

structural importance assigned to them by Mr Mackintosh, and when we come to include within his classification the spines of the Spatangoids and Clypeastroids, according to the structural features he has employed to separate his principal series, we should be compelled to unite into one series groups which have no systematic affinity and are zoologically widely separated. The mere fact that the spines of the Diadematidæ are hollow does not seem a sufficient reason for contrasting them to the spines of all the other Desmosticha. I should be more inclined to consider the spines of the Diadematidæ (adopting the nomenclature of Mackintosh) as monocyclic Acanthosphenota, with a more or less hollow interior. An excellent example of the type showing affinities to the Diadematidæ and to the Echinidæ is *Pseudoboletia*; in one section (Pl. XXXVIII. fig. 3) we have the hollow spine as in Diadematidæ, in the other (Pl. XXXIX. fig. 11) the central portion of the shaft is completely occupied by reticulations as in the Echinidæ.

From the examination of the few young spines of Echinids which have been figured thus far either by Müller¹ or by myself,² there does not seem to be in the early stages very great differences in the structure of the spines. The young spines are in all cases polygonal, made up of rectangular meshes placed in regular stories one above the other; the upper set of meshes open, while the outer beams send off into the interior smaller rods, the first rudiments of the second or third row of wedges of the polycyclic spines or merely lateral offshoots connecting the large calcareous wedges, the original beams forming the rectangular meshes of the young Sea-urchin. There is no difference in the typical structure of the spine of the young of *Cidaris*, *Echinus*, *Strongylocentrotus*, *Arbacia*, *Echinocyamus*, or *Schizaster*, the genera of which the young spines have thus far been figured.

The modifications which eventually give to the spines their final characteristics are all derived from the changes undergone by this single primitive fenestrate type, and are not features which are found developed early in the plutean stage, or based upon radically different types of structure. The very fact that we have among the Echinids the anomalies to which Mackintosh refers, shows us plainly that the derivation from the original embryonic type has not gone on during growth equally in all the genera of the same family, some of the genera retaining a much more embryonic condition than others. By embryonic, I mean the simple fenestrate structure of the spines such as still exists among some of the Clypeastroids and Spatangoids, in which the reticulation does not extend towards the central part of the shafts, or in the simpler monocyclic types of such genera as *Astropyga* and the Salmacidæ. It is among the Desmosticha, belonging to the Cidaridæ, the Salenidæ, the Diadematidæ, and the Echinidæ, among the oldest genera,

¹ J. Müller, Ueber die Larven u. Metamorphosen der Ophiuren u. Seeigel, Abhand. Berlin Akad., 1848-1855, Abhandlungen, i., iv., vi., vii.

² A. Agassiz, Embryology of Echinoderms, Mem. Am. Acad., 1864; The Homologies of Pedicellariæ, Am. Naturalist, 1873.