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TREPONEMA PALLIDUM IN PERIPHERAL NERVE TISSUE OF SYPHILITIC CHANCRES

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Abstract. Biopsies for electron microscopy were obtained from syphilitic chancres of 7 patients, 6 males and one female. In 4 of the patients, *Treponemata pallida* were seen gathering around peripheral nerves and invading the spaces between Schwann cells and their basal lamina. No definite degenerative changes were seen in the axons. In all patients, *Treponemata pallida* were gathering around the small blood vessels. The fine structure of *Treponema pallidum* in the lesions included a twined cytoplasmic cylinder with an inner and an outer lamina, an axial fibril consisting of three to five parallel filaments, each consisting of six microtubules, and a covering, outpouching periplastic membrane.

Key words: T. pallidum: Electron microscopy; Nerve tissue changes; Primary syphilis

In the human syphilitic chancre, *T. pallidum* has been found to gather around small blood vessels and penetrating their vascular wall. Some of the treponemes are phagocytosed by invading macrophages, plasma cells, perivascular cells, and endothelial cells (1, 5, 8). In the present study, *T. pallidum* was found in peripheral nerves of human syphilitic chancres. The fine structure of *T. pallidum* in tissue was compared with that of cultivated treponemes.

MATERIAL AND METHODS

The study comprises 7 patients, 6 males and one female, aged 23 to 41 years. They were referred because of genital ulcers of 1–6 weeks' duration, located to the glans penis, the prepuce and, in the female, the perianal area. By darkfield microscopy, typical treponemes were found in all but the female. Standard Syphilis Tests were positive in all but one. Two of the ulcers were mildly painful.

A 3-mm punch biopsy was taken from the edge of the ulcers, using 1% lidocaine as an anaesthetic. The specimens were immediately fixed in ice-cooled 6% glutaraldehyde in 0.5 M cacodylate buffer, pH 7.2, with 7.5% sucrose. The samples were osmicated, dehydrated in a series of alcohol solutions, and embedded in Epon 812. Ultrathin sections were stained by uranyl acetate and lead citrate and observed in a JEOL 100 CW electron microscope.

RESULTS

T. pallidum was demonstrated in all biopsies. In 4 of the 7 patients, peripheral nerves were observed in the sections. In these cases *T. pallidum* was present in epi-, peri- and endoneurium (Fig. 1). Most of them were located in the space between the Schwann cells and their basal lamina of both myelinated and unmyelinated axons (Figs. 2, 3 and 4). Neither in the cytoplasm of Schwann cells nor within the axons treponemes were found. The perineural cells contained fat droplets. Neurotubules were distinct in the axons. Some treponemes were engulfed by the perineural cells, but showed no evidence of destruction or cell degeneration (Figs. 1, 2, 3 and 4). Numerous treponemes were seen in the perivascular areas and in the vascular walls in all seven biopsies. Some *T. pallida* were being phagocytosed by macrophages and plasma cells, as reported earlier by Metz & Metz (5), Azar et al. (1), and Sykes et al. (8).

Fine structure of T. pallidum

T. pallidum was seen as a cylindrical, spiral organism, measuring 5–20 μm in length. In some sections it appeared elongated and wavy (9). The cell body of *T. pallidum* in the tissue was found to be covered with a double-layered cell membrane, and it contained dense granules (Fig. 4). The cell body was twined around an axial fibril consisting of three to five filaments with a diameter of about 16 nm (Figs. 3 and 4 A). Each individual filament consisted of six microtubules arranged in a circle around a bright center (Fig. 5). The surface of the cell body and the axial fibrils was partly covered with a pouch-forming, multilayered coat, the periplastic membrane (2, 6). The ends of the treponemes were not covered. Several treponemes in the tissue and in phagocytic cells were lacking the periplastic membrane. Dense bodies or basal granules (4, 6), serving to attach the axial filaments, were not found in the ultrathin sections.

