EXPLANATION OF THE PLATES.

Plate 13.

Fig. 1. *Asteropsis imperialis*, abactinal view, slightly reduced.
2. „ „ actinal view, slightly reduced.

Plate 14.

Fig. 1. *Amphiura pusilla*, actinal view, × 16.
2. „ „ abactinal view, × 16.
3. „ „ arm-spines, × 16.
4. *Ophiopeza cylindrica*, actinal view, × 7.
5. „ „ abactinal view of arm, × 7.
6. *Gnathaster rugosus*, mouth-plates, × 7.
7. *Ophiopeza Danbyi*, abactinal view of arm, × 7.
8. „ „ actinal view of arm, × 7.
9. *Evechinus chloroticus*, spicules of tube-feet, × 65.

New Species of *Perichæta* from New Britain and elsewhere; with some Remarks on certain Diagnostic Characters of the Genus.

By Wm. Blaxland Benham, D.Sc. (Lond.), M.A. (Oxon.), Aldrichian Demonstrator in Comparative Anatomy, Oxford.

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(Plates 15 & 16.)

The paper contains a description of five new species, viz.: *Perichæta novæ britannicæ*, *P. Sedgwickii*, *P. Arturi*, *P. Floweri*, and *P. Madelinæ*, with a description of *P. malamaniensis*, Benham, and, further, some remarks in reply to a criticism by Dr. Michaelsen of statements made by me in reference to the value of certain characters usually regarded as of specific value for the genus *Perichæta*.

Owing to the kindness of Mr. Adam Sedgwick, I am enabled to describe three new species of *Perichæta* which were collected by Dr. Arthur Willey on New Britain, during his excursion amongst the South Sea Islands in search of the eggs of *Nautilus*.

No Earthworms appear to have been recorded from this island; and though they were rather poorly preserved in 70-per-cent. alcohol, I have been able to make out certain interesting peculiarities and novelties. As the number of species of this genus is now getting very large, it is necessary to give very careful

descriptions of all external features that are of diagnostic value; even the colour of preserved specimens is of some aid in distinguishing species; and in order to emphasize the specific characters, I append a "diagnosis" to the description of the individual specimens examined. The lack of this diagnosis in many recent writings renders the matter of comparison extremely laborious; while, on the other hand, a mere formal diagnosis unaccompanied by more detailed description is insufficient. The addition of careful figures of the chief structures is most important, and a comparison with other apparently similar species should not be omitted.

PERICHÆTA NOVÆ BRITANNICÆ, n. sp.

There were fourteen rather stout worms, slightly pointed at each end; of a dark purple-brown colour, without any bands or other markings; the clitellum is a purer brown, marked by two narrow darker bands encircling the body. The posterior region of the body is only slightly lighter than the anterior region, but the last dozen or so segments, as is not unusually the case in this genus, are quite as dark as, or even darker than, the anterior end of the worm. The body-wall behind the clitellum is transparent.

The *length* of the specimens varies from 75 mm. to 180 mm., the average length being 110 mm., with a diameter of 5 mm. The specimen taken for description measures 130 mm., and consists of 120 segments.

The *male pores* are small, circular, and pit-like, situated on slightly raised papillæ, oval in outline (Pl. 15. fig. 1 *a*). Immediately behind each papilla, or "porophore" (as I would term this area which carries the male pore and which is usually glandular, to distinguish it from other variable specific "copulatory papillæ"), is a somewhat crescent-shaped depression, light brown in colour (*s'*), occupying the hinder part of segment XVIII. Just in front of the porophore on segment XVII., behind the chætal ring, is a similarly coloured area, rather more elliptical in shape (*s*). These four marks are very conspicuous, and possibly act as suckers. Further, on each side of each male pore is a small pit-like depression (*p*), one mediad and one laterad of the pore: these are arranged, therefore, much in the same way as in *P. purpurea*, Benham, from Celebes*.

