matrix, containing cells of various shapes ; it is frequently pigmented and is penetrated by numerous lacunæ, in which the blood flows. In­side the mantle, in all parts of the body, except along the ven­tral edge, there is a cavity,—the atrial or peribranchial cavity, —which opens to the exterior by the atrial aperture. This cavity is lined by a layer of cells derived origin­ally from the ecto­derm @@1 and directly continuous with that layer through the atrial aperture (fig. 5) ; consequently the mantle is covered both externally and inter­nally by ectodermal cells.

The branchial aper­ture (mouth) leads in­to the branchial si­phon (buccal cavity or stomodæum), and this opens into the anterior end of a very large cavity (the bran­chial sac) which ex­tends nearly to the posterior end of the body (see figs. 4 and 5). This branchial sac is an enlarged and modified pharynx, and is therefore properly a part of the ali­mentary canal. The oeso­phagus opens from it far back on the dorsal edge (see below, p. 612). The wall of the branchial sac is pierced by a large number of ver­tical slits, — the stigmata, —placed in numerous trans­verse rows. These slits place the branchial sac in communication with the

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peribranchial or atrial cavity, which lies outside it (fig. 5, *P).* Between the stigmata the wall of the branchial sac is traversed by blood-vessels, which are arranged in three regular series (fig. 6),—(1) the transverse vessels, which run horizontally round the wall and open at their dorsal and ventral ends into large longitudinal vessels, the dorsal and ventral sinuses *; (2)* the fine longitudinal vessels, which run vertically between adjacent transverse vessels and open into them, and which bound the stigmata; and (3) the internal longitudinal bars, which run vertically in a plane

internal to that of the transverse and fine longitudinal vessels. These bars communicate with the transverse vessels by short side branches where they cross, and at these points are prolonged into the lumen of the sac in the form of hollow papillæ. The edges of the stigmata are richly set with cilia, which drive the water from the bran­chial sac into the peribranchial ca­vity, and so cause the currents that flow in through the branchial aperture and out through the atrial.

Along its vent­ral edge the wall of the branchial sac is continu­ous externally with the mantle (fig. 5, *B*), while internally it is thickened to form two parallel longitudinal folds bounding a groove, the “ endostyle,” hypobranchial groove, or ventral furrow (figs. 4, 5, *end).* The endoderm cells which line the endostyle are greatly enlarged at the bottom and on parts of the sides of the furrow so as to form projecting pads, which bear very long cilia. It is generally supposed that this organ is a gland for the pro­duction of the mucous secretion which is spread round the edges of the branchial sac and catches the food particles in the passing current of water ; but it has recently been pointed out that there are comparatively few gland cells in the epithelium of the endostyle, and that it is more prob­able that this furrow is merely a ciliated path along which the mucous secretion (produced possibly by the subneural gland) is conveyed posteriorly along the ventral edge of the branchial sac. At its anterior end the edges of the endostyle become continuous with the right and left halves of the posterior of two circular ciliated ridges,—the peri­pharyngeal bands,— which run parallel to one another round the front of the branchial sac. The dorsal ends of the posterior peripharyngeal band bend posteriorly (en­closing the epibranchial groove), and then join to form the anterior end of a fold which runs along the dorsal edge of the branchial sac as far as the oesophageal aperture. This fold is the dorsal lamina (figs. 4, 5, *dl*). It probably serves to direct the stream of food particles entangled in a string of mucus from the anterior part of the dorsal lamina to the oesophagus. In many Ascidians this organ, instead of being a continuous membranous fold as in *A. mentula,* is represented by a series of elongated triangular processes—the dorsal languets,—one attached in the dorsal median line opposite to each transverse vessel of the branchial sac. The anterior peripharyngeal band is a complete circular ridge, having no connexion with either the endostyle or the dorsal lamina. In front of it lies the prebranchial zone, which separates the branchial sac behind from the branchial siphon in front. The prebranchial zone is bounded anteriorly by a muscular band—the pos­terior edge of the sphincter muscle,—which bears a circle of long delicate processes, the tentacles (figs. 4, 7, 8, *tn).* These project inwards at right angles so as to form a net­work across the entrance to the branchial sac. Each tentacle consists of connective tissue covered with epithe-

@@@1 According to E. van Beneden and Julin’s recent investigations (yo) only the outer wall of the atrium is lined with epiblast, the inner wall being derived from the hypoblast of the primitive branchial sac.