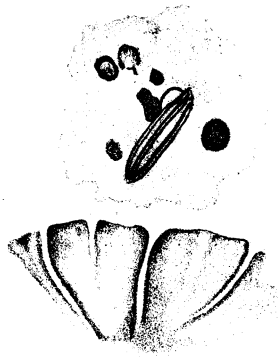

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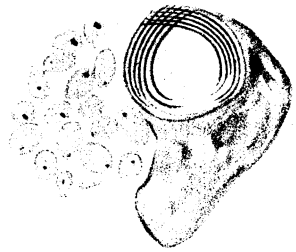

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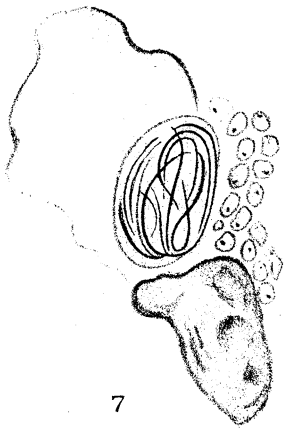

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found within the lymphocytes of guinea-pigs, and by means of the jelly method of examination, the development of these bodies into free spirochætes is demonstrated in the same way that it has recently been shown that "Kurloff's bodies" also become spirochætes. I would suggest that these new parasites be called *Spirochæta lumbrici.*

REFERENCES.

1910. H. C. Ross and J. W. Cropper, 'Induced Cell-reproduction and Cancer,' London, John Murray.
1912. E. H. Ross, 'Roy. Soc. Proc.,' B, vol. 85, p. 67.

Notes on the Polymorphism of Trypanosoma gambiense *in the Blood and its Relation to the Exogenous Cycle in* Glossina palpalis.

By Miss MURIEL ROBERTSON.

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I. *Introduction.*

The following paper deals with the well-known phenomena of the fluctuation in the numbers of trypanosomes present in the blood of an animal infected with *T. gambiense*, and with the equally familiar question of the polymorphism of the parasites.

The relation of these factors to the production of infected *G. palpalis* is also discussed, and evidence is brought forward to show that a certain type of trypanosome is responsible for the carrying on of the cycle in the transmitting host. The actual details of the structure of the trypanosomes and the sequence of developmental stages in the fly are not touched upon in this account. They will, I hope, form the subject of a subsequent paper.

II. *General Condition of a* T. gambiense *Infection.*

It is advisable to consider first the fluctuation in the numbers of the parasites. It is important to note here that a close study of any given infection brings out very clearly that the multiplication of the trypanosomes occurs in the circulating blood-stream. Search has also been made for any type of multiplication in the cells of the lung, liver, and spleen, so far entirely without success. Moreover, the invariable correlation between a rise in the

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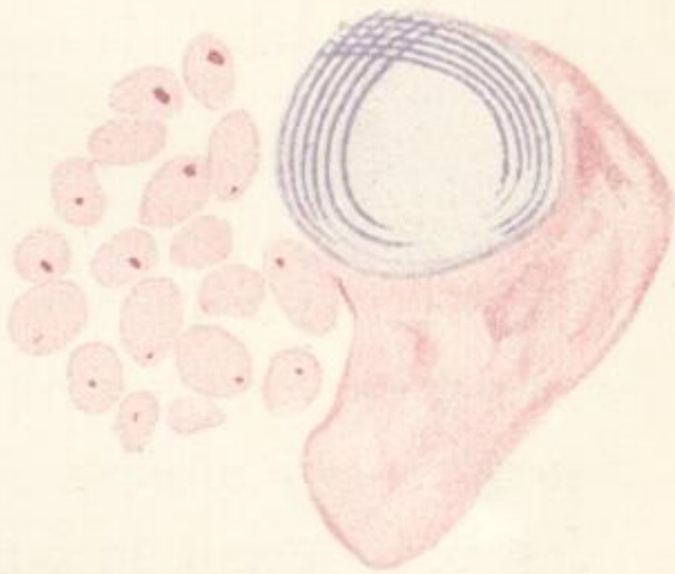

