SPIROCHÆTES IN THE BLOOD IN TRENCH FEVER.

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DURING the last two or three years I have examined a very large number of blood films taken from cases of trench fever in France and in our local military hospitals. For the former I desire to thank Captain Adrian Stokes, R.A.M.C., and especially Captain A. T. Nankivell, R.A.M.C., for kindly sending me films from France.

The Difficulties Met With.

In common with so many other observers, my attention was primarily directed to the search for spirochætes, as the disease has many characteristics of a spirochætosis. Nothing but failure resulted from very prolonged efforts. Whatever be the cause of trench fever, it exists either in very small numbers or in the form of some minute, characterless, or invisible organism, otherwise it would have been detected before this.

It is quite conceivable that the causal organism is present in exceedingly small numbers in the blood. In syphilis, in rat-bite fever, and in infectious jaundice spirochætes are definitely known to be the cause, and in each case occur in the peripheral blood at one or other stage of the disease; yet how many observers have succeeded in finding them in human blood? My own experience in the case of infectious jaundice illustrates this. Captain Adrian Stokes kindly sent me eight blood films taken from a definite case of infectious jaundice on the fourth day of the disease. A fortnight's examination entirely failed to find a single spirochæte. Subsequently he sent me six films from a case on the second day of the disease, and after numerous very prolonged examinations extending over several days I found two spirochætes.

Further, it is probable that if spirochætes do occur in the blood of trench fever they will be more likely to be found during the first attack, and it is not always easy to say from the first attack of fever what the condition may turn out to be. Of the numerous films that I examined from cases in our local hospitals none were earlier than the third or fourth relapse.

Present Investigation.

In order to obtain blood films from the earliest stage of trench fever I applied to General Sir David Bruce, chairman of the Commission on Trench Fever, and he asked Major W. Byam, R.A.M.C., to send me films from successfully inoculated or scarified men at the Hampstead Military Hospital, both just before and during an attack of the disease. I take this opportunity of expressing my thanks to both of these workers for their kindness.

In two out of six of these cases I have found a few spirochætes or spirochætal-like bodies in one or two of the many blood films examined. Major Byam's notes on these cases were as follows:—

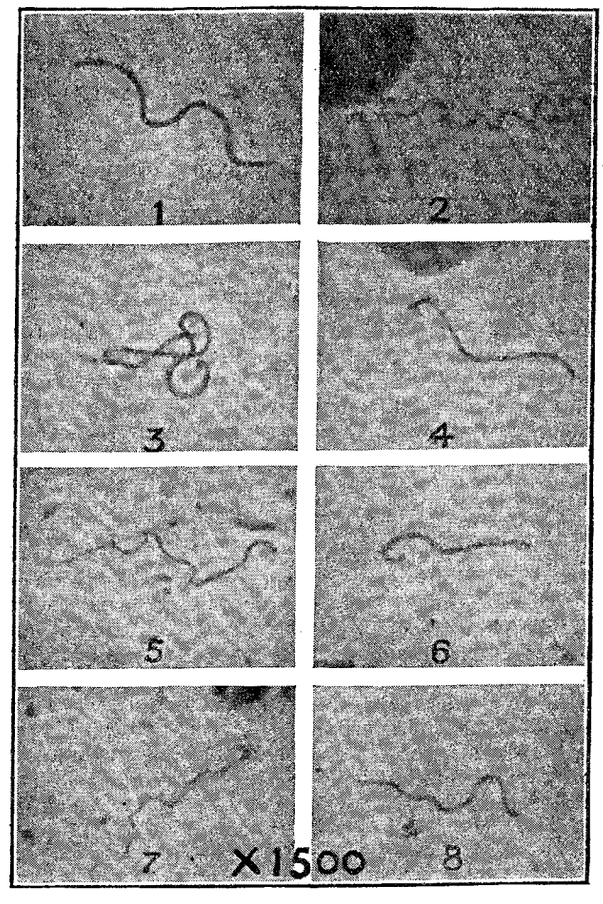
CASE 1.—Peripheral blood smears, 3.15 P.M., April 14th, 1918. On April 14th, at 11 A.M., developed trench fever as result of inoculation with infected lice excreta. Incubation eight days. Onset with frontal headache and pains in left hip, left side and down left arm. (Left arm was seat of scarificatio i.) 3.15 P.M.: Slight shivering and increased headache. T. 102° F.; P. 84. Pains in muscles of thigh and in both hips and loins. April 15th, 10 P.M.: Second day of disease. Blood films.

CASE 2.—Blood films, 11.20 A.M., Nov. 13th, 1918. First attack of fever.

The spirochætes or spirochæte-like structures vary considerably in their form, but they have in common the fact that they are all stained with Giemsa a delicate blue tint; they are all faintly granular, and in no case are the ends pointed. Figs. 1, 3, 4, and 6 could be found with the 1/12 oil immersion objective. Figs. 2, 5, 7, and 8 are very faint indeed, and the photomicrographs show them even better than they are seen under the microscope.

I have marked the position of each by a small ring on the film by a diamond-marker; the size of the ring is such that the whole is included in the field with a magnification of 240 diameters. Yet when such a ring is examined with a 1/12 objective it is most difficult to find the organism, especially that shown in Figs. 5, 7, and 8. It would therefore be almost impossible to find such a structure by direct examination with an oil immersion lens. I found them by means of dark-ground illumination, logged and marked their position before mounting. This fact may vitiate against Figs. 5, 7, and 8 being regarded as spirochætes.

The photomicrographs give a better impression of the appearance of the structures than any description.



Spirochætes in blood films of trench fever. The original micro-photographs have been slightly enlarged in reproduction, and the magnification is now × 2000.

FIG. 1 (*Case 1*).—Blood film A, taken at 10 P.M., April 15th, on secon day of fever; open wavy spiral, ends round, length 12·6μ with two turns, diameter 0·4μ, slightly denser stained areas are seen in its course.

FIG. 2 (*Case 1*).—Blood film B, taken at 3.15 P.M., April 14th, on first day of fever; length 13·3μ with five spirals, small and slightly irregular.

FIG. 3 (*Case 1*).—Blood film C, taken at 10 P.M. April, 15th, on second day of fever; an irregular knotted form.

FIG. 4 (*Case 1*).—Blood film D, taken at 3.15 P.M, April 14th, on first day of fever; a wavy filament with one or two turns, with very fine granules, length about 11μ.

FIG. 6 (*Case 1*).—Blood film D, taken at 3.15 P.M., April 14th, on first day of fever; similar wavy filament.

FIGS. 5, 7, and 8 (*Case 2*).—Blood film I, taken at 11.20 A.M., Nov. 13th, during first day of fever; faintly stained filaments, with numerous irregular spirals.

Consideration of the Findings.

The questions which naturally arise are these actual spirochætes, and, if so, what relation have they to trench fever?

In answer to the former question, they have the general appearance of spirochætes, although those from the second patient are very elusive, of slight refractive power, and very difficult to see. The staining reactions with Giemsa, a pale blue colour, is not, however, common in spirochætes in general. They cannot be regarded as artefacts, and the faint irregular structures in Figs. 5, 7, and 8 cannot be compared to "streamers," which, in my experience, are never met with in ordinary air-dried stained films.

Whether they have any actual causal relation to trench fever is much more difficult to say. The fact that they were detected only in the blood of definite cases of artificially induced trench fever, and then only during the first attack of fever, is at least suggestive. The generally accepted statement "that at least in one stage of development the virus of trench fever is filterable" does not exclude that virus being a spirochæte. Some spirochætes are known to be filterable, and Noguchi states that the *Spirochæta icterohæmorrhagiæ* will pass the Berkefeld candle V.