

of the small roundish or ovoid cells protrudes one or more vibratile flagella. The fully developed spores, which commence their vibrations even within the central capsule, emerge when it ruptures, and swim about freely in the surrounding water by means of the flagellum. At this stage of its existence the young Radiolarian represents essentially the simplest form of the Flagellata, such as *Astasia* or *Euglena*; the unicellular body is for the most part ovoid or subcylindrical, sometimes fusiform or reniform, usually from 0.004 to 0.008 mm. in diameter (Pl. 1, fig. 1c; Pl. 129, fig. 11). In the anterior part of the flagellate cell, immediately behind the base of the flagellum, lies a homogeneous, spherical nucleus, whilst in the posterior part are usually several small fat-granules and often also a small oblong crystal (hence the name "crystal-spore," "Krystall-Schwärmer"). The number of vibrating flagella, which are extremely long and fine, seems to be variable, usually one, sometimes two, occasionally perhaps three, or even four or more (see note B).

A. The formation of the motile spores in the central capsule was first observed by J. Müller in *Acanthometra* (1856, L. N. 10, p. 502), then by A. Schneider in *Thalassicolla* (1858, L. N. 13, p. 41), and finally by myself in *Sphærozoum* (1859, L. N. 16, p. 141). These older observations were, however, incomplete, for the origin of the motile corpuscles from the contents of the central capsule was not observed. The first complete and detailed observations upon the formation of spores in the Radiolaria were published in 1871 by Cienkowski (L. N. 22, p. 372, Taf. xxix.); they relate to two different Polycyttaria, *Collosphæra* and *Collozoum*. These investigations were supplemented by R. Hertwig on *Collozoum* and *Thalassicolla* (1876, L. N. 26, pp. 28, 43, &c.); on *Collozoum* he made the important discovery that the Polycyttaria form two kinds of spores, one with and the other without crystals, and that the latter are divided into macrospores and microspores (compare the chapter on "Reproduction," §§ 212-216). Quite recently Karl Brandt has confirmed these observations, and has extended them to all the genera of Polycyttaria (1881, L. N. 38, p. 393, and 1885, *loc. cit.*).

B. The number of flagella, projecting from each spore, is very difficult to determine, owing to their extraordinary length and slenderness. It appeared to me that in the majority of those Radiolaria whose spores I investigated only a single flagellum could be demonstrated with certainty, although sometimes two, springing from a common base, seemed to be present. Compare the chapter on "Reproduction," (§ 215) and the recent work of Karl Brandt on Sphærozoea (1885, L. N. 52, pp. 145-174).

143. *The Actinophrys-Stage.*—The fate of the flagellate zoospores which emerge from the mature central capsule of the Radiolaria has not hitherto been decided by actual observation; all attempts to rear the swarming zoospores have been in vain, for they have soon died. From what we know, however, of the comparative morphology of the Protista, the hypothesis is fully justified, that between the *Astasia*-stage of the flagellate swarm-spores, and the well-known *Actissa*-stage of the simplest Radiolaria, there lies an intermediate developmental stage, which may be regarded as being essentially the simplest Heliozoan form, *Actinophrys* or *Heterophrys*. The swarm-spore is very probably converted directly in to a simple floating *Heliozoon* by its elongated or ovoid body