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XIII. *Observations on Australasian Polyclads.*By Professor W. A. HASWELL, *M.A., D.Sc., F.R.S., F.L.S.*

(Plates 35-37.)

Read 6th June, 1907.

THE Polyclads of Australasia have hitherto received very little attention. Stimpson's "Descriptions of some new Marine Invertebrates" (22), published in 1855, contains diagnoses of several members of the group obtained in Port Jackson. Schmarda in the first volume of his 'Neue wirbellose Thiere,' issued in 1859, published some observations on several species from New South Wales and New Zealand. In Saville Kent's 'Great Barrier Reef' three species are referred to as *Pseudoceros Kentii*, n. sp., von Graff, *Pseudoceros dimidiatus*, n. sp., von Graff, and *Prostheceræus flavomaculatus*, n. sp., von Graff; these were apparently named by von Graff, but I am not aware that any account of them has been published. Woodworth (26) described a few species from the same locality. Marianne Plehn (18) described a species from New Zealand and the Chatham Islands, and another from Tasmania. T. W. Kirk (10) described two New Zealand species, and T. F. Cheeseman (2) two more. Lastly, Laidlaw (11) described *Leptoplana australis* and *Stylochus vigilax* from specimens in the collection of the British Museum, and recognized a specimen of *Cryptocelides Loveni*, Bergendal, labelled "Port Phillip, J. B. Wilson."

Of Stimpson's descriptions it is impossible to make any use, and the same holds good of Schmarda's. Though, presumably, the forms from Port Jackson described by these authors are the same as some of those dealt with in the following pages, it is quite impossible, without the opportunity of examining the original specimens, to attain to any certainty in this direction. Thus it is quite possible that Stimpson's *Dioncus badius* was the species here referred to as *Leptoplana australis*, Laidlaw, and at first I was disposed to name it *Leptoplana badia* in order to retain the old name; but on reconsideration I came to the conclusion that it would be better to avoid any identifications of such a merely conjectural kind, and to set Stimpson's and Schmarda's names aside altogether.

Lang's comment on Stimpson's paper may be quoted here:—"Die Diagnosen sind alle sehr kümmerlich. Bei dem gänzlichen Fehlen der Abbildungen werden deshalb die Arten wohl kaum wieder mit Sicherheit zu erkennen sein. Ihre generische Zugehörigkeit ist in den meisten Fällen nicht zu errathen" (17, p. 17). Of Schmarda's descriptions the same author observes:—"Leider sind die anatomischen Beobachtungen äusserst kümmerlich und die Angaben über Fehlen oder Vorhandensein und Stellung der Augen, Lage und Natur der Oeffnungen des Körpers, Form des Pharynx etc. wohl nicht ganz zuverlässig; so dass vielen der beschriebenen Arten ihre Stellung im System nicht mit Sicherheit angewiesen werden kann" (*op. cit.* p. 19).

I have pleasure in acknowledging assistance received from Mr. R. Etheridge, Curator



of the Australian Museum, Sydney, and Prof. W. B. Benham, of Dunedin, N.Z., by both of whom I was given the opportunity of examining specimens from the collections under their charge, to Mr. Chas. Hedley for specimens collected at Masthead Island and Cooktown, and to Mr. S. J. Johnston, B.A., B.Sc., Senior Demonstrator of Biology, Sydney University, for the specimens of *Diplosolenia*.

The most important morphological and physiological results embodied in the following are:—(1) the discovery of a new Planocerid (named *Tripylocelis*) with three reproductive apertures; (2) the discovery of a *Cryptocelis*-like form with a genito-intestinal canal; (3) the evidence of a peculiar mode of copulation by localized perforation in the new Australian genus *Echinoplana*.

The nomenclature of the parts of the female reproductive apparatus of the Polyclads is somewhat confused, and, without any intention of dogmatizing as to homologies, it is necessary that I should state here the terms used in the following descriptions, and the sense in which they are employed. The term *ovaries* needs no comment. The *oviducts* are the ducts by which the ova reach the uteri. The *uteri* are the two elongated chambers in which the fully-developed ova collect, and in which they undergo maturation and may become fertilized. The ducts by which the ova pass out from the uteri are the *uterine ducts*; very commonly the right and left uterine ducts unite to form a *median uterine duct*. The remainder of the apparatus consists of a median passage to the whole of which I apply the term *vagina*. The part of this into which the female aperture directly leads is the *antrum femininum*. This, or a part of it, may have its walls thickened to form a *bursa copulatrix*. The part following on this is the *ootype*; this is the region into which the ducts of the shell-glands open. The ootype usually runs upwards and forwards, or directly upwards, and bends sharply back to pass into the *dorsal limb of the vagina*, the shell-gland ducts being frequently continued on this for some distance, and even on the terminal portions of the uterine ducts. Into the dorsal limb of the vagina open the uterine ducts, or median duct, as the case may be. Beyond this point the vagina may be prolonged backwards. Sometimes it terminates in a median sac, the *receptaculum seminis*; rarely there are two receptacula, right and left. In a few cases the vagina terminates behind by opening on the ventral surface of the body by a *posterior female aperture*.

TRIPYLOCELIS TYPICA, n. g., n. sp. (Plate 35.)

In the living condition this Polyclad is about 1.5 to 2 cm. in length, and in breadth about 0.75 to 1 cm.—the breadth not being more than half the length. The brain, tentacles, and eyes are in the first fifth. The mouth is in front of the middle. The male aperture is in the last third. The space between the male and female apertures is about one-half of that between the latter and the posterior margin.

The tentacles are in the form of elongated cones; they are not retractile into depressions at their bases. The arrangement of the eyes (Pl. 35. fig. 2) is fairly constant. Each tentacular group comprises some twelve to twenty. Two or three small eyes are usually to be detected in the tentacles above the level of the others. Of the remainder there are rarely any situated directly over the brain; but they all, or nearly all, lie in

front of or behind it, those in front being the more numerous (about 50), arranged in two parallel groups with a small space between them.

The colouring varies somewhat, but is never very pronounced. Some specimens are almost colourless, but for the light green ramifications of the intestinal caeca; but in most there is a faint diffused brown tint due to the presence of minute dots of brown pigment, which are most numerous in the region behind the pharynx. The ventral surface is usually of a light brown colour except in the more central parts, where the pharynx and principal parts of the genital apparatus appear white. One of the most striking features in the aspect of the living animal is the conspicuousness of the intestine and its main branches owing to their presenting the appearance of narrow, dark greenish lines on the dorsal aspect of the animal.

The mouth leads into the pharynx by a funnel-like passage. The pharynx has about eight to ten pairs of lateral folds and the intestine gives off about the same number of main diverticula. Pharynx and intestine are almost conterminous.

The two vasa deferentia (Pl. 35. fig. 1) join at about the point of union of the anterior and middle thirds of the penis. The median duct thus formed runs forwards with an almost straight course for some distance; it is slightly dilated, and its wall is somewhat thickened, so that it may be regarded as forming a median vesicula seminalis. Further forwards it becomes narrower, and is thrown into a number of coils, in the ordinary, retracted condition of the penis. Eventually, when it reaches a point a little distance in front of the anterior end of the penis, it bends sharply round, and runs almost straight back through the axis of the granule-gland papilla, where the ducts of the granule-glands open into it (granule-gland reservoir).

The penis (figs. 1 & 3) is an elongated muscular cylinder, without spines or other special chitinous developments, straight in a well-extended specimen, but more or less bent in a specimen contracted in the direction of the long axis. In front it is quite circular in cross-section; further back it is more or less compressed. Its walls consist of outer longitudinal and inner circular layers of muscular fibres of approximately equal thickness, and of a layer of columnar epithelium bounding the lumen. Surrounding it is a thick mass of retiform parenchyma.

Projecting backwards into the lumen of the penis from its anterior end is the conical papilla (granule-gland papilla) perforated by the terminal part of the ejaculatory duct, having the ducts of the granule-glands opening into it. This papilla is formed of an involution of the muscular wall of the penis filled with the retiform tissue that surrounds it.

The chief (anterior) female aperture leads into an ootype (fig. 1) of long-oval form with greatly plicated walls. At its anterior end this bends back and passes into the dorsal limb of the vagina. The latter runs backwards near the dorsal surface of the body, and receives from below the unpaired ducts formed by the union of the right and left uterine ducts. Instead of terminating blindly or expanding into a receptaculum seminis, as in most other Polyclads, the vagina then bends downwards and opens on the ventral surface some little distance behind the main female aperture (Pl. 35. figs. 1, 5, & 6). This posterior continuation of the oviduct has a thick muscular wall; its epithelium is

raised up into a number of longitudinal ridges. Behind the point where the median uterine duct leaves it below a process of epithelium projects into the lumen; this may, perhaps, act as a valve for preventing the passage of the eggs backwards to the posterior female aperture.

The uteri are wide tubes containing, in the sexually active animal, numbers of ripe eggs, together with quantities of spermatozoa. The eggs are all at the same stage. In each is the usual centrally-placed spindle with four chromosomes.

This appears to be the fourth Polyclad genus in which a second female aperture has been discovered. But in other respects the four forms have very little in common. Lang's genus *Trigonoporus**, of which two American species—*T. folium* and *T. dendriticus*†—have been described by Verrill, has no tentacles, has numerous scattered cephalic eyes, and has a separate prostate with independent duct. Of the affinities of *Bergendalia*, Laidlaw, little is known, but in that genus the second aperture leads into the antrum femininum. *Laidlawia*, Herzig, has the aperture in question on the dorsal instead of the ventral side, and there is a well-developed receptaculum seminis. In *Polyporus*, Plehn, there is a close correspondence in the relations of this aperture with what we find in *Tripylocelis*. The single specimen of *Polyporus* found was not sexually mature, so that little was ascertainable regarding the reproductive apparatus; but there are pores all round leading into the intestinal branches, and there are no eyes.

If we leave the occurrence of the third reproductive aperture out of account the closest relationships of *Tripylocelis* are with the Planoceridæ. The members of Lang's group B of the species which he referred to the genus *Planocera* are, apparently, the nearest relatives. But the relationship is by no means very close, the differences in the male reproductive apparatus being very considerable.

Tripylocelis typica is perhaps the commonest Polyclad that occurs between tidal limits in Port Jackson. It is chiefly to be found in tidal pools among the thalli of *Ulva* and can usually be obtained in considerable numbers by pulling the Algæ to pieces and shaking them out in a vessel of water.

It is an extremely active form, swims vigorously, and on the surface of a solid object is able to progress rapidly by advancing lateral lobes, which are able to adhere to the surface, and are pushed forward from right and left sides alternately—the result being a kind of “walking,” as distinguished from “creeping” or “looping” locomotion.

The following is a definition of the genus *Tripylocelis*:—

Planoceridæ with fairly broad, oval, leaf-shaped body, with conical non-retractile tentacles. Brain-tentacles and eyes relatively further forward than in *Planocera*—in the first fifth or thereabouts. Two groups of tentacular eyes, and smaller eyes just in front of and behind the brain; no marginal eyes. Three genital apertures. Male aperture a considerable distance behind the pharyngeal sac. Principal female aperture not far behind the male: second female aperture on the ventral surface not far behind the first. Penis muscular, without sheath and without chitinous parts. A small median

* 17, p. 502.

† As pointed out by Laidlaw (14), the generic position of these is doubtful.

vesicula. Prostate-gland reservoir situated in the course of the ejaculatory duct. No bursa copulatrix. Vagina continued backwards to open on the ventral surface by the second female aperture.

The discovery by Herzig (9) of a Polyclad (named by him *Laidlawia*) which has a second female aperture situated not on the ventral but on the dorsal side, may be regarded as of some importance, as it may help us towards a determination of the homologies of the parts. A correspondence with the Trematode "canal of Laurer" and with the Cestode "vagina" and receptaculum seminis obviously suggests itself. Bergendal has recently described a Triclad with a second female aperture, and I have shown that such an opening (dorsally situated) occurs in the *Acæla*, so that an arrangement of this kind would seem to be very widespread in the Platyhelminthes. In all such cases the object of the arrangement is, most probably, to enable fresh supplies of spermatozoa to be taken in without any interference with the passage outwards of the fertilized ova. But it may be that in some cases the canal has lost its function, though still persisting, or may have become adapted to other uses.

DIPLOSOLENIA JOHNSTONI, n. g., n. sp. (Plate 36. figs. 1 & 2.)

This is a very large Polyclad, one preserved specimen measuring 6 cm. in length and 3 cm. in breadth. The mouth is somewhat in front of the middle—in the third centimetre. The reproductive apertures are situated close together (or combined in one) at the junction of the fourth and fifth centimetres. The tentacles are rather long and of conical shape: they are placed a little behind the junction of the first and second centimetres. The eyes are in two very compact groups, each comprising about 30, at the bases of the tentacles, and two longitudinally extended less compact groups between them, each of these also comprising about 30. The dorsal surface is almost black, with a narrow light margin.

The pharynx has about twelve pairs of lateral folds.

In two of the specimens, which have the penis exerted and a considerable length of the stylet projecting, the male and female apertures are separated by a distinct interval. On the other hand, in the specimens with the penis retracted the parts of the body-wall in the neighbourhood of the apertures become involuted to form a kind of common antrum having but a single external opening.

The ventral part of the vagina is a long narrow passage the lumen of which has a triangular cross-section in the greater part of its extent. Its muscular investment is thin, and it has an epithelium of long narrow cells. In the posterior part of its extent, in the specimen sectioned, the lumen is filled entirely with the shell-gland secretion which completely saturates the epithelium. Further forwards numerous spermatozoa are also present; but in the anterior part of the passage these disappear and the lumen is filled with the shell-gland secretion.

The vagina becomes bent back sharply on itself, the dorsal limb running back to a point just over the base of the (exserted) stylet, where it bifurcates to form the ducts of the two lateral receptacula seminis which run almost transversely outwards (fig. 2). This dorsal part of the vagina is a narrow cylindrical tube, with an epithelium of

comparatively short and broad cells and a thick muscular wall. Not far behind its origin it receives on the ventral side a median duct formed by the union of the right and left uterine ducts. In the lumen of these there are many spermatozoa.

The two receptacula seminis (fig. 1) are of great size, and when distended with sperms become very conspicuous structures. In a mounted specimen 30 mm. in length one of them is 4 mm. long. In the distended condition the stretched wall is very thin and its structure is difficult of determination. But in the collapsed state the wall appears relatively thick, and is found to have essentially the same structure as that of the unpaired receptacle of *Leptoplana australis*. It has a thick muscular investment, and an epithelium of large cells, each of which has a prominent rounded process at its inner end, having the appearance of an exuding droplet of secretion.

Each lateral vas deferens is dilated to form an extensive elongated seminal vesicle, but this does not appear specially thickened—at least in the distended condition it is in in the specimen sectioned. From the two lateral vesiculæ a pair of narrow ducts run inwards and at the base of the penis unite to form the ejaculatory duct.

The penis is enclosed within an elongated sheath. The penis itself consists of a very thin-walled chitinous tube enclosed in a thick layer of circularly-arranged fibres. The tube or stylet is 5 or 6 mm. in length, tapering to a sharp point at its free end, slightly dilated and funnel-shaped proximally. The layer of circular fibres is continued, somewhat reduced in thickness, over the portion of the penis which is protruded in the specimen sectioned: its function must be to bring about peristaltic contractions of the thin-walled chitinous tube and so of enclosed ducts. Within the tube is a layer of longitudinal muscular fibres: internally the lumen is occupied by a core of parenchyma in which run ejaculatory and prostatic ducts, the former towards the centre, the latter towards the dorsal side.

