

XXIX.—Turbellaria of the Scottish National Antarctic Expedition. By Dr J. F. Gemmill and Dr R. T. Leiper.* *Communicated by Sir JOHN MURRAY, K.C.B.*
(With a Plate.)

(Read March 5, 1906. Issued separately August 7, 1907.)

There were seven Turbellaria in the material handed to us by Mr W. S. BRUCE, all obtained in April 1903 from Scotia Bay, South Orkney Islands (9–10 fms., Station 325, lat. 60° 44' S., long. 44° 51' W.). Their occurrence is interesting, as, although STUDER (*Ueber Seethiere aus dem Antarktischen Meere*, 1876) mentions, without adequately describing it, a *Eurylepta* from Kerguelen Island, there are no definite records, so far as we have been able to ascertain, of Turbellarian species from nearer the Antarctic than the coasts of South America.

POLYCLADA.

Tribus *Cotylea*. Fam. *Euryleptida*. Genus *Aceros* (1). *Aceros stylostomoides*, n. sp.
(Plate figs. 1 and 2.)

Specific Diagnosis.—An *Aceros* with mouth and male opening extremely closely approximated; with dorsal pore connecting the hinder part of the main gut with the dorsal surface; with about fifteen eyes on either side in the brain groups, and eight to nine in the marginal groups.

The two examples of this species are much curled. They measure 3–4 mm. in length and .9 mm. in greatest thickness, and they are of a warm brown tint, mottled on the dorsal surface by a coarse, darkly pigmented network, the strands of which arise from a longitudinal band on either side of the middle line.

As the specimens differ in the relative degree of contraction of certain parts (notably the pharynx), they will be distinguished hereafter, when necessary, as specimen (*a*) and specimen (*b*).

Body Wall.—The musculature is strong ventrally, especially in the region of the sucker, but over the dorsum it is weak, being channelled by the coloured network mentioned above. This appears to be formed by spaces within and immediately beneath the muscular layer, containing numerous minute round particles of brownish black pigment. The sucker lies a little behind the middle of the body. In specimen (*a*) its centre is near the junction of the third and fourth body fifths, and in specimen (*b*) slightly further forward. It is of large size and slightly elevated.

Digestive System.—The mouth (external opening of pharyngeal sac) is situated at the commencement of the second body fifth. In specimen (*a*) the pharynx measures less than a fifth of the body length, its own length being about a fifth greater than its

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breadth, while the pharyngeal sac and the pharynx are contained within the second body fifth. In specimen (*b*) the pharynx is longer and more cylindrical. In both specimens the lumen of the pharynx is dilated just in front of its oblique opening into the gut.

The main gut is spacious and extends to near the posterior end of the body, giving off five lateral roots on either side and a median anterior root. All the roots branch freely without apparently anastomosing. The main gut opens to the external surface by a ciliated pore in the mid-dorsal line near the commencement of the last body fifth in specimen (*a*), and rather further forward in specimen (*b*).

Brain.—The brain is large and lies close in front of the wall of the pharyngeal sac. With the anterior gut root it occupies the entire depth of the interior of the body in the middle line.

Eyes.—Immediately beneath the basement membrane and overlying the brain are two groups of eyespots each containing about fifteen ocelli. These groups are separated from one another by the anterior gut root. Deeply sunk in the parenchyma, on the outer anterior surface of the brain on either side, is a single ocellus similar to that described by LANG in *Aceros inconspicuus* (1); there are also eight to nine eyespots scattered along the anterior body margin on either side of the middle line. These may be described as tentacular eyes, though actual tentacles are absent from this as from the other species of *Aceros*.

Genital Organs.—The male aperture lies immediately behind the mouth in specimen (*a*), while in specimen (*b*), owing apparently to differences in muscular contraction, it might almost be described as having a common opening with the mouth.

The male organs consist of penis, "granule gland," seminal vesicle, vasa deferentia, and testes.