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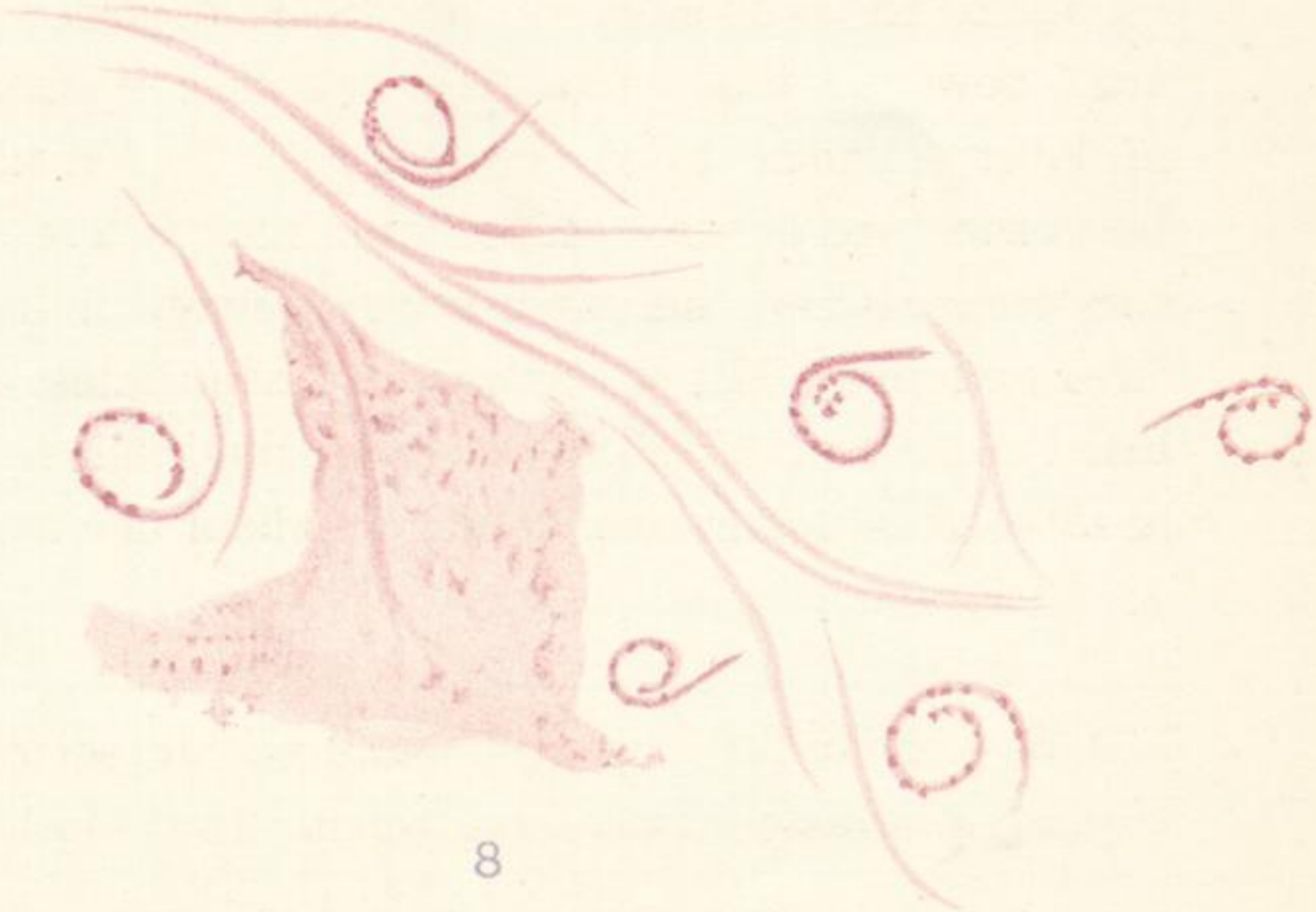

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