The prostate is a median structure which extends forwards as far as a point a little in front of the point of union of the oviducts. Its duct, at first narrow, widens, then becomes narrower and sinuous, then expands into a channel devoid of epithelial lining, which acts as a reservoir. This runs back for some distance parallel with the ventral limb of the vagina and on its ventral side. This sinus or reservoir passes behind into a narrow cylindrical duct with well-defined walls, which runs to the base of the penis and traverses that organ throughout its length, running within the hollow stylet, parallel with and dorsal to the ejaculatory duct, but remaining separate from the latter.

The following are the chief features which distinguish this genus:—There is a pair of nuchal tentacles with groups of tentacular eyes: no marginal eyes. Reproductive apertures closely approximated. Vagina long and narrow throughout, without bursa copulatrix. A pair of large receptacula seminis. Duct of prostate separate from ejaculatory duct throughout its entire length. A pair of vesiculæ seminales in the form of large dilatations of the right and left vasa deferentia. An elongated penial stylet.

So far as I am aware, only two Polyclads are known to possess paired receptacula, viz. *Discocelis tigrina*, Lang ("horseshoe-shaped gland"), and *Leptoplana subviridis*, Plehn (Laidlaw). This character, together with the complete separation of prostatic

and ejaculatory ducts, would suffice to distinguish *Diplosolenia* from all other *Planoceridæ*.

Idioplana, Woodworth (26), resembles *Diplosolenia* in the exceptional feature of the complete separation of prostatic and ejaculatory ducts; but it has marginal eyes, has, apparently, no penial stylet, and has a median vesicula.

Planocera has the ejaculatory and prostatic ducts uniting to form a common duct; its penis is lined with chitinous spines, and the vagina gives rise to a bursa copulatrix: the receptaculum seminis is unpaired.

Stylochoplana, again, has the prostate intercalated in the course of the ejaculatory duct, has a median vesicula, a single receptaculum, and possesses a bursa copulatrix; while *Stylochus* has marginal eyes, the reproductive apertures situated close to the posterior end, has the prostate separate, but with its duct uniting with the ejaculatory duct, a single vesicula, and no receptaculum.

Paraplanocera, though it has paired vesiculæ, resembles *Planocera* in the character of the penis and in the unpaired receptaculum; it also has a muscular diverticulum of the vagina of the nature of a bursa copulatrix.

LEPTOPLANA AUSTRALIS, Laidlaw. (Plate 36. figs. 3-5.)

This is, so far as my data go, the most widely distributed, as well as one of the largest, of the Australasian Polyclads. It is one of the commonest of the Port Jackson species, and was obtained also at Jervis Bay, on the southern part of the New South Wales coast. It is by far the commonest species on the coast of Tasmania, and it extends also to New Zealand.

Leptoplana australis may be identical with *Dioncus badius* of Stimpson (23), or with *D. oblongus* of the same author, both of which were found in Port Jackson, and it may also be the same as *Polycelis australis* of Schmarda (20), which was found on the New South Wales coast. But the characters given by the authors named are not of a nature to justify even generic determination. Thus Stimpson's definition of the genus *Dioncus* runs:—"Corpus planum, dilatatum. Caput corpore continuum. Os subcentrale. Ocelli numerosi, in umbones duos claros subdistantes dispositi. Maricolæ." The description which he gives of *D. badius* is as follows:—"Body half as broad as long, of a reddish-brown colour above, with a flake-white dust intermixed. Anteriorly there are two prominent circular knobs, which contain, scattered over the entire surface, the very numerous and minute eyes. Below the body is of a pale sepia colour, except the white digestive organs, and the mouth is placed behind the centre. Length 1.5; breadth 0.75 inch." *D. oblongus* is stated to differ from *D. badius* mainly in having a clear space around the eyes on each knob.

Schmarda's *Polycelis australis* may be this species, but the characters given and the figure would not warrant an identification. The following is the description:—

"Der Körper ist platt, länglich, vorn abgerundet und rückwärts kaum weniger verschmächtigt. Die Farbe des Rückens ist dunkelbraun mit unterbrochener blasser Mittellinie. Die Bauchseite ist röthlichbraun. Länge 30 mm., Breite 13 mm. Die Augen stehen in zwei Gruppen am ende des ersten Sechstels, sie sind einander sehr



genähert und besitzen einen weissen Hof der sich nach vorn und auswärts in einen kurzen Streifen fortsetzt welcher mit dem der anderen Seite divergirt. Die Mundöffnung ist zwar auch hier wie bei der vorigen Species central; die Geschlechtsöffnungen sind jedoch dem Centrum sehr viel näher gerückt und liegen im zweiten Drittel des Körpers. Das Parenchym ist dicker und stärker, als es bei andern *Polycelis* der Fall ist."

Schmarda found his specimens on the coast of the Illawarra district, New South Wales, and in Auckland Harbour, New Zealand.

Leptoplana australis reaches a large size; the largest specimens I have seen alive were 3 inches long. It is subject to great variation in colour. The larger specimens are very dark—some almost black, with a lighter line round the edge. Smaller specimens are much lighter—some with only a light general shade of brown, through which run the branching mottled bands of olive-green that represent the ramifications of the intestine.

Quite conspicuous features of the upper surface are the two clear colourless rounded knobs on which the "tentacular" groups of eyes are borne. These are situated at about the junction of the first fourth of the length of the body with the second. They are of oval or elliptical outline, with the long axis directed forwards and outwards. Each of them comprises about forty eyes. Smaller eyes are arranged in two groups separated by a definite mesial space; they are more numerous than the tentacular eyes, and are almost entirely in front of them.

The ventral surface is grey, the reproductive apparatus (or rather certain portions of it) forming a more or less pronounced white pattern on it. The mouth is always a little in front of the middle; the male reproductive aperture is about halfway between the mouth and the posterior border, and the female aperture a short distance behind the male.

The pharynx gives off about fifteen to seventeen pairs of diverticula, and the number of main intestinal branches is about the same.

The vesicula seminalis is at the junction of the lateral vasa deferentia and the ejaculatory duct. From this the ejaculatory duct runs forwards to the prostate reservoir. The latter is a thick-walled, long, oval body, the appearance of which in the entire specimen differs a good deal according to the way in which it lies. In an end view it presents a remarkable wheel-like appearance which is not recognizable in a lateral view. In sections this wheel-like effect is found to be due to the presence of a ring of longitudinal recesses which open into the lumen at the end nearest the base of the penis after traversing the wall of the organ throughout its length.

From the end of the prostate reservoir opposite that at which it enters the ejaculatory duct runs forwards to the base of the penis. The latter is of great length. It encloses a narrow, twice-curved, hollow, chitinous stylet, dilated into a funnel proximally, and distally tapering to a fine point. In the two largest specimens it is sharply bent near the apex.

The female aperture leads into the antrum femininum, which runs upwards and backwards as a wide passage to open into the ootype or shell-gland reservoir. The latter is remarkably developed, much wider than the antrum, with a minutely folded

inner surface: it is produced backwards some distance behind the female aperture. Its wall is very thick and muscular, as is that of the antrum, which may be regarded as assuming the character of a *bursa copulatrix*. In front it narrows somewhat; at its anterior end it bends sharply back as it passes into the narrow receptacular duct or vagina. The right and left uterine ducts run almost transversely inwards from the corresponding uteri, and unite to form a short unpaired duct which enters the vagina just over the male aperture. Behind this junction the backward prolongation of the vagina runs as a narrow tube on the left side of the ootype to open immediately behind the posterior extremity of the latter into a very large sac (receptaculum seminis). The anterior part of the duct is slightly constricted at regular intervals—the constrictions producing a beaded appearance. In some specimens this beaded appearance extends throughout its length. The receptaculum itself is a sac with folded walls lined by a large-celled columnar epithelium. Sometimes it appears collapsed and empty or nearly so: more frequently it contains a great mass of spermatozoa together with granules or droplets of a secretion evidently derived from the columnar cells. In some specimens sperms occur throughout the length of the duct.

The entire reproductive system of *L. australis* has a very close resemblance to that of *L. fallax*, Diesing, as described by Quatrefages (21). The chief differences appear to be that in the latter species the penial stylet is coiled on itself, the vagina is sinuous, and the accessory sac is unsymmetrically developed*. *L. alcinoi* and *L. vitrea*, as figured and described by Lang (17), resemble *L. australis* in the peculiar internal structure of the prostate reservoir, but differ from it in other respects—notably in the relatively slight development of the receptaculum seminis.

There is a considerable difference between individuals of *L. australis*, when fixed, as regards the length of the posterior prolongation of the vagina (duct of the receptaculum seminis) and the size of the receptaculum itself. But it seems most probable that this is due to differences in the condition of the parts and the degree of contraction which they have undergone.

L. australis occurs at a comparatively high level between tide-marks, and is to be found by turning over stones.

In sections of one of the Port Jackson specimens I was interested to find in the pharynx unmistakable fragments of an Enteropneust. This was the more remarkable since no Enteropneust has ever been recorded as occurring in Port Jackson.

In the intestine of a Tasmanian specimen was the lingual ribbon of a Gastropod.

What may be a dwarf variety of this species is common in Lyttleton Harbour, N.Z. Preserved specimens are under 1 cm. in length. In the living condition it is transparent, with some brown pigment on the dorsal surface, and is of very delicate consistency, so that it is very difficult to obtain entire specimens. The eyes are much fewer in number than in mature specimens of the ordinary *L. australis*, but in this respect there is a correspondence with immature specimens of that form. In

* In Quatrefages's figure the lateral uterine ducts are represented as opening separately, and, moreover, as opening, not into the vagina, but into the ootype, which is obviously an error.

small specimens of the latter, however, the reproductive apparatus is undeveloped, whereas the small forms now under consideration are sexually mature. In the reproductive system the main differences may be reduced to differences in proportions: the penial stylet, granule reservoir, vesicula seminalis, antrum femininum, and receptaculum seminis have all the same general character as in *L. australis*. Perhaps the most important difference is in the great relative width of the dorsal limb of the vagina (or duct of the seminal receptacle).

From Lyttleton Harbour, from Waiheke, Auckland Harbour, and from Kaikoura, I have specimens of *Leptoplana* differing little from the Australian specimens which I have referred to *L. australis*. The tentacular groups of eyes are denser owing to the larger size of the individual eyes, but in other respects there is a close correspondence. In one of the specimens (from Kaikoura) the penial stylet, instead of tapering to a fine point, ends in a truncated extremity provided with a circlet of hook-like processes; and in another (from Auckland Harbour) it is nearly straight and relatively short. But such differences are probably merely individual variations.

Of the identity of this common Australian species with Laidlaw's *Leptoplana australis* (11) I have no great doubt, though the description given is not very full. The arrangement of the eyes agrees fairly well; and the reference to the "long nearly straight stylet" of the penis, to the prostate divided into some six or seven longitudinal chambers, as well as the allusion to *L. alcinoi* as an allied species, all seem to point to this determination. The colour given, dark chocolate-brown, is unusual.

The British Museum specimens described by Laidlaw were collected in Port Phillip by Dr. R. Lendenfeld.

It is a somewhat remarkable fact that Plehn (18) records the occurrence in French Pass (northern New Zealand), and also in the Chatham Islands, of a species of *Leptoplana* which corresponds in many respects with *L. australis*, but which has only one genital aperture, like that author's *L. californica* (19), and is not regarded by her as distinct from the latter species. In the hope of finding something corresponding to this, I have looked over my Australian, Tasmanian, and New Zealand specimens set down as *L. australis*; but they all have the two separate apertures, and I have as yet seen nothing corresponding with Plehn's species.

MICROCELIS SCHAUINSLANDI, Plehn (18).

A solitary specimen which I obtained at St. Helens, on the east coast of Tasmania, resembles Plehn's (18) species (also from Tasmania) in such points as are capable of being made out. It has the same general very characteristic arrangement of the eyes and posterior position of the pharynx, but the specimen was damaged and little can be made of the reproductive apparatus. It was observed to be, like *Cryptocelis*, an exceedingly sluggish form of unusually firm consistency. Its colour on the upper surface was brown, very distinctly mottled.

Resembling the above in the posterior position of the pharynx, the marginal eyes, the two separate but closely approximated reproductive apertures, and the presence of a median receptaculum seminis, is a New Zealand Polyclad which I have found under

stones in Lyttleton Harbour. But in this the numerous minute eyes over the brain-region are (imperfectly) divided into two by a narrow space, and though they extend forwards nearly to the anterior margin, it is only as a relatively narrow band. Moreover, the marginal eyes only extend over less than a half of the margin. The female aperture leads vertically upwards to the ootype, which runs forwards a short distance and narrows as it bends backwards. Into the dorsal limb on the ventral aspect the uterine ducts open at a point nearly directly over the female aperture. Posteriorly the vagina is produced and terminates in a large and complicated receptaculum seminis. The male apparatus was not distinguishable in the entire mounted specimen, and sections are not available at present.

ECHINOPLANA CELERRIMA, n. g., n. sp. (Plate 36. figs. 6 & 7; Plate 37. figs. 1-3.)

This is a rather small Polyclad, averaging about 1.5 cm. in length and 6 mm. in breadth at the broadest part (towards the anterior end). The colour varies somewhat and is never very pronounced. Usually the dorsal surface has a reddish-brown tint. There are no tentacles. The eyes (Plate 37. fig. 1) are arranged in two somewhat elongated groups, one on either side of the brain, each including about thirty. The brain and the eyes are in the first fifth of the length of the body. The mouth is distinctly behind the middle. The male aperture is about halfway between that and the posterior end—at about the junction of the third fourth with the last. The female aperture is a considerable distance behind the male, nearer the posterior end than to the latter. In front of it is a peculiar, transversely corrugated area of the integument. In front of the male aperture in the living specimen the penis is usually plainly recognizable as a narrow elongated brown object.

The pharynx has twelve to fifteen pairs of lateral folds, and the number of pairs of intestinal cæca is about the same. The main intestine extends some distance in front of the anterior extremity of the pharynx.

The lateral vasa deferentia (Pl. 37. fig. 2) open into an elongated median vesicula seminalis, which terminates in front in a very fine duct (duct of vesicula). This traverses from before backwards a conical papilla projecting backwards into the lumen of the granule reservoir from its anterior extremity and opens into the latter.

The granule reservoir is of great length: it has the form of a tube with muscular walls, wider at its proximal or anterior end than at its distal or posterior, with three sharp bends in its course. In its posterior part it presents about half a dozen slight regular constrictions. Its muscular layers are of considerable thickness and its epithelium is thrown into a series of longitudinal folds.

The ejaculatory duct, narrow and coiled where it leaves the granule reservoir, widens posteriorly as it traverses the penis. The anterior narrow part has a very definite cylindrical epithelium surrounded by a condensed layer of the muscular fibres of the penis; many granule-gland ducts traverse the muscular layers and perforate the cells of the epithelium to open into the lumen. Posteriorly the duct soon loses its epithelium and becomes beset with the horny teeth described below.

The penis consists of an enormously thick mass of muscular fibres occupying the greater part of the vertical diameter of the body and about a tenth part of the

transverse. In the living animal, and to a still more marked degree in preserved specimens, its position is indicated by a rounded elevation on the dorsal surface. There is no enclosing sheath or sac, the more peripheral muscular fibres passing into the muscular layers of the body-wall or into the layers of parenchyma-muscle that surround the various neighbouring organs (intestinal branches, vasa deferentia, uteri). The muscular fibres are some longitudinal in direction, some circular, some radial, but they are not arranged in any definite layers or zones. At the external aperture the muscular mass is quite continuous with the muscular layers of the body-wall. The entire lumen of the penis (distal part of ejaculatory duct) is lined with horny spines or teeth. These (Pl. 36. figs. 6 & 7) are largest in the neighbourhood of the external opening, gradually decreasing in size anteriorly. The larger spines are slightly curved, pointed, and have a shape comparable to that of the claw of a bird. In the smaller spines the base is relatively more expanded than in the larger and the distal part more abruptly curved. In the neighbourhood of the opening a process from the underlying tissue projects into the cavity of the spine: further forwards this is not recognizable.

