Spore-like Structures in the Tubercle Bacillus

Electron microscopy of ultra-thin sections of avian tubercle bacilli growing on various solid media has revealed details of their internal anatomy. In the initial phase of growth, the structure was similar to that described in the ordinary bacteria[1-3]. Each rod contained a central dense core in the form of a thread or group of granules within an electron-transparent area (Fig. 1). This structure is believed to represent the nuclear apparatus. There appeared to be some correlation between the phase of growth of the bacillus and the configuration of the dense core. When division by transverse fission took place, each daughter cell contained its own nuclear apparatus. The cytoplasm of the avian tubercle bacilli showed certain differences from the bacteria, and contained large, fairly dense granules (300 A.); but the general pattern of reproduction appeared to be the same.

In later stages of development, under certain conditions, the avian bacilli had a very different internal structure. When grown as slide cultures on thin chicken plasma–embryo extract clots, they did not all divide directly by transverse fission; some of them elongated into filaments, and round bodies were observed forming in the cytoplasm. At first these bodies were difficult to distinguish from the remainder of the cytoplasm; but later they were clearly seen. The nuclear apparatus was still present during the early stages of the formation of the round bodies and was quite distinct from them. The number of round bodies increased until they filled the whole filament except for a peripheral region which contained cytoplasmic granules and dense, metaphosphate bodies (Fig. 2). The round bodies were of uniform internal density and each was enclosed in a dense outer membrane. During the final stages of development some of the filaments contained large vacuoles which appeared to be associated with the formation of the round bodies. Cross-walls were present dividing the filaments into sections each of which contained two or more dense bodies.

In previous studies of unsectioned avian tubercle, rows of vacuoles[4] or intracellular units[5] of varying density and with sharply defined membranes were observed. The interpretation of these units presented some difficulties. They varied in density and were certainly not sap vacuoles as suggested by Knaysi, Hillier and Fabricant[6]; nor could they be identified with the protoplasts[7] of other bacteria, as they were embedded in the cytoplasm. The most likely assumption seemed to be that they were spores, and this was suggested[5]. Our observations on thin sections support this interpretation. From a recent paper by Chapman[8] on spore formation in *Bacillus cereus* and *Bacillus megaterium*, it is seen that the spores in these organisms are strikingly similar to the round bodies in the avian tubercle bacilli.

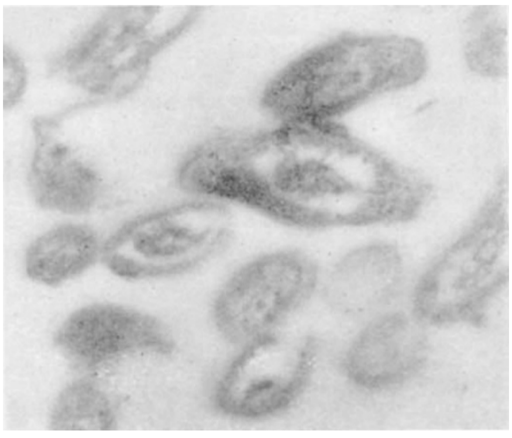

Fig. 1. Elongating rods with central vacuole containing dense structures (nuclear apparatus). Cytoplasmic granules. × 35,000

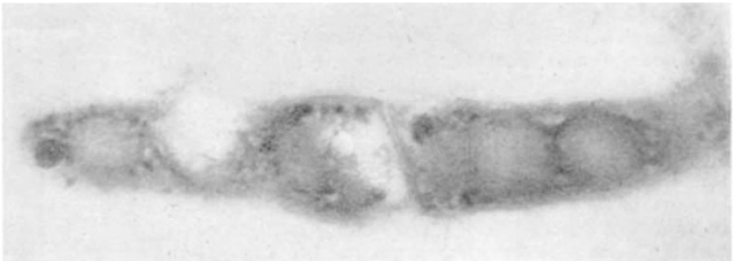

Fig. 2. Dividing filament containing row of spore-like bodies. Note cytoplasmic granules surrounding spores. × 40,000

From this evidence it is suggested that under certain conditions the avian tubercle bacillus produces spores. In future experiments the spore-like bodies will be isolated and their subsequent behaviour studied to test the accuracy of this hypothesis.

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Effect of Electrolytes on the Rate of 'Supercontraction' of Wool Fibres

Wool fibres have been shown to shorten (supercontract) when held in steam and rapidly stretched and relaxed, or when treated with hot solutions of reagents breaking disulphide bonds, with cold solutions of metal ammonium hydroxides, or with hot solutions of formamide, certain phenols, or lithium bromide (see Alexander and Hudson[1]).

The effects of phenols, formamide, metal co-ordination complexes, and lithium bromide have been