which in the absence of sunlight are able to evolve oxygen by the aid of the phosphoresence of other abyssal animals. Since the PHÆODARIA are, for the most part, dwellers in the deep-sea, and since the voluminous phæodium must be of great physiological importance, a positive solution of this hypothetical question would be of no small interest (compare § 89).

206. *Respiration.*—The respiration of the Radiolaria is animal in nature, since all Protista of this class, like all other true Rhizopoda, take in oxygen and give off carbon dioxide. Probably this process goes on continuously and is tolerably active, as may be inferred from the fact that Radiolaria cannot be kept for long in small vessels of sea-water unless either they contain numerous Xanthellæ or the water is well aërated. The oxygen is obtained from two sources, either from the surrounding water or from the enclosed Xanthellæ, which in sunlight evolve considerable quantities of this gas. Correspondingly, the carbon dioxide which is formed during the process of oxidation of the Radiolaria is either given up to the surrounding water or to the inquiline Xanthellæ, which utilise it for their own sustenance (§§ 204, 205).

The significance of the symbiotic Xanthellæ for the respiration of the enclosing Radiolaria may be shown experimentally in the following way. If two Polycyttarian colonies of equal size, both of which contain numerous Xanthellæ, be placed in equal quantities of filtered sea-water in sealed glass tubes, and if one tube be placed in the dark the other in the light, the colony in the former rapidly perishes, but not that in the latter; the Xanthellæ excrete only under the influence of sunlight the oxygen necessary for the life of the Radiolarian (compare Patrick Geddes, L. N. 42, p. 304).

207. *Circulation.*—In the protoplasm of all Radiolaria, both inside and outside the central capsule, slow currents may be recognised which fall under the general term circulation, and have already been compared to the cyclosis in the interior of animal and vegetable cells, as well as to the sarcode streams in the body of other Rhizopoda. These plasmatic currents or "plasmorrheumata" probably continue throughout the whole life of the Radiolaria, and are of fundamental importance for the performance of their vital functions. They depend upon slow displacements of the molecules of the plasma (plastidules or micellæ) and cause a uniform distribution of the absorbed nutriment and a certain equalisation of the metastasis. Furthermore they are of great importance also in the inception of nutriment, the formation of the skeleton, locomotion, &c. Sometimes the circulation is directly perceptible in the plasma itself; but usually it is only visible owing to the presence of granules (sarcogranula), which are suspended in the plasma in larger or smaller numbers. The movements of these granules are usually regarded as passive, due to the active displacement of the molecules of the plasma. Although the intracapsular protoplasm is in communication with the extracapsular through the openings in the capsule membrane, nevertheless the currents exhibit certain differences