The female aperture leads into a narrow passage surrounded by a thick mass of parenchyma with numerous muscular fibres. Through this mass run numerous shell-gland ducts, and these perforate the epithelium of the passage in all parts except the part immediately adjacent to the aperture, so that an antrum as distinct from an ootype or shell-gland reservoir can hardly be said to exist. This part of the ootype gives off laterally a number of very short and small diverticula, which have a fairly regular arrangement. When it approaches near the dorsal surface of the body it expands in the interior of a rounded prominence which projects dorsally in this region a little in front of the female aperture. As it passes forwards it becomes narrower and gives off short irregular diverticula. When it reaches the muscular mass of the penis projecting behind the male aperture it passes to the left, and is continued forwards as a narrow diverticulum (Pl. 37. fig. 3) for some distance beyond the male reproductive aperture. Not far from its anterior extremity it receives on its dorsal side the common uterine duct. This unsymmetrical anterior prolongation of the vagina has not a specially developed muscular layer, so that it cannot be looked upon as a bursa copulatrix. On the other hand, the ducts of the shell-glands open into it in much greater abundance than into the central part of the ootype itself, and it is best looked upon as a prolongation of the latter. The reflected portion, or dorsal limb of the vagina, produced backwards in most Polyclads beyond the point at which it receives the uterine duct, and frequently leading to a receptaculum seminis, is here entirely absent.

Clear evidence of the mode of action of the copulatory parts of the reproductive apparatus is afforded by two of my series of sections. In one, a transverse series, there is traceable a long narrow object running obliquely, on one side only, through the thick mass of tissue referred to above as surrounding the vagina, the upper end lying near the lumen of the latter. Traced downwards this body is found to run to the ventral surface, where it terminates by perforating the epidermis of the corrugated area in front of the female aperture, projecting slightly on the exterior. In front, between this body and the lumen of the vagina, the tissue is unusually open and spongy, and in the interstices

are numerous spermatozoa, entirely absent in other parts. Moreover, in the adjoining part of the lumen, and in that part alone, there are numerous spermatozoa. The long narrow body is found, when examined under a high power, to consist of a strand of globules of prostate secretion, or something indistinguishable from it in appearance, mixed with spermatozoa. Its entire length is roughly about 0.6 mm.

There can be little doubt that we have here to do with a wound inflicted by the formidably armed penis. The copulating individuals were applied together by their ventral surfaces, the corrugated areas acting like the suckers of the *Cotylea*, as organs of adhesion, when the penis of the one was driven in through the mass of tissue surrounding the lumen of the vagina, nearly penetrating as far as the latter. The spermatozoa and prostate secretion were then discharged and the penis withdrawn, a plug of prostate secretion closing up the wound and thus preventing the escape of the spermatozoa. The passage of the spermatozoa to the interior of the lumen is facilitated by the fact that in the middle region of the vagina there are very few shell-gland ducts passing inwards and perforating the epithelium.

In another specimen, cut into a series of longitudinal vertical sections, the same thing appears. Here there is a large mass of spermatozoa in the substance of the wall of the vagina, and this is connected with the ventral surface in front of the corrugated area by a narrow cleft filled with prostate secretion mixed with spermatozoa, the plug of this material projecting freely on the surface. But in this case the perforation has actually passed through the epithelium of the vagina, and in this position a portion of the mass of spermatozoa projects freely into the lumen.

Such a mode of copulation as this—by perforation of the body-wall in a definite locality—has not been proved to occur in other Polyclads, and is certainly exceptional in that class. Perhaps it may be found to occur in the case of other forms with chitinous penial parts and a thick-walled bursa copulatrix. I have found a similar type of copulation to characterize *Prorhynchus* (7) and *Stratiodrillus* (8).

The ova in the uterus are all in the stage with a centrally placed spindle and, usually, a spermatozoon (rarely more than one) in various phases of transition in the cytoplasm.

Echinoplana is apparently more nearly allied to *Leptoplana* than to any described genus. But it differs in several very important points from the members of that genus. The entire structure of the male copulatory apparatus is widely different from what we find in *Leptoplana* or in any related form. The same holds good of the corresponding parts of the female reproductive apparatus. The complete absence of a reflected or dorsal limb of the vagina is a very special feature, and the massive vagina with its unsymmetrically placed anterior diverticulum is as characteristic, in its way, as the penis with its array of teeth.

Paraplanocera, Laidlaw (15), has a similar diverticulum of the vagina, or, more strictly, has a bursa which is in the form of a muscular diverticulum of the vagina; but it has no other points of resemblance to the form now under consideration, though the penis has small chitinous spines. *Paraplanocera* has tentacles, an independent prostate, paired vesiculæ, and a receptaculum seminis.

Echinoplana may be defined as a Leptoplanid without tentacles or marginal eyes. Two

elongated groups of tentacular eyes. Mouth behind the middle of the ventral surface. Separate male and female reproductive apertures. A median vesicula, between which and the penis is an elongated prostate reservoir. A very large penis without sheath, lined internally with numerous chitinous teeth. Ventral limb of vagina (antrum and ootype) with very thick walls. No dorsal limb present. Single unsymmetrical diverticulum projecting forwards from vagina. No receptaculum seminis.

Echinoplana celerrima is one of the commonest of the Polyclads of Port Jackson. It is characterized by great alertness and activity. In addition to the ordinary swimming and creeping movements, it progresses like *Tripylocelis*, but much more actively, by a kind of "walking." Lateral lobes of the extremely mobile body assume the function of lateral appendages. It is interesting to note that a precisely similar mode of locomotion was observed by Lang in *Planocera Graffi*, of which he writes—"Wenn *Planocera Graffi* abwechselnd rechts und links Partien des vorderen Körperandes vorstreckt und dann den Körper nachzieht so sieht es beinahe aus wie wenn sie sich derselben als Füße bediente" (17, p. 635).

ENTEROGONIA PIGRANS, n. g., n. sp. (Plate 37. fig. 4.)

This Polyclad is of oval or elliptical outline, 1 cm. in length in the preserved condition and 5 or 6 mm. in breadth. It is a thickish form, of comparatively firm consistency, remarkable for its extremely sluggish movements. The general colour is greenish or dark grey on the dorsal side; when the living animal is examined with a simple lens, this becomes resolved into innumerable spots of dark olive, very minute towards the margin, larger towards the middle. The ventral surface is reddish grey, except where the pharynx and main testicular ducts show white. In two of the specimens there is a dark spot towards the posterior end—the appearance being produced by the intestinal branches here being of a peculiarly dark colour. This does not appear to be constant; but when it does occur it probably is in some way associated with the occurrence of the genito-intestinal passage referred to below.

The mouth is considerably behind the middle of the body, and, in the fixed specimen, the reproductive apertures are situated very close together, and are nearer to the posterior edge than to the mouth. There are numerous scattered minute eyes over the brain-region, and between the latter and the anterior margin, as well as marginal eyes running all round the periphery. The eyes over the brain-region are quite irregularly distributed, and not in any way bilaterally grouped, a feature which would in itself distinguish the present species from Lang's *Cestoplana alba* and *C. compacta* (17, p. 472).

The male aperture leads into a nearly vertical antrum, the epithelium of which is thickened and raised into ridges. Here are situated the unicellular glands corresponding to the prostate glands. Into the antrum projects the penis in the form of a short muscular papilla entirely devoid of chitinous parts. The ejaculatory duct, formed by the union of the lateral vasa deferentia, is a sinuous tube which presents no appearance of becoming thickened or dilated to form a *vesicula seminalis*.

The *antrum femininum* is a vertical chamber with a fairly thick muscular wall. The ootype curves forwards and upwards from the antrum and bends sharply downwards and

backwards to form the dorsal limb of the vagina. The ootype is characterized by the development of a peculiar spiral ridge of its epithelium. The dorsal limb of the vagina, after receiving on its ventral side the common duct formed by the union of the lateral uterine ducts, runs backwards as a narrowing tube, which opens behind into the median posterior branch of the intestine—a *genito-intestinal passage* being thus established.

The absence of distinct prostate glands, other than the glandular cells in the wall of the antrum, and other features connect this form with *Discocelis*. But in that genus there is a pair of lateral receptacula, and there is a common genital atrium. In Laidlaw's recently-created genus *Thalamoplana* (16) there are distinct male and female apertures; but there is a concentric receptaculum seminis, and the prostatic cells in the epithelium of the antrum are raised on muscular ridges. *Microcelis*, Plehn (18), is also allied, but has a large receptaculum. The occurrence of the genito-intestinal canal is of such importance that it seems desirable to distinguish the Australian form from the members of these allied genera.

The discovery of the genito-intestinal canal helps to connect more definitely the receptaculum seminis of Polyclads with parts that occur in other Platodes. The correspondence of the canal in question with the similarly-named canal in the *Heterocotylea* cannot well be doubted; while the homology between the latter and the Laurer's canal of the *Malacocotylea*, though it may be open to question, seems to have the balance of evidence in its favour*. If we accept this conclusion, we must regard as representing Laurer's canal in the Polyclads not only the genito-intestinal canal of *Enterogonia*, but the receptaculum seminis of the *Acotylea* in general (unpaired in most, paired in *Discocelis tigrina*, *Leptoplana subviridis*, and *Diplosolenia*, with an opening on the dorsal surface in *Laidlawia*), and the posterior female passage of *Trigonoporus* and *Tripylocelis*.

CESTOPLANA AUSTRALIS, n. sp. (Plate 37. fig. 5.)

I have only obtained a single specimen of a species of *Cestoplana*, which, superficially at least, is very like the European species *C. rubrocincta*, Grube. It is a long and narrow Polyclad, which, as Lang remarks, might readily be taken for a Nemertean; its length was 2 cm., its breadth 3 mm. The upper surface is of a light neutral tint in front, becoming reddish orange further back. Close to each lateral border runs a band of the most vivid vermilion, and a median band of the same runs along the whole length. In front the lateral bands bend inwards and unite with one another some little distance from the anterior extremity. Posteriorly the two lateral bands unite just in front of the slight notch or depression at the posterior end, but the median band terminates a short distance in front of this. The narrow space between the lateral band and the lateral border is almost colourless. There are very many very minute eyes scattered over the anterior portion, with the exception of a zone round the margin.

The only external difference which I can detect between the Australian and European species is that in the former the three longitudinal bands completely fuse, whereas in

* See Goto, 5, p. 154.

the latter they do not. The specimen was immature and the reproductive system undeveloped.

This somewhat aberrant Polyclad creeps, but never swims. As Lang remarks of the European form, the anterior portion begins to move while the posterior is still at rest.

Found between tide-limits in Port Jackson (Woollahra Point).

PSEUDOCEROS (?) CARDINALIS, n. sp. (Plate 37. fig. 6.)

The length of the preserved specimens is 1 cm., the breadth 8 mm. The colour of the upper surface in the living animal was bright scarlet.

The tentacles are very inconspicuous, being mere blunt lobes at the sides of the anterior median notch. The central group of eyes numbers about 150 altogether. It is obscurely divided into two behind by a very narrow space, but is undivided in front. The tentacular eyes are difficult to count, owing to their being very closely aggregated anteriorly; but there appear to be about 100 on each tentacle, distributed equally on the dorsal and ventral surfaces. The mouth is situated just below the brain. The male reproductive aperture is at the beginning of the second sixth of the entire length, and is only a short distance behind the mouth. The female aperture is about one-sixth of the length behind this. The sucker is situated about the middle of the length of the body; it has the form of a disk elevated above the general level of the ventral surface.

The wall of the bell-shaped pharynx is devoid of the foldings characteristic of other species of *Pseudoceros*.

The male apparatus is single. There is a conical penis, which contains a chitinous stylet; there is a pear-shaped granule reservoir, and a large long-oval vesicula seminalis thrice the length of the granule reservoir.

Two specimens were obtained together on an oar-weed brought up by the trawl in Iron Cove River, Port Jackson.

Of the two specimens obtained, one was mounted entire, the other was cut into sections. The latter was found to contain ripe ova in the uteri, but the testes were immature and contained no spermatozoa, and the vesicula seminalis contained only a granular mass. There were no spermatozoa in the uteri; but in the parenchyma, near the dorsal surface, directly over the ootype, was a large mass of mature spermatozoa which must have been received by perforation of the penis of another individual, and there was a similar mass somewhat further forwards*.

The nature of the pharynx distinguishes this from the described species of *Pseudoceros*, with which in other respects it is nearly allied. The generic position of this and also of the following species cannot be looked upon as definitely settled.

PSEUDOCEROS (?) LIMBATUS, n. sp.

The length of the preserved specimen is 1.5 cm., the breadth 0.5 cm. I am indebted to Mr. Alan McCulloch for a coloured sketch of the living animal, in which the upper surface is light red with a well-defined marginal band of purple.

* These contained spermatozoa of two distinct kinds.

The tentacles are comparatively large, subtriangular, and to judge from Mr. McCulloch's sketch, must, in the living animal, have extended well beyond the notch in which they are situated. There are about 30-40 eyes in each tentacle and about 40 on each side above. The cerebral eyes are concentrated into a single dense clump. The mouth is situated just behind the brain. Both of the reproductive apertures are situated well in advance of the middle of the body, the male at about the junction of the second and third sevenths, the female close behind it.

The sucker is somewhat in front of the middle. It is not an elevated disk as in *Pseudoceros cardinalis*, but a shallow circular pit with a radial arrangement of its muscular fibres. The pharynx is small and situated anteriorly, but is strongly plicated.

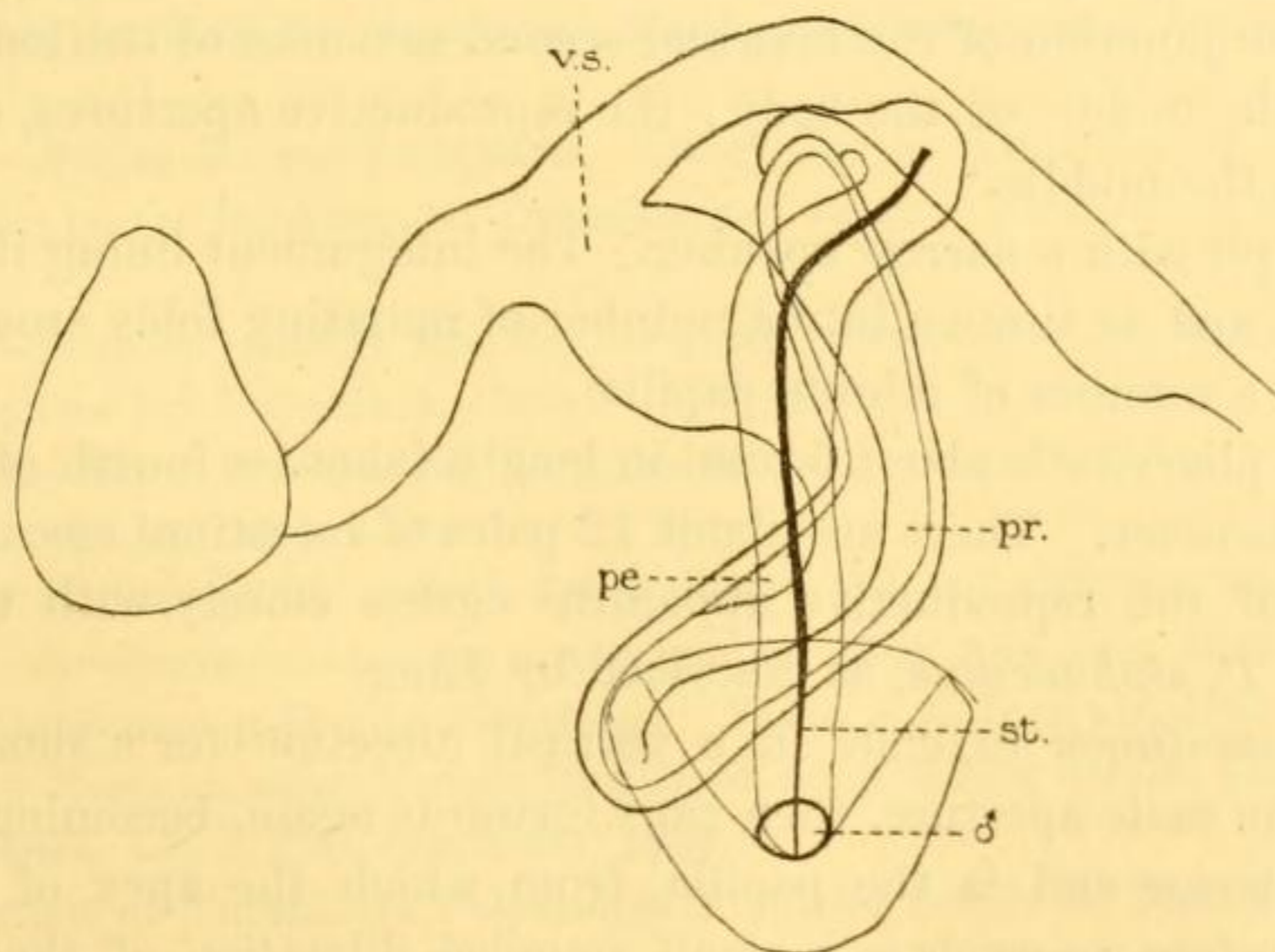
The penis, which is directed backwards, has a tubular chitinous stylet. There is a small, oval, prostate reservoir and a large prostate. The male apparatus is situated partly below, but mainly behind the pharynx. The female apparatus appears to be quite simple.