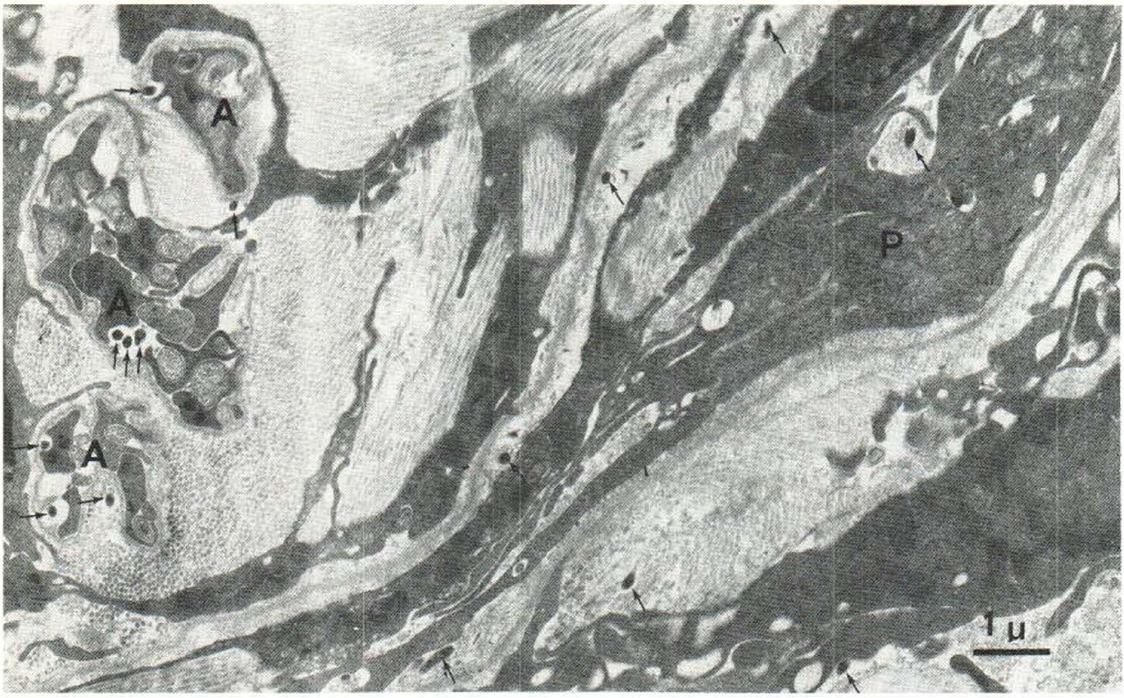

Fig. 1. Peripheral nerve with invading treponemes (*arrows*). Axons (*A*). Perineural cells (*P*). The axons are shown at a higher magnification in Fig. 2. ×10 000.

