On Haplobranchus, a New Genus of Capitobranchiate Annelids.

By

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With Plate IX.

Occurrence.—This very interesting worm was kindly placed in my hands for description by Professor Lankester, who received it last November in quantity from Mr. Thomas Bolton, F.R.M.S., of Birmingham, accompanied by a sketch of the animal in its tube, which I have reproduced in a modified form in fig. 1. Respecting its habitat, I may quote the words of Mr. W. H. Shrubsoll, who writes as follows:—

"The worms have been familiar to me for a long time, and occasionally I have met with them in great abundance on the coast of Sheppey. Not having books of reference at command I had no means of knowing whether they were described or not, and I assumed that they were.

"As far as my experience goes, they are always found associated with diatoms on the surface of soft mud at the bottom of gullies, and the presence of the diatoms insures to the animal a plentiful supply of oxygen.

"There is generally an inch or so of water overlying the mud, and the diatomaceous film at the bottom is ornamented with silvery-looking globules of oxygen.

"As it is impossible to collect either the diatoms or the

worms without getting well besmeared, and sometimes walking knee-deep in the tenaceous mire, it is hardly to be wondered at that they have hitherto escaped attention."

Associated with the worm was a species of Nais, which Professor Lankester has identified as the Nais littoralis of O. F. Müller, which has for many years been unrecorded, no naturalist, in fact, having seen it since Oersted's description and figure in 1842. There were also numerous free-living nematoids and rhabdocœl planarians.

Mr. Bolton tells me that he has seen the worm once before in a gathering from the mouth of the Liffey.

Anatomy.—The animal is minute, adult specimens not exceeding 6 mm. in length.

The tube is about twice the length of the animal, and is composed of particles of mud, with here and there a diatom (Pleurosigma, sp.).

Segments and appendages.—The "head" consists of a prostomium and a peristomium.[1]

The prostomium is much reduced and hidden by the peristomium, which rises to form a "collar" around it; this collar is higher upon the ventral than upon the dorsal surface. There are two prostomial tentacles, which are short, have pigment in the walls, and are not ciliated; they are much obscured by the palps and peristomial tentacles (figs. 1, 2, 3, and 5, prost.

[1] In the description, I make use of the following nomenclature:—The Prostomium (Præstomium, Huxley) is the lobe in front of the mouth; it may bear two kinds of appendages, (1) prostomial tentacles (antennes, Milne-Edwards and De Quatrefages; cirri, Kinberg), which spring from its dorsal surface, and generally resemble in character the appendages of the peristomial somite; and (2) palps (palpi, Kinberg; infero-lateral præstomialcirri, Huxley; antennes externes, Milne-Edwards and De Quatrefages), which spring from the lower surface of the prostomium and differ very considerably in character in different families of annelids. The Peristomium (Peristomium, Huxley; Mund-segment, Grube), which is the first somite of the body, and, it may be, the second and third fused with it; and although retaining ordinary characters in a few families of annelids, *e.g.* Syllidæ, very generally becomes much modified. Its appendages are peristomial tentacles (tentacules, De Quatrefages).

tents.) They are united at their base with the palps and more posteriorly with the two most dorsal of the peristomial tentacles.

The palps are very long, and, springing ventrally, bend over at their free ends towards the dorsal region. They are richly ciliated upon their dorsal surface, and each contains a large blood-vessel, with the green blood nearly filling up its lumen; they can thus be instantly recognised, as the peristomial tentacles have no such blood-vessel, but merely prolongations of the general body cavity.

The prostomium bears at its sides a pair of black pigment spots (fig. 5, *oc.*), which can be seen through from the ventral surface, and appear at first sight to lie upon the collar, but transverse sections have demonstrated their true position (fig. 5).

The peristomium, which forms the collar, as stated above, bears two pairs of appendages, each consisting of a very short basal piece and two long rami (noto- and neuropodial), of these the ventral ramus is the longer in each case, but is not so long as a palp. They are all richly ciliated upon their inner faces, and contain prolongations of the general body cavity, but no special blood-vessel.

The mouth, which is hidden by the collar, lies between the palps and the bases of the prostomial tentacles.

The somites of the body (counting the peristomial somites as the first) are twelve in number, of these somites 1—9 form the "thorax," and differ from somites 10—12 which form the "abdomen."

The parapodia are very slightly raised from the surface of the body, and slightly more so in the posterior than in the anterior somites.

As the peristomum bears no setæ the second somite is the first setigerous somite and bears dorsal capillary setæ only they are of two varieties placed in two bundles with usually three in each bundle, and resembling respectively figs. 8 and 9, which represent setæ from the following somite. The one variety has a very long and delicate blade, while in the other

the blade is shorter and wider; in both cases the blade only occurs on one side of the axis.

The third somite has similar setæ but slightly more numerous (the usual number of the various kinds of setæ is accurately shown in fig. 2), and bears in addition ventral "crochet" setæ (fig. 10). These are not actually forked but evidently correspond to the "crochet" setæ of allied worms.

The remaining somites in the "thorax" bear similar setæ, the crochet setæ present slight variations. Figs. 10 and 11 represent the extreme conditions, the capillary setæ in the posterior segments of the thorax gradually approach the condition shown in fig. 12, intermediate in character between figs. 8 and 9.

In the "abdomen," an inversion in the position of the setæ occurs, the capillary setæ becoming ventral, and the crochet setæ dorsal, at the same time their character is changed (fig. 14); the capillary setæ become longer, more flexible, are often bayonet-shaped (not well shown in fig. 13), and the blade occurs on both sides of the axis; the "crochet" setæ become very numerous and are closely placed in a transverse row, they are finely serrated on one side at the free extremity.

Alimentary canal.—The alimentary canal is simple, there is a constriction between the fifth and sixth somites, and between the sixth and seventh; in the sixth somite it is dilated, from the seventh somite to the anus, in the terminal somite, it gradually narrows, immediately in front of the anus it is slightly dilated (fig. 4). The canal is ciliated at any rate in its posterior half, the anterior portion presents a brown pigment in the walls.

Blood-vessels.—The complete distribution of the circulatory system is not easily determined.

The blood is green.

There is a dorsal vessel which bifurcates in the peristomial and terminal segments, the two branches in each case turning round and uniting to form a ventral vessel. The dorsal and ventral vessels are connected in the tenth and eleventh somites

by a pair of lateral commissures. Lateral commissures were also observed in the somites which contained the ova in the female (somites 4 and 5).

In the central region, the dorsal and ventral vessels pass towards the sides and appear to form a sinus around the intestine, Claparède thought to have observed this condition in Fabricia armandi, and De Quatrefages in Amphicorina.

Vessels pass to the head, but it was not possible to make out their exact origin; these dilate into a sinus at the base of the peristomial tentacles (Claparède, 'Rech. Anat. sur les Annélides, &c., dans les Hebrides,' 1861, describes similar sinuses at the bases of the branchiæ in Fabricia quadripunctata and calls them "branchial hearts"), but vessels pass from them into the palps only, a single trunk to each, which alternately fills and empties, as is the case in Fabricia and in Polydora and Spio.

Nephridia.—It was impossible to determine definitely the Nephridia; in somites 10 to 12 (fig. 4, Neph.) paired bodies are seen at the base of the parapodia, which I take to be Nephridia.

In the third somite there are two bodies, the structure of which could not be ascertained, owing to the amount of pigment in the wall, but they are doubtless modified Nephridia and function as tubiparous glands; they open at the bases of the parapodia on each side in the same somite.

Gonads.—The sexes are distinct. The spermatozoa are seen floating in various stages of development in the body cavity in the thoracic somites 7, 8, and 9, but not in the abdominal somites (fig. 4).

They are confined to the central region of the somite around the alimentary canal by a membrane. The spermatospheres are not spherical, but much elongated rope-like bodies.

They cannot be passed from segment to segment, and the manner in which the spermatozoa are shed is uncertain.

In the females the ova are found in somites 4 and 5 (fig. 2), and attain a very large size in the body cavity; their shape is continually being altered by the movement of the wall of the

intestine. Their large size probably necessitates their passing to the exterior by rupture of the body wall.

Nervous system.—I have been unable to determine the structure of the nervous system. The supra-œsophageal ganglion nearly fills the prostomium.

There are no caudal eyes.

There are no auditory capsules.

Affinities.—Haplobranchus comes into the family Serpulidæ on account of its capitobranchiate nature, but differs from all hitherto known genera of the family in that the tentacles, while they remain free, are devoid of any secondary filaments and of any trace of cartilaginous support. It agrees with the sub-family Sabellidæ in the absence of any thoracic membrane and operculum.

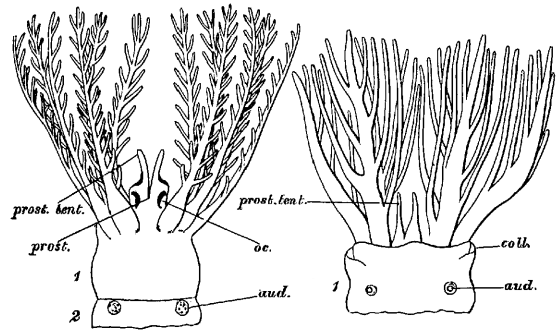
There are certain genera of the Sabellidæ which present some approach to its simplicity of structure. These are: Amphiglena, Clap.; Fabricia, Blainville; and Amphicorina, De Quatr. These forms present certain characters in common which are absent in Haplobranchus. The first pair of Nephridia, belonging to the second somite, which are modified as tubiparous glands, and which in all true Sabellids open on each side at the base of the parapodium, are united in these three genera in the dorsal region, and open by a single median dorsal pore at the base of the branchiæ. In Haplobranchus, although I have not been able to make out their exact relations, there is no doubt they are not thus specially modified. These three genera present auditory capsules in the peristomial segment and caudal eyes, of neither of which is there any trace in Haplobranchus.

On the other hand, these three genera agree with one another and with Haplobranchus in the comparatively simple structure of the head; the prostomium not being completely fused with the peristomium is still recognisable, and presents prostomial tentacles and palps. The peristomial collar, completely absent in Amphiglena, is only slightly developed in the other forms. There is little differentiation of the regions of the body

—thorax and abdomen; the setæ are simpler than in other sabellids, and the copragogal groove is absent.

A comparison of the heads in these genera seems to throw considerable light upon the nature of the processes of the head in the Serpulidæ.

In Amphiglena[1] the prostomium remains well developed, bear-



A. Diagram of head of Amphiglena, dorsal view.
B. Diagram of head of Fabricia,, dorsal view. *prost.* Prostomium. *prost. tent.* Prostomial tentacles. *l.* Peristomial somite. *coll.* Peristomial collar. *oc.* Eye-spots. *aud.* Otocyst. After Claparède.

ing lateral pigment spots and a pair of tentacles. It is difficult to make out the nature of the palps from Claparède's figures; there are two ventral processes which may represent them. The branchiæ which, according to Claparède, vary in number, from eight to twelve, have taken up such a position as to form a circular crown, and bear along their whole length a series of short, opposite, secondary filaments.

The branchiæ appear to spring from the peristomium.

In Fabricia,[2] also, prostomial tentacles may be definitely determined.

[1] Claparède, 'Glanures Zootomiques parmis les Annélides de Port Vendres,' p. 32, pl. 3.

[2] Claparède, loc. cit., p. 36, pl. 3.

The branchiæ have become modified owing to the great development of the secondary filaments, which arise alternately and attain the same length as the main stems.

In Haplobranchus, prostomium and tentacles closely resemble those of Amphiglena, but the palps are well developed. There is some little uncertainty about the determination of the organs I have so marked as palps, but their slightly greater muscular development, their blood supply, and their close connection with the ventral region of the prostomium, point to their being different in nature to the other tentacles.

The branchial tentacles it is which are so especially interesting in Haplobranchus, their definite arrangement, united in pairs at the base, the absence of any secondary filaments, the rich ciliation upon their inner faces,[1] and the absence of any branch of the closed vascular system in this lumen are all interesting characters, and point to their being similar to the peristomial tentacles of other annelids which are just taking on that branchial function which is the most marked feature of the whole family. These tentacles on account of their united bases may really be said to represent two parapodia on each side, each possessing a notopodial and a neuropodial ramus, indeed, they remind one very forcibly of the peristomial tentacles of such an annelid as Nereis. Their condition seems to me very strong evidence in favour of their peristomial nature, and consequently of the peristomial nature of the branchiæ of the Serpulidæ. This view was entertained by Milne Edwards,[2] but De Quatrefages [3] states that the branchiæ of the Serpulidæ receive their nerve supply from the supra-œsophageal nerve ganglion, and consequently he considers them to be prostomial.

Claparède and Mecnikow [4] have shown that in Dasychone

[1] Since sending my drawings to the press, I have observed a distinct tendency to a grouping in the arrangement of the cilia; upon the surface of the branchiæ, groups of cilia springing from a very slightly raised serpentine ridge.

[2] 'Règne An. ill.,' pl. 1 E, explanation of fig. 2.

[3] De Quatrefages, 'Hist. Nat. des Ann.,' tome ii, p. 401.

[4] 'Zeit. für wiss. Zoologie,' Bd. xix, 1869, Taf. xvi.

lucullana, the first rudiments of the branchiæ arise as two processes which soon bifurcate, and are clearly placed below the very large prostomium. This is at a stage when three setæ bundles are visible.

The prostomial lobe, which in Dasychone never bears any tentacles or palps, gradually aborts, and the secondary branchial filaments appear to have a terminal origin. Thus developmental history, so far as we know it, favours the view of the peristomial nature of the branchiæ.

Systematic Description.

Family—Serpulidæ. Tribe—Sabellidæ.

Haplobranchus, g. n.

Head distinct.

Pro- and peristomium almost fused, two prostomial tentacles, two palps.

Collar slightly developed.

The paired branchiæ consist each of four free tentacles united at the base in pairs, and entirely devoid of secondary filaments; they are richly ciliated. No blood-vessel in the branchiæ, a single blood vessel in each palp.

Tubiparous glands not united.

Caudal eyes absent.

Auditory capsules absent.

Sexes distinct.

H. aestuarinus, sp. n. Isle of Sheppey, England, W. H. Shrubsoll; Mouth of the Liffey, Ireland, Tho. Bolton.

Specific characters where a single species only is known must always be guardedly put forward, but judging from allied forms, the following would seem to have such weight:

Length 4—6 mm.

Nine somites (8 setigerous) in the thorax.

Three somites in the abdomen.

The shape of the setæ, figs. 8—14.

Blood green.

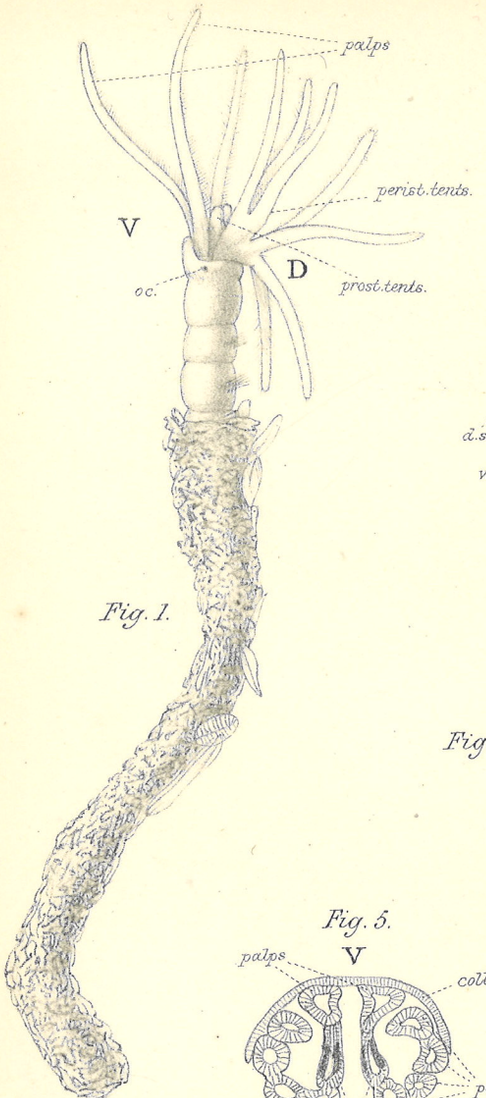


Fig. 1.

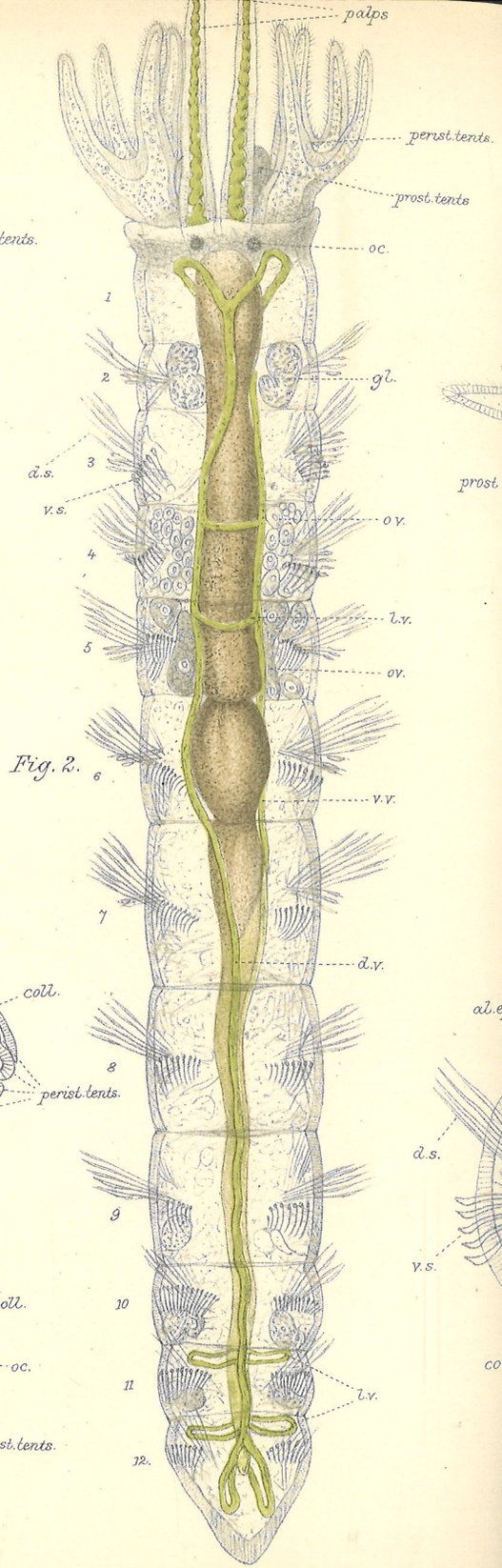
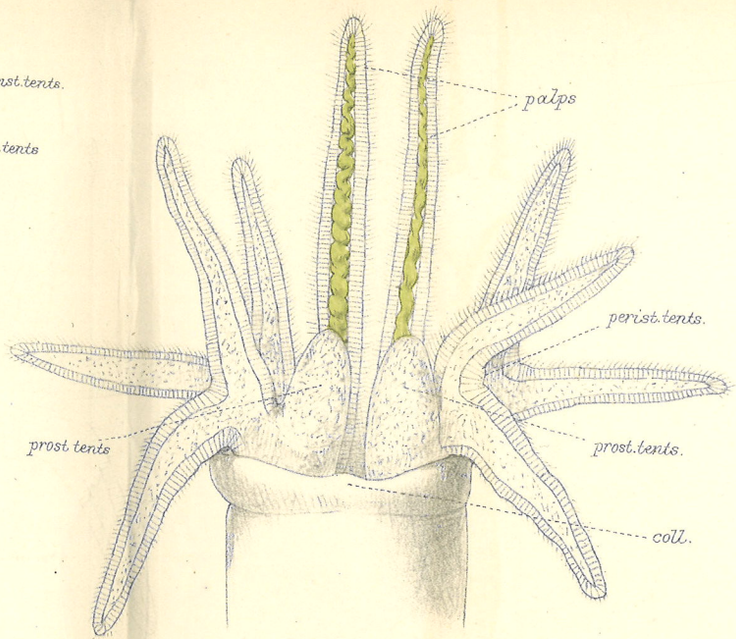


Fig. 2.



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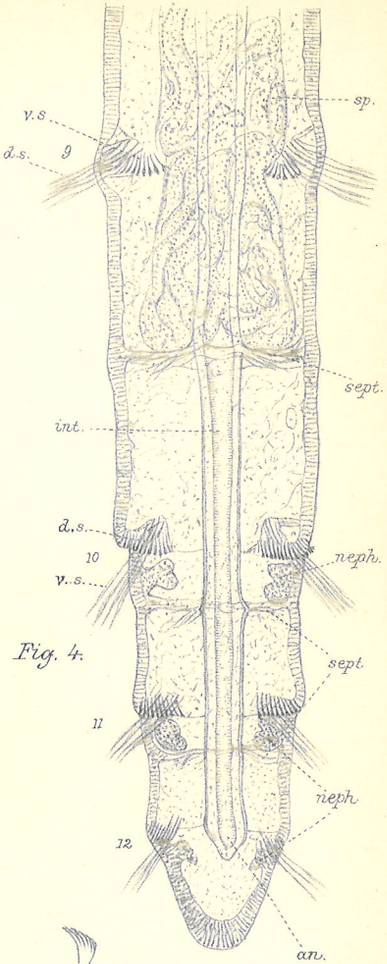
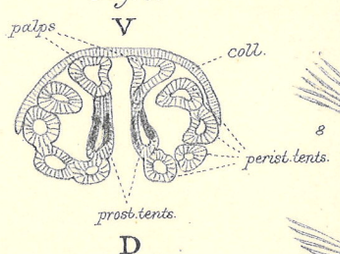


Fig. 4.

Fig. 5.



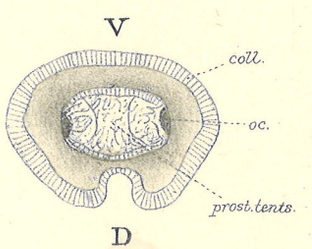


Fig. 6.

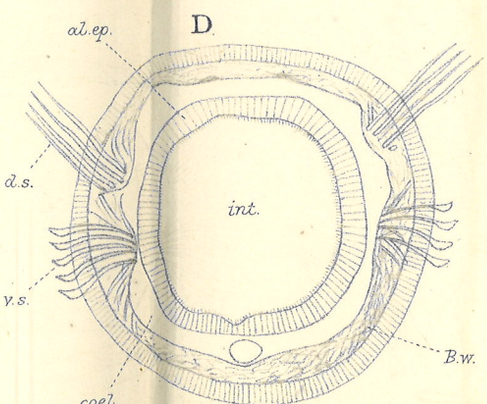


Fig. 7.

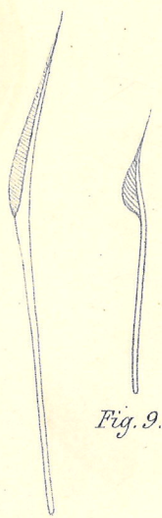


Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

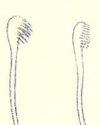


Fig. 14.

A. G. Bourne del.

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DESCRIPTION OF PLATE IX,

Illustrating Mr. A. G. Bourne's paper on 'Haplobranchus aestuarinus.'

References.

Prost. Prostomium. *Prost. tent.* Prostomial tentacles. *Palps.* Palps. *Perist.* Peristomium (1st body somite). *Coll.* Peristomial collar. *oc.* Eye-spots. *v . s.* Ventral setæ. *d. s.* Dorsal setæ. *d. v.* Dorsal vessel. *v. v.* Ventral vessel. *l. v.* Lateral commissural vessels. *sept.* Intersegmental diaphragms. *inst.* Intestine. *m.* Mouth. *an.* Anus. *neph.* Nephridia. *gl.* Tubiparous glands. *sp.* Spermatoblasts. *ov.* Ova.

Fig. 1.—Lateral view of animal, as seen projecting from its tube.

Fig. 2.—Ventral view of the entire animal (female), killed with corrosive sublimate and rendered transparent with glycerine jelly. The body is rather flattened out to show approximately the number of the setæ. The eye-spots are represented as showing through the collar.

Fig. 3.—Dorsal view of the head.

Fig. 4.—Posterior segments (male) uncompressed. *sp.* Spermatoblasts in various stages of development. *neph.* Nephridia.

Fig. 5.—Transverse section passing through the base of the prostomial tentacles, showing their connection with the palps. The collar is cut in the ventral region only, where it stands highest.

Fig. 6.—Transverse section passing through the eye-spots, and just in front of the mouth.

Fig. 7.—Transverse section passing through somite 6. *b. w.* Body wall. *cœl.* Body cavity. *int.* Intestine. *d. s.* dorsal setæ. *v. s.* Ventral setæ. *al. ep.* Alimentary epithelium.

Figs. 8 and 9.—Dorsal setæ from anterior somites 2 to 9 (cp. Fig. 12).

Fig. 10.—Ventral seta from somite, 3.

Fig. 11.—Ventral seta from somite. 9.

Fig. 12.—Dorsal seta from somite 9.

Fig. 13.—Ventral seta from somite 11 (compare with anterior dorsal fig. 12).

Fig. 14.—Dorsal setæ from somites 11 and 12 (compare with anterior ventral figs. 10, 11).