But for the character of the pharynx, this form might perhaps be included in the genus *Prosthecercæus*; but a plicated pharynx does not appear to occur in any of the *Euryleptidæ*, and, in spite of certain points of divergence from the other species, I think it best to refer it, for the present, to the genus *Pseudoceros*.

The only specimen was obtained by Mr. Chas. Hedley, F.L.S., on a reef at Masthead Island, Capricorn Group, Queensland.

PROSTHECERÆUS ANOMALUS, n. sp.

The tentacles are of moderate size in the preserved specimen and in the form of flattened cones. The cerebral eyes are arranged in two closely approximated groups over the brain—about 30 in each group. There are about 100 tentacular eyes. The



mouth, which is very small, is situated immediately behind the brain. The male aperture is just behind the pharynx; the female aperture is a little distance behind the male. The sucker is situated at about the middle of the length.

The pharynx is cylindrical, about a sixth of the entire length. The intestine is fairly wide, nearly half the length, with numerous pairs of cæca, the branches of which anastomose.

The penis (text-fig., *pe.*) contains a very slender elongated chitinous stylet (*st.*). The prostate (*pr.*) is relatively long and narrow.

The ootype is nearly vertical in position. Continuing it backwards is the wide vagina; the latter bifurcates behind into two thick tubes, which pass almost transversely outwards, each becoming divided into two. Each of these opens into a wide thin-walled sac, and there are thus four of these—the *receptacula seminis*. From the vagina, on its ventral side, is given off the median uterine duct, which soon bifurcates.

The female reproductive apparatus of this species thus appears to differ in a radical way from that of the species of the genus described or figured by Lang. The presence of the four receptacula connected by their ducts with the vagina is, in fact, so far as I am aware, a quite unique condition. In the other *Cotylea* in which they have been found to occur the "accessory glands" are connected with the oviducts (see Lang, pp. 297-300, pl. 23. figs. 1 & 3, pl. 24. fig. 1, &c.).

I have only one example of this interesting form—an old stained and mounted specimen obtained in Port Jackson.

PROSTHIOSTOMUM MACULATUM, n. sp. (Plate 37. fig. 7.)

The largest specimen is about 2 cm. in length and 7 mm. in breadth in the preserved condition. Both anterior and posterior ends are rounded. The general colour of the dorsal surface is light brown with a few large darker spots. The "cerebral" eyes are disposed in two elongated imperfectly separated groups completely united in front, each comprising about 50 in a mature specimen. There are about 100 marginal or submarginal eyes in front of these. The mouth is situated immediately behind the cerebral eyes at the junction of the first and second sevenths of the length. The sucker is a little behind the middle of the body; the reproductive apertures, a little in front of this, are nearly in the middle.

The sucker is a pit with a narrow opening. The integument lining it has its epidermis greatly thickened, and is thrown into a number of radiating folds around a longitudinal slit bordered with a number of minute papillæ.

The cylindrical pharynx is about 5 mm. in length (about a fourth of the total length) and 1.5 mm. in diameter. There are about 12 pairs of intestinal cæca.

The structure of the reproductive apparatus agrees closely with that of the corresponding parts in *P. siphunculus*, as described by Lang.

The *antrum masculinum* extends in a vertical direction for a short distance, passes slightly behind the male aperture, then runs forwards again, becoming strongly bent on itself. At its anterior end is the papilla, from which the apex of the penial stylet projects. The prostate reservoir is a small rounded dilatation of the ejaculatory duct. The median vesicula is of great relative size with very muscular walls. The lateral (accessory) vesiculæ seminales are smaller, spherical bodies with very thick walls and small lumina

The female aperture leads into an antrum which takes the form of a bursa copulatrix with very thick walls. The ootype has a very contracted lumen with folded walls; it extends downwards to the neighbourhood of the ventral surface. The shell-glands are very highly developed, extending through more than one-half of the length of the body.

In a specimen which has been cut into longitudinal vertical sections there is beneath the integument of the dorsal surface, in the region immediately behind the sucker, a great mass of spermatozoa, and a similar mass on and around the sucker on the ventral surface. The sections are imperfect, and though a fissure enclosing spermatozoa is to be traced downwards from the dorsally situated mass, it is impossible to determine to what extent this has been formed by *post-mortem* treatment. In any case there is sufficient evidence of the occurrence here of an indirect form of copulation by perforation of the integument.

In view of this observation it is of interest to note that Lang expresses a suspicion that the structure of the parts in *Prosthiostomum* points to self-fertilization (17, p. 638).

From *Prosthiostomum siphunculus*, Delle Chiaje (sp.), and from *P. dohrnii*, Lang (17), this Australian species is distinguished by the number and arrangement of the eyes; and similar differences distinguish it from Laidlaw's (15) two species, *P. elegans* and *P. cooperi*, from the Maldives.

BIBLIOGRAPHY.

1. BERGENDAL.—Einige Bemerkungen über *Cryptocelides Loveni*. Kongl. Fysiogr. Sällskapets Handlingar, Ny följd, iv. 1892, 3*.
2. CHEESEMAN, T. F.—On two new Planarians from Auckland Harbour. Trans. N.Z. Inst. xv. 1882.
3. COLLINGWOOD, C.—On thirty-one Species of Marine Planarians, &c. Trans. Linn. Soc., Zool. (2) i. 1876.
4. GAMBLE, F. W.—British Marine Turbellaria. Quart. Journ. Micro. Sci. xxxiv. 1893.
5. GOTO, S.—Studies on the Ectoparasitic Trematodes of Japan. Journ. Coll. Sci. Imp. Univ. Japan, viii. 1894.
6. GRAFF, L. VON.—Enantia spinifera der Repräsentant einer neuen Polycladen Familie. Mittheil. naturwiss. Vereins für Steiermark, 1889.
7. HASWELL, W. A.—On a Prorhynchid Turbellarian from Deep Wells in New Zealand. Quart. Journ. Micro. Sci. vol. xl. n. s. 1898.
8. ——— On a new Histriobdellid. Quart. Journ. Micro. Sci. vol. xliii. n. s. 1900.
9. HERZIG, E. M.—*Laidlawia trigonopora*, n. gen., n. sp. Zool. Anz. xxix. 1905
10. KIRK, T. W.—On some new Marine Planarians. Trans. N.Z. Inst. xiv. 1881.
11. LAIDLAW, F. F.—Notes on some Marine Turbellaria from Torres Straits and the Pacific. Mem. and Proc. Manch. Lit. & Phil. Soc. xlviii. 1903.
12. ——— A Collection of Turbellaria Polycladida from the Straits of Malacca (Skeat Expedition). P. Z. S. 1903, i. pp. 301–318, pl. 23.

* I have not been able to see this paper.

13. LAIDLAW, F. F.—Turbellaria Polycladida of Zanzibar, collected by C. Crossland.—Part I. The Acotylea. P. Z. S. 1903, ii. pp. 99–113, pl. 9.
14. ——— Suggestions for a Revision of the Classification of the Polyclad Turbellaria. Mem. and Proc. Manch. Lit. & Phil. Soc. vol. xlviii. 1903.
15. ——— The "Marine Turbellaria." Fauna and Geography Maldive and Laccadive Archipelagoes, 1902.
16. ——— Report on the Polyclad Turbellaria collected by Professor Herdman at Ceylon in 1902. Report Pearl Oyster Fisheries of the Gulf of Manaar, 1904. Suppl. Report No. 9.
17. LANG, A.—Die Polycladen. Fauna u. Flora des Golfes von Neapel, xi. 1884.
18. PLEHN, M.—Ergebnisse einer Reise nach dem Südl. Pacific (Schauinsland, 1896–1897). Polycladen. Zool. Jahrb. Abth. f. Syst. &c. Bd. xii.
19. ——— Drei neue Polycladen. Jen. Zeitschr. Naturw. Bd. xxxi. 1897.
20. SCHMARDA, L. K.—Neue wirbellose Thiere, Bd. i. 1859.
21. QUATREFAGES, A. DE.—Mémoires sur quelques Planariés marines. Ann. Sci. Nat. 3^e série, Zool. t. iv. 1845.
22. STIMPSON, W.—Descriptions of some new Marine Invertebrata. Proc. Acad. Nat. Sci. Philad. vol. vii. 1855.
23. ——— Prodromus descriptionis animalium, etc. Proc. Acad. Nat. Sci. Philad. 1857.
24. STUMMER-TRAUNFELS, R. VON.—Tropische Polycladen. 1. Das Genus *Thysanozoon*, Grube. Zeitschr. f. wiss. Zool. Bd. lx. 1895.
25. VERRILL, A. E.—The Marine Planarians of New Zealand. Trans. Conn. Acad. viii. pp. 459–520, pls. 40–44 (1888).
26. WOODWORTH, W. McM.—Some Planarians from the Great Barrier Reef of Australia. Bull. Mus. Comp. Zool. Harv. Coll. vol. xxxii. pp. 63–67.

EXPLANATION OF THE PLATES.

Lettering.

d., anterior diverticulum of ootype. *ej.*, ejaculatory duct. *int.*, intestinal cæca. *m.*, mouth. *oot.*, ootype. *p.*, penis. *p.s.*, penis-sheath. *p.st.*, penial stylet. *pr.*, prostate reservoir or prostate ducts. *r.*, receptaculum seminis. *r.d.*, duct of receptaculum. *sh.gld.*, shell-glands. *ut.*, uterus. *ut.d.*, uterine duct. *va.*, dorsal limb of the vagina. *v.d.*, vasa deferentia. *v.s.*, vesicula seminalis.

PLATE 35.

