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ULTRAMICROSCOPIC ORGANISMS.

By J. J. MACKENZIE, B.A., M.B.,
Professor of Pathology, University of Toronto.

WITH the discovery of bacteria and the demonstration of their form and dimensions by the older bacteriologists, the question very early arose as to whether, with the recognition of these minute forms of life we had reached the limits of size of organized beings or whether there were not smaller organisms yet which we had not seen or could not see because of their minuteness. This question became the more pressing, the more we sought in vain for the organisms which caused such diseases as scarlet fever, measles, small pox, rabies and many other forms of infection; and the idea was frequently expressed that there must be forms of life smaller than the smallest known bacteria, so small in fact, that they probably were beyond the range of microscopic vision, and that on this account we have failed to find the parasites of these diseases. In regard to bacteria a striking fact may be noted in the remarkable uniformity of size of the various members of the group. They vary, it is true, enormously in the length of their cells or cell complexes, but in regard to the thickness of the cell or the diameter of globular forms, individual members of the group vary very slightly from an average of 1·0 micron to 1·5 microns. If we take one of the largest as an example, called on account of its size *bacillus megatherium*, we find that its width does not exceed 2·5 microns, whilst the smallest of the disease producing forms the bacillus which causes epidemic influenza, has a length of 1·2 microns and a width of 0·4 micron. Recently Erwin von Esmarch has described a putrifactive spirillum from water which is 1-3 microns long and 0·1-0·3 micron wide, the smallest of the bacteria which has ever been cultivated.

The possibility of demonstrating the existence of organisms which are too small to see with the strongest microscope would seem to be a difficult problem, and so it is, and we consequently cannot proceed to the demonstration by ordinary methods of bacteriological research. It has been necessary to adopt certain, what might be called extraordinary methods to give evidence of their existence.