

their colonies or cœnobia is to a great extent determined by the development, number, size and arrangement of the alveoles in their calymma (compare Pls. 3-8). In these cases there is not unfrequently developed a large central alveole (see note C) whose thickened wall encloses a globe of jelly and serves as the central support of the whole colony (Pl. 5, fig. 1). Still more striking, however, is the arrangement in certain Polycyttaria, where each individual of the colony (or each central capsule with its calymma) is enclosed in a large alveole, whose firm wall often attains considerable thickness (Pl. 4, figs. 2, 3). The whole colony then appears as an aggregate of numerous cells, each of which possesses two envelopes, the inner central capsule and the outer alveolar membrane; between these lies in the Collosphærida the siliceous lattice-shell (Pl. 6, fig. 2). These pericapsular alveoles may be regarded as an outer cell-wall more correctly than the membrane of the central capsule itself, but the arrangement may also be compared to the temporary encystation of other Protista (see note D).

A. The extracapsular vacuoles in the calymma were first observed in 1851 by Huxley, in *Thalassicolla* and *Sphærozoum*, and compared with Dujardin's sarcode vacuoles (L. N. 5). Afterwards J. Müller noticed that generally these "large clear vesicles are covered by a fine membrane," and hence he called them "alveoles" (L. N. 12, pp. 3, 7, &c.). In my Monograph I have described them more in detail as "extracapsular alveoles" (1862, p. 88, Tafs. i.-iii. xxxii.-xxxv.). Ever since then the point has been debated whether these clear spaces are simple vacuoles in the sense of Huxley or vesicular alveoles as stated by J. Müller. This contention is unnecessary, for both varieties are present, and often no sharp line can be drawn between them. R. Hertwig has recently come to the conclusion that they are as a rule "membraneless vacuoles," but that they "sometimes become surrounded by a special envelope" (L. N. 33, p. 31). He even succeeded "in extracting from a *Collosphæra* the large vesicle which lies in the centre of many colonies and removing its covering of central capsules and jelly."

B. The *mechanical importance* of the alveolar structure, which certainly increases the elasticity and mechanical resistance of the voluminous calymma, has not yet been sufficiently realised; in the case of those Radiolaria which have no skeleton, or at all events no lattice-shell, it may take the place of this as a protective envelope. Furthermore, by taking in and giving out water it may discharge a hydrostatic function, causing the organism to rise or sink in the water.

C. The *large central alveole* found in the colonies of many Polycyttaria (especially Collosphærida) and first described in my Monograph (Taf. xxxiv. fig. 1), has since then been observed by Hertwig, Bütschli, and other investigators, and recognised as the "central support of the whole colony, surrounded by a delicate membrane" (compare L. N. 33, p. 31, and L. N. 41, p. 436). In a colony of *Trypanosphæra transformata* (Pl. 5, fig. 1), which I observed living while in Ceylon in 1881, the membrane of the large central alveole was surrounded by a firm network of sarcoplegma, and could be mechanically isolated from the central jelly-sphere which it enclosed.

D. The *pericapsular alveoles*, figured in Pl. 4, figs. 2, 3, from a *Sphærozoum*, and in Pl. 6, fig. 2, from a *Siphonosphæra*, were very well preserved in some preparations in the Challenger collection; perhaps their development coincides with the formation of spores, and may be regarded as an encystation.