The penis is large, of an elongated, pyriform shape, almost equal in length to the retracted pharynx in specimen (*a*), but slightly shorter in specimen (*b*). The lumen of the penis is dilated posteriorly, and is lined by a single layer of greatly elongated cells. Its relatively thin muscular wall forms a uniform sheet round the dilated part of the lumen and tapers off gradually towards the apex. The lumen of the penis is connected posteriorly by an extremely fine passage with the large "granule gland" (prostatic vesicle). This passage receives from behind the minute canal from the seminal vesicle. The "granule gland" vesicle is lined by a single layer of cubical, non-ciliated epithelium covered by a thin muscular wall. The seminal vesicle has a strong muscular wall and is filled in both specimens with spermatozoa. It lies behind the "granule gland" and below the gut, and ends in a pair of vasa deferentia which by rapid and repeated branching come into connection with the small and very numerous lobules of the testis. These lobules are scattered throughout the lateral parts of the body in the septa between the gut branches, ventral to the ovarian tubes.

The female apparatus consists of aperture, shell-gland portion, duct of uterus, uterus, oviducts, and ovarian tubes.

The aperture lies just in front of the sucker; the shell-gland portion is short and dilated and has highly glandular walls. The tissue surrounding it, as well as that around the lower end of the uterine duct, is crammed with granules. The uterine duct, which is dilated, but empty in both specimens, is lined by cells possessing remarkably long cilia, and passes backwards below the gut, to end in the two uteri into which the oviducts open. The ovaries are found throughout the lateral parts of the body, dorsal to the testes. Many of the ovarian tubes contain yolk-like material, which seems to be derived from the transformation of cellular elements within their walls. This arrangement seems to replace the special uterine glands described as occurring in *Aceros inconspicuus* and certain other *Euryleptidæ*.

Systematic.

The specimens described above may be included in the Euryleptid genus *Aceros*, LANG, as amended by PLEHN (2). The original description of the genus is as follows (1): —Körper glatt; Mund unmittelbar hinter dem Gehirn; Pharynx cylindrisch; Hauptdarm mit circa fünf Paar Darm-ast-wurzeln; Darm-äste nicht anastomosirend; männliche Oeffnung sehr nahe hinter dem Mund; männlicher Begattungs-apparat unter dem Pharyngeal-tasche; weiblicher mit seiner Oeffnung dicht hinter derselben; ein Paar Uterus-drusen; sehr wenige Augen (jederseits drei) im Gehirn-hof; sehr wenige Augen in je einer seitlichen Gruppe am vorderen Körper-rande an der Stelle wo bei den verwandten Gattungen die Tentakeln stehen die bei dieser Gattung fehlen.

Two species of *Aceros* have been described, viz., *A. inconspicuus*, LANG (1), the species for the reception of which the genus was founded, and *A. nationalis*, PLEHN (2).

A. inconspicuus, from the Gulf of Naples, is a small member of the genus measuring 3 mm. long by 1.3 mm. broad. The dorsal surface is mottled, owing to the presence of finely granular pigment under the basement membrane. Over the brain there are two groups of three eyes, the outermost eye on each side being deeply sunk and lying on the outer anterior surface of the brain. There are four marginal eyes on either side, evidently in the position of the absent marginal tentacles. The mouth is in front of the end of the first body fourth. The male opening is close behind the mouth; the female opening is a little in front of, and the sucker a little behind, the middle of the body.

A. nationalis, from the neighbourhood of Cape St Vincent, is larger, measuring 5 mm. by 2.5 mm., and has a large cylindrical pharynx, which in the retracted condition measures one-fourth of the body length. The mouth is at the beginning of the second body sixth, the male opening at the end of the second body fifth, and the female opening almost exactly in the middle of the body. Behind this lies the sucker, which is large and muscular. Over the brain area there are two groups of eyespots each containing twelve to fifteen ocelli. The marginal ocelli are about thirty on either side.

