ventral edge of the branchial sac externally to the endostyle, and communicates laterally with the ventral ends of all the transverse vessels of the branchial sac. The sinus leaving the dorsal end of the heart is called the cardio-visceral vessel, and this, after giving off to the test the branch above mentioned, breaks up into a number of sinuses, which ramify over the alimentary canal and the other viscera. These visceral lacunæ finally communicate with a third great sinus, the viscero-branchial vessel, which runs forward along the dorsal edge of the branchial sac exter­nally to the dorsal lamina and joins the dorsal ends of all the transverse vessels of the branchial sac. Besides these three chief systems there are numerous lacunæ in all parts of the body, by means of which anastomoses are established between the different currents of blood. All these blood spaces and lacunæ are to be regarded as derived from the blastocœle of the embryo, and not, as has been usually supposed, from the cœlom (*30*). When the heart contracts ventro-dorsally, the course of the circulation is as follows : the blood which is flowing through the vessels of the branchial sac is collected in an oxygenated condition in the branchio-cardiac vessel, and, after receiving a stream of blood from the test, en­ters the heart. It is then pro­pelled from the dorsal end of the heart into the cardio-

visceral vessels, and so reaches the test and digestive and other organs ; then, after circulating in the visceral lacunæ, it passes into the viscero-branchial vessel in an impure condition, and is distributed to the branchial vessels to be purified again. When the heart on the other hand contracts dorso-ventrally, this course of circulation is reversed. As the test receives a branch from each end of the heart, it follows that it has afferent and efferent vessels which­ever way the blood is flowing. In some Ascidians the vessels in the test become very numerous and their end branches terminate in swollen bulbs close under the outer surface of the test. In this way an accessory respiratory organ@@1 is probably formed in the superficial layer of the test. The blood corpuscles are chiefly colourless and amoeboid ; but in most if not all Ascidians there are also some pigmented corpuscles in the blood. These are gener­ally of an orange or reddish brown tint, but may be opaque white, dark indigo-blue, or of intermediate colours. Pre­cisely similarly pigmented cells are found throughout the connective tissue of the mantle and other parts of the body.

*A. mentula* is hermaphrodite, and the reproductive organs lie, with the alimentary canal, on the left side of the body. The ovary is a ramified gland which occupies the greater part of the intestinal loop (see fig. 4). It contains a cavity which, along with the cavities of the testis, is derived from a part of the original cœlom, and the ova are formed from its walls and fall when mature into the cavity. The oviduct is continuous with the cavity of the ovary and leads forwards alongside the rectum, finally opening near the anus into the peribranchial cavity. The testis is com­posed of a great number of delicate branched tubules, which ramify over the ovary and the adjacent parts of the intestinal wall. Those tubules terminate in ovate swell­ings. Near the commencement of the rectum the larger tubules unite to form the vas deferens, a tube of consider­able size, which runs forwards alongside the rectum, and, like the oviduct, terminates by opening into the peri­

branchial cavity close to the anus. The lumen of the tubules of the testis, like the cavity of the ovary, is a part of the original cœlom, and the spermatozoa are formed from the cells lining the wall. In some Ascidians repro­ductive organs are present on both sides of the body, and in others (*Polycarpa)* there are many complete sets of both male and female systems, attached to the inner surface of the mantle on both sides of the body and projecting into the peribranchial cavity.@@2

Embryology@@3 and Life History.

In most Ascidians the eggs are fertilized in the peribranchial cavity, and undergo most of their development before leaving the parent ; in some cases, however, the eggs are laid, and fertilization takes place in the surrounding water. The segmentation is com­plete and regular (fig. 10, A) and results in the formation of a spherical blastula, which then undergoes invagination (fig. 10, B). The embryo elongates, and the blastopore or invagination opening comes to be placed on the dorsal edge near the posterior end (fig. 10, C). The hypoblast cells lining the archenteron are columnar in form, while the epiblast cells are more cubical (fig. 10, B, C, D). The dorsal surface of the embryo now becomes flattened and then depressed to form a longitudinal groove, extending forwards from the blastopore to near the front of the body. This “medullary groove” now becomes converted into a closed canal by its side walls growing up, arching over, and coalescing in the median dorsal line (fig. 10, D). This union of the *laminæ dorsales* to form the neural canal commences at the posterior end behind the blastopore and gradually extends forwards. Consequently the blastopore comes to open into the posterior end of the neural canal (fig. 10,

D), while the anterior end of that cavity remains open to the exterior. In this way the archenteron communicates indirectly with the exterior. The short canal leading from the neural canal to the archenteron is known as the neurenteric canal (fig. 10,

@@@1 See Herdman, *Nature,* vol. xxxi. p. 247.

@@@2 For structure of other forms, see p. 614 *sq.* below.

@@@3 For reproduction by gemmation, see under “ Classification,” p. 614 *sq.* below.