* Ann. & Mag. Nat. Hist. xviii. 1896, p. 429.

The male pores are relatively close together, as there are only four chætæ between them, as counted on the stripped cuticle.

There are two pairs of *spermathecal pores*, between the segments VII./VIII., VIII./IX., appearing as wide conspicuous slits, which under a hand-lens look double, as if each pore led into two ducts. Between these pores are 4 to 6 chætæ. This number is obtained by taking lines joining the two pores of each side and counting the chætæ (on segment VIII.) between these two parallel lines.

The first *dorsal pore* is between segments XII./XIII.: the pores are visible in the clitellar segments of this particular specimen, in which, however, the clitellum is not fully formed.

The *clitellum* occupies the normal position, and there are no chætæ on the segments composing it.

The *chætal ring* is complete, *i. e.* there is neither dorsal nor ventral gap; the chætæ number:—

32 on segment II.
56 „ VI.
72 „ XIII.
74 „ XXVI.

Internal Anatomy.—There are no particularly stout septa, the four following the gizzard being very little stouter than those behind; but those around the pharynx are, as usual, thick. The gizzard appears to occupy segments IX. and X., there being a short piece of œsophagus in segment VIII., in the place where the gizzard usually commences. The paired cæcum arises in segment XXVII., and extends forwards into segments XXVI. and XXV.; its base, as in a few other species, being deeply notched so as to form four short lobes (fig. 1 *d*). This phenomenon is already recorded in some half a dozen species, in addition to three recently described by myself from Celebes*; but in most of these the lobes are more numerous: in *P. trityphla*, Bedd.†, however, there are only three lobes.

The two *sperm-sacs* on each side are tongue-shaped, not lobed, and lie in the usual segments. There are two pairs of *spermathecæ*, in segments VII. and VIII., opening anteriorly: the thin-walled sac is large and very distinctly marked off from the duct (fig. 1 *c*); it contains a mass of yellowish-white substance (secretion), compacted together to form a somewhat club-shaped

* *Loc. cit.*

† Beddard, P. Z. S. 1896, p. 205.

mass (*x*); in addition, some flocculent matter lies loose in the sac. The diverticulum is as long as the main sac; it consists of a narrow duct gradually dilating to form an oval swelling at the tip: this is filled with a white mass of spermatozoa (*sp.*).

The *spermiducal gland* (fig. 1 *b*) is nearly rectangular, occupies 2½ segments, viz. XVIII., XVII., and half of XVI., and consists of three main lobes, each of which is lobulated; the whole may be described as "compact." Its duct (*d*) is short, stout, and hardly at all curved. It is directed obliquely inwards and backwards, as it passes away from the gland; it then makes a sudden bend and dips nearly vertically downwards to reach the exterior: there is no muscular bulb.

The species is quite distinct from any other *Perichæta* from this region.

The following may be regarded as the diagnostic characters:—

PERICHÆTA NOVÆ-BRITANNICÆ, n. sp.

Dark purple, without light bands; clitellum brown. Measures 110 mm. × 5 mm.; with 120 segments. Male pores small, circular, on oval papillæ ("porophores"); behind each on XVIII. a curved sucker-like depression; a similar one on XVII. behind the chætæ. Further, small pits, one laterad and one mediad of each pore. Two pairs of spermathecæ, in VIII. and IX., with pores anterior: a large globular sac, with long duct receiving a moderate diverticulum, with short, slightly curved duct slightly dilated distally. Dorsal pore XII./XIII. Chætal ring complete; 56 chætæ in front of, 74 behind, the clitellum. Cæcum with four digitiform secondary lobes; spermiducal gland rectangular, in three segments, short stout duct; no bulb.

Hab. Blanche Bay, Gazelle Peninsula, New Britain.

PERICHÆTA SEDGWICKII, n. sp.

Of this species there were only two very soft specimens, measuring 90 mm. and 110 mm. respectively; the latter is 5 mm. in diameter, and consists of 86 segments.

