

Translation.

ON A NEW PROTOZOON (PIROPLASMA DONOVANI, LAVERAN AND MESNIL), THE PARASITE OF AN INDIAN FEVER.

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LAVERAN and Mesnil, after recapitulating Leishman's, Donovan's and Ross's observations, proceed:—

The preparations which we have received by the kindness of Dr. Donovan are from several cases. There are spleen and liver smears both containing parasites. Some of these preparations were well stained by Donovan (Romanowsky method), others we have ourselves stained by the blue Borrel-eosin tannin method.

In these preparations the parasite is seen as a small pyriform, oval or spherical body, free or enclosed in a red blood corpuscle (figs. 1 to 5). In some of our preparations pyriform bodies which Ross, by the way, does not mention are in the majority. In shape they exactly resemble the most typical forms of *Piroplasma bigeminum* of Texas fever and are no doubt the typical form of the human parasite which we are describing. They measure 2.5 to 4 μ in length and 1.5 in width (figs. 7 to 9).

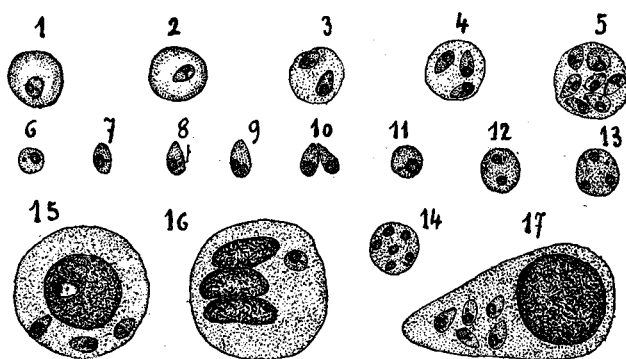
In these bodies, as also in the round or oval ones, there is a fairly large chromatin sphere (probably karyosome); in the pyriform bodies it is usually placed at the side of the larger extremity. On the same transverse diameter as this mass there is generally another smaller round or rod-shaped body; this is sometimes joined to the first by a thin pedicle. The remainder of the parasite is finely granular and nearly clear.

Red blood corpuscles into which parasites have entered alter rapidly. They become pale and granular, and do not take up stains like normal cells. One corpuscle may contain from one to seven or eight parasites without becoming hypertrophied in proportion. We came across one which had fourteen parasites; it had about trebled in size.

Ross does not believe in intracorpuseular parasites. To us any other interpretation of the numerous figures we and Ross have seen seems difficult. Donovan had called our attention to this. Let us simply recapitulate. (1) Some of the corpuscles had retained their normal staining reactions, either throughout or only at the periphery. (2) The substance outside the parasite varies inversely as the number of parasites present. This is easily explained in our hypothesis, but hardly by Ross's theory of "a matrix in which spores are produced." Leishman agrees with us as to intracorpuseular forms. Finally, infected corpuscles which are not found in smears made

post mortem are present in proportion to the excellence of the preparation made by puncture during life. Free forms are, however, always much more numerous than intracorpuseular ones. These intracorpuseular forms suggest that at some time or other the parasites must be found in the peripheral circulation. Donovan says he has not yet found them there, and there were none in a preparation which he sent us.

We have frequently found the perfect parasites in varying numbers enclosed in mononuclear or polynuclear leucocytes; some even seemed to be in the nucleus (fig. 15), but in these cases the nucleus was always altered.



FIGS. 1 and 2.—Red blood corpuscles normal in shape and appearance, each containing a small piroplasma.

FIGS. 3, 4, 5.—Altered red blood corpuscles containing 2 to 7 parasites.

FIGS. 6, 7, 8.—Free parasites—round, oval and pyriform.

FIG. 9.—Pyriform parasite dividing.

FIG. 10.—Two pyriform parasites, probably showing longitudinal division.

FIG. 11.—Large round parasite.

FIGS. 12, 13, 14.—Forms of multiplication by repeated division of the nucleus.

FIGS. 15, 17.—Large mononuclear leucocytes, with parasites in the protoplasm as well as in the nucleus.

FIG. 16.—Polynuclear leucocytes with a parasite in the protoplasm ($\times 1,000$).

The parasites appear to multiply by simple division (this is the commonest way) or by multipartition. In the first case the large chromatin mass divides into two and the pyriform body, which has hardly increased in size, splits longitudinally (figs. 9, 10). In the second case the parasite slowly increases in size and becomes globular; soon its nucleus divides; this results in the formation of bodies which may attain the diameter of a red blood corpuscle with from two to eight chromatin masses; the smaller chromatin particles are frequently absent, or are fewer than the large masses. These large bodies with four to eight nuclei closely resemble red blood corpuscles containing the same number of parasites and sometimes it requires a little care to distinguish them. Ross must have confounded these two conditions. At the termination of this evolution there is apparently a radial division of the parasite into mononuclear elements. Some rosettes which we have seen we think must have originated in this way. The parasites never at any

time contained any pigment. Where should this new organism be placed? The almost constant existence of the small chromatin mass so like the centrosome of trypanosomes naturally suggests a trypanosome or at least one of the flagellata. Neither Donovan, Ross, nor ourselves have been able to demonstrate a flagellum.

We believe that we can eliminate this hypothesis. The facts which we have enumerated show that there is no essential difference between Leishman's bodies and the known piroplasmata—especially the *P. bigeminum*. A pear-shaped and longitudinal division is the rule, as in *P. bigeminum*—division into four or more is frequently seen in piroplasmata. Finally, the existence of intracorpuseular forms removes the last objection to this view.

We can therefore only adhere to the name *Piroplasma Donovanii* which we originally gave to this parasite. The fact that this human piroplasma has been found in two places in India as far apart as Madras and Calcutta suggests that the geographical distribution of the disease is an extensive one. It would be well to organise a systematic search for Leishman's bodies in the non-malarial remittent fevers of Southern Asia, and especially of French Indo-China.

The piroplasmata already occupy an important place in veterinary pathology. This is the first time that a definite human disease has been ascribed to a well-defined piroplasma.

NOTE.—Spotted fever of the Rocky Mountains was ascribed by Wilson and Chowing to a piroplasma; the nature of the latter is doubtful; in any case it has nothing to do with the Indian fever with which we are now dealing.

