soon seized by a great number of others, and immediately carried towards the mouth, the apparatus of which develop­ing itself, soon reduces it to a pulp.”@@1

The intestinal canal which this food has to traverse is, like that of the Fistulides, long, cylindrical, and tortuous, with a vent separate from the mouth. There is no chylo- poetic viscus ; but Blainville deems to be hepatic some glandular spots which he has detected in the parietes of that portion which may be regarded as stomach.@@2 The intestine is fringed throughout with a mesentery, on the under edge of which Monro found two vessels without valves, nearly equal in size and parallel to each other, which he injected with quicksilver, and from them filled a beautiful net-work of vessels, not only on the intestines, but dispersed on fine membranes, which tie the intestine to the inner side of the shell. “ I could not however,” he conti­nues, “ observe that these two vessels communicated with each other directly, nor by the medium of any organ like to our heart ; nor could I observe in the living animal any beating organ like to the heart ; yet near to the anus, and connected to the rectum, which is the place of the heart in many other worms, I found a small organ, which seems to be hollow. It appears to be highly probable that one of these vessels is the principal artery or aorta, and the other analogous to our vena cava ; and that they communicate by invisible branches, and circulate the blood by the muscular action of their coats, without the intervention of a heart, nearly in the way the vessels in fishes carry the blood from the gills back to their heart.”@@3 Blainville however, with a full knowledge of Monro’s opinions, and of subsequent dis­coveries, aided too by his own dissections, acknowledges that he cannot tell which vessels are arterial and which venous, and thinks it very possible that there is no such distinction in animals so low in organization as the Echi- nides, the vessels being at one and the same time both arteries and veins.@@4 How the blood circulates is therefore a subject of conjecture ; but we know more precisely the manner in which it is aerated. Lying along the inner sur­face of each of the *ambulacra,* there is a branchial leaf or doubled membrane, “ not unlike the processes or subdivi­sions of the gills of a skate,” and having a direct communi­cation with the external tubular suckers, already described as pullulating from the ambulacral pores. The water suck­ed in by these tubes gains access within the shell by two of the pores (for there is a pair to each sucker), and by their divergence is carried into the opposite folds of the bran­chiae. Here one portion of the sea-water is supposed to be exuded into the general cavity of the shell, between its inner covering and the intestine; while another portion is again collected, by anastomosing vessels, into five large ducts, that terminate, each by two branches, in large sacs or receptacles over the sockets of the teeth, communi­cating with each other ; and from these the liquor passes down the sockets of the teeth, and is discharged into the sea, on each side of the tooth, between the socket of the tooth and beginning of the œsophagus.@@5 Such is the course of the fluid as described by Monro ; but later anatomists maintain that the current has in fact exactly the reverse direction ; and they inform us that the sea-water which fills the interior cavity is introduced through certain membra­nous tubes, arranged in ten small groups round the oral aperture in the base of the shell. Be the fact as it may, there remains a provision of aqueducts most curiously con­trived for conducting the medium of respiration and assi­milation through the body ; and very probably the current is propelled and directed in its way by the action of vibratile cilia, which, in these animals, as in most others, clothe all the serous surfaces of the internal viscera, keeping the fluid in contact with them in perpetual change and renewal, and not allowing it to stagnate even on the outer shell.@@6

The ovary or roe occupies much space within the shell, being very large in proportion to the animal and its other viscera, it is divided into five or four lobes, disposed radi­antly, each lobe having a distinct exterior aperture, as well as a communication with each other. The apertures are placed round the anal when this is central, but otherwise their relationship is not so regular and constant. It is pro­bable the ova, after their extrusion, undergo no change analogous to a metamorphosis.@@7 We have examined the young of Echinus esculentus when it did not exceed one- eighth of an inch in diameter, and then it had the form and armature of adultness ; but the prickles were toothed along their sides, and the forcipated organs appeared to have only two prongs. The pieces of which the shell was built were few in number, and the spines round its base were most developed, but the globular form was as perfect as when full grown. It is enlarged in its growth, partly by the deposition of new matter on the edges of the pentagons of which the areæ are constructed, and partly by the for­mation of additional pieces intercalated among the others. These new pentagons are formed principally near the dorsal summit, where the connection between the areæ and ambu­lacra remains loosest. “ If, carrying the examination still farther, we remove the spines, we shall then observe that amongst the oviducal and interoviducal plates, and the inter- ambulacral plates that bear spines, there are some less fully developed, irregular in form, wanting even the mammellæ and the spines, and taking their place among the mammellated plates only in proportion as they gradually attain to a larger size. The new plates are at first very small, and may be compared to points of ossification, which at first grow simul­taneously in all directions, though their lower side completes its formation sooner than the upper, and the upper side is sometimes yet incomplete, even when an incipient mammella is observable in the middle of it. In the region of the body where this increase takes place, the membrane which unites all the plates, and spreads itself over their surface, forming an articular capsule about the base of the spines, is softer and more spongy than it is in the inferior part, where the plates are consolidated and immoveable. It is in fact this spongy mass that deposits the calcareous matter of which the plates are composed ; and the spines shoot out in the centre almost in the same manner as the horns of a stag. They do not become moveable until they have attained a certain stage of development ; and there is a period in their growth after which their size does not increase. Those however which drop off accidentally are replaced by others, formed, as those had been, by the tume­faction of the membrane which covers the plates. We may always observe, in a single specimen of the *Cidaris,* all the gradations of increase, from that of the plates which have completed their growth, and bear spines several inches long, down to the smallest points of ossification of the plates yet unfurnished with spines. These facts I have ascertained by examining several individual specimens, which exhibit­ed all the intermediate stages of development through which the pieces in question must pass; and indeed, when we have no direct means of observing the growth of an animal in one individual, the only resource left us is to compare a great number of individuals, representing a

*@@@1 Bridgew. Treatise,* i. p. 210.

@@@2 *Man. d'Actinologie,* p. 72.

@@@3 77<e *Struct, and Phys, of Fishes,* p. 67.

*@@@\* Man. d'Actinolυgie,* p. 76.

@@@s Monro’s *Struct. and Phys. of Fishes,* p. 69.

@@@• See Sharpey in *Cyclop, of Anat. and Phys.* i. p. 617. Ehrenberg says that the prickles of Echinus saxatilis are covered with these cilia. *Ann. des Sc. Nat.* n. s. iv. p. 304.

@@@7 It has been usually believed that the Echinides were hermaphrodites, but Μ. Edwards and Dr Peters are said to have discovered that they are of separate sexes. *Ann. and Mag. of Nat. Hist,* vol. i. p. 156.