

THE COMPARATIVE MORPHOLOGY OF THE SPIROCHETES OF SYPHILIS AND YAWS (FRAMBOESIA TROPICA).*

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There has always been considerable interest in the tropical disease known as yaws or *framboesia tropica*, not only for itself, but also on account of its resemblance to syphilis, and one group of English physicians, headed by Mr. Hutchinson,¹ has even gone so far as to say that if "yaws be not syphilis it is very clear that it offers a very exact parallel to it." The physicians of Mr. Hutchinson's school have tried to clear up the question of the origin of syphilis by suggesting that it is an evolutionary form of yaws.² All authorities unite in agreeing that the two diseases have many points of resemblance and that their relationship to one another is a most intimate one.

When the spirochete of yaws was first described by Castellani³ in June, 1905, his announcement aroused great interest among the students of syphilis as well as among the students of tropical diseases. It seemed probable that at least one of the riddles of medicine might now be answered.

In his first publication³ Castellani says distinctly that he does not commit himself in any way as regards the etiology of Parangi. In his second article on the subject⁴ he is still non-committal. In his third report,⁵ which was published only one week later, he tells us that Professor Schaudinn had kindly examined some of his preparations and had written him under date of Aug. 8, 1905, that the yaws smears contained three varieties of spirochetes, one of which was very delicate and resembled closely *Spirochæta pallida*, and at this time Castellani expresses himself very decidedly as to the identity of the two organisms. In his summary he says that one of these spirochetes is extremely delicate and, in his opinion, it is absolutely identical with *Spirochæta pallida* of

* Read at the fifth annual meeting of the American Society of Tropical Medicine, held in Baltimore, March 28, 1908.

1. Allbutt and Rolleston: *System of Medicine*, Lond., 1907, ii, Part ii, 701.
2. Osler: *Modern Medicine*, Phil., 1908, iii, 439.
3. Castellani, Aldo: *Jour. Ceylon Br. Brit. Med. Assn.*, 1905, ii, 54.
4. Castellani, A.: *Brit. Med. Jour.*, Nov. 11, 1905, ii, 1280.
5. Castellani, A.: *Brit. Med. Jour.*, Nov. 18, 1905, ii, 1330.

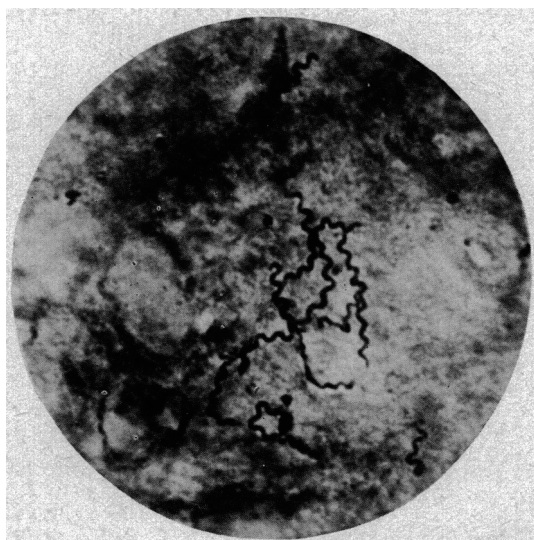


Fig. 1.—Spirochete of yaws, *Spirocheta pertenuis* (x1500).

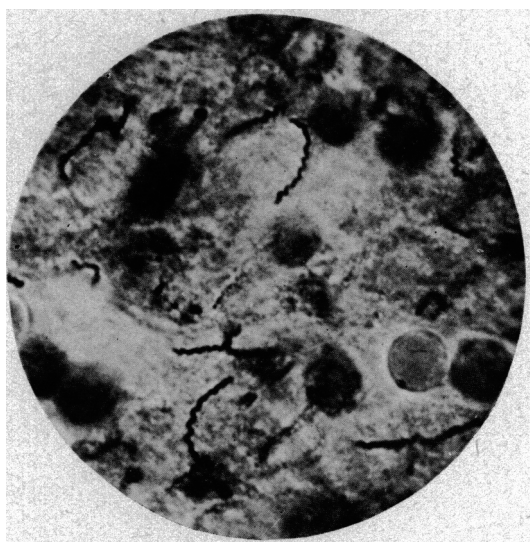


Fig. 2.—Spirochete of syphilis, *Spirocheta pallida* (x1500).

Schaudinn. But even after making such a positive statement as that he has apparently not convinced himself in the matter, as he adds in the same breath that "if my hypothesis should be proved to be wrong a proper name for the organism might be *Sp. pallidula*. Castellani's next article⁶ is entitled "Is Yaws Syphilis?" This is not a mere note on the question, but a rather complete discussion of the entire problem, and in this paper he comes to two conclusions which at first sight are not consistent with one another. He concludes that yaws is not syphilis, and also that spirochetes of yaws are, in his opinion, morphologically identical with *Spirochæta pallida* of Schaudinn; he maintains, however, that this does not prove the identity of the two diseases, since the bacillus of leprosy and of tuberculosis and many other acid-fast bacilli are morphologically identical, while the diseases are quite distinct.

Since 1906 three independent series of studies have been made on the subject of the unity or duality of syphilis and yaws, and the same general conclusions have been reached in all three studies (Castellani,⁷ Ashburn and Craig,⁸ L. Halberstaedter⁹), namely, that yaws is a separate and distinct disease from syphilis, and that an inoculation of monkeys with yaws does not confer any immunity against syphilis, nor does the inoculation of syphilis confer any immunity against yaws.

To return now to the question of the morphology of the spirochetes of these two diseases: Last summer I examined numerous smears made from yaw lesions, and I must confess that I could not satisfactorily differentiate one variety from the other, although I felt that there were certain minute differences which are too elusive, however, to be put down in so many words. Later in the year I was so fortunate as to obtain two nodules which had been excised from patients suffering with yaws; these I studied according to the silver nitrate method of Levaditi,¹⁰ and in both specimens were found innumerable spirochetes which at first sight appeared to be absolutely identical with *Spirochæta pallida*. A little study, however, showed that there were differences between the two and that these variations were not accidental, but regular and constant. These differences may be appreciated by comparing the two accompanying photomicrographs, which were taken under exactly the same conditions as to magnification, light, etc. The photomicro-

6. Castellani, A.: Jour. Trop. Med., 1906, ix, 4.

7. Castellani, A.: Jour. Hyg., 1907, vii, 558.

8. Ashburn and Craig: Philippine Jour. of Sci., Manila, 1907, ii, 441.

9. Arb. a. d. k.: Gsndhtsamte, Berlin, 1907, xxvi, 48.

10. Jour. Am. Med. Assn., 1907, xlvi, 605.

graphs represent average fields; they were not selected for this special purpose.

It is evident: (1) That *Spirochæta pertenuis* (Fig. 1) is slightly thicker than *Spirochæta pallida* (Fig. 2).

(2) That the distance from crest to crest of the waves is greater.

(3) That the dip from the crest to the hollow is greater as a rule.

(4) That the waves are not quite so regular in their height.

(5) That the number of forms showing longitudinal division is greater.

(6) That there is a greater tendency for the spirochete to curl up one end into a loop or more or less solid ball.

Prowazek,¹¹ in some comparative studies on spirochetes, has come to practically the same conclusions as these. He adds one point which is of considerable interest—a point which was forecasted by Castellani in one of his earliest papers—and that is, that these organisms have a resting form which is oval or round and which is produced by a coiling up of the spiral. One often sees individuals with one end looped or coiled into a more or less solid round or oval body which represents a transition stage between the fully extended and the coiled up resting stage.

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11. Arb. a. d. k.: Gsndhtsamte, Berlin, 1907, xxvi, 23.