XXVIII. *On the Anatomical Characters of three Australian species of* Tunicata *referable to Savigny's subgenus* Cæsira. *By* John Denis Macdonald, *F.R.S., Assistant Surgeon of H.M.S. 'Herald,' commanded by Captain* H. M. Denham, *R.N., F.R.S. Communicated by* George Busk, *Esq., F.R.S., F.L.S.*

Read January 20th, 1859.

I. In another paper, on the anatomical characters of *Perophora Hutchisoni*, I had occasion to notice the frequent occurrence of a small sessile and solitary Ascidian, attached to the same branches of *Amphibolis*, covered with a similar granular coating, and so far exhibiting a corresponding habit. As this little tunicary forms the type of a well-marked genus, of which we have discovered several species, a short description of it may not be uninteresting.

The body is of a depressed pyriform shape, and from one-half to three-fourths of an inch in length. It generally rests a little on one side, as well as on its base, being thus in part sessile and in part recumbent.

The two external openings lie nearly on the same plane, and in general appearance, more especially in the contracted state, resemble those of *Boltenia*, a resemblance which is heightened by an infolding of the test extending between them. The branchial aperture, however, is obscurely divisible into six rays instead of four.

The test is exceedingly thin, and so densely studded with fine grit, that it is rather difficult to investigate its structure satisfactorily; an internal glistening coat of a fibrous texture is nevertheless distinctly traceable.

The *pallio-vascular* system, which is so highly developed in other cases, is scarcely at all visible in the present species, a circumstance most probably to be accounted for by the thinness of the test, the greater part of whose apparent thickness is due to extraneous matters.

On removing the test, an elaborate system of reticulated vascular canals, invested with a greenish-yellow pigment, presents itself beneath the epithelium of the mantle and the more superficial fibres of the muscular coat.

The outer part of the branchial opening is armed with a circlet of simple, pointed or bifid tentacula, the equivalents of which are also present in *Boltenia*; and, as in the latter genus, the inner rim of the same opening is surrounded by compound tentacula, divided into pretty equal branchlets and pinnæ.

The branchial network is composed of rather stout transverse bars and very delicate longitudinal nervures, strengthened at intervals by stronger ones assuming the character of folds.

The mouth is situated at that part of the respiratory chamber which is nearest to the cloacal cavity, and leads by a very short œsophagus almost directly into an elongated

stomach which curves gently downwards and backwards, and gradually diminishes in size to the point where it becomes continuous with the intestine. The latter courses backwards and then upwards on the right side of the body, until, having arrived opposite the branchial opening, it bends suddenly forwards, forming a simple loop, and again passes towards the stomach, above but parallel with its former course, to terminate in the cloacal chamber close to the position of the mouth.

The liver is of a rudimentary character in this species, consisting of minute sacculations, which emboss the surface of the stomach, and impart to it a rich amber or brown hue.

The ovaria are two in number, one lying on either side of the body, between the branchial membrane and the muscular coat. The right ovarium does not occupy the loop of intestine, as it does in *Boltenia* and most other Tunicata, but is placed in a recess in front of it. These organs are pyriform in shape and laterally compressed, with the smaller end and the short duct issuing from it directed towards the cloaca. The testes are also two in number, consisting of numerous elongated and finely-divided lobules radiating round the base of the ovaria.

II. In Hamelin's Harbour, Shark Bay, a second species of this genus, but of much larger size, is rather plentiful. Unlike that just described, it appears to lie loosely, or with a very slight attachment, on the sandy bottom, being too massive to be supported on the delicate stem of a *Zostera* or an *Amphibolis*.

The body of the animal is somewhat rounded, compressed on the sides, and averages one inch and six-tenths in antero-posterior measurement, and one inch and three-tenths in the vertical direction.

The test itself is very thin; but numerous branched and interlacing fibres, often tubular, and containing prolongations from the mantle, arise from every part of its outer surface, and form a matrix for the lodgement of shell and coral grit, foraminifera, and other extraneous matters. In this way the coat assumes a thickness of about one-fifth of an inch.

The external openings lie nearly on the same plane upon the upper or neural surface; but they are usually so surrounded with small and irregular processes of the test, that it is difficult to determine their actual configuration; they are, however, connected by a straight fold of the test, as in the former species.

The mantle presents an almost uniformly greenish-yellow tint, produced by minutely-divided and reticulated vessels.

The fibres of the muscular coat are delicate, and rather loosely disposed over the general surface of the body, though very strongly developed round the branchial and cloacal openings, in circular and radiating bundles. The lining membrane of the latter opening presents a rosy hue; and just within the margin of that which leads to the respiratory chamber spring several tentaculiform bodies, which appear to correspond with the duplicatures of the contracted aperture. The true tentacula, however, always lie internal to these or their modifications in the Tunicata generally.

The tentacula in the present, as in the former species, are compound, consisting of a tapering central portion, with six or seven pairs of subramose lateral processes, openly set with minute papillæ. Both the axis and rami are crested or angulated in the middle,

gently curved, and ornamented with yellow vascular lines. The curvature of these beautiful organs is due to the presence of longitudinal muscular fibres on the concave border, having no others to antagonize them on the opposite side.

The branchial network is minute and regular, and the membrane is thrown into about fourteen longitudinal folds; seven on either side of the body extending between the branchial and oral apertures, and increasing in length from before backwards, in which direction also they gradually become more curved.

The mouth is small and surrounded by the converging ends of the longitudinal folds of the branchial membrane, leading into a short œsophagus, which curves downwards and backwards to join an elongated stomach, from whose tapering pyloric end the intestine takes a very similar course to that described in the former case, and terminates in the cloacal chamber near the position of the mouth.

The liver consists of numerous short and compressed glandular sacculi of a rich brownish-red colour, lying on the left side and along the inferior border of the stomach, into which their contents are poured.

The products of digestion are usually to be seen in the intestine, connected together by a plastic substance, and rolled into a filiform, continuous, and highly convoluted mass, extending from the stomach to the vent.

The testes and ovaria are identical in character, position and relations with those of the foregoing Ascidian.

The heart lies on the left side of the body, just below and in front of the corresponding ovarium. It rests on a small brown cylindroid body with rounded extremities, and exhibiting a slight curvature, with its concavity looking upwards and forwards. This body appears to lie loosely in a blood-sinus adapted to receive it, and is chiefly composed of minute cells, cell-nuclei, and an amorphous matter enclosed in a membranous sac, but exhibiting no very definite arrangement. What its real nature is I have not been able to determine, though I am disposed to believe that it may be the representative of the "*elæoblast*" of the Salpian.

III. In Shark Bay also, and in about three fathoms water, we obtained another small Ascidian, so nearly allied to those just described as to merit brief notice here. It is nearly of the same size as the King George's Sound species, but rather more narrowed and produced above, and more rounded at the base.

The branchial and cloacal openings lie on nearly the same level, at the extremes of the upper border, and are tubular and prominent, though capable of considerable retraction.

The test is thin, smooth, colourless, and beautifully transparent, so far calling to mind the pelagic Tunicata generally. It is, however, loosely covered over with the fine sandy particles of the sea-bottom on which it rests, being apparently quite unattached, though perhaps unable to change its place at will.

The muscular coat and its epithelial covering are also quite transparent and free from pigment.

The external openings, particularly at their base, are surrounded with radiating and

circular muscular fibres, while others are scantily distributed in various directions over the body.

The branchial network is very delicate and rests upon a stout transparent membrane, which is sacculated or embossed towards the respiratory cavity.

The internal tentacula are compound, as in the former species; and the mouth, stomach, intestine, testes, and ovaria exhibit the same general disposition, so that the description of those organs above given will equally apply to the present case, with the following exceptions, namely, that the stomach in the latter is covered with a very dark pigmentary matter, probably including biliary follicles, and the intestinal loop is more open, so that the right testis and ovarium lie within it.

Finally, the heart holds a slightly oblique position below the left ovarium, and rests on a curved cylindroid body tinted with a rich madder-brown pigment, unquestionably the equivalent of the organ which I have assumed to be an "*elæoblast*" in the last-described species.

June 1858.

EXPLANATION OF THE PLATE.

Tab. LXIV.

[The same general references apply to all.]

I. *Cæsira parasitica.* King George's Sound species.

Fig. 1. Animal *in situ*, with a cluster of zooids of *Perophora Hutchisoni*.
- *a*. Branchial, and
- *b*. Cloacal opening (both being contracted and radiately puckered).

Fig. 2. The animal removed from the test, to show its internal parts.
- *c*. Nervous ganglion.
- *d*. Position of the mouth.
- *e*. Stomach, and *e'*. Liver.
- *f*. Intestinal canal and loop.
- *g*. Rectum.
- *h*. Right testis.
- *i*. Right ovarium.

Fig. 3. Simple external tentacula, magnified.

Fig. 4. One of the compound internal tentacula.

Fig. 5. Immature ova.

Fig. 6. Perfect ovum with additional yelk-granules and outer covering.

II. *C. ficus.* Shark Bay species (No. 1).

Fig. 1. The animal as it appears in its natural state, with one or two Sertularians growing on its granular coat.