

oval bodies averaging in length $\frac{1}{12,000}$ inch, and in breadth $\frac{1}{20,700}$ of an inch. On agar the spores are arranged in long rows, side by side, and are greater in diameter than the cells from which they are derived. The earliest appearance of spore formation takes place in 41 hours, at 36° C (Cheyne), but in some cases it is even sooner. The spores are formed in the centre of the rod, and the formation occurs as follows: The rod begins to swell and become spindle-shaped. Occasionally the swelling is more marked at one end than in the centre. The spindle-shape increases in size, and the centre of the swelling gradually ceases to take the stain. The capsule of the spore is apparently formed within the rod and is not merely the outer part of the rod. In three or four hours the rod is seen to have almost or completely disappeared, although parts of the faint outline of the ordinary bacillus may be noticed.

Germination of Spores—Under favourable conditions the beginning of the germination of the spores takes place in about three hours. The spore loses its oval shape, becomes elongated, and is soon seen to burst through the spore capsule. It then presents the appearance of a short rod, with a pale envelope embracing one end. The rod gradually leaves the spore capsule, and then goes on multiplying as a full grown bacillus. According to Eisenberg (39), the spores are decolorized by the tubercle bacilli stain, but preparations may be obtained by using the Ziehl-Neelsen stain and alcohol for decolorization. The spores also stain by the method of Neisser.

Polymorphism.—Variations in size and shape may be brought about by growth in acid media, or in media containing different sugars. These variations occur also in the same culture, subjected to exactly similar conditions of growth.

Involution Forms.—Abnormal forms are especially abundant when the bacillus is grown on blood serum; peculiar Y-like forms and clubbed shapes are of common occurrence, and relatively few spores are found.

BIOLOGICAL CHARACTERS.

Bouillon—"In meat infusion at the temperature of the body, they grow rapidly, causing muddiness and, after a few days, a slight but not tenacious scum" (23). In bouillon, with a reaction of +.08 (57), at 37° C., there is a slight turbidity in 14 hours, especially noticeable when the tube is shaken. In 24 hours, the liquid is uniformly turbid, with a very fine sediment. In 48 hours, the turbidity increases and a pellicle commences to form. Reaction of the culture at this time, +.07. After 96 hours the broth is clear, with a pellicle, white, rather massive, and somewhat tenacious. There is also much sediment. Reaction, after 10 days' growth,—neutral.

Glycerine Bouillon—Media with original reaction of +.08. At 37° C., the bouillon becomes slightly turbid in 12 hours, and quite turbid in 24, with a fine, whitish pellicle on surface, which does not extend to the sides of the tube. If the culture is shaken, the pellicle deposits in flaky masses. The reaction is +1.2. In 36 hours, the turbidity clears, leaving the media bright, with a smooth, thin, tenacious, and white pellicle on the surface. In many cases the pellicle becomes very wrinkled and greasy-looking. At the end of 8 days, the reaction is +2.2, and the bouillon is several shades darker in colour, but quite clear. The reaction after 14 days' growth is +4.2. At 22° C. the same changes occur but growth is slower. The bacilli are relatively less numerous than in bouillon and are slightly shorter and thicker.

Glucose Bouillon.—With a reaction of +2.0, at 37° C., the broth is more turbid than plain bouillon after 14 hours' growth; and in 24 hours, the

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