The *colour* is reddish brown, nearly brick-red, with pale yellowish chætal bands. The dark band is divided into two by a very narrow but distinct pale line in each intersegmental groove. Behind the clitellum, as well as on the first seven segments of the body, there is a distinct but narrow longitudinal streak of darker tint along the mid-dorsal line: the light chætal band is in the anterior segments much broken up by extensions of

the dark bands between individual chætæ. Each dark band extends across the pale ventral surface, but becomes much narrower and lighter in colour as it passes downwards from the sides; this ventral darker band is much broader, although still faint, in segments II., III., IV.

This plan of colouring, in alternate light and dark bands, is very frequent in the genus, and has already been described by several observers for various species.

The *clitellum* does not entirely embrace the usual segments (fig. 2 *b*); it begins behind the chætal ring of segment XIV., and extends only as far as the chætæ on segment XVI. These chætal rings being lighter than the interchætal regions, on first impression—especially to a zoologist who may be only familiar with the subfamily Lumbricidæ—the clitellum appears to occupy two entire segments, but in reality it covers *one whole and two half segments*. The clitellum is fully developed, of the usual thickness, and its margins are quite well marked, and it has the same appearance in both worms. The limited extent of the clitellum recalls *P. mandhorensis*, *P. bermudensis*, and others. There are *complete* circles of chætæ on each of the segments XIV., XV., and XVI.

The *male pores* are small and circular (fig. 2 *a*), on rather prominent papilliform porophores (*po*), of large size, which are separated by 8 chætæ. The prominence of the porophore is in part due to the existence of a horseshoe-shaped depression, deep but narrow, surrounding on three sides the area which carries the pore; it is deeper in front of than behind the porophore, and the free limbs of the horseshoe are directed externally. An examination of the other specimen suggests that it is due to the extension and union of two crescents, one in front and one behind, the porophore, situated apparently intersegmentally, or just on the borders of the segment XVIII. The general description implies an appearance resembling the conditions described for *P. novæ britannicus*; but a comparison of the drawings serves to make clear the differences, and to demonstrate the necessity of such figures to illustrate these small differences, which a mere verbal description is insufficient to convey distinctly to the mind.

In Perrier's *P. aspergillum*, Beddard's *P. bermudensis*, and in Rosa's *P. hippocrepis*, the depression is represented by a series of minute pores or "suckers."

There are three pairs of spermathecal pores situated between

the segments V./VI., VI./VII., VII./VIII., with 13 chætæ on segment VII., between the lines joining the pores.

The first *dorsal pore* is between segments XII./XIII.; the pores are invisible on the clitellum.

The *chætal ring* is not complete: there is a distinct dorsal gap, as may be premised from the existence of the dorsal longitudinal band of colour. There is also a ventral gap, about twice the width of a normal gap.

The chætæ of segments V., VI., VII. are distinctly larger than those on other segments (figs. 2 *e*, 2*f*), while those of segments IV. and VIII. are intermediate in size; in these segments, too, the chætæ are larger on the ventral and lateral surfaces than dorsally. The length of the normal chæta is 0·228 mm., while the larger ones measure 0·341 mm. Similar enlarged chætæ have been described in *P. hawayana*, Rosa, on the 3rd, 4th, and 5th segments, and in *P. sandvicensis*, Bedd., and others.

The chætæ number 22 on segment II.
„ „ 29 „ VI.
„ „ 44 „ IX.
„ „ 50 „ XII.

(The cuticle on segment XIII. was incomplete.) Further back there were 54 on a segment.

Internal Anatomy.—There are no conspicuously stout septa.

The gizzard is tubular, not bell-shaped, and lies in segments VIII., IX.