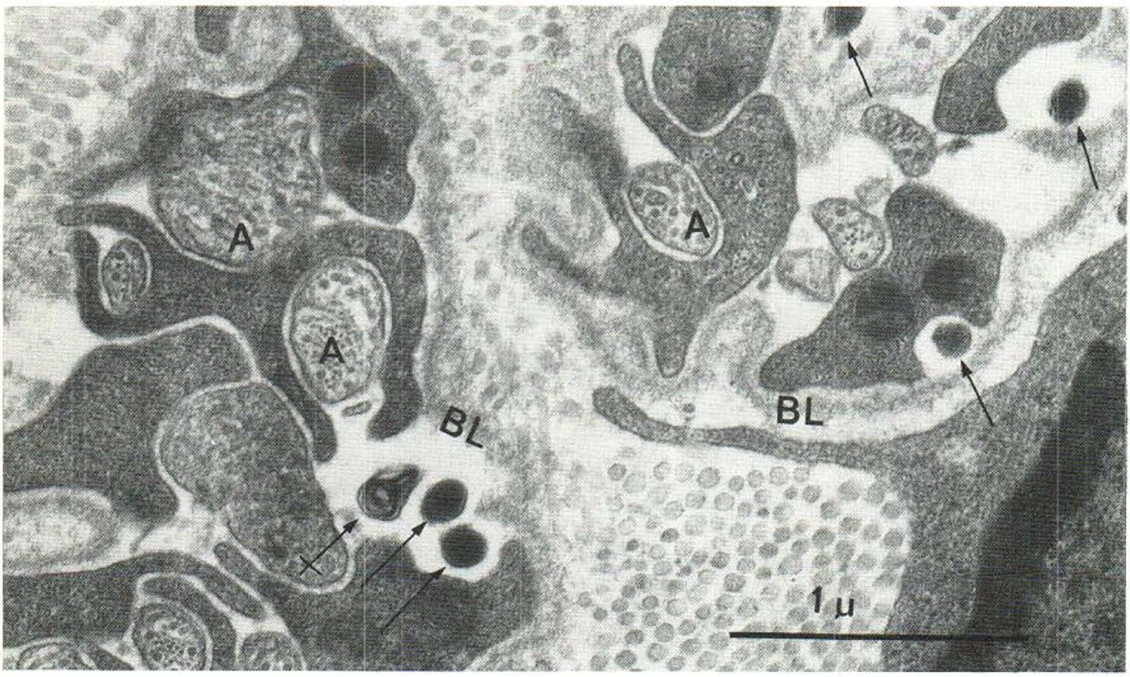

Fig. 2. Unmyelinated axons (*A*) with treponemes (*arrows*) in spaces between axon and basal lamina of Schwann cells (*BL*). Neurotubules of axons are seen distinctly. Arrow with a cross points to a periplastic membrane. ×40 000.

