

Pl. LX. fig. 2—*a.d.*; fig. 6, *a'*. Figs. 4, 5, 7, *a'*; fig. 8, *a.d.*), where muscle fibres are absent, indicates that if it be nervous, it must be not only of a motor but also of a sensory nature. This conclusion also follows from the fact that stimulation of one of the oral pinnules of *Antedon rosacea* causes the flexion of all the ten arms. This result is not simply due to general irritability; for if so, it would follow when any pinnule was stimulated; whereas stimulation of one of the ordinary pinnules is only followed by flexion of the arm which bears it. This experiment therefore is evidence of a reflex action of a somewhat complex nature; and the axial cords must be the paths of both afferent and efferent impulses. For there is no ambulacral nerve in these oral pinnules, which resemble those on the hinder arms of *Actinometra* (Pl. LVI. fig. 7; Pl. LXI. fig. 3) in being ungrooved, and devoid of tentacles, blood-vessels, and ventral nerve (fig. 4). The latter is normally connected with the tentacles, and possibly also with a general subepidermic plexus; but it has nothing whatever to do with the bodily movements of the animal, though perhaps influencing those of the tentacles and of the marginal leaflets or covering plates.

Here then we have evidence in the Crinoid of a mesodermic nervous system analogous to that which has been discovered of late years in the Cœlenterates, Worms, and Chætognatha. As regards the latter group, O. Hertwig is inclined to think that "bei den Chætognathen sensibles und motorisches Nervensystem von einander vollständig gesondert sein, ersteres wäre ektodermal, letzteres gleich den Muskeln mesodermal."¹

Considering that nervous tissues are well developed in the mesoderm of Cœlenterates, one would certainly expect to find them in that of Echinoderms. The nervous system of a Holothurian only remains in connection with the epidermis at the distal ends of the tentacles and tube-feet; while the radial nerves of Ophiurids and Urchins are separated from the exterior by limestone plates, though coming into connection with the epidermis on the tube-feet. Besides the subepidermic plexus on the outside of the shell of an Urchin which sends fibrils to the muscles of the pedicellariæ, there is another which is formed by filaments that are given off from the lateral branches of the radial nerves, the connection of which with the subepidermic plexus has not been definitely traced. Romanes and Ewart have further discovered that the general co-ordination of the spines for the purpose of locomotion depends on the integrity of an internal nervous plexus which is "everywhere in intimate connection with the external, apparently through the calcareous substance of the shell."²

There is, therefore, no very great difficulty involved in the belief that a mesodermic nervous system is present in the Crinoids. The morphological difficulties resulting from its anti-ambulacral position are, however, considerable. But they are of precisely the same character as we have to face, when describing the chambered organ and the vascular axis of the stem as a part of the circulatory system of a Crinoid. Ludwig appears to have

¹ Die Chætognathen, *Jenaische Zeitschr.*, Bd. xiv. p. 234.

² *Phil. Trans.*, 1881, p. 874.