For the reception of *A. nationalis* within the genus *Aceros*, PLEHN amends LANG's

description of the genus by leaving out reference to the very small number of eyes characteristic of *A. inconspicuus* as apparently not of generic importance, and, by substituting "under or close behind the pharyngeal sac" for "under the pharyngeal sac" to indicate the position of the male apparatus. The first of these alterations is required by *A. stylostomoides*, but in regard to the position of the male apparatus this species conforms to the generic type as instituted by LANG.

In the Euryleptid genus *Stylostomum* (3), mouth and male aperture open together by a common antrum, and there is no median anterior gut root. LANG remarks that, except for these two points, *Stylostomum* is almost exactly the counterpart of *Aceros*. It is noteworthy therefore to find that in *A. stylostomoides* the male opening and the mouth are so closely approximated that in certain states of contraction they may almost be said to open together.

The presence of a dorsal pore in *A. stylostomoides* is extremely interesting. The pore canal passes downwards and forwards from the surface to the hinder part of the main gut in the median line, and is clothed by epithelium agreeing in character with the body epithelium except that its cells are provided with longer cilia. The basement membrane is continued down the wall of the canal, and there are sphincter fibres at the junction with the gut.

Dorsal pores are described by LANG as occurring in *Cycloporus*, *Yungia*, and probably also in *Oligocladus* (4). In *Cycloporus* they are very numerous and occur near the body margin. Here the extremities of the ultimate gut branches become enlarged to form vesicles which open on the dorsal surface, each by a tiny pore.

In *Yungia* the pores occur on the dorsal surface at the places at which the anastomosing gut branches meet. Here short diverticula from the branches end in small vesicles opening by the pores.

In *Oligocladus* the hindmost gut root on either side sends a diverticulum backwards towards the dorsal surface in the middle line. These meet with one another and with a mesial process from the main gut in a cell mass close under the dorsal body epithelium. LANG was not able to find a pervious canal opening on the surface through the cell mass in question, but he considers that in all probability this was due to contraction of the tissues.

The same author suggests that such pores may be considered as being homologous with an anus, and that the numerous marginal pores in *Cycloporus* may be looked upon as representing a primitive condition recalling the marginal excretory pores of Cœlenterates.

In *Yungia* the pores, though fewer, are still numerous, and scattered over the lateral parts of the dorsum; while in *Oligocladus* there is only one pore, but it is connected with the two last gut roots as well as with the main gut. *A. stylostomoides* would complete the series, inasmuch as it has a single opening which is comparatively large, and is connected only with the main gut.

We are of opinion, however, that these pores, occurring as they do in a few

scattered species of Turbellaria, are to be looked upon as new formations without phylogenetic importance.

It may be well to summarise here the points in which this new species of *Aceros* differs from those previously described.

A. stylostomoides differs from *A. inconspicuus*, LANG (recorded from the Gulf of Naples):—

1. By the number of eyes (*a*) in the brain groups (about fifteen in the former and three in the latter on either side), and (*b*) in the tentacular groups (eight to nine in the former and four in the latter on either side);
2. By the presence in the former of a dorsal pore leading into the main gut;
3. By the absence from the former of special uterine glands.

A. inconspicuus differs from *A. nationalis*, PLEHN (recorded from the neighbourhood of Cape St Vincent):—

1. By the much greater approximation in the former of the mouth and the male aperture. In the latter these openings are separated by fully a sixth of the body length;
2. By the number of eyes in the tentacular groups (eight to nine in the former and thirty in the latter on either side);
3. By the presence in the former of a dorsal pore and the absence of separate uterine glands.

POLYCLADA.

Tribus *Cotylea*. Genus (nov.) *Nuchenceros*, referred provisionally to Fam. *Euryleptidæ*, LANG. Type, *Nuchenceros orcadensis*, n. sp. (Plate figs. 3-6).