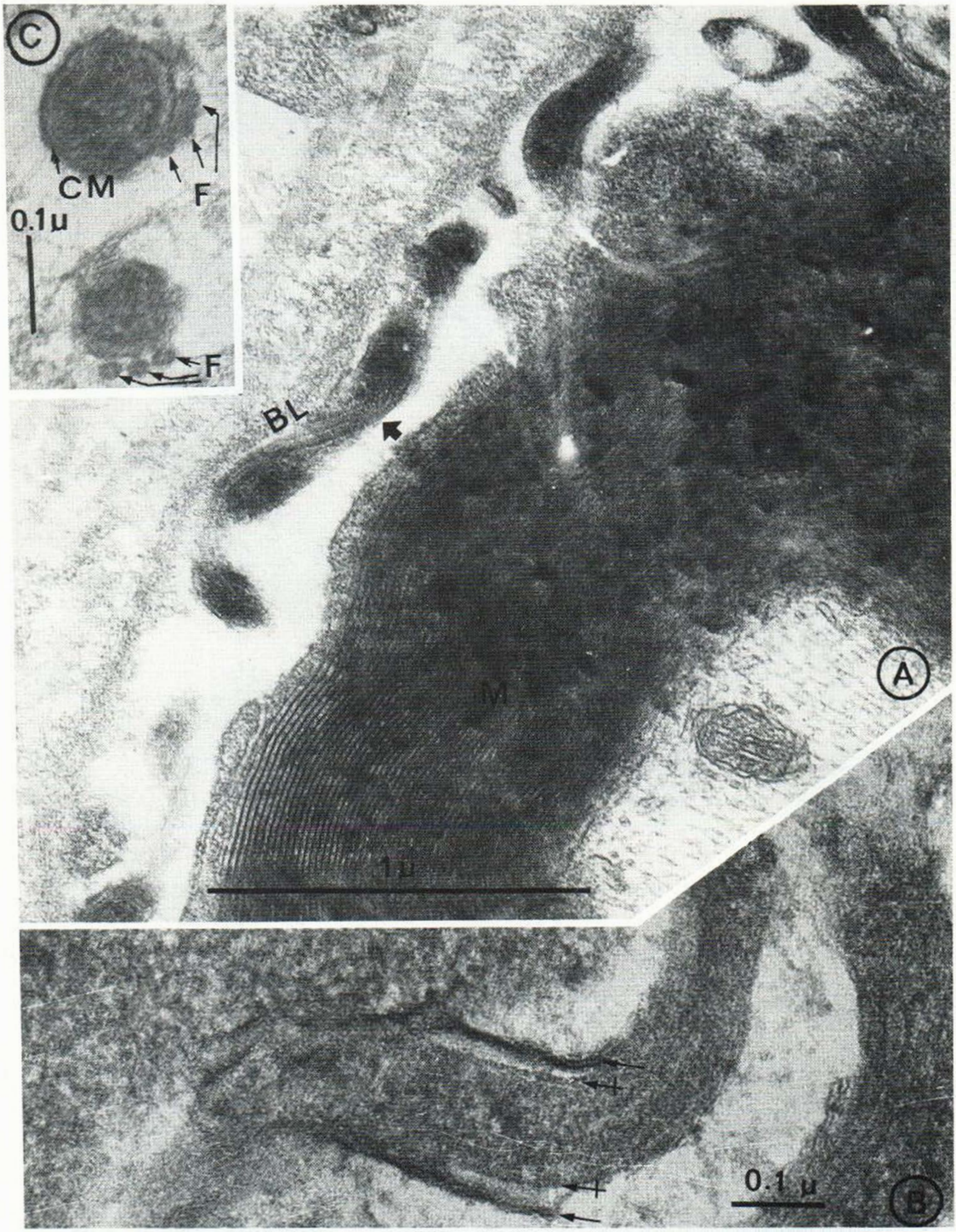

Fig. 3. (*A*) Treponemes in a myelinated nerve. One treponeme is cut longitudinally, presenting axial filaments in spiral (*thick arrow*). Myelin (*M*). Basal lamina (*BL*). ×60 000. (B) A treponeme shows a double-layered periplastic membrane (arrow) covering the thick cytoplasmic membrane (arrow with a cross). ×150 000. (C). Cross-section of two treponemes shows axial filaments (*F*) and cytoplasmic membrane (*CM*). No periplastic membrane is seen. ×150 000.