The intestine was so rotten that a touch was sufficient to tear it, and I am not certain whether there are or are not any lateral cæca on the usual segment. I believe, however, that they are absent. But a very exceptional, indeed, I believe, a unique feature in the anatomy of *Perichæta* was observed: viz., the existence of a *median, unpaired, ventral cæcum* in segment XXII. As the worm was opened from the side, in accordance with my usual procedure in dealing with worms of which I have only one or two specimens, this ventral cæcum was at once seen without touching the intestine, but in attempting to search for the normal paired cæcum, the intestinal wall ruptured and broke into pieces.

The vascular system in the anterior part of the body showed up well, on account of the light-brown colour of the blood; the ventral vessel was seen to be double in front of septum IX./X.—as in several other species.

Large "latero-intestinal" hearts occur in segments X. and XI.,

and a still larger one in segment XII.; but in this last, as in the dorsal vessel posterior to this segment, the blood was purple. I have not seen this difference in colour noted before, and I am not able to explain it.

There are three pairs of *spermathecæ*, all alike; the sac is somewhat heart-shaped (fig. 2 *c*), and has a distinct and curved duct, on which is borne a very small sessile globular diverticulum (*div.*). The *spermiducal gland* (fig. 2 *d*) is large and has a very "loose" structure (perhaps due to ill-preservation); it is deeply cleft, and occupies segments XVII., XVIII., and XIX. The duct (*d*) is short and nearly straight, and opens directly to the exterior.

The diagnosis is as follows:—

PERICHÆTA SEDGWICKII, n. sp.

Reddish-brown bands alternating with yellow chætal bands, median dorsal brown stripe; measures 100 mm. × 5 mm., with 86 segments. Clitellum XIV. to XVI., with complete circles of chætæ. Male pore small, on papilliform porophore, surrounded by a horseshoe-shaped deep groove. Three pairs of spermathecæ, in VI., VII., VIII., opening anteriorly; pyriform sac, with long duct, bearing small, globular, sessile diverticulum. Dorsal pore XII./XIII. Chætal ring with dorsal and ventral gaps; 45 chætæ in front of, 54 behind, clitellum; those of segments IV. to VIII. larger than the rest. *A median ventral intestinal cæcum* in XXII. the usual pair of cæca absent (?) Spermiducal gland large, loose, much incised; short, straight duct; no muscular bulb.

Hab. Blanche Bay, New Britain.

Affinities.—There are seven species recorded by Beddard in his monograph, possessing 3 pairs of spermathecæ in segments VI., VII., & VIII., to which four have since been added.

From those with a "short clitellum," viz. *P. bermudensis*, Bedd., *P. mandhorensis*, Mich., *P. hawayana*, Rosa, the present species differs in a number of points.

In *P. bermudensis* nothing is recorded about the colour-banding; there are chætæ only on the last clitellar (16th) segment; enlarged chætæ exist in segments II., III., IV., and various other differences, such as the group of pores round the "porophore." *P. hawayana* differs, too, in the position of the stouter chætæ, in the dorsal pore, the paired cæca, the shape of the sperma-

theca, and several other points. *P. mandhorensis* has long diverticula to the spermathecæ, a long penial duct, paired cæca, and so on.

I consider the facts above recorded to be sufficient to differentiate the present species as distinct—more especially, the peculiar ventral intestinal cæcum and the porophoral area.

Perichæta Arturi, n. sp.

There were about a dozen specimens of this third species, ranging in length from 70 mm. to 125 mm., with a diameter of about 4 mm. In addition, there are three immature individuals of 50 mm. to 80 mm. in length.

The *colour* of the worm, with the cuticle still on, is violet anteriorly to the clitellum, and brown posteriorly; the clitellum itself is deep purple, with a very narrow nearly white band at each end of it, which is better marked in some specimens than in others. The clitellum occupies the usual segments. After removal of the cuticle the general tint of the body is purple-brown, darker anteriorly, the clitellum is deep brown, and the body greyish brown posteriorly. Thus the violet tinge, so noticeable at first, is due to the cuticle.