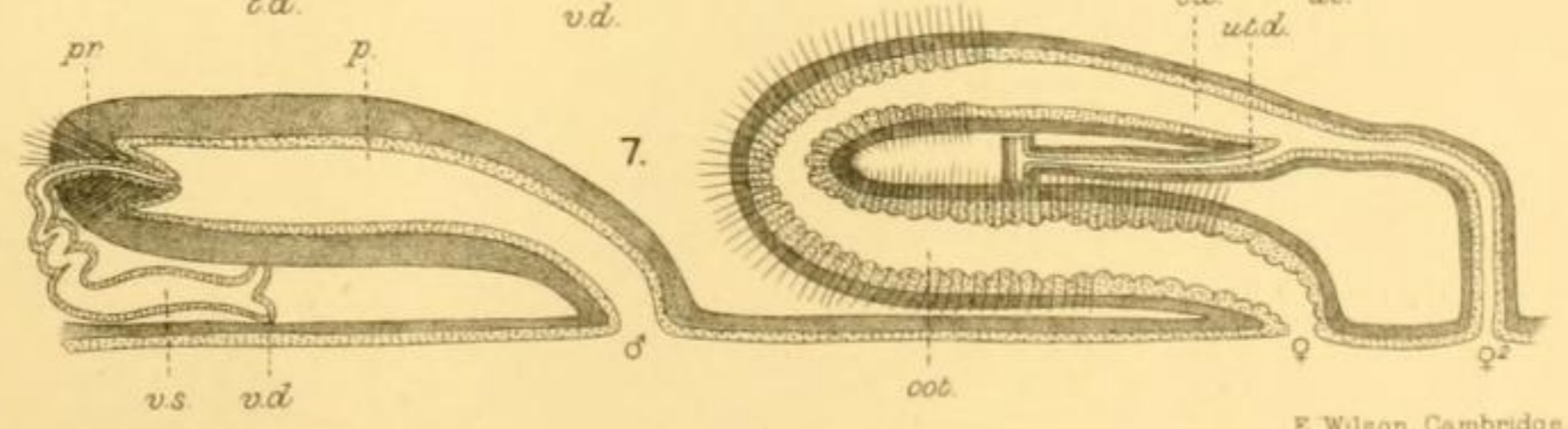
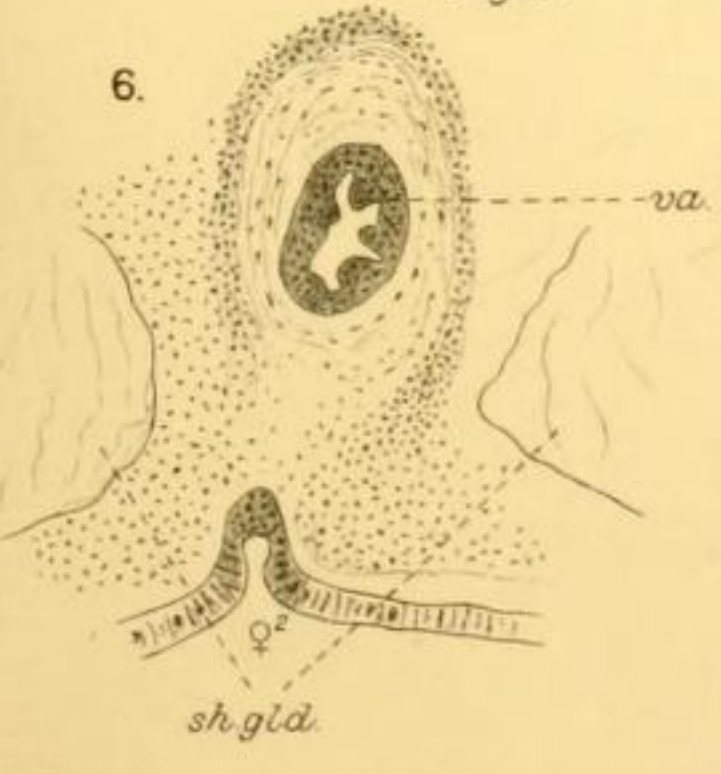
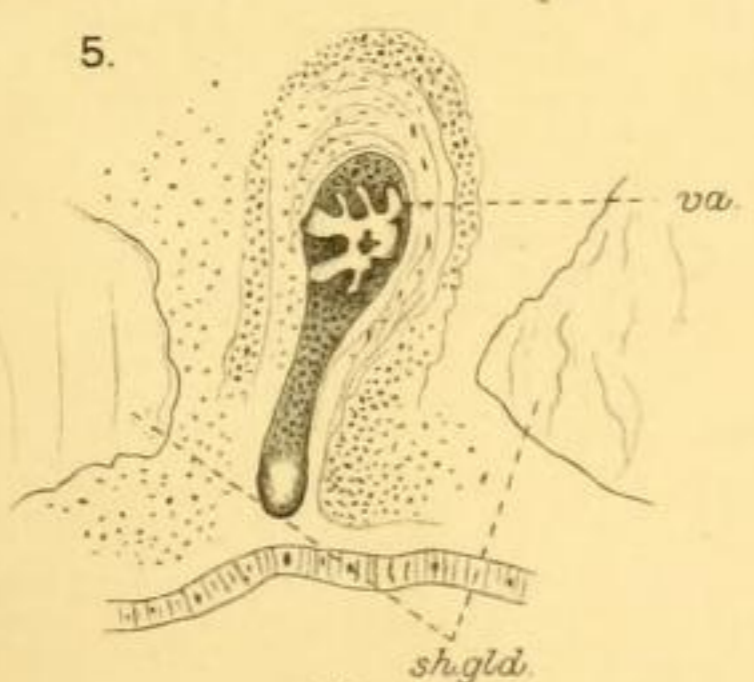
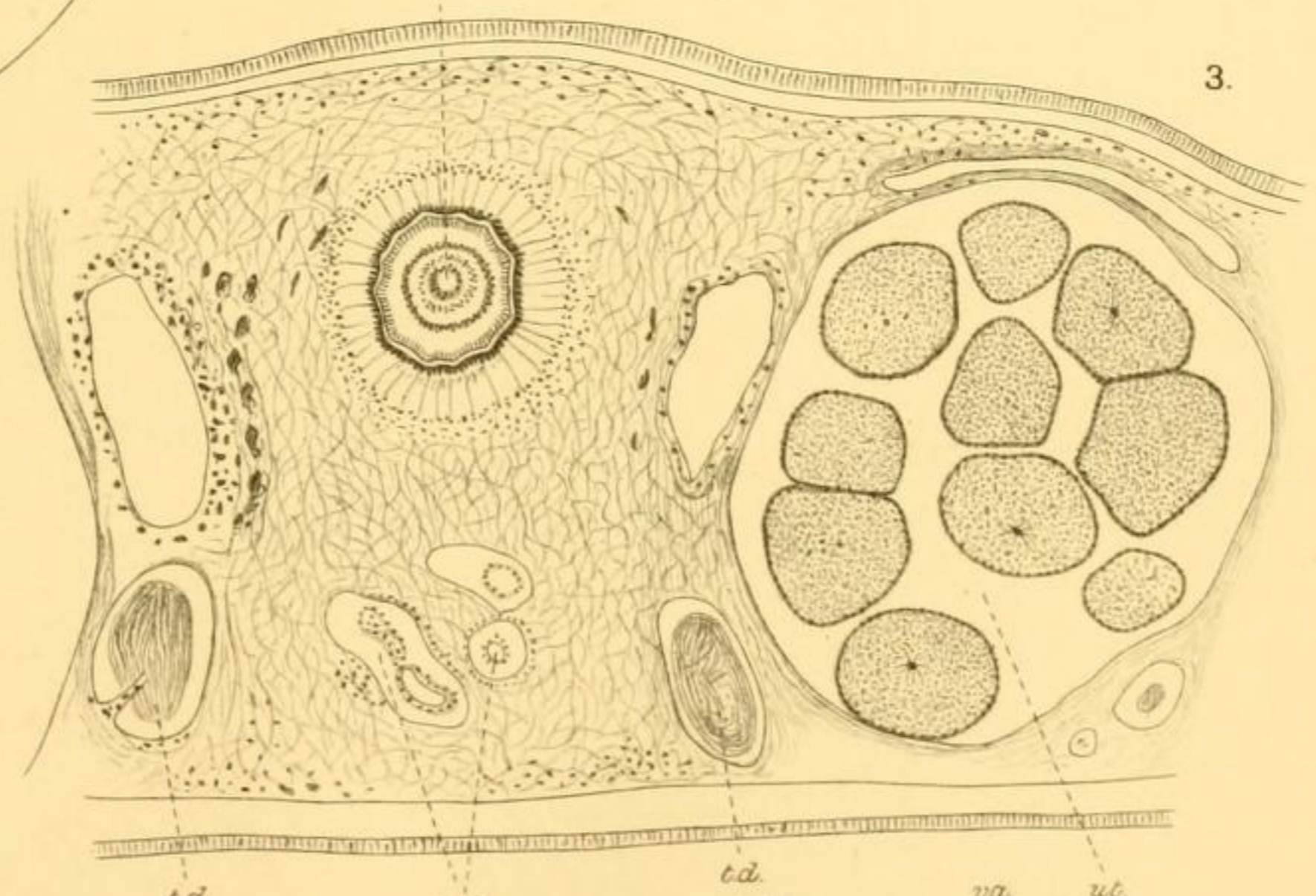
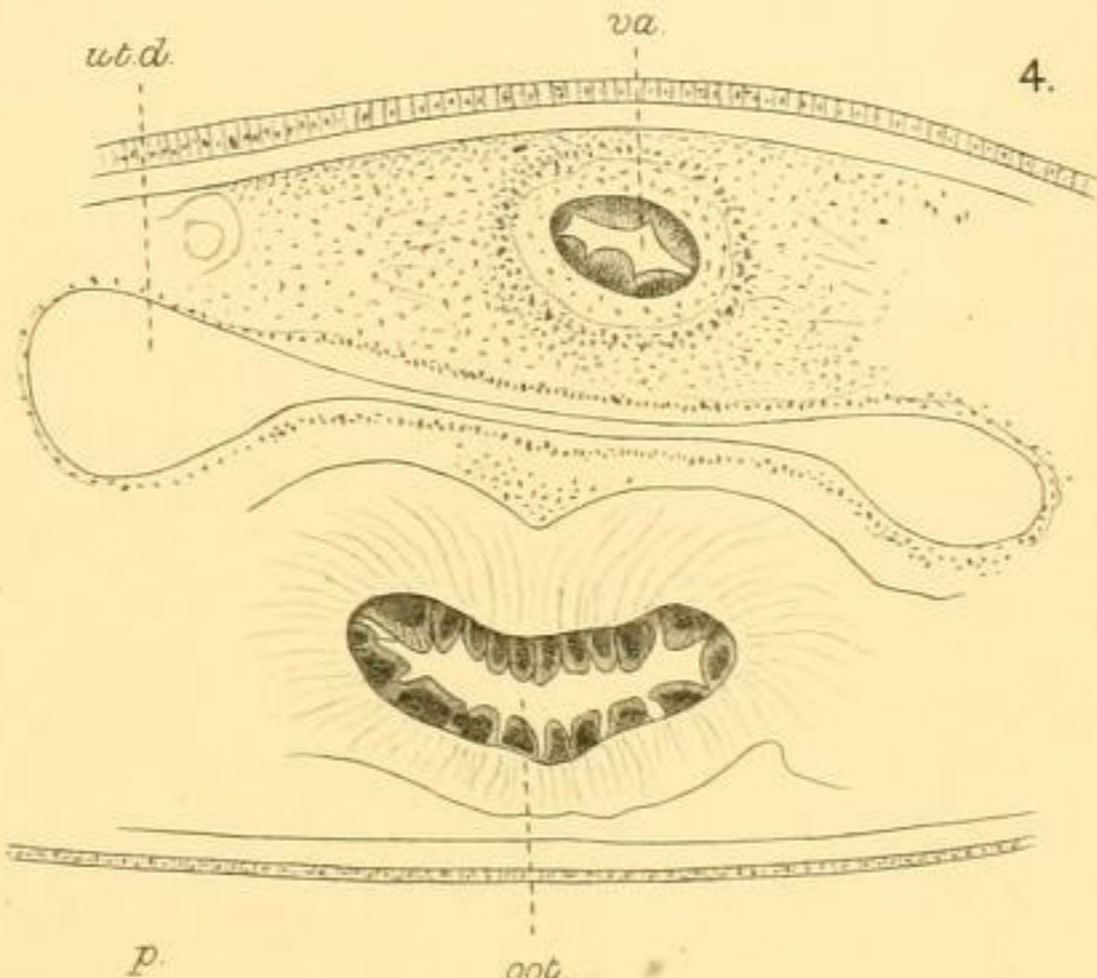
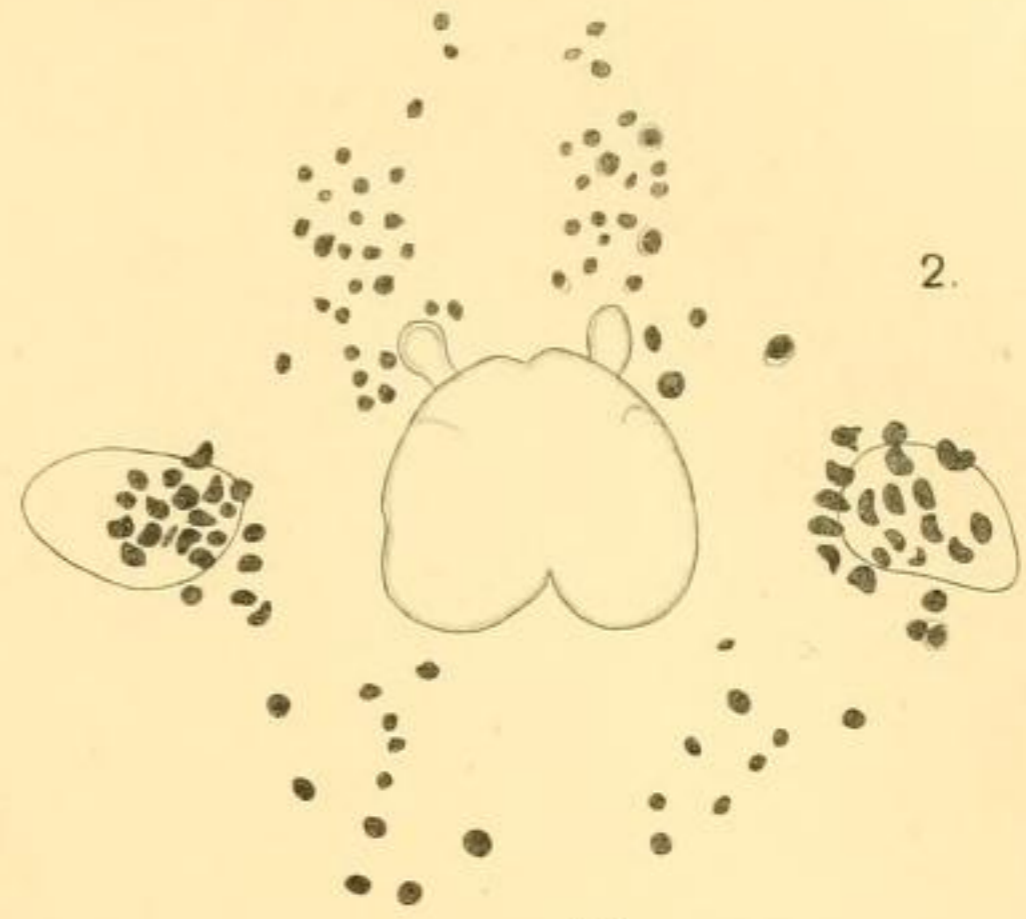
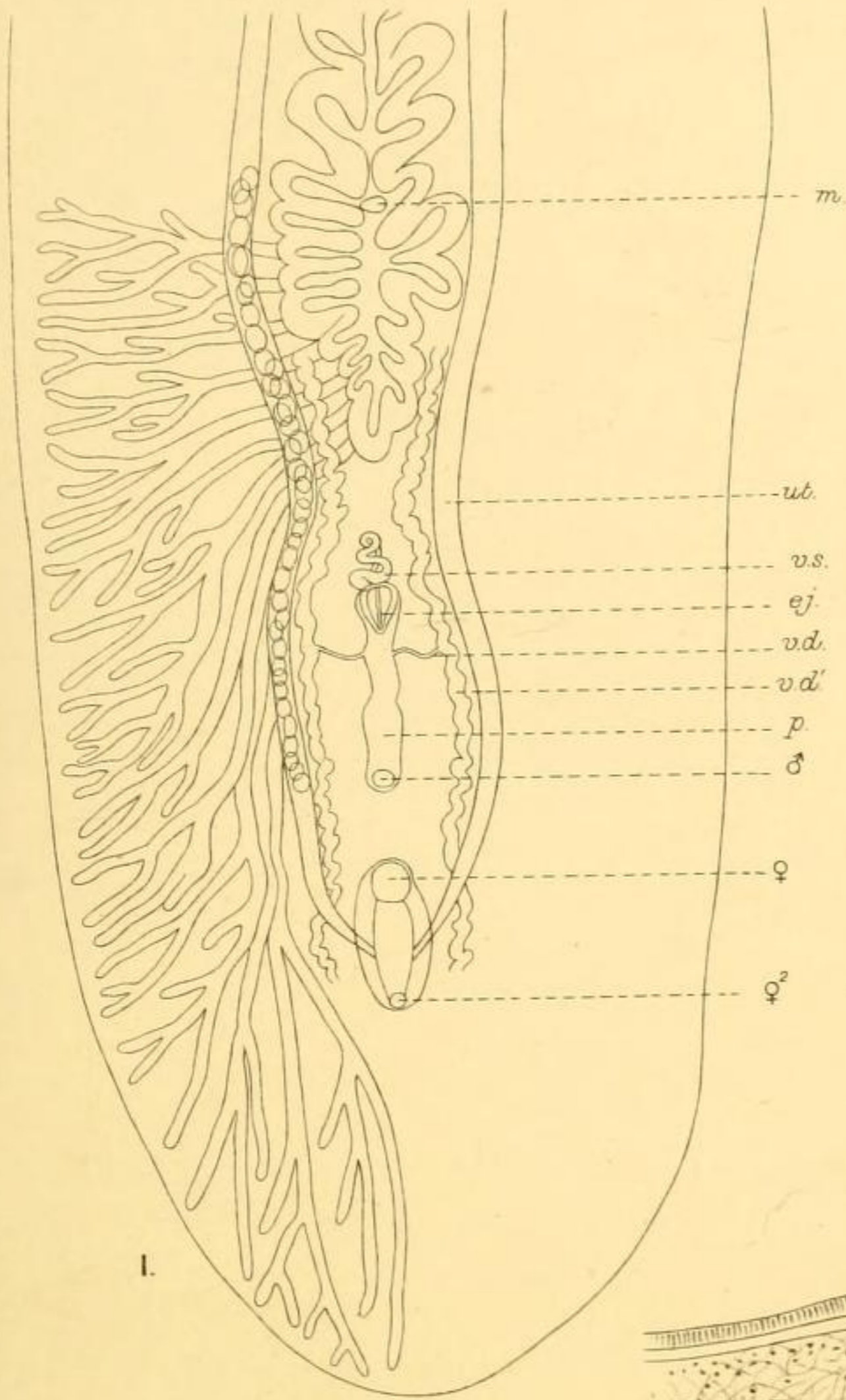
- Fig. 1. *Tripylocelis typica*. General view of the organization. × 15.
- | | | | |
|--------|---|---|---|
| 2. | " | " | Brain, eyes, and outline of tentacles. |
| 3. | " | " | Transverse section passing through the proximal part of the penis. |
| 4. | " | " | Transverse section at the point where the lateral uterine ducts unite. |
| 5 & 6. | " | " | Two successive transverse sections passing through vagina and its ventral aperture (♀ ²). |
| 7. | " | " | Diagrammatic lateral view of the reproductive ducts. |

PLATE 36.

- Fig. 1. *Diplosolenia johnstoni*. General view of the reproductive ducts from the ventral aspect. Vasa deferentia and ejaculatory duct shaded; ootype dotted.
2. " " Transverse section passing through the point of union of the ducts of the receptacula seminis.
3. *Leptoplana australis*. General view of the reproductive ducts from the ventral aspect.
4. " " Diagrammatic lateral view of the reproductive apparatus. Epithelia dotted; muscular layers shaded.
5. " " Eyes. The two oval bodies are the anterior appendages of the brain.
- 6 & 7. *Echinoplana celerrima*. Spines of the penis. $\times 500$.

