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A spirochete found in the blood of a wild rat.

By **W. J. MACNEAL.**

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Of thirty nine wild rats (*Mus decumanus*) caught here at Morgantown one has shown a minute actively motile spiral organism in the blood. It is present in very small numbers and careful search with high magnification is necessary to detect its presence. In freshly drawn blood it appears as an elastic spiral rapidly darting about, as often with one end forward as the other, forth and back, rotating on its long axis as it goes. The movement is frequently too rapid for the eye to follow. The spiral turns appear quite permanent. At times a lashing movement of the whole body is seen but the organism straightens out quickly to its former shape. When caught among blood cells it jostles them about in a lively fashion, while it is itself invisible. This seems to be due to these flexuous movements of the whole organism. Actual contact of the spiral appears to be necessary before the blood cells are moved, which suggests that flagella are absent or too slender to make a visible impression on an erythrocyte.[1] The organisms are difficult to measure in the living condition but the greatest length observed is about 5 μ. Much shorter forms are recognizable in the fresh preparation, though harder to see on account of the more active movement. The refractive index of the parasite is not very great.

The parasite stains readily by the various modifications of the Romanowsky stain, and very intensely by the rapid method which I have recommended for clinical staining of *Spirochæta pallida*.[2] It takes a uniform deep violet red color. The measurement of a number of individuals shows a marked variation in length, the shortest forms, consisting of one and three quarters turns or nodes, having a length of 1.75 μ; the longest, consisting of three and

[1] Since this communication was written a long slender whip-like process extending from each end of a spiral has been clearly demonstrated. These are interpreted as locomotive organs.

[2] MacNeal: *Journal Amer. Med. Assn.*, Feb. 16, 1907.

one half turns, being 3.55 μ long. Rather infrequently spirals 3.75 to 4.00 μ in length are seen, and these present central constrictions suggesting transverse division. From the striking variation in length also, this would appear to be the mode of multiplication. All intermediate lengths are seen. The width of the filament is approximately 0.25 μ, the gross width of the coil about 0.65 μ. The length of a turn or node (crest to crest) is 1.0 to 1.5 μ, fairly constant, but indicating some longitudinal extensibility of the coil. By raising the plane of focus above the stained parasite the upper segments of the turns are seen more clearly than the lower. They run forward from left to right. In lower focus the lower halves are the more clearly defined, and are seen to extend forward from right to left. The spiral therefore corresponds to the ordinary right hand screw, turning clockwise as it proceeds from a given point. This seemed to be true of all the individuals examined, though some were too much flattened against the glass to manifest an appreciable difference in focus.

The infection is readily transferred to other wild rats by intraperitoneal injection of a very small drop of infected blood in normal salt solution. In many cases not more than ten or twenty parasites could have been present in the injection, yet, so far, the wild rats have always developed the infection. Of seven wild rats inoculated, the parasites were first detected in the blood of one on the fifteenth day, in one on the eleventh, in one on the twelfth, in three on the tenth and in one on the seventh day. The last mentioned was a small rat and received a relatively large dose, one fourth cubic centimeter of defibrinated blood and one-half cubic centimeter of a thick suspension of the organs in salt solution, from a rat showing one spirochete in every four fields of blood film. The parasites never become very numerous and disappear in from one to nine days. This apparent recovery is then followed by repeated relapses. The parasites may become more numerous in the blood during the relapse than in the primary invasion. Neither a certain recovery nor a fatal result has, as yet, been observed.

White rats are susceptible, with an incubation period of four to eight days, according to the dose employed.

The house mouse (*Mus musculus*) is apparently more resistant.

So far only one has been successfuly inoculated. A relatively large dose was injected and the incubation period was twelve days. Three other mice were observed for six, ten and twelve days, respectively, after inoculation without showing a parasite.

Similar spirochetes have been described by Carter (in rat), Lingard (in bandicoot, *Mus giganteus*), by Nicolle and Comte (in bat), by Wenyon and by Breinl and Kinghorn (in house mouse); all these in the circulating blood. Borrel and Gaylord have described spiral organisms in mouse carcinomata, and one of the forms found by Borrel has been shown by Wenyon to be identical with his *Spirochæta muris* found in the blood of mice. Morphologically the parasite found here in the rat is apparently identical with this one of Borrel and Wenyon. Its behavior in animals is somewhat different. Therefore, I tentatively suggest for it the name *Spirochæta muris*, var. *Virginiana*, following the principle suggested by Calkins.[1] Its specific relation to that organism must be left for further work to determine.

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Experimental ligation of splenic and portal veins, with the aim of producing a form of splenic anemia.

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From the pathological study of four cases of splenic anemia showing partial or complete obstruction of splenic or portal veins due to old thrombophlebitis, the writer was led to believe that the splenic enlargement (fibrosis) and the clinical picture of splenic anemia might be produced experimentally in animals. During the last two years he has carried on a series of observations upon dogs whose splenic veins had been ligated at varying distances from that organ. Briefly, the results have been as follows:

In dogs examined from one week to three months after the operation the spleen was found greatly enlarged, firm and dark in color. This enlargement reached its extreme about four weeks after the ligation.

[1] Calkins: *Journal of Infectious Diseases*, April, 10, 1907.