

both physiologically and morphologically; and further, they have failed from not sufficiently taking into account the dorso-central system of Clypeastroids, and in attempting to pass at once from the Goniocidaridæ (the regular Echinids) to the Spatangoids (Petalosticha) have left out an important term of comparison.

From embryological data<sup>1</sup> the madreporic body indicates in Echinids, Starfishes and Ophiurans the line along which the suture of the open spiral of the young Echinoderm has taken place. It is the only body in the regular Echinoidea which can denote any axis, and from the mode of development of the interambulacral system, after the ambulacral, merely indicates that the two ambulacra adjoining it are developed at the opposite ends of the open spiral once forming the young Echinoderm; so that any starting-point we wish to take, in making out formulæ for the arrangement of the plates, ought to be chosen with reference to the position of the madreporic tubercle, and should be either the one to the right or to the left of it, that is, either of the ambulacra which Lovén has numbered III. and II. They mean something, and have a definite value, which the others have not; and the fact that the right anterior interambulacrum frequently contains the madreporic body in Spatangoids is no proof that the interambulacral area of regular Echinids which contains it is the right anterior interambulacrum, as has been supposed by the majority of writers on the Echinoidea.

Nothing in the position of the anus can help us to determine in the Desmosticha which is the odd interambulacrum except the tendency we see in some genera of the anal system to approach that interambulacrum; since while within the genital ring nothing in its position can guide us to any axis corresponding to that of other sub-orders where additional structural features leave us no doubt of its position. I have shown in the Revision of the Echini that the general trend of the alimentary canal and its windings are of no assistance in this matter, and that the position of the anus in different genera of Echinometradæ shows that, in the regular Echinoidea at any rate, it cannot be used to determine any axis; while, on the contrary, the position of the anus in the Clypeastroids and Petalosticha, and the frequent specialisation of one of the ambulacra in the latter, gives us a ready clue to fix the axis of these groups.

The youngest Echinids I have examined, immediately on the resorption of the Pluteus (Mem. Am. Acad., 1864), show plainly why we should not have the relations between the different ambulacral and interambulacral plates discovered by Lovén limited to a single one of the zones. The first trace of the ambulacral system in each ambulacrum consists of five loops becoming subsequently five tentacles, which are absolutely similar. These large embryonic tentacles are not, as Lovén supposes, temporary, as can be readily seen on examining the figures of the paper referred to above, which shows the gradual increase in number of the original tentacles, the mode of formation of

<sup>1</sup> See A. Agassiz, Embryology of Echinoderms, Mem. Am. Acad., 1864; A. Agassiz, Embryology of the Starfish, 1864.