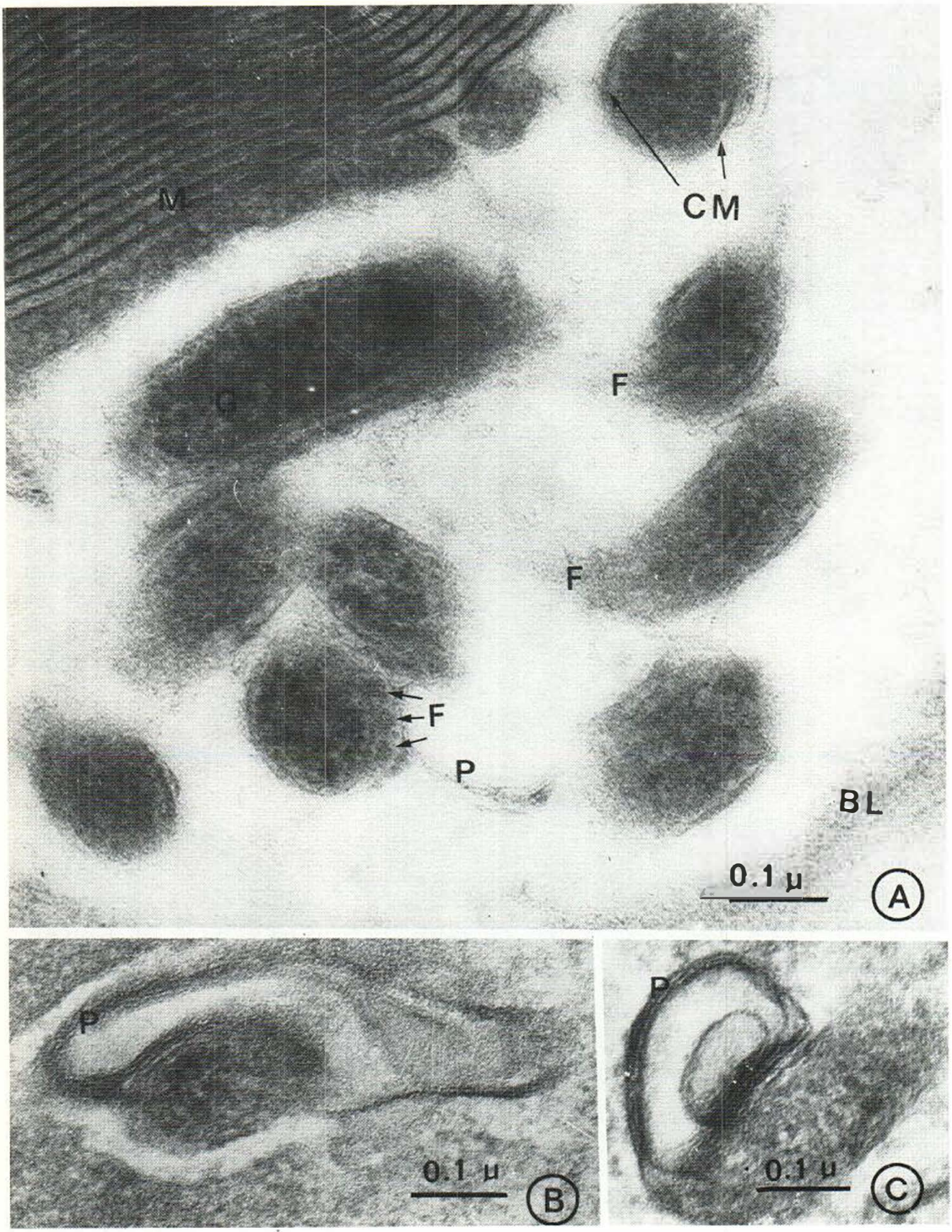

Fig. 4. (A) Treponemes in a myelinated nerve. Myelin (*M*). Basal lamina (*BL*). The treponemes cut transversely show a thick cytoplasmic membrane (*arrow CM*), dense intracytoplasmic granules and axial filaments (*F*). Periplastic membrane (*P*). ×150 000. (B, C). Treponemes show pouch of multi-layered periplastic membrane (*P*) covering a part of the cytoplasmic cylinder. ×150 000.

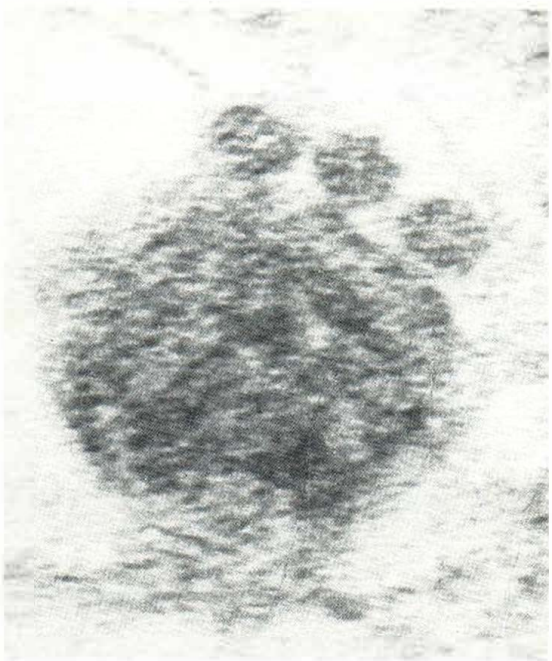

Fig. 5. Cross-section of treponeme shows axial fibril with three filaments, each consisting of six microtubules. ×550 000.

COMMENT

In this study the finding of treponemes gathering inside the basal lamina of Schwann cells of syphilitic chancres was invariable in all 4 patients in whom we succeeded in finding nerve tissue. This strongly indicates the neurotropic character of *T. pallidum*. Degenerated axons of syphilitic chancres were demonstrated by Wrzolkowa & Kozakiewics (9), also suggesting involvement of nerves, but no treponemes were found. In experimental symphiloma of rabbits, Ovćinnikov & Delektorskij (7) found a few *T. pallidum* between the collagen fibrils of the endonerium, but there was no evidence of selective gathering of treponemes inside the basal lamina of Schwann cells. When comparing the fine structure of *T. pallidum* in the chancres with that of cultivated treponemes (3, 4, 6), no fundamental differences were found. The number of axial filaments varied from three to five, and we found each filament to consist of six microtubules, a finding not described before. Some treponemes lacked the periplastic membrane. We found no basal granules, but we believe this to be due to an incidental lack of cut sections from the ends of the treponemes.

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