

further demonstration of this was furnished by Bütschli in the general account of the organisation of the Radiolaria which he published in 1882 in Bronn's *Klassen und Ordnungen des Thierreichs* (L. N. 41).

In our knowledge of the developmental history of these Protista the last two decades have witnessed less progress than in their comparative anatomy. The most important advance in this direction has been the proof that in all the main groups of the class the contents of the central capsule are used in the formation of swarm-spores. The movements of these zoospores in the central capsule had indeed been observed by several previous authors in the case of the SPUMELLARIA and ACANTHARIA (L. N. 10, 13, 16; compare also § 142, Note A). The origin of the flagellate spores from the contents of the central capsule and their peculiar constitution were, however, first described fully by Cienkowski in 1871 (L. N. 22, p. 372). Soon after this, R. Hertwig discovered that in the social Radiolaria (Polycyttaria or Sphærozoea) two different forms of zoospores are formed, one with, the other without crystals, and that the latter are also divided into macrospores and microspores (compare L. N. 26, and § 142). Recently this sexual differentiation has been shown by Karl Brandt to exist in all the groups of Sphærozoea, and its regular interchange with the formation of crystal-spores has been interpreted as a true "alternation of generations" (compare L. N. 52 and also § 216). The other forms of development also, especially reproduction by cell-division (§ 213) and gemmation (§ 214), have been elucidated by the recent investigations of the same author.

The palæontology of the Radiolaria has of late made important and interesting advances. Until ten years ago fossil remains of this class were known exclusively from the Tertiary period; almost the only source of our information was to be found in the researches of Ehrenberg, commenced in 1838, continued in his *Mikrogeologie* in 1854, and concluded in his last work (L. N. 25) published in 1875 (compare L. N. 16, pp. 3-9, 191-193). In the year 1876 a number of Mesozoic Radiolaria from the chalk were described by Zittel (L. N. 28), and afterwards others from the Jura by Dunikowski (L. N. 44). That fossil Radiolaria occur in Mesozoic formations, especially in the Jura, as well preserved and as abundantly as in the Tertiary rocks of Barbados, was shown in 1883 by Rüst (L. N. 48). By the examination of numerous thin sections he discovered that in all the main divisions of the Jurassic formation (Lias, Dogger, Malm) there are distributed jaspers, flints, cherts, and other quartzites, which consist largely of the siliceous shells of Polycystina; the same is true also of many Coprolites found in the Jura. The full account of these and the descriptions and figures of 234 Jurassic species, distributed in 76 genera, are contained in the *Beiträge zur Kenntniss der fossilen Radiolarien aus Gesteinen des Jura* (L. N. 51, 1885). But even in the older rocks, the Trias, the Permian, and Carboniferous systems, and even as far downwards as the Silurian and Cambrian formations, Rüst has recently shown the existence of fossil Radiolaria,