Two examples of this extremely interesting polyclad were obtained, the one (specimen *a*) having its male structures in maturity, the other (specimen *b*) being quite immature. They measure respectively 4.5 and 4 mm. in length, are oval in shape, and of a brownish colour which is lighter underneath. The surface is destitute of papillæ. Their most striking characteristic is the presence of a pair of slender nuchal tentacles studded with eyes and containing no visceral branches. The tentacles in question measure an eighth of the body length, and are situated at a sixth of the body length from the anterior margin.

Eyes.—The eyes are in three groups on either side: (1) anterior marginal, three to four in number, large, and embedded in the parenchyma; (2) tentacular, about twenty-four in number on either side, clustered thickly, especially on the outer and anterior sides of the tentacles; (3) cerebral, a somewhat diffuse group comprising (*a*) eyes right over the brain, (*b*) eyes lateral to the brain, and (*c*) eyes behind the brain, and occurring as far back as the junction of the first and second body thirds. The cerebral subgroups are not definitely separated from one another, and the total number of eyes they contain is about thirty on either side.

Brain.—The brain lies in front of the mouth, at the junction of the first and second body fifths.

Sucker.—The sucker, which is large and slightly elevated, lies a little in front of the middle of the body. It rests on a pad of muscular tissue which is continued into the walls of the posterior part of the pharyngeal sac. Here the tissue in question is permeated by fine mucous canals which open into the sac.

The older specimen (specimen *a*) is much injured dorsally, and has its pharynx retracted to an extreme degree. Partly owing to the injury and partly to the extremely hard nature of the tissues below the pharyngeal sac, a satisfactory series of sections of this specimen was not obtained. This circumstance is all the more to be regretted seeing that the smaller specimen, though it furnished a good series of sections, was quite immature as regards the genital organs.

Digestive System.—The mouth lies in front of the brain and opposite the tentacles, at one-sixth of the body length from the anterior body margin. The pharyngeal sac is long and narrow, with a backward diverticulum above the position of the sucker. In specimen (*b*) the pharynx, which is long, tubular, and tapering towards the apex, lies fully extended within the pharyngeal sac. (Plate fig. 4.) In specimen (*a*) the pharynx is completely retracted within the posterior part of its sac, the mouth leading first into a slightly dilated part from which the sac is continued backwards as a narrow canal to the posterior dilatation in which the pharynx lies. The cavity of the pharynx opens into the gut a little behind the junction of the first and second thirds of body length.

The main gut is spacious, extending forward for a considerable distance in front of the internal opening of the pharynx. The lateral gut roots are five in number on either side, and some of their branches anastomose near the margin. The anterior gut root extends forward over the middle part of the brain and divides without anastomosing with any of the branches of the first lateral gut roots.

Genital Organs in Specimen (a).—The male opening lies close behind the mouth and leads into a penis sheath cavity of considerable size. (It must be stated here that, owing to the injured condition of the specimen, the succeeding part of this description of the male organs may not be quite complete or accurate, and it is therefore liable to correction should further specimens be obtained.) At the bottom of the penis sheath cavity is a small conical elevation, above which is a muscular backward diverticulum of the penis sheath cavity. (Plate fig. 5.) The elevation is perforated by a fine passage which appears to be continuous with the central canal of an oval organ lying close behind. The walls of this organ are so hard and dense as to show practically no histological structure. Into the posterior end of its central cavity opens a short canal formed by the union of the two vasa deferentia. These last are full of spermatozoa and irregularly dilated, each exhibiting a very large swelling just before its first main branch is given off. The lobules of the testis are numerous, large, and scattered throughout the lateral parts of the body.

The conical elevation mentioned above may represent an apical portion of the penis, and the oval organ a combined bulbar portion and granule gland. A vesicula seminalis appears to be wanting, its place being taken by the much-dilated vasa deferentia. The dorsal diverticulum of the sheath cavity may have something to do with the mechanics of protrusion of the bulbar part of the penis.