PLATE 37.

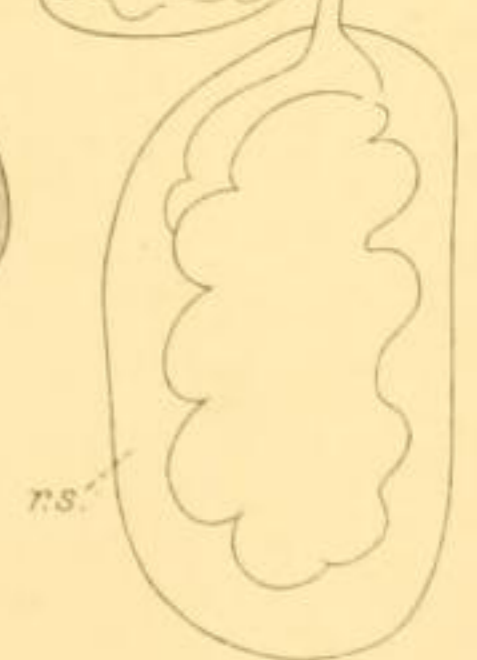
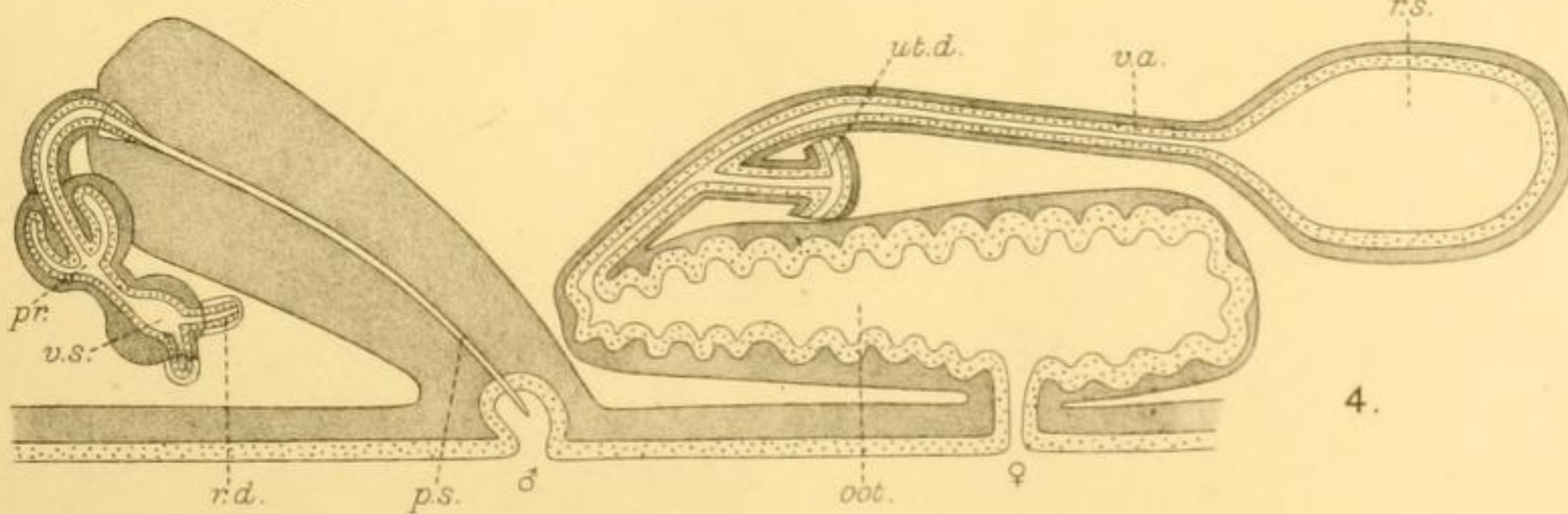
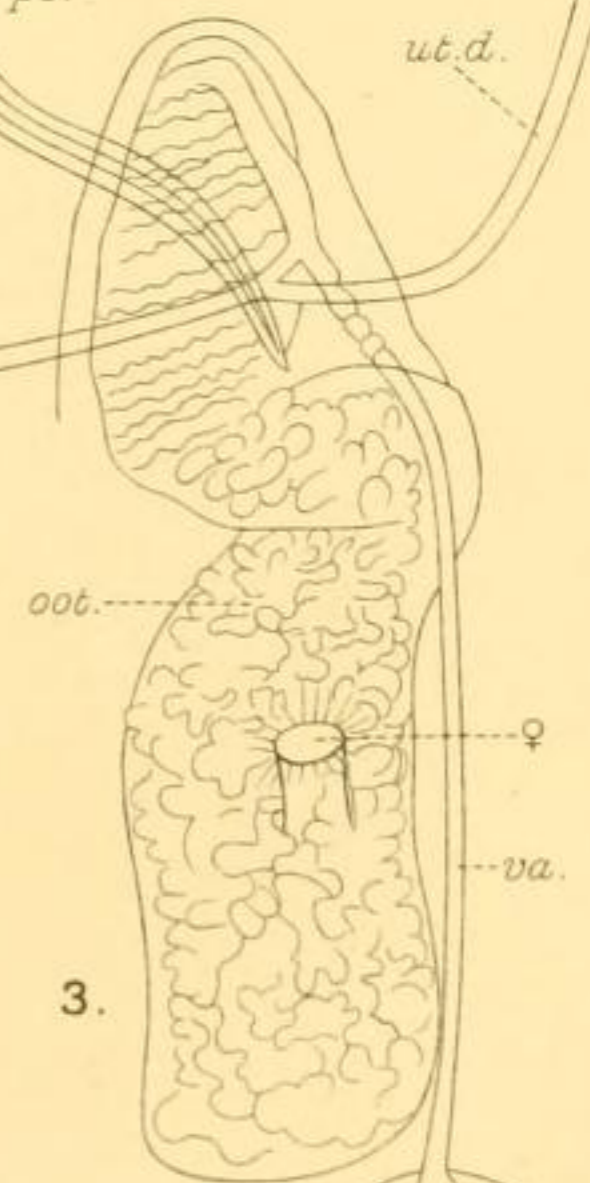
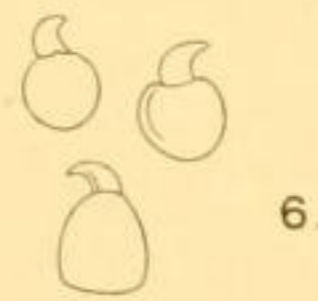
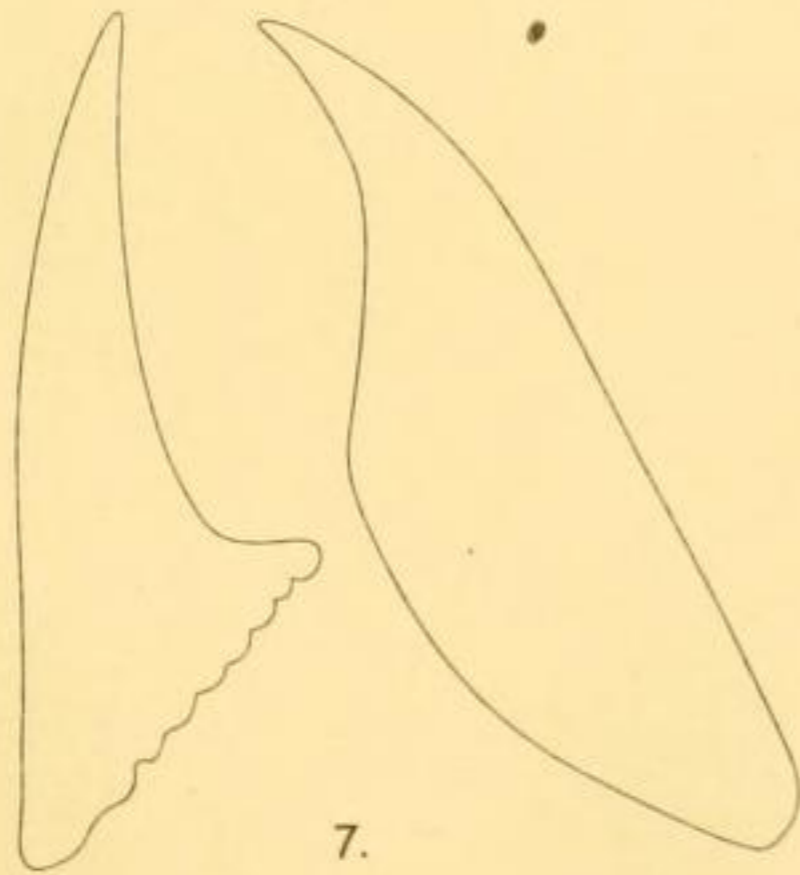
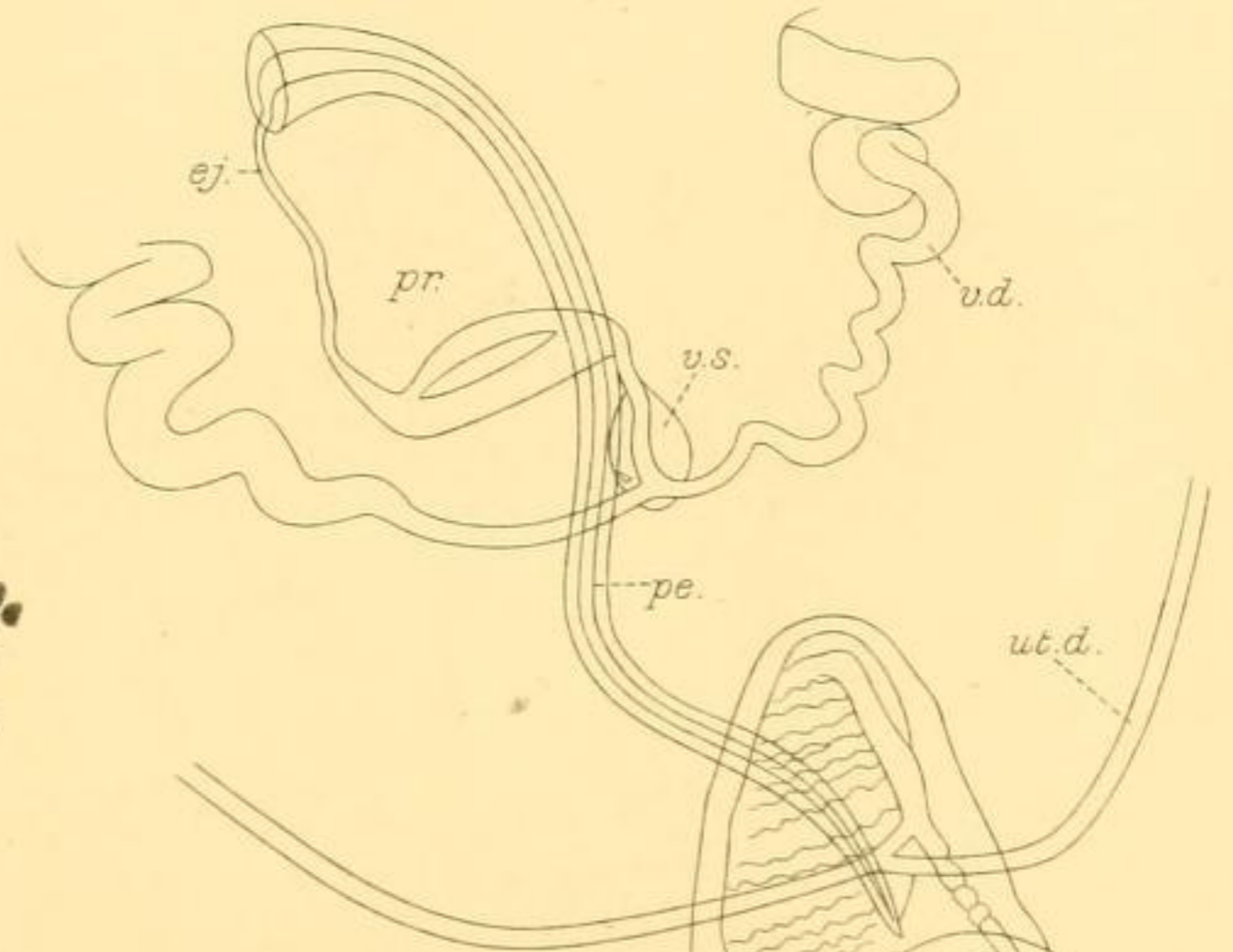
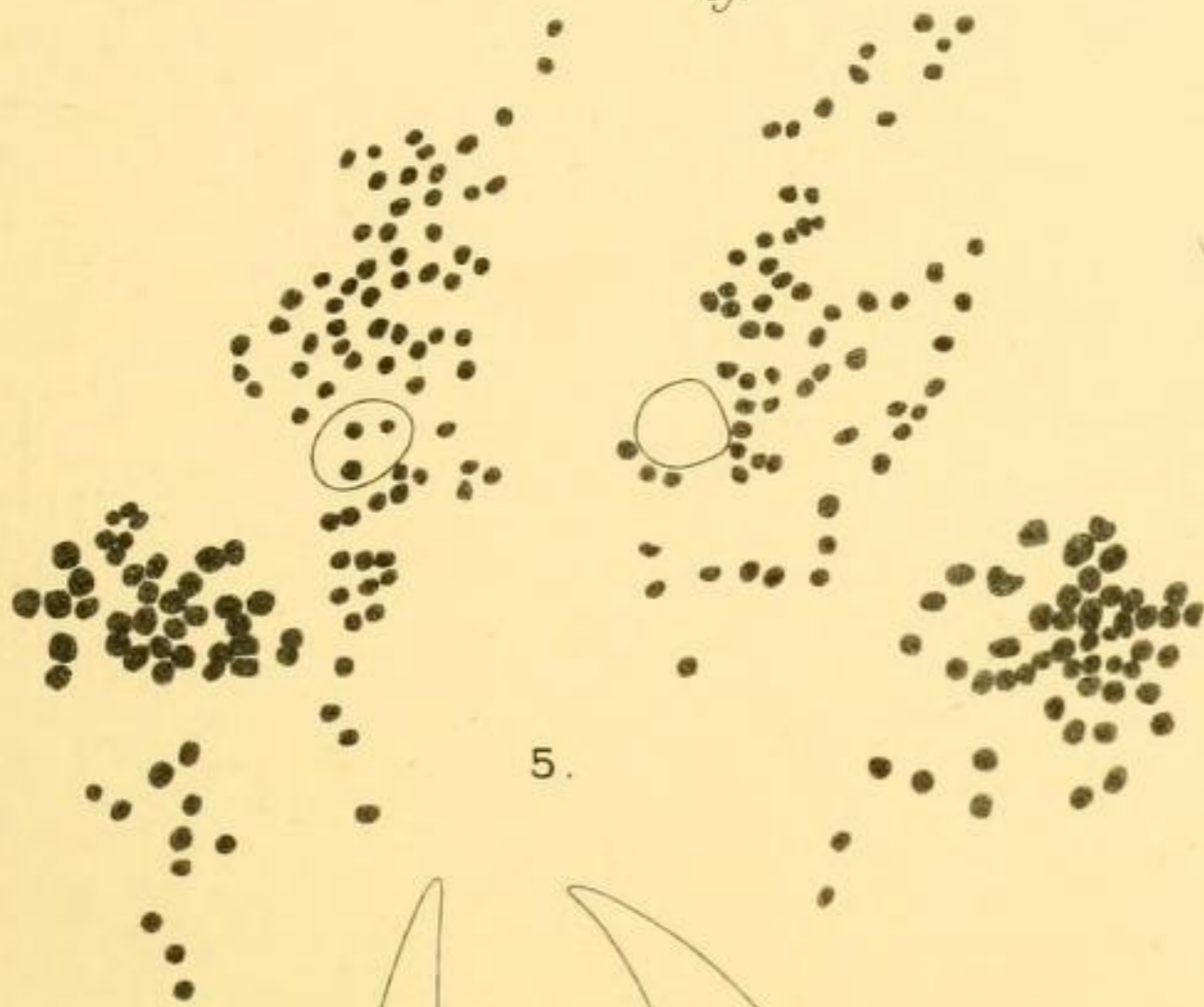
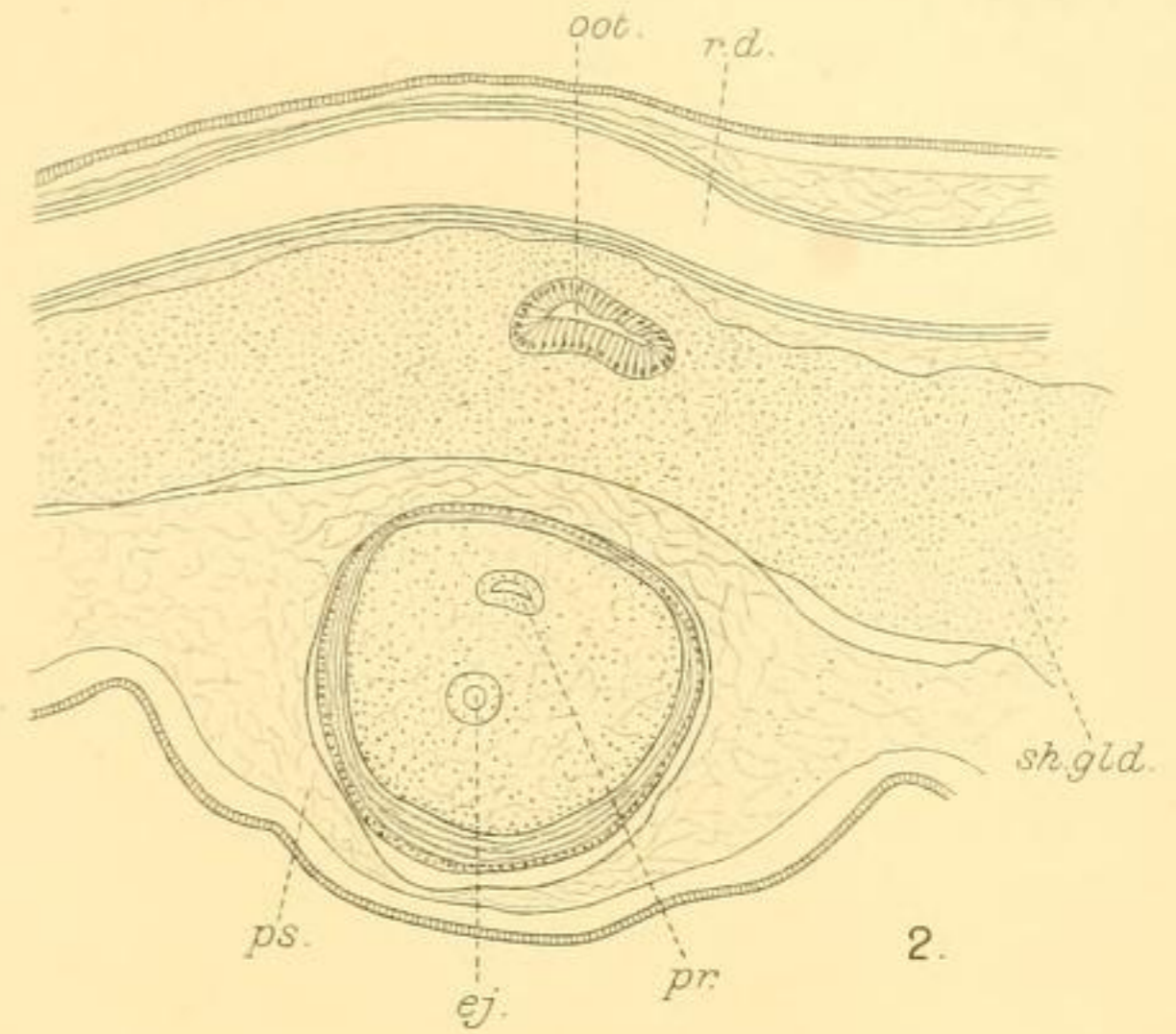
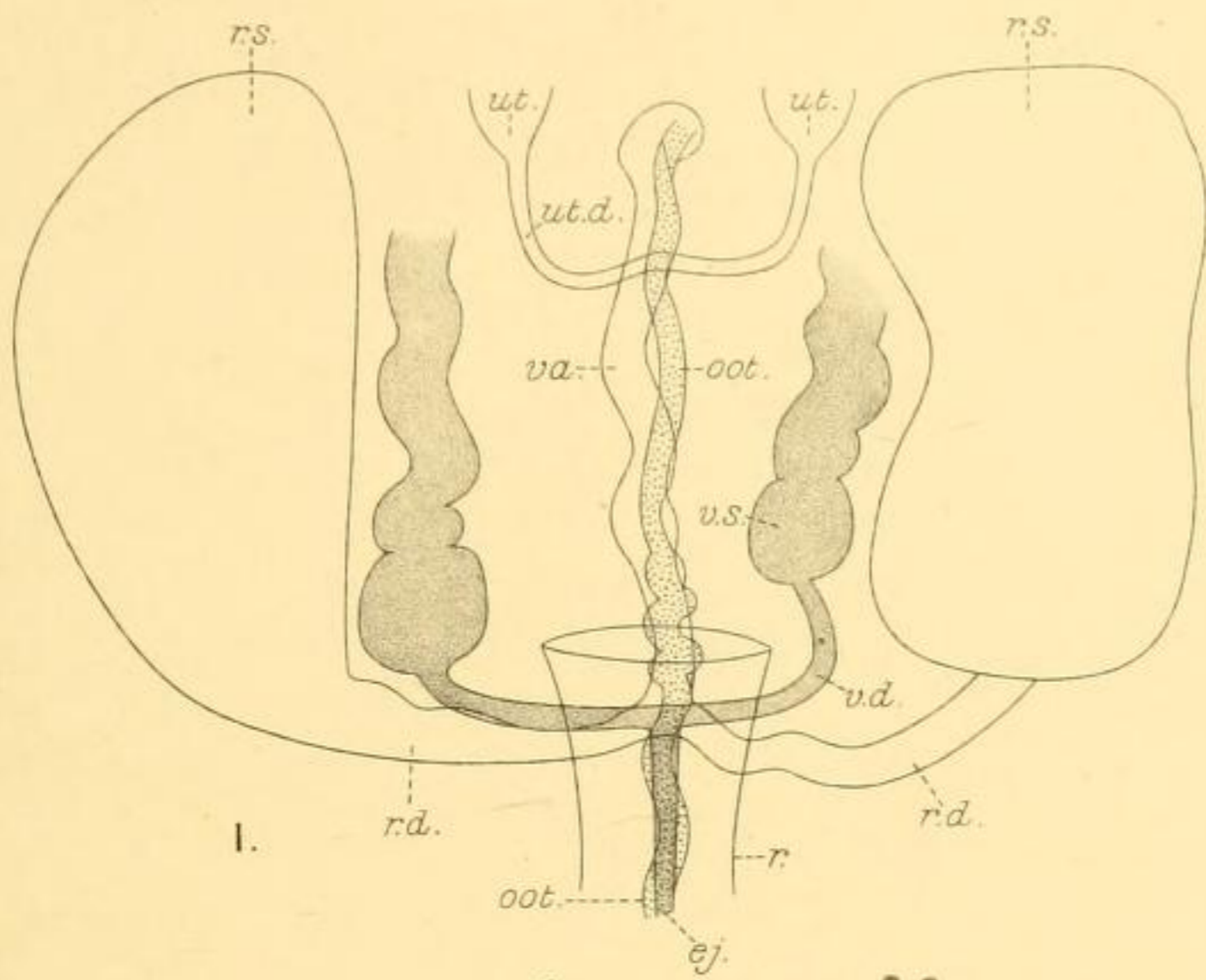
- Fig. 1. *Echinoplana celerrima*. Brain and eyes; from stained and mounted specimen.
2. " " General view of the reproductive apparatus, from the ventral aspect.
3. " " Transverse section passing through the point of union of the uterine duct with the diverticulum of the ootype.
4. *Enterogonia pigrans*. Diagrammatic lateral view of the reproductive apparatus, showing the genito-intestinal canal. Epithelial parts dotted; muscular layers shaded.
5. *Cestoplana australis*. Outline magnified, to show arrangement of vermilion bands.
6. *Pseudoceros cardinalis*. Ventral view of male reproductive ducts.
7. *Prosthlostomum maculatum*. Cerebral eyes.