There are no chætal bands, the chætæ being set in a ring only very slightly paler than the rest of the surface.

The body-wall is very transparent, even in front of the clitellum.

On stripping off the cuticle, I was astonished to see a long *penis* issue from the male pore—pulled out with the cuticular lining of the penial duct. This penis (Pl. **16**. fig. 4*a*) is a thread-like, cylindrical, slightly-pointed, organ 5 mm. long, so that when pressed forwards it reaches to about the **14th** segment.

A penis quite of this kind has not been recorded hitherto in any earthworm, so far as I am aware; but it is almost precisely similar to that of the Leech (*Hirudo*).

The *male pores* are slit-like, on oval, slightly raised porophores, which are separated by twelve chætæ. There are no copulatory papillæ. There is a single pair of *spermathecal pores*, not very evident, between segments VII./VIII., with about 18 chætæ between them.

The series of *dorsal pores* commences between segments XI./XII.

The *chætal ring* is incomplete, presenting a small dorsal gap equal to about twice the usual inter-chætal space; there is no ventral gap. The chætæ of segments V., VI., VII. are larger than the rest, as in the preceding species; while those of segments IV. and VIII. are intermediate in size between these and the normal chætæ.

There are no chætæ on the clitellum, which is fully developed.

The chætæ number 19 on segment II.
„ „ 44 „ VI.
„ „ 51 „ XIII.
„ „ 52 „ XXVI.

The number of segments in the worm varies considerably, for instance:—

One worm measuring 70 mm. has 66 segments.
„ „ 110 „ 88 „
„ „ 120 „ 88 „
„ „ 125 „ 95 „
„ „ 125 „ 100 „

This slight discrepancy in the relation between length and number of segments suggests that the measurements are not true: the worms are so soft that as one holds them, they stretch to nearly any length. A worm containing 100 segments, for instance, should not measure so much as 125 mm., for the segments are not as much as 1 mm. long, in such a relatively small worm: it is more probable that the true length of each segment is nearer $\frac{3}{4}$ mm., and a worm with this number of segments would be 75 mm. long. Such an estimation of relation of number to length is derived from the study of carefully preserved specimens of other species of *Perichæta*, which have not undergone undue shrinkage.

Internal Anatomy.—The study of the septa in this worm suggests that the usual location of the gizzard in the genus requires further investigation. The peripharyngeal septa are, as usual, fairly stout; the septum between segments VII./VIII. is, as usual, distinct and attached to the anterior margin of the gizzard (Pl. 16. fig. 4 *e*); there is also a septum VIII./IX., attached to the body-wall at the intersegmental groove, and passing as a delicate sheet of tissue—not a mere strand, as is so often the case—to be inserted in the gizzard, just before its hinder end becomes everted to form the rim of the bell. Septem IX./X. is absent, but the four following septa are quite

thick. The gizzard, therefore, appears to belong almost entirely to segment VIII. (fig. 4 *e*), and scarcely enters the next segment. Its relative size and extent, as well as the fact that there is a normal proportion of œsophagus between it and the septum X./XI., seem to indicate that the gizzard practically belongs to *one segment*, not only in this species, but possibly in others, in which it is variously stated to occupy segments VIII. & IX., or VIII. IX. X., for the reason, chiefly, that there are no septa between these segments and that it occupies nearly, but not quite, the entire space between the septa VII./VIII. and X./XI. There is nearly always a certain amount of œsophagus between the gizzard and this hinder septum (X./XI.), which, in the various species I have dissected, is much larger than it appears to be at first sight.