The immature specimen has no male external opening, but in a mass of parenchym cells below the anterior part of the pharyngeal sac there are two small cavities connected with one another. (Plate fig. 3.) These probably represent the penis sheath cavity and the granule gland (bulbar portion of penis). From the dorsal side of the first a minute cavity arises which probably gives rise to the apical portion of the penis. The vasa deferentia unite behind the granule gland without opening into it, and they are traceable for a considerable distance as narrow, undilated canals. It is remarkable that at this stage there is no communication between the various cavities mentioned above and the external surface.

Female Organs.—The female opening in specimen (*a*) lies just in front of the sucker and near the junction of the first and second thirds of body length. It leads by a narrow canal into the widened shell-gland portion. The duct of the uterus is traceable for a short distance as a solid mass of cells, but its cavity is not yet developed. Uteri and oviducts cannot yet be made out, and the ovarian tissue is in an extremely embryonic condition. In the immature specimen only the cavity of what is probably the shell-gland portion is recognisable (Plate fig. 3), and like the male cavities it is cut off from the external surface.

Systematic.

Until other species of this genus are found and described, it would be premature to delimit the characters in the above description that are of generic from those of specific importance. We therefore confine ourselves to designating *N. orcadensis* as type of the genus, referring to the above description for details, and summarising the outstanding characters as follows:—

Slender nuchal tentacles containing eyes but no gut branches; large sucker situated a little in front of the middle of the ventral surface; mouth in front of brain; pharynx long, tubular; pharyngeal sac with a backward extension above the sucker; gut with unpaired anterior and five pairs of lateral roots; genital apparatus entirely beneath the pharyngeal sac.

In general structure *Nuchenceros* resembles the Euryleptid genus *Oligocladus*, LANG (5), having like it the mouth in front of the brain, the pharynx long and tubular, and the genital openings below the pharyngeal sac which extends backwards above the sucker. But in *Oligocladus* the tentacles are of the marginal type containing gut branches, while *Nuchenceros* has nuchal tentacles such as are characteristic of the Acotylean *Planoceridæ*.

Again, according to our description, the male organs of *Nuchenceros* resemble those

found in *Planocera insignis* in the features wherein these organs differ from the Euryleptid type, *i.e.* absence of vesicula seminalis and of a separate granule gland (6).

Nuchenceros appears therefore to exhibit certain characters intermediate between the two great polyclad tribes the *Acotylea* and the *Cotylea*. Probably in the end a new Cotylean family will have to be created for its reception; but meanwhile, until the characters of the genital organs are more definitely determined, we think it best simply to call attention to its close general resemblance to *Oligocladus*, a member of the family *Euryleptidæ*, notwithstanding the fact that none of the *Euryleptidæ*, and indeed none of the *Cotylea* hitherto described, possess true nuchal tentacles.

Reference is made by LANG (7) to imperfect descriptions by KELAART (8) and COLLINGWOOD (9) of an Acotylean species from Ceylon, called by the former *Planaria meleagrina* and by the latter *Stylochoplana meleagrina*, which possesses both marginal and nuchal tentacles. As LANG considers that the nuchal tentacles of polyclads are the more primitive, and the marginal ones are newer formations, he is not surprised that cases should occur in which both kinds are present, but he would naturally expect such cases to be Acotylean. In this connection it is worthy of special note that *Nuchenceros* has a tentacular group of eyes in addition to the marginal and cerebral groups.

In any case it is evident that the usually accepted definition (10) of the tribus *Cotylea* must be widened by the exclusion or modification of the two following phrases, "Ohne Tentakeln oder mit Randtentakeln," "Ausser den Gehirnhofaugen kommen auf dem Nacken keine anderen Augen Gruppen (Tentakelaugen der Acotyleen) vor," in order that this tribus may still include *Nuchenceros*, with its special tentacles and the groups of eyes associated with them.

TRICLADIDA.

Three specimens identified as belonging to the species *Gunda Ohlini*, BERGENDAL, which has been recorded from the coast of Patagonia (11).

REFERENCES.

