longitudinal sections of the gametophyte. So far as I have investigated the matter, there seems to be evidence of the existence of an apical cell.

E. C. JEFFREY.

UNIVERSITY OF TORONTO,
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BACTERIA WITH ASSIMILATORY PIGMENTS, FOUND IN THE TROPICS.—The following Bacteria, having a greenish colouration and showing when exposed to light a faint evolution of oxygen, perceptible by means of motile Spirilla or Micrococci and very exceptionally causing *Bacterium termo* to faintly re-act, were found in water-cultures of more or less purity developed in diffuse daylight at Buitenzorg: viz. a motile green Bacterium=*B. chlorinum* (Engelmann)[1]; a non-motile Micrococcus-form to which the provisional name of *Streptococcus varians*[2] has previously been given; two forms closely resembling Van Tieghem's *Bacillus virens* and *Bacterium viride*[2]; two green Spirilla, one resembling *S. tenue* and the other *S. undula*; and finally a large Bacillus-form somewhat resembling the *Bacillus virens* of Van Tieghem. This last form occurs as short rods, 2·5 to 3 μ broad and commonly 12 to 15 μ, more rarely 5 to 20 μ long. A formation of colourless refractile endosporous spores is often shown. The spores are oval and 1·5 to 2 μ broad by 2 to 3·5 μ long. In all cases the pigment is diffused throughout the plasma of the bacteroid-cell, and this is especially clearly shown in the large *Bacillus virens* and *Spirillum undula* forms.

Of the two more common red water-Bacteria, *Monas okenii* was not found in either Java or Ceylon, but *Bacterium photometricum* was. In Java *B. photometricum* appears to be abundant and widely distributed. In water-cultures exposed to diffuse daylight, the Bacteria collect in the form of a red crust upon the walls of the cylinder. By removing this crust a large mass of the red *Bacteria* may be obtained; which if the growth is of recent formation may be nearly pure, and, what is of more importance, almost entirely free from other coloured Bacteria or Confervae. If to the brownish red mass thus obtained alcohol is added, the resulting fluid is reddish in colour, turning to a dark dirty green on warming. If ether is now added

[1] Engelmann, Zur Biologie der Schizomyceten, Bot. Zeit. 1882.

[2] The Evolution of Oxygen by coloured Bacteria: Journal of the Linnean Society, 1897.

[3] Van Tieghem, Bull. Soc. France, XXVII, 1880, p. 174.

and the mixture then diluted with water and shaken, the ether separates and rises to the surface as a dark bluish green fluid, showing a red fluorescence, whilst the fluid beneath is colourless and contains a white flocculent residue. As the ether evaporates, a pinkish red dye which it also holds in solution, but which is masked by the green dye, is deposited in rings at the edges and on the sides of the tube or evaporating basin. If, instead of using ether, the separation of the green dye from the warmed alcoholic extract is effected by benzene, the fluid beneath remains a pinkish red, whilst the supernatant benzene is dark bluish green in colour, and shows a red fluorescence in reflected light. The alkali and acid methods[1] of extraction for alkachlorophyll and chlorophyllan yielded brownish fluids only. Both the benzene and the ether extracts, when exposed to light and in the presence of oxygen, rapidly become brown and fade. It is true that the material from which these extractions were made was not absolutely pure, microscopical examination before extraction showing the presence of occasional green organisms; and even though these formed but a fraction of a percentage of the total mass, still for absolute certainty the extraction needs to be repeated with perfectly pure cultures, which, owing to the peculiar conditions under which *B. photometricum* develops, and the consequent extreme difficulty of isolating it, are by no means easy to obtain in sufficient quantity. Still as far as they go the facts above mentioned seem to indicate that a green dye apparently identical with chlorophyll may be extracted from *B. photometricum*, as well as a pinkish red one which is insoluble in benzene but soluble in ether, and in alcohol even when diluted largely with water. Engelmann[2] has shown that the point of maximal assimilation in *B. photometricum* corresponds with the point of maximal absorption, which curiously enough lies, as determined by his bolometer experiments, in the dark ultra-red rays. It appears, therefore, that *B. photometricum* resembles the Florideae in so far as the bacterio-purpurin which it contains is a compound assimilatory chromophyll, which when treated with hot alcohol splits up into two differently coloured substances, namely, chlorophyll and a pinkish red pigment which in colour and solubility shows a distinct resemblance to the pinkish red pigment which may be extracted from red Algae.

A. J. EWART.

[1] See Marchlewski, Chlorophyll and its Derivatives.

[2] Engelmann, Bot. Zeitg., Oct. 1888.