In his Monograph, Beddard gives as a character of the genus the position of the gizzard in segments VIII., IX., the intervening septum being absent. The fact that the gizzard does lie in the 8th segment in certain species is recorded by Beddard * in *P. Everetti*, *P. pentacystis*, and *P. kinabaluensis*; but the evidence in support of this statement is not given, nor is the fact emphasized, though similar evidence to that just given for the present species is recorded for *P. trityphla*, Bedd. †. Moreover, Rosa ‡ regards the 8th segment as the normal morphological position of the gizzard: he says, in his description of *P. Udei*:

> "Ventriglio grande a tronco di cono, lungo quasi tre segmenti ma anch' esso appartemente morfologicamente al solo segmento 8° perciò il setto rudimentale 8/9 è profondamente infundibulato."

Michaelsen also finds species in which the gizzard is confined to segment VIII.

There is a simple and short intestinal cæcum on each side, arising in segment XXVII., and not extending beyond the preceding segment.

The vascular system is rather instructive. The dorsal vessel, after passing forward through septum X./XI., gives off a small "lateral heart," immediately in front of the septum (*a*, fig. 4 *e*); in front of this another commissural vessel (*b*), not dilated, arises from the dorsal vessel, just behind the gizzard, and presumably

* Annals & Mag. Nat Hist. xvi. 1895, p. 69.

† Proc. Zool. Soc. 1896, p. 205.

‡ Ann. Mus. Civ. Stor. Nat. Genova, (2) xvi. 1896, p. 522.

it belongs to the segment IX.; next, a pair of vessels going to the gizzard itself leave the dorsal trunk immediately anteriorly to the delicate septum VIII./IX., and evidently belong to segment VIII. The next blood-vessel (*c*) to leave the trunk lies in front of the septum VII./VIII. (quite in front of the gizzard).

The arrangement of the vascular system thus bears out my contention as to the locality of the gizzard, and it will be worth while to examine the distribution of the blood-vessels in this region in cases in which the gizzard appears to lie in more than one segment. Very little has been recorded by recent observers on the arrangement of vessels in *Perichæta*; it has become the fashion to mention the last "heart" only.

The generative organs present a considerable amount of variability. The *spermathecæ* are a pair in segment VIII., opening anteriorly (Pl. 16. fig. 4 *d*). Normally the sac is globular and smaller than the diverticulum; and the latter is a long cylindrical tube, highly muscular, more or less coiled or undulating, and not dilated at the end. The duct of the sac and the diverticulum appear to communicate in the substance of the body-wall. In one specimen ("B") the spermatheca was much smaller; the diverticulum smaller than the ovoid sac, and evidently empty of spermatozoa: nevertheless this specimen was larger than others in which the spermathecæ were larger. In another specimen opened ("A") the spermathecæ were absent, but in other respects the worm appeared fully developed.

The *spermiducal gland* and copulatory apparatus present a condition which, up to the present time, is unique, I believe, in the genus.

The gland itself, though subject to slight variation in size and proportion, occupies segments XVII., XVIII., and XIX. It consists, normally, of two great squarish lobes, distinctly separated from one another (fig. 4 *b*). Each lobe is incised round its margin with a few shallow notches: passing from each of these two lobes is a narrow duct; and the two unite to form the "penial duct" (*d*, fig. 4 *c*). This is of considerable size and passes directly mediad across the top of a great oval glandulo-muscular sac (*b*), which is nearly as long as the two lobes of the glands taken together. Having reached nearly to the mediad or internal margin of this sac, it bends sharply upon itself and runs alongside its former course, but extends further outwards, viz. as far as the outer edge of the spermiducal gland itself. This recurrent

limb of the U-shaped duct rests upon a finger-shaped prolongation (*c*) of the muscular bulb, or glandulo-muscular sac, as it is better to term it, which extends outwards between the two lobes of the gland. In reality, as sections show, the penial duct *enters* the "penial sac" or finger-shaped diverticulum about halfway along its extent, though at first sight the communication appears to be at the tip of the diverticulum. In other specimens

Fig. 1.