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AUSTRALASIAN POLYCLADS.

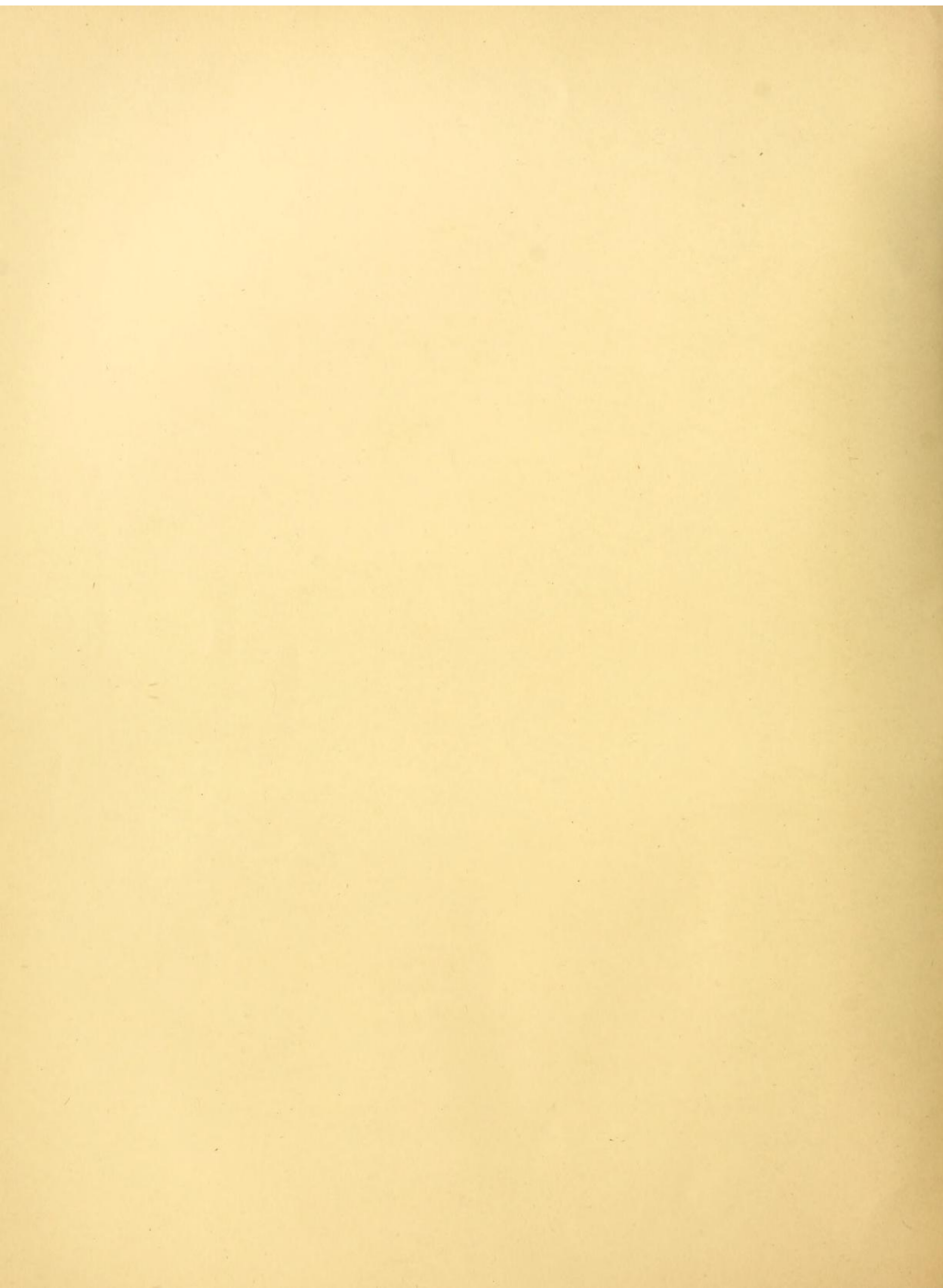
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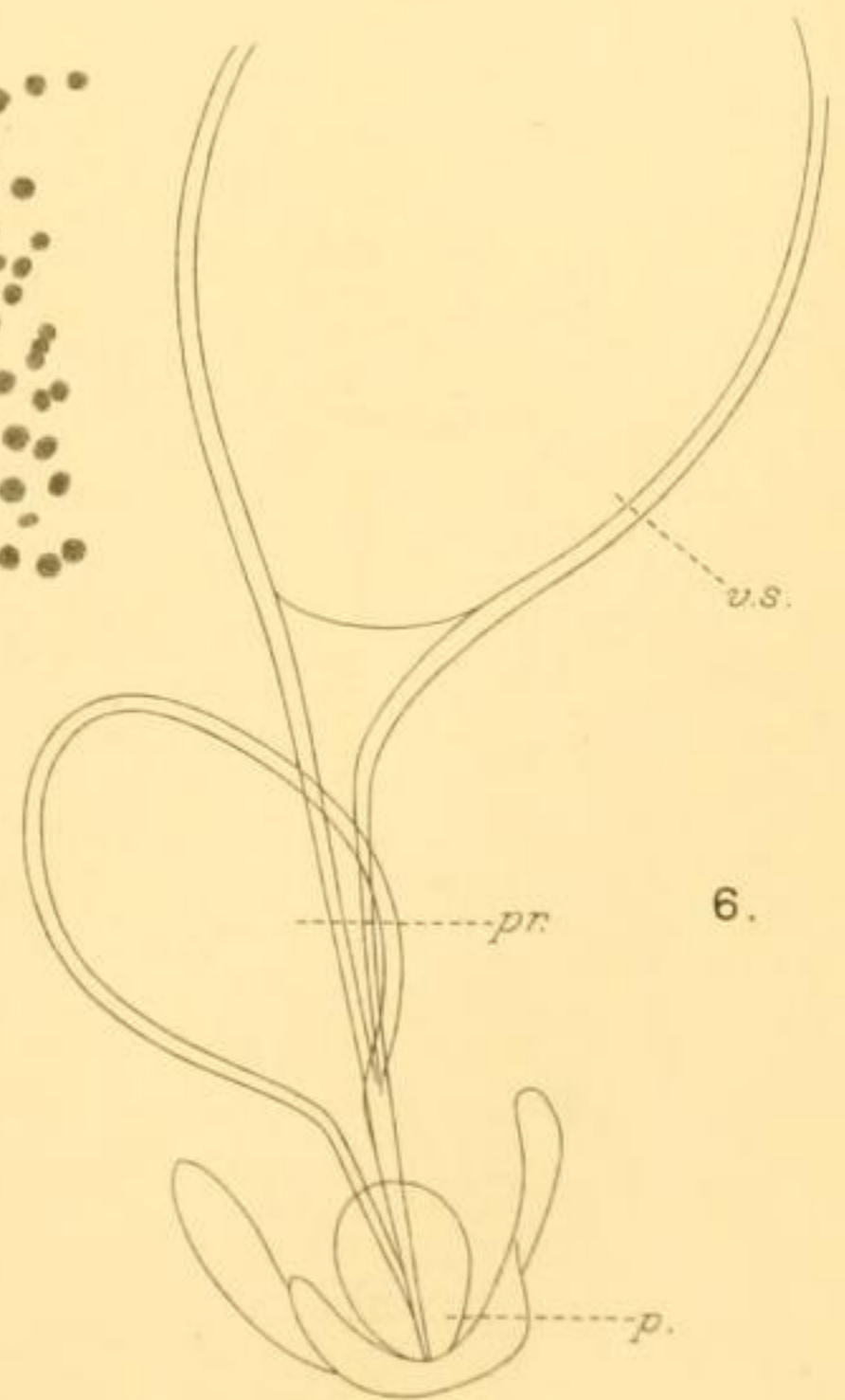
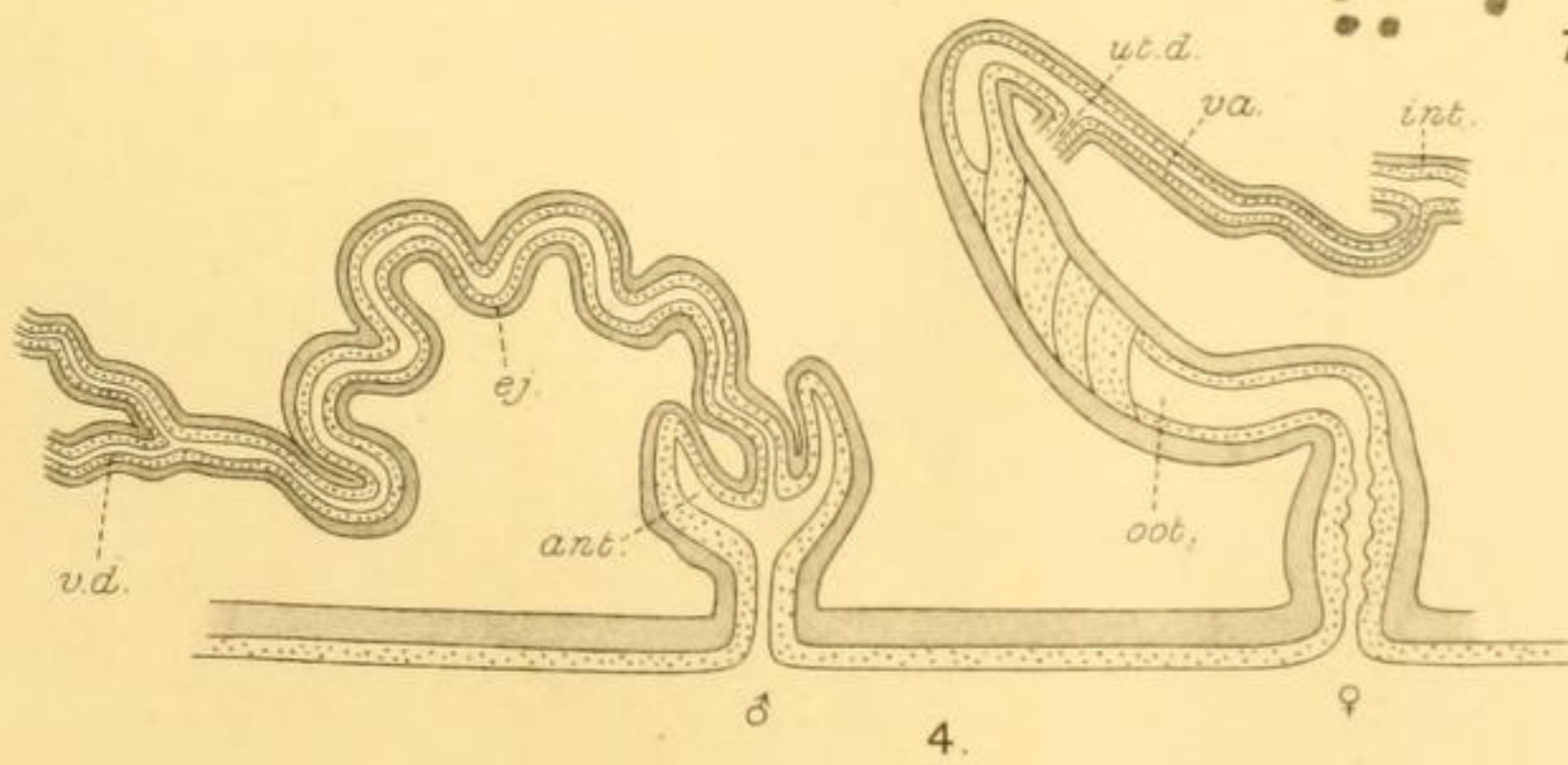
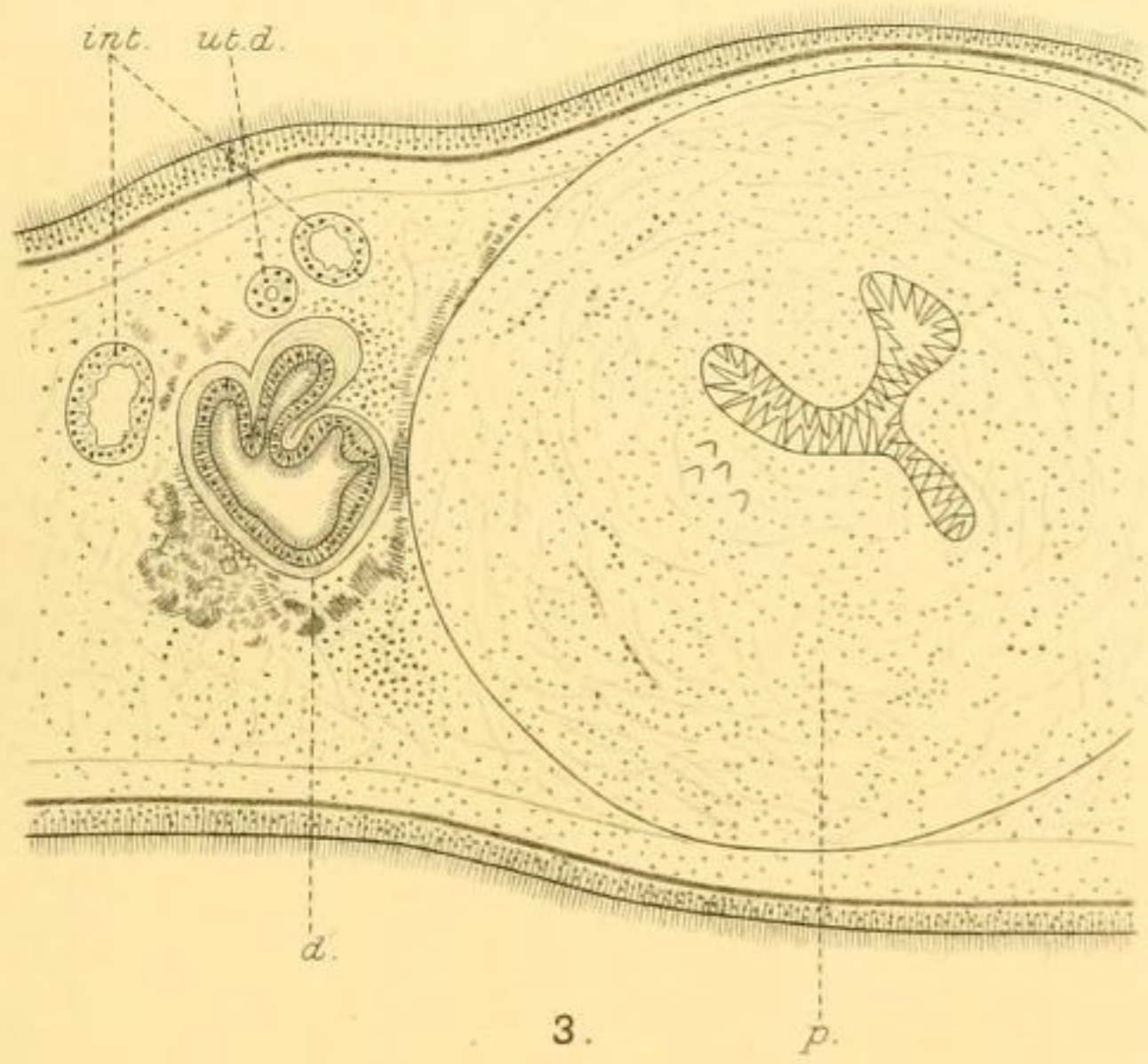
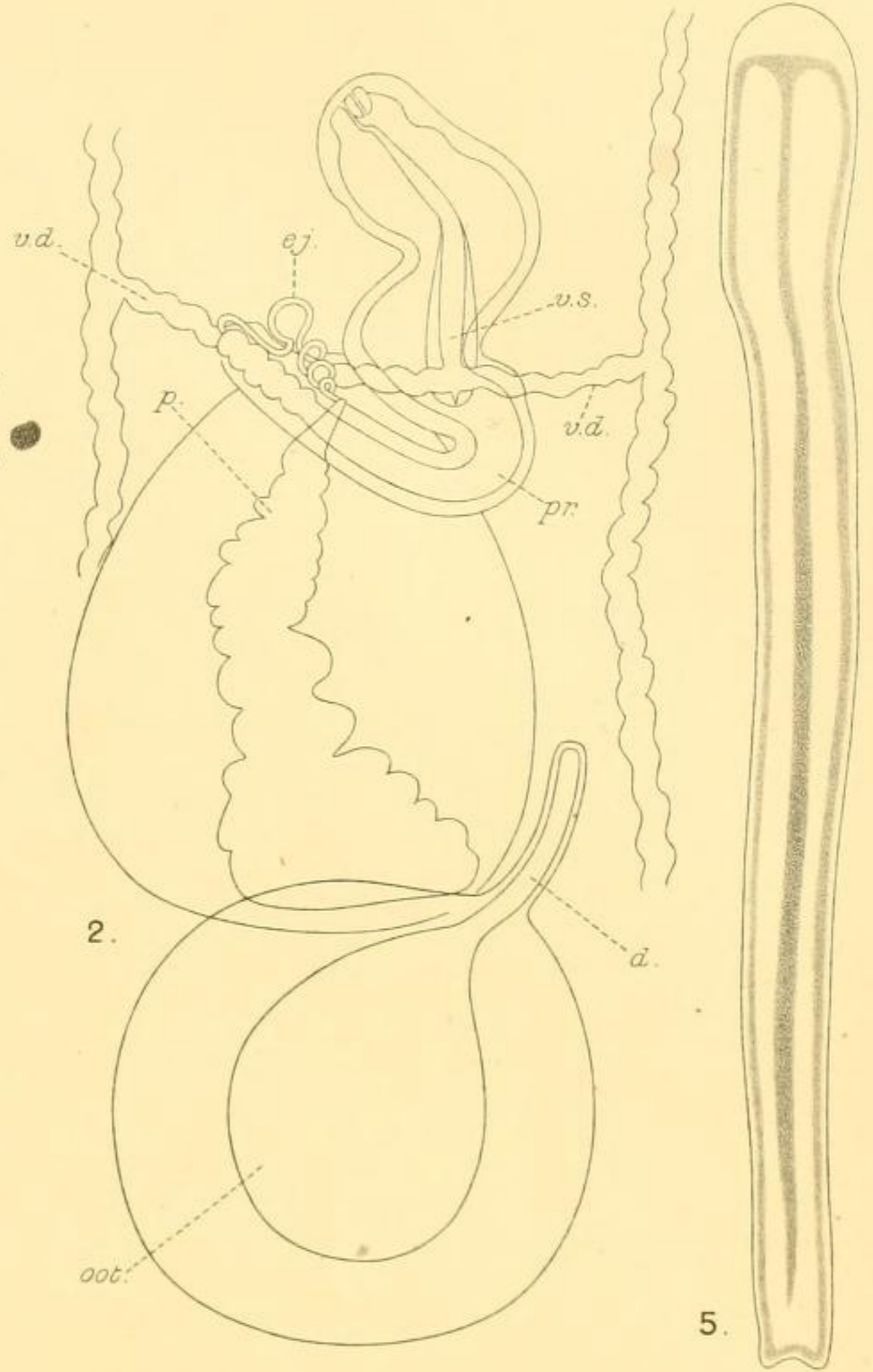
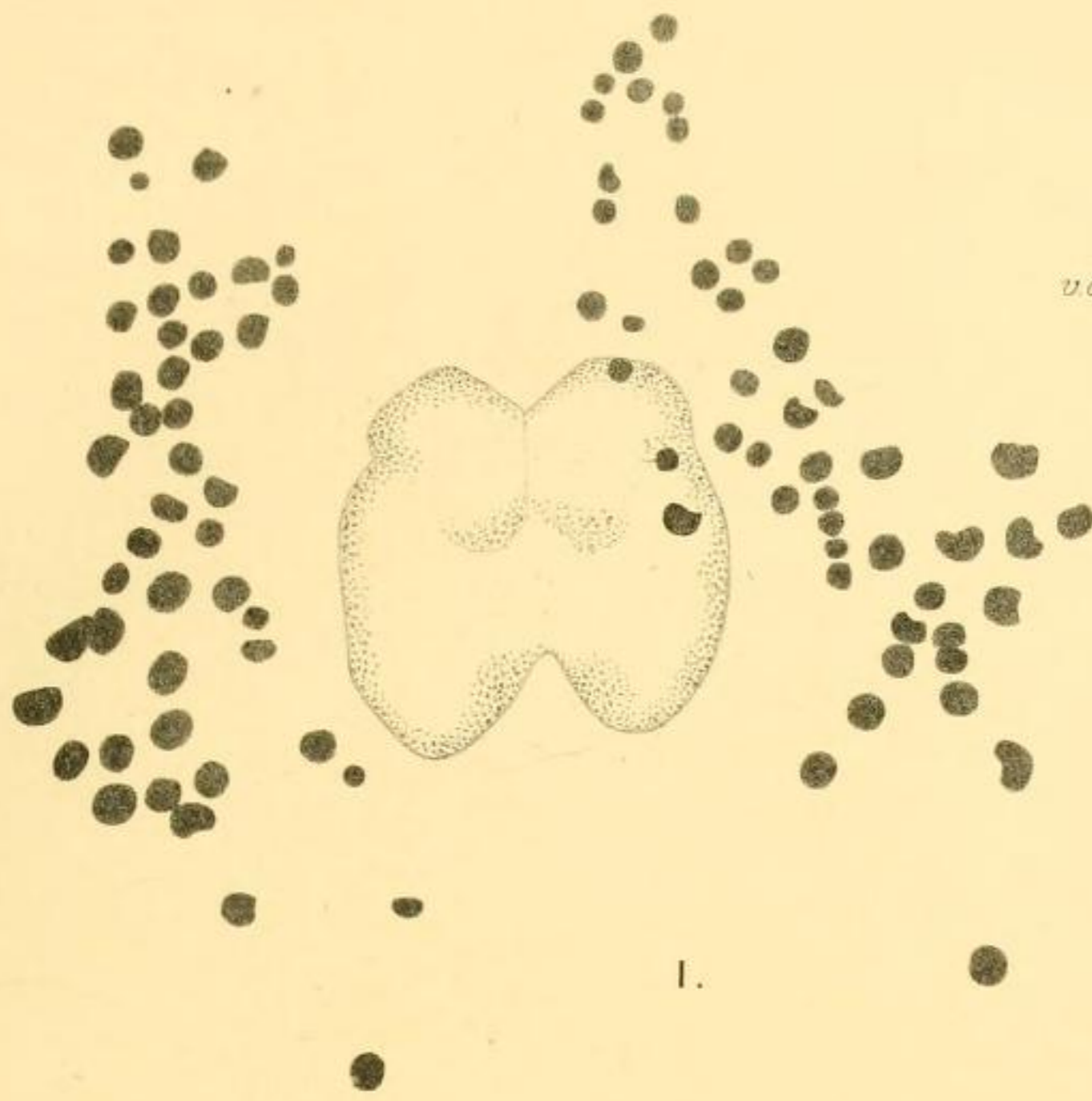


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