- (1) *Fauna u. Flora des Golfes von Neapel*, vol. ii. p. 589.
- (2) *Ergebnisse der Plankton Expedition*, Humboldt Stiftung. II. Heft f, 1896.
- (3) *Fauna u. Flora*, etc., vol. ii. p. 585.
- (4) " " " " pp. 155-160.
- (5) " " " " p. 580, and *Atlas Taf.*, 30.
- (6) " " " " pp. 236-7.
- (7) " " " " pp. 192, 194, 613.
- (8) *Journal of the Ceylon Branch of the Royal Asiatic Society*, 1856-8, Colombo, 1858, pp. 134-9.
- (9) *Transactions of the Linnean Society of London*, II. Series, vol. i., part 3, 1876.
- (10) *Fauna u. Flora*, etc., vol. ii. p. 521.
- (11) *Zoolog. Anzeiger*, vol. xxii. pp. 521-4.

EXPLANATION OF FIGURES.

<i>ag.</i> Anterior gut root or its branches.	<i>mu.</i> Muscular layer of body wall.
<i>br.</i> Brain.	<i>mu.s.</i> Sphincter muscle of pore canal in fig 3.
<i>br.e.</i> Eyes belonging to the brain area group.	<i>p.</i> Dorsal pore.
<i>ep.</i> Surface epithelium.	<i>pe.</i> Penis.
<i>fa.</i> Female aperture.	<i>ph.</i> Pharynx.
<i>fo.</i> Female organs (undeveloped) in fig. 3.	<i>p.ho.</i> Internal opening of pharynx.
<i>g.</i> Main gut.	<i>ph.s.</i> Pharyngeal sac.
<i>g.1.</i> First lateral gut root.	<i>ps.</i> Penis sheath.
<i>g.2.</i> Second „ „	<i>s.</i> Sucker.
<i>g.3.</i> Third „ „	<i>sg.</i> Shell gland.
<i>gr.g.</i> Granule gland (prostatic vesicle).	<i>t.</i> Tentacle.
<i>m.</i> Mouth.	<i>vs.</i> Vesicula seminalis.
<i>ma.</i> Male aperture.	<i>ut.d.</i> Efferent canal of uterus.
<i>mc.</i> Mucous canals in the muscular tissue behind pharyngeal sac.	<i>ut.</i> Commencement of uterus.

DESCRIPTION OF PLATE.—(For lettering see above.)

Fig. 1. Sagittal section of *Aceros stylostomoides* (specimen *a*).

Fig. 2. Dorsal pore of *A. stylostomoides* (specimen *b*). The canal is oblique and of considerable length, its lumen being fairly uniform but slightly contracted near its inner and outer ends. The cells lining it are richly ciliated.

Fig. 3. Sagittal section through genital region of immature *Nuchenceros orcadensis*, highly magnified. Description on p. 7. There is no connection at this stage between the various cavities and the external surface.

Fig. 4. Sagittal section of *Nuchenceros orcadensis* (specimen *b*).

Fig. 5. Sagittal section of *N. orcadensis* (specimen *a*).

Fig. 6. Longitudinal section of *N. orcadensis* (specimen *a*), passing through the tentacle on one side. The absence of visceral branches in the substance of the tentacle will be noted.

GEMMILL & LEIPER: TURBELLARIA OF SCOTTISH NATIONAL ANTARCTIC EXPEDITION.