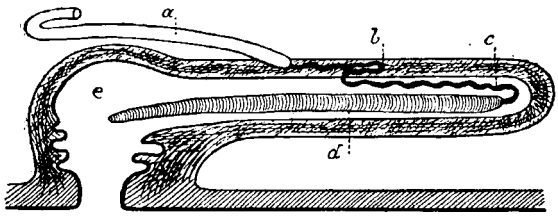
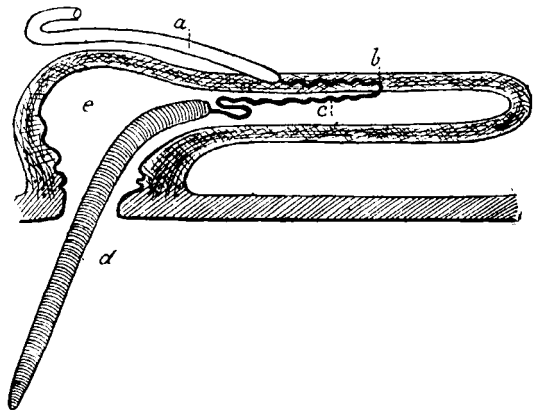


Diagram of a section across the glandulo-muscular sac of the spermiducal gland of *P. Arturi* (*cf.* Pl. **16.** fig. 4 *c*). The penis at rest. *a*. Penial duct. *b*. Portion of the duct passing through the wall of the penial sac. *c*. Portion of the duct lying free in the "penial sac." *d*. The penis itself. *e*. "Atrium," or cavity of the muscular part of the glandulo-muscular sac.

Fig. 2.



Similar diagram, showing penis protruded. Letters as in Fig. 1. The part of the penial duct (*c*) has been pulled out by the protrusion of the penis.

the recurrent limb of the penial duct (as in fig. 4 *c*) did not extend more than halfway along this diverticulum, and this

was the case in the specimen the "penis" of which was drawn out on pealing off the cuticle. Further investigation, as well as a series of sections, shows that the penis is a cylindrical str u with strongly muscular wall, traversed by two narrow canals—the sperm-duct and duct of the spermiducal gland (text-fig. 3). It lies, when at rest, in the "penial sac" (text-fig. 1), and the penial duct, which passes to it (*b*, *c*), is bent upon itself; when in use, the free end is forced out of the male pore by the contraction of the muscular wall of the sac, and the tube (*c*) simply unbends (text-fig. 2). It is, in fact, a protrusible organ and not an introvert.

Hitherto our ideas upon the "penis" of the genus *Perichæta*, as of other forms with stout "penial ducts," like the Acanthodrilidæ, have been somewhat vague; but it has been presumed that this duct is capable of eversion, *i. e.* it is a "pleurecbolic introvert." In the present instance—as sections of the penis in a condition of retraction and protrusion demonstrate—there is no unfolding of the wall of the penial duct: its free end is merely pushed outwards, in the same manner as the penis of the Leech.

Beddard makes the following remarks in his general account of the "penis" in the Oligochæta, p. 124 of his 'Monograph.' "I have found specimens of *P. Houlleti*, killed in alcohol, with the terminal part of the muscular duct of the spermiducal gland everted. I have not noticed the occurrence of this in allied forms, but it very possibly takes place." . . . "In some species of *Perichæta* the muscular duct of the spermiducal gland opens into a wide and rather thin-walled terminal chamber which opens directly to the exterior: it is here, again, possible that this terminal chamber is protrusible; but I have no facts at hand to prove or disprove the possibility."

The "glandulo-muscular sac" in the present species does not present the firm, compact appearance figured for the "muscular bulb" of other species, which is usually hemispherical and smooth. But the muscular tissue is loose, the fibres not being so definitely arranged in circular and longitudinal series; and further, this sac contains two great oval glands, one in front and the other behind the entrance of the penis (text-fig. 3, *a*, *a'*).

Each gland is a somewhat pear-shaped organ lined by a single layer of tall gland-cells.

Rosa has described, in *P. glandulosa*, a group of conspicuous

glands at the side of the "spermiducal gland," but these are isolated and open by several independent pores around the male

Fig. 3.

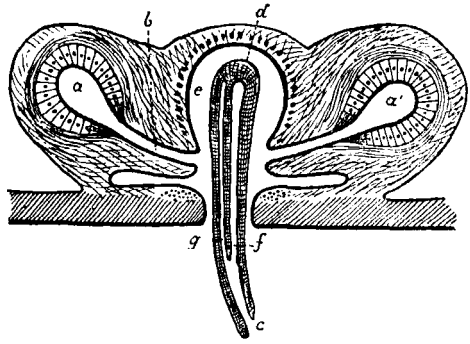


Diagram of a longitudinal section of the glandulo-muscular sac of *P. Arturi*. *a*, *a'*. The anterior and posterior glands, lined by glandular epithelium. *b*. Duct of gland leading to the "atrium" (*e*). *d*. The end of the protruded penis, cut longitudinally to show the two ducts. *f*. The duct of the spermiducal gland. *g*. The sperm-duct. *c*. External pore, common to *f* and *g*.

pore. In several other species, e. g. *P. aspergillum* and *P. bermudensis*, glands of smaller size similarly open by small isolated pores in this region; but I do not recall any other species of the genus with a "glandulo-muscular" apparatus like that of *P. Arturi*.

The copulatory apparatus amongst Earthworms is very varied, and among those organs which serve as a "penis," that of *Eudrilus* appears to bear most resemblance to that of the present worm; in it a small tongue-shaped papilla, traversed by the sperm-duct, lies, when at rest, in a subspherical muscular sac, as described and figured by Perrier and Beddard and Horst. Beddard has suggested that this papilla or "penis" is capable of protrusion when the muscular sac is everted. Perrier* has figured it protruded, and it is so in a specimen in my possession. It is not only very much smaller than the penis in *P. Arturi*, but its mode of protrusion is evidently quite different, being due to the contraction of the wall of the atrium, and not to the unfolding or straightening of a part of itself. And in other

* Nouv. Arch. Mus. Paris, 1872, pl. 2. fig. 28.

cases the copulatory organ is formed by an eversion of a muscular sac carrying with it the pore of the sperm-duct which traverses its wall, as again in *Moniligaster* *.

I describe another species, *P. malamaniensis* with a penis similar to that of *P. Arturi*.

Amongst the slight variations in structure of this spermiducal gland and apparatus in *P. Arturi* may be mentioned the fact that, in one instance, the gland on one side was very much reduced. In another case it was three-lobed on one side (see Pl. 16. fig. 4 *b*), and the penial duct passed below instead of above the gland, possibly as the result of a sudden contraction or struggle at the death of the worm.

The worm may be characterized as follows :—

Perichæta Arturi, n. sp.

Violet anteriorly, greyish brown posteriorly. Measures about 100 × 4 mm. (?), with 90 segments. Male pores slit-like, on circular porophores; a long thread-like *penis* protrudes from each on peeling off the cuticle. One pair of spermathecæ in viii., pore anterior; globular sac, short duct; diverticulum longer than sac, slightly undulating, and scarcely dilated terminally. Dorsal pore xi./xii.

A dorsal gap interrupts the ring of chætæ, which are 50 before and behind the clitellum; those on iv. to viii. larger. Simple, paired intestinal cæca in xxvii. Spermiducal gland cleft into two quadrate lobes, each much incised; penial duct long, between the lobes, sharply bent in U-shape; large glandulo-muscular sac with a prolongation between the lobes of the gland, receiving the penial duct.

Hab. Blanche Bay, Gazelle Peninsula, New Britain.

Affinities.—Of the four species of *Perichæta* enumerated by Beddard as showing a single pair of spermathecæ in segment viii., none show any close resemblance to the present one; though *P. sangirensis*, M., exhibits at first sight