lium (endoderm), and contains two or more cavities which are continuous with blood sinuses in the mantle. In the dorsal median line near the anterior end of the body, and imbedded in the mantle on the ventral surface of the nerve ganglion, there lies a small glandular mass—the subneural gland—which, as Julin has shown (*24*), there is reason to regard as the homologue of the *hypo­physis cerebri* of the vertebrate brain. Julin and E. van Beneden have sug­gested that the function of this organ may possibly be renal.@@1 The sub­neural gland, which was first noticed by Hancock, communicates anteriorly, as Ussoff (*23*) pointed out, by means of a narrow duct with the front of the branchial sac (pharynx). The opening of the duct is enlarged to form a funnel-shaped cavity, which may be folded upon itself, convoluted, or even broken up into a number of smaller openings, so as to form a complicated projection, called the dorsal tubercle, situated in the dorsal part of the prebranchial zone (fig. 7). The dorsal tubercle in *A. mentula* is somewhat horse-shoe-shaped (fig. 8) ; it varies in form in most Ascidians according to the genus and species, and in some cases in the individual also. Possibly, besides being the opening of the duct from the sub­neural gland, it may be a sense-organ for testing the quality of the water entering the branchial sac.

The single elongated ganglion in the median dorsal line of the mantle between the branchial and atrial si­phons is the only nerve-centre in *A. mentula* and most other *Tunicata.* It is the degenerate remains of the anterior part of the cerebro-spinal nervous system of the tailed larval Ascidian (see below, p. 614). The posterior or spinal part has entirely disappeared in most *Tunicata.* It persists, however, in the *Appendiculariidæ,* and traces of it are found in some Ascidians (*e.g*., *Clavelina* ; see Julin). The ganglion gives off distributory nerves at both ends,

which run through the mantle to the neighbourhood of the apertures, where they divide and subdivide. The only sense-organs are the pigment spots between the branchial and atrial lobes, the tentacles at the base of the branchial siphon, and possibly the dorsal tubercle and the languets or dorsal lamina. These are all in a lowly developed con­dition. The larval Ascidians on the other hand have well- developed intra-cerebral optic and auditory sense-organs ; and in some of the pelagic *Tunicata* otocysts and pigment spots are found in connexion with the ganglion.

The mouth and the pharynx (branchial sac) have already been described. The remainder of the alimentary canal is a bent tube which in *A. mentula* and most other Ascid­ians lies imbedded in the mantle on the left side of the body, and projects into the peribranchial cavity. The oesophagus leaves the branchial sac in the dorsal middle line near the posterior end of the dorsal lamina (see fig. 4, œ*a).* It is a short curved tube which leads ventrally to the large fusiform thick-walled stomach. The intestine emerges from the ventral end of the stomach, and soon turns anteriorly, then dorsally, and then posteriorly so as to form a curve—the intestinal loop—open posteriorly. The intestine now curves anteriorly again, and from this point runs nearly straight forward as the rectum, thus com­pleting a second curve—the rectal loop—open anteriorly (see fig. 4). The wall of the intestine is thickened inter­nally, to form the typhlosole, a pad which runs along its entire length. The anus opens into the dorsal part of the peribranchial cavity near to the atrial aperture. The walls of the stomach are glandular ; and a system of delicate tubules with dilated ends, which ramifies over the outer wall of the intestine and communicates with the cavity of the stomach by means of a duct, is probably a digestive gland.

A mass of large clear vesicles which occupies the rectal loop, and may extend over the adjacent walls of the in­testine, is a renal organ without a duct. Each vesicle is the modified remains of a part of the primitive coelom or body-cavity, and is formed of cells which eliminate nitro­genous waste matters from the blood circulating in the neighbouring blood-lacunæ and deposit them in the cavity of the vesicle, where they form a concentrically laminated concretion of a yellowish or brown colour. These concre­tions contain uric acid, and in a large Ascidian are very numerous. The nitrogenous waste products are thus de­posited and stored up in the renal vesicles in place of being excreted from the body. In other Ascidians the renal organ may differ from the above in its position and structure ; but in no case has it an excretory duct, unless the subneural gland is to be regarded as a renal organ.

The heart is an elongated fusiform tube placed on the ventral and posterior edge of the stomach, in a space (the pericardium) which is part of the original coelom or body- cavity, the rest of which exists merely in the form of lacunæ and of the cavities of the reproductive organs and renal vesicles in the adult Ascidian. The wall of the heart is formed of a layer of epithelio-muscular cells, the inner ends of which are cross-striated ; and waves of contraction pass along it from end to end, first for a certain number of beats in one direction and then in the other, so as to reverse the course of circulation periodically. At each end the heart is continued into a vessel (see fig. 9), a large sinus or lacuna lined with a delicate endothelial layer. The sinus leaving the ventral end of the heart is called the branchio-cardiac vessel,@@2 and the heart itself is merely the differentiated posterior part of this sinus and is therefore a ventral vessel. The branchio-cardiac vessel, after giving off a branch which, along with a corresponding branch from the cardio-visceral vessel, goes to the test, runs along the

@@@1 See also Herdman, *Nature,* vol. xxviii. p. 284.

@@@2 On account of the periodic reversal of the circulation none of the vessels can he called arteries or veins.