

nourishment of the Radiolaria, yet they are by no means indispensable to them. On the other hand, the physiological individuality offers more complicated relations in the social Radiolaria (Polycyttaria) which live united in colonies or cœnobia. Here the actual *Bion* (or the fully developed physiological individual) is not represented by the individual cells, but by the whole multicellular cœnobium, which in each species has a definite form and size. In these cœnobia, which are usually spherical or cylindrical jelly-like masses, several millimeters in diameter, numerous cells are so intimately united that only their medullary portions (the central capsule with the endoplasm) remain independent; the cortical portions (calymma and exoplasm) on the contrary uniting into a common extracapsulum. This discharges, as a whole, the functions of locomotion, sensation, and inception of nutriment, while the separate central capsules act in the main only as reproductive organs (forming spores) and partly also as the central organs of metastasis (digestion). Each cœnobium may also be regarded as a polycyttarium, *i.e.*, a "multicellular Radiolarian," whose numerous central capsules represent so many sporangia or spore-capsules.

On this head compare the section in my monograph of 1862 (L. N. 16), entitled *Die Organisation der Radiolarien-Colonien; Polyzoen oder Polycyttarien?* (pp. 116 to 126); and also R. Hertwig, *Zur Histologie der Radiolarien*, 1876 (L. N. 26, p. 23).

14. *Monocyttaria* and *Polycyttaria*.—In the majority of the Radiolaria each unicellular organism passes its individual life in an isolated condition (as a Monocyttarium). Only in a part of the SPUMELLARIA numerous unicellular individuals are united into societies which are regarded as cœnobia or colonies (Polycyttaria). This is the case in three different families belonging to the PERIPYLEA, in the Collozoida (without a skeleton, Pl. 3), the Sphærozoida (with a Beloid skeleton, Pl. 4), and the Collosp hærida (with a Sphæroid skeleton, Pls. 5–8). All three families of Polycyttaria (or social Radiolaria), agree in their mode of forming colonies, since the central capsules of the social individuals remain separate and lie in a common jelly-like mass, which is formed by the fusion of their extracapsulum. The chief part of the voluminous colonies, which attain a diameter of several millimetres (sometimes more than 1 cm.), and are generally spherical, ellipsoidal or cylindrical, consists therefore of the jelly-like calymma, and this is penetrated by a sarcoplegma, to whose meshes all the individual organisms contribute by means of the pseudopodia, which radiate from their sarcomatrix. A further peculiarity in which the social SPUMELLARIA differ from the solitary consists in the fact that the former are precocious and the latter serotinous in the division of the nucleus (§ 64). Whilst in the solitary or monozootic SPUMELLARIA the middle of the central capsule is occupied by the simple nucleus, and this divides only at a late period (immediately before the formation of spores) into the numerous spore nuclei, in the colonial or polyzootic SPUMELLARIA this division takes place very early, and the middle of each central capsule is usually occupied by an oil-globule.