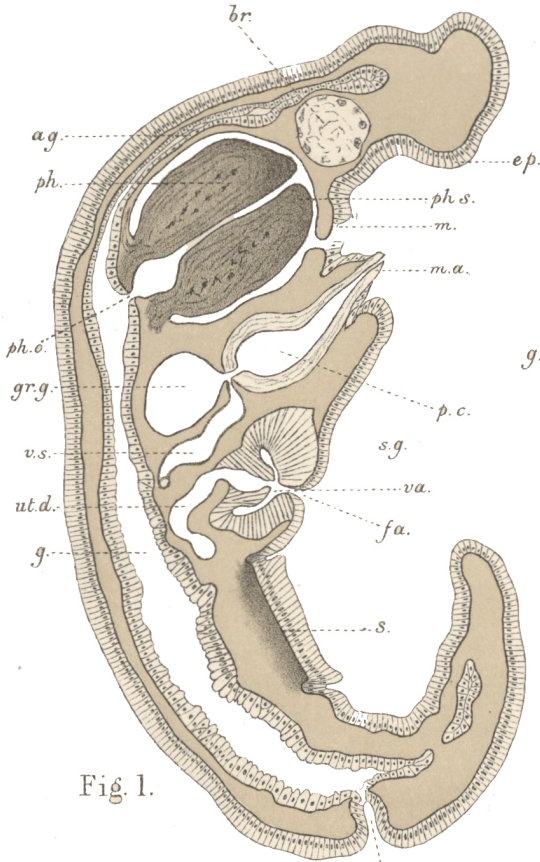


Fig. 1.

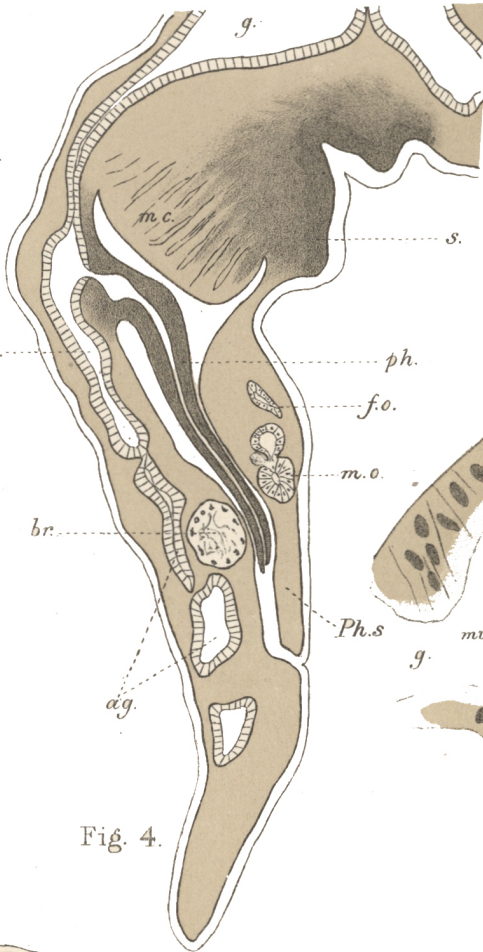


Fig. 4.

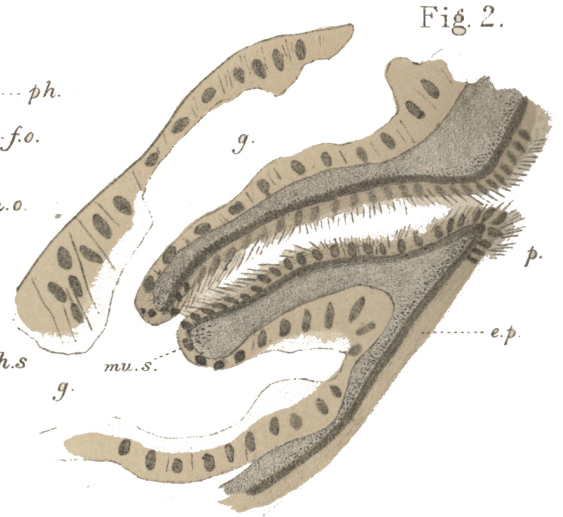


Fig. 2.

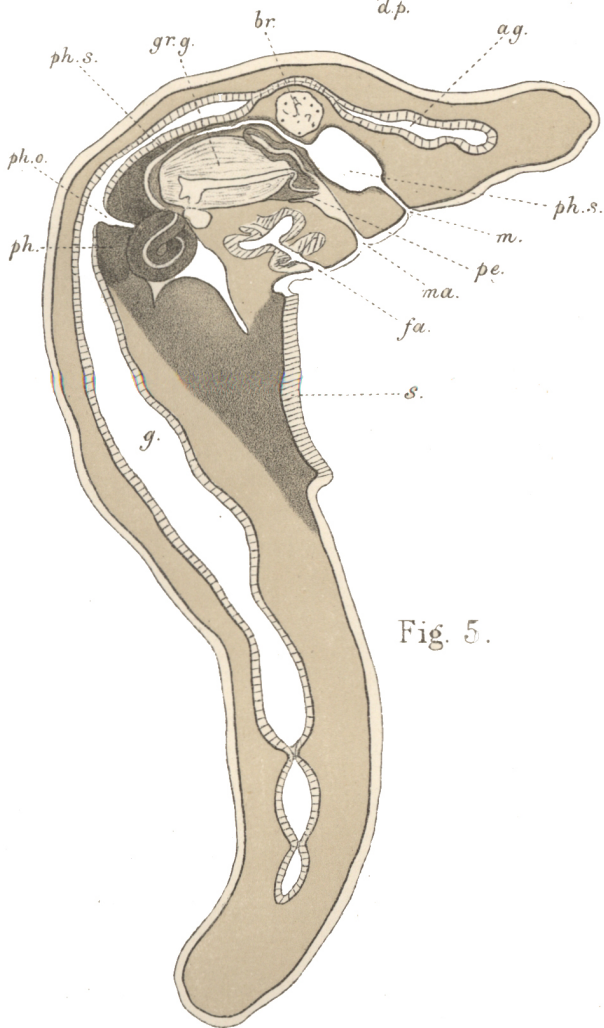


Fig. 5.

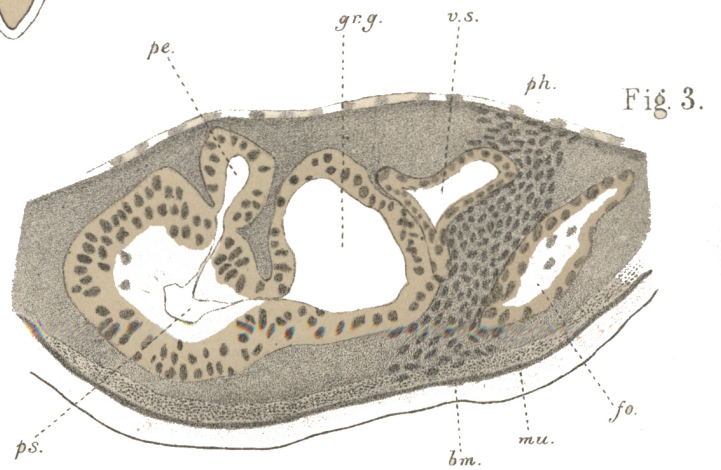


Fig. 3.

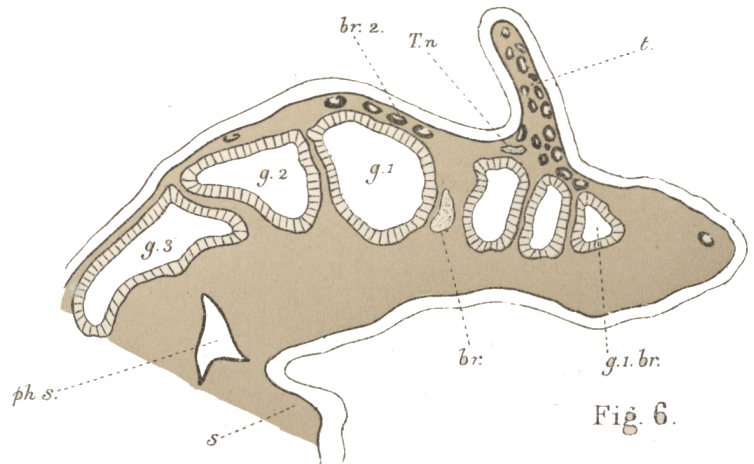


Fig. 6.