

Spengelia, a New Genus of Enteropneusta.

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With Plate 47.

PART I.—DIAGNOSIS.

FROM a rock-pool on the weather side of Lifu (Loyalty Islands) last year I obtained a single specimen of an Enteropneust living in company with *Ptychodera flava*,¹ which has proved, on examination, to constitute the type of a very distinct new genus.

Having been informed by Mr. J. P. Hill that he had received two kinds of Enteropneusta from Funafuti, one of which was *Pt. flava*, and the other a new species, I sent my material to him for comparison. Mr. Hill saw at once that my form was quite distinct from the Funafuti species, and he had the goodness to leave it intact until my return to Sydney.

The genera of Enteropneusta, as defined by Spengel, fall naturally into three groups, for which it is to be hoped Professor Spengel will shortly create family names.

Group I, including the genus *Ptychodera*, briefly characterised by the presence of an outer layer of circular muscles

¹ In a former paper on *Pt. flava* I suggested to add the name "*caledonica*" until Eschscholtz's species should be re-examined. Meanwhile Mr. J. P. Hill has informed me that the same species occurs at Funafuti.

Under these circumstances it will be well to cancel the name "*caledonica*," and if the form from the Marshall Islands turns out to be different, then its name, i. e. the name given by Eschscholtz, must be changed.

in the integument of the trunk, the occurrence of dorsal roots putting the fibrous layer of the collar nerve-cord in connection with the fibrous layer of the epidermis, and the presence of liver saccules, and of synapticula between the branchial bars.

Group II, including the genera *Schizocardium* and *Glandiceps*, characterised by the presence of an inner layer of circular muscles (inside the longitudinal layer), and by the occurrence of a long vermiform process extending forwards from the anterior end of the notochord or proboscis cæcum.¹

Group III, including the genus *Balanoglossus*, characterised by the absence of circular muscles in the integument of the trunk, and by the absence of synapticula.

Spengelia belongs to the second of the above groups, but exhibits features which render it a remarkably synthetic genus.

The following table (compiled from Spengel) will suffice to show the relation of *Schizocardium* and *Glandiceps* to one another, and will assist in the appreciation of the characters of *Spengelia*.

SCHIZOCARDIUM.	GLANDICEPS.
1. Ventral septum of proboscis extends to anterior end of vermiform process of notochord.	Ventral septum of proboscis stops short at base of vermiform process of notochord.
2. Pericardial auricles well developed.	Pericardial auricles rudimentary.
3. Peripharyngeal spaces present.	Peripharyngeal spaces absent.
4. Synapticula present.	Synapticula absent.
5. Œsophageal portion of branchial sac reduced.	Œsophageal portion of branchial sac well developed.
6. Liver saccules present.	Liver saccules absent.
7. Medial gonads absent.	Medial gonads present.
8. Anterior, unpaired, post-branchial intestinal pores (Darmforten) present.	Ditto.

¹ It would be desirable to translate the German word "Eicheldarm" in such a way as not to involve an abstruse morphological conception, which some authors object to,

9. Posterior, paired, præleptic intestinal pores present. Ditto.
10. Accessory genital pores present, which, when they occur laterad from the main series, perforate the longitudinal musculature. Ditto.

Spengelia agrees with *Glandiceps* in the characters mentioned in the above table under Nos. 1, 2, 3, 5, 7, and probably 6.¹ It only agrees specially with *Schizocardium* in the possession of synapticala (No. 4 in above table), this being also a marked *Ptychoderoid* feature.

A further most interesting reminiscence of the *Ptychodera* type in the organisation of *Spengelia* is the occurrence of vestigial roots arising from the dorsal side of the collar nerve-cord.

SPENGELIA POROSA, nov. gen. et sp.

External Form. [See Pl. 47, fig. 1.]

The proboscis was longer than the collar, measuring, when extended, 10.5 mm.² It was pear-shaped, and of a rich yellow colour. The collar measured 6.25 mm., and was coloured a rich orange, especially in the middle region, while the posterior region of the collar was whitish yellow. The rest of the body had a dull yellow colour.

The branchial region was 30 mm. in length, and in this region the body was quite cylindrical and faintly annulated. The post-branchial portion of the body, present in the specimen, measured about 20 mm.

Apart from the absence of genital pleura, *Spengelia* was readily distinguished from among the multitude of *Ptychodera flava* by the length of the proboscis and the bright orange-coloured collar.

But what at once distinguishes *Spengelia* from any other *Enteropneust* hitherto described is the occurrence on each side of the dorsal middle line of a series of deep dermal pits

¹ Unfortunately the post-genital region was lacking from my specimen.

² After preservation in a picro-acetic mixture the proboscis measured 5.25 mm., and the collar 4 mm.

in the post-branchial genital region. The mouth of each pit is about 1 mm. in diameter.

At a glance the pits appear to be regularly paired, but a re-examination has shown that they are not quite so regular as represented in fig. 1.

In the fresh condition the sides of the genital region of the body were occupied by elongated, somewhat pyriform bodies, which caused definite ridges on the external surface. These projections were caused by the gonads. The individual was a mature male.

The dermal pits lie in the submedian line, in direct continuation from the branchial groove, and the most anterior pits invade the posterior extremity of the branchial region, in consequence of which a number of the outer pores of the posterior gill-slits do not open near the surface of the body, but deep down at the base of the dermal pits.

The last newly formed gill-slit on each side opens directly from the gut into the base of a dermal pit; and at first I thought they represented the intestinal pores (Darmporten) described by Spengel (discovered originally by Schimkewitsch).

Under some circumstances it might be very difficult to distinguish true gill-slits from intestinal pores.

Spengelia differs from Schizocardium and Glandiceps in the absence of anterior intestinal pores. I am unable to say anything about the posterior intestinal pores, as my specimen was incomplete.

Transverse sections show that the dermal pits of Spengelia are remarkably deep, extending through more than half the thickness of the body, and actually branching amongst the gonads. They appear to serve for the irrigation of the gonads. If anyone saw a single section passing through the middle of a dermal pit, he would say that Spengelia possessed genital pleuræ. Perhaps these pits owe their origin to an incomplete fusion of genital pleuræ with the body-wall; or they may merely represent local depressions of the floor of a branchio-genital groove.

Apart from their connection with the gut by means of the

posterior gill-slits, the dermal pits do not communicate with the intestine, although they extend very near to the wall of the latter.

INTERNAL STRUCTURE.

1. Vermiform Process of Notochord.—This is a long, generally solid cord of cells, lying in the centre of the proboscis, and surrounded by a stout limiting membrane, which serves for the insertion of the median dorso-ventral muscles of the proboscis. Its diameter is not quite equal throughout its course. It agrees closely with the corresponding process in *Glandiceps*, particularly in the fact that the ventral septum of the proboscis does not accompany it, as it does in *Schizocardium*.

2. Collar Nerve-cord.—One of the most interesting and generically important characters of *Spengelina* is the occurrence of vestigial dorsal roots. They do not reach the epidermis, nor do they contain fibres or "Punktsubstanz." Otherwise their similarity to the roots of *Ptychodera* is complete. I have seen two such roots in *Spengelina*. The anterior root is the longer, and it runs obliquely, so that it appears in several sections separate from the nerve-cord. It is mostly solid, but contains a few minute disconnected cavities. The posterior root is hollow and much shorter than the anterior root, so that it does not appear in section separate from the nerve-cord.

3. Splanchnic Nerve-fibres.—A rather puzzling feature in the anatomy of *Spengelina* is the occurrence of a layer of nerve-fibres (Punktsubstanz) at the base of the epithelium of the buccal or throat cavity. Anteriorly it is a thick layer, and it becomes gradually thinner posteriorly. It may be traced as a very thin layer for a long distance beyond the opening of the notochord into the buccal cavity, and even at the base of the epithelium forming the œsophageal portion of the branchial sac. The occurrence of this well-defined layer of splanchnic nerve-fibres round the throat and œsophagus alone distinguishes *Spengelina* from all other Enteropneusta.

4. *Synaptacula*.—By preparing out a piece of the wall of the branchial sac I became aware of the presence of *synaptacula* in *Spengelia* before seeing them in section (fig. 3).

5. *Gonads and Genital Ducts*.—In the branchial region gonads occur both medially and laterally, that is on each side of the branchial groove (fig. 2). Their ducts open at the lips of the latter. In the post-branchial region where the dermal pits occur, the genital pores are numerous, and are not confined to the submedian line, so that several genital pores may be seen in one section. Some genital pores open into the dermal pits, while others open directly to the exterior near the dorso-lateral margin of the body. But in *Spengelia*, contrary to what obtains in other *Enteropneusta* (with exception of *Balanoglossus canadensis* and of the mediad accessory pores of *Schizocardium brasiliense*), the accessory genital ducts and pores do not perforate the longitudinal musculature. In the post-branchial region of *Spengelia* there is a very wide interval between the dorsal longitudinal muscles and the ventro-lateral longitudinal muscles, and all the genital pores occur in this interval.

6. *Miscellaneous*.—With regard to other points, it is only necessary to mention here that *Spengelia* agrees with *Schizocardium* and *Glandiceps* in having an unpaired asymmetrical proboscis-pore. The canal (*Eichelporte*) leading to the pore swells out into a large vesicle before discharging to the exterior, and at the base of the vesicle there are muscle-fibres presenting the appearance of a sphincter muscle.

Spengelia further agrees with *Glandiceps* in the massive development of chondroid tissue in the neck of the proboscis and in the length of the posterior cornua of the proboscis skeleton.

In the preserved condition the gill-pores were clearly visible at the base of the branchial grooves, as they are in *Glandiceps talaboti*.

7. *Summary*.—If it were not for the presence of vestigial roots in the collar nerve-cord, *Spengelia* (apart from its own peculiar features, e. g. dermal pits, splanchnic layer of

"Punktsubstanz," accessory genital pores not perforating the longitudinal musculature, &c.) might almost be defined as a *Glandiceps* with *synapticula*. Spengel specially mentions the absence of *synapticula* as indicating the primitive character of *Glandiceps*. In a recent paper in the 'Quarterly Journal of Microscopical Science'¹ dealing with impressions of *Ptychodera flava* derived from an examination of fresh material, I expressed the opinion that *Ptychodera* presented a more primitive type of organisation than the other known *Enteropneusta*. The discovery of this new genus, *Spengelia*, which has so many points in common with *Glandiceps* (see above), and yet which has *synapticula* between the branchial bars and vestigial roots arising from the collar nerve-cord, goes a long way to prove that *Ptychodera* is relatively primitive, and that *Glandiceps* and *Balanoglossus* are derived forms.

I hope to supplement the above account by a second part containing an illustrated description of the anatomy of *Spengelia*. What has been said is enough to establish the genus.

My work, so far as it has gone on the preserved specimen, has been carried out in Professor W. A. Haswell's laboratory at the University of Sydney. I made some sections of *Ptychodera flava* for purposes of control, but in addition I have had the advantage of examining Mr. J. P. Hill's beautiful preparations of three species of *Ptychodera*, besides having his opinion on various points in my own preparations of *Spengelia*, notably on the vestigial roots and the splanchnic layer of "Punktsubstanz."

SYDNEY; May 10th, 1897.

¹ Vol. 40, p. 165.

EXPLANATION OF PLATE 47,

Illustrating Mr. Arthur Willey's paper, "Spengelia, a New Genus of Enteropneusta."

FIG. 1.—Dorsal view of *Spengelia porosa*, after a sketch from the living animal, showing the dermal pits behind the branchial grooves. *p.* Proboscis. *c.* Collar. *d. g.* Median dorsal groove. *br. g.* Branchial or branchio-genital groove. *d. p.* Dermal pits.

FIG. 2.—Macroscopic section through the mid-branchial region of *Spengelia*, showing the medial gonads and the œsophageal groove. *m. g.* Medial gonad. *d. l. m.* Dorsal longitudinal musculature. *br. g.* Branchio-genital groove. *v. l. m.* Vento-lateral longitudinal musculature. *l. g.* Lateral gonads. *œ.* Œsophageal groove. *br. s.* Branchial sac.

FIG. 3.—Portion of branchial skeleton of *Spengelia*, to show synapticula. From a preparation treated with caustic soda and mounted in glycerine. Zeiss, 3 A, cam. luc. *t. b.* Skeleton of tongue-bar. *s. b.* Skeleton of primary or septal bar. *sy.* Synapticula.

