prepared the photomicrographs. The biochemical estimations were performed through the kindness of Dr. D. Curnow (Royal Perth Hospital). The α-tocopherol was kindly supplied by Roche Products, Ltd.

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Structure and Action of the Sucker of *Echeneis*

Fig. 1 is a diagram of the sucker of *Echeneis* taken after staining it with alizarin red and rendering it transparent in glycerin. This reveals the presence of a chamber below the posterior shield of the sucker, about which no mention has so far been made in the literature. Hora[1], who at first doubted whether the sucker was a real sucker, later was convinced that the outer rim functioned as a sucker and that there were smaller paired suckers as well; Sewell's[2] observations confirmed this.

My observations show: (1) That in addition to the paired chambers there is an unpaired chamber below the posterior shield which has no opening on the dorsal side. (2) While all the other paired chambers are filled with sea water when the fish is swimming about, this chamber also contains some fluid but not sea water as there appears to be no connexion with the exterior. (3) At the posterior end of the chamber there is a pear-shaped hollow bony structure with one or more openings in it and there are two channels one on either side of it suggesting that by its movement forward and backward it can act as a valve regulating the flow of liquid in the chamber. (4) The entire base of the disk is paved with bone consisting of plates overlapping each other and with two pairs of holes in them. (5) The laminæ carry transverse bars against which the bases of the teeth abut, forming effective buttresses. (6) A pair of large hooks from the buttress interlock with the holes in the basal plates. (7) The pear-shaped, hollow, bony structure becomes completely detached when teased in caustic potash.

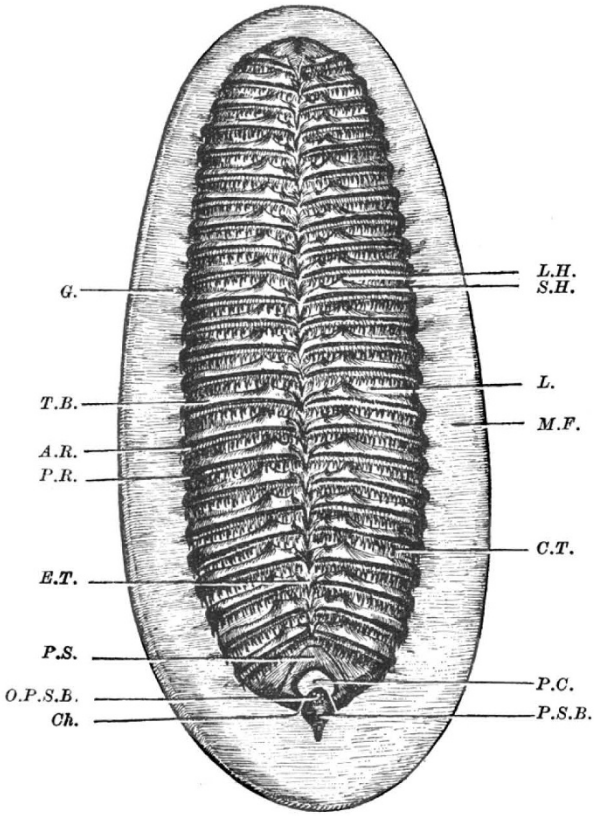

Fig. 1. The sucker of *Echeneis* as seen when stained in alizarin red and rendered transparent in glycerin. *A.R.*, anterior ridge; *Ch.*, channel; *C.T.*, comb-like teeth in three rows; *E.T.*, enlarged tooth pointing backwards; *G.*, glyph or spillway; *L.*, lamella between ridges; *L.H.*, large hook which fits into basal plate below; *M.F.*, marginal flap; *O.P.S.B.*, opening in pear-shaped body; *P.C.*, posterior chamber; *P.R.*, posterior ridge; *P.S.*, posterior shield; *P.S.B.*, pear-shaped body (valve); *S.H.*, small hook which fits into basal plate below; *T.B.*, transverse bar or buttress

The attachment presumably takes place in the following stages: (1) the marginal flap is the first to adhere; (2) the sea water is next sent out of the paired pouches from below the posterior ridge of each lamella; (3) next the interlocking of the lamellæ with the basal plates takes place; (4) any remaining water escapes by the spillways resembling siphonoglyphs; (5) the posterior shield is the last to adhere when the body fluid in the median chamber is withdrawn.

The release of the disk can be brought about by admitting sea water artificially: that is, by inserting sticks, strings or the blade of a penknife, but in Nature the processes mentioned above work in reverse. The posterior shield is the first to be released by the admission of body fluid into the chamber below it. Sea water now enters the space between the shield and the surface of adhesion and is carried to the siphonoglyphs, through which it enters, bringing about the release of the hooks. Water now is able to enter into the paired chambers, producing the "hissing sound" mentioned by Hora[2] and the "slight sucking noise" of Sewell[3]. During the process the water is strained free of all solid particles which might be floating in the sea water by the comb-like teeth. As each chamber is partly overlapped by the next a set of chain reactions occur so that all the paired pouches are progressively filled with sea water and the entire disk released.

Sewell mentions that when *Echeneis* is attached to any object all the movements of the fish except those of the mouth and gills seem to be suspended, and Norman[4], quoting it, says a detailed study of the nervous mechanism involved would be of interest. I venture to suggest that the movement of the body fluid in and out of the posterior chamber is obviously responsible for the setting of the nervous mechanism to work.

A detailed description of the sucker is in preparation, and it is expected to show that the sucker instead of being a partial vacuum is really a mechanism precisely built and as efficient as any that human ingenuity can invent, in which case the sucking power must be 15 lb./sq. in. As some of the suckers cover an area of more than 8 sq. in., the fish, theoretically at least, must be able to suck with a power exceeding 100 lb.

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[1] Hora, *Nature*, **111**, 68 (1923).
[2] Hora, *Nature*, **115**, 47 (1925).
[3] Sewell, *Nature*, **115**, 48 (1925).
[4] Norman, *Nature*, **143**, 52 (1939).