OBSERVATIONS ON THE FORMATION OF "BUDS" BY THE SPIROCHÆTE OF RELAPSING FEVER IN THE LOUSE.

By Lieutenant-Colonel J. C. Kennedy,
Central Laboratory, Baghdad.

There is still much to be done towards the elucidation of the life history of Spiræchæte recurrentis in the body of the louse. The following would appear to be proved and generally accepted:

1. The spirochætes after ingestion by the louse very soon disappear from the gut and cannot be found on dissection.

2. For the first four days thereafter the spirochætes remain invisible and the louse is not infective.

3. On the fifth to the sixth days the spirochætes are still invisible but the louse is infective.

4. On the seventh to the eighth days spirochætes appear as slender forms in the louse which is still infective.

5. From the tenth day onwards adult spirochætes appear in the louse which is now practically non-infective.

6. The adult (non-virulent) spirochætes usually disappear from the body of the louse by the nineteenth day, but may be found up to twenty-five days.

7. There is hereditary transmission of the virus in the louse as the offspring are infective.

Two stages, therefore, in the life history of the spirochæte in the louse are unknown—first, the stage of invisibility during the first four days and, secondly, the transmission to the offspring.

These gaps in our knowledge will no doubt be filled when we have acquired the means of recognizing and studying the granule phase of spirochætes in its entirety. Meanwhile I am induced to make an observation which so far as I know has not yet been recorded, and which in many respects is very similar to that made by Leishman in the case of S. Duttoni in the tick, and because there would appear to be some who do not believe that spirochætes undergo any developmental phase in the body of the louse.

These observations were made on the contents of two lice which were dissected twenty-four and thirty hours, respectively, after being removed from the person of a relapsing fever case who had been ill for about three days. Both lice harboured large numbers of spirochætes, and from the size and number of the spirochætes had probably become infected more than ten days previously.

There were no spirochætes inside the gut but enormous numbers in the colomic fluid and round about the posterior end of the gut. The majority were large, collected in clumps and motile but delicate and
"Buds" by the Spirochete of Relapsing Fever
granular in appearance. There were also a number of small forms, in one case, particularly at the anterior end of the body cavity, but none were found in the salivary glands. Their presence was ascertained by rapid examination of the wet specimens, which were then fixed in osmic acid or alcohol and stained by Leishman, Giemsa or Heidenhain's stains. The presence of "buds" was realized when examining a slide by dark ground illumination, and on closer examination they were found in several others. After a careful examination by both methods of illumination, there is no doubt in my mind of the spirochetal origin of these "buds."

The originals of the accompanying drawings were made by means of a camera lucida, magnifying about 1,500 diameters, and many of the objects are depicted as they appear both with dark ground and with direct illumination. Those figures with a following the number are from the same objects as those bearing the corresponding number. The "buds" vary in size from 2.2 μ to 4.5 μ, and their situation in relation to the spirochetes may be terminal, subterminal or lateral. They stain feebly with Leishman or Giemsa stains, but Heidenhain's brings them up better and differentiates one or more deeper staining portions (figs. 12a to 15a, 27). They are not very refractile (dry film), but frequently show a refractile granule (figs. 9, 10, 12, 13). Bodies similar in appearance were found lying free, presumably detached from the spirochete, and one was found in the preparation made from an ovum, but this may have been accidental (fig. 28).

Large numbers of refractile granules were found in the celomic fluid, in the tissues round the gut, and some clumps in the ovaries and ova. It is, of course, impossible to say which were of spirochetal origin.

In one of the specimens from the celomic fluid, it was noted that the spirochetes had an affinity for certain cellular elements. These cells were round and cyst-like, 4-8 μ to 6 μ in size, with a well-defined margin, and staining a faint slaty-blue with Leishman. A number showed one, two or more chromatin granules at the margin (fig. 25a). These granules undoubtedly were spirochetal and were refractile by dark ground illumination (figs. 16 to 26). With Heidenhain's iron hæmatoxylin they stain uniformly a deep black. Similar cells are to be found in non-infected lice but without the granules.

As the relapsing fever season is now practically over, I do not anticipate having much opportunity for further investigation at present.

DESCRIPTION OF DRAWINGS.

Figs. 1 to 7.—Appearance of spirochetes with granules and "buds" seen with dark ground.
Figs. 8 to 15.—Ditto. Compare these with figs. 8a to 15a, which are the same spirochetes seen with direct illumination. Stained Heidenhain's iron hæmatoxylin.
Figs. 16 to 26.—Cellular elements with refractile granules, with and without spirochetes attached. Dark ground.
Figs. 25a and 26a.—The same as figs. 25 and 26. Leishman's stain.
Fig. 27.—"Bud" showing differentiation of a deeper staining portion. Compare "buds" 12a, 13a, 14a, and 15a.
Fig. 28.—"bud" from crushed ovum.
REFERENCES.

Such references as are available to me at present are for the most part the extracts published in the "Tropical Diseases Bulletin."

NICOLLE and BLANC. C. R. Acad. Sc., 1914.
NUTTALL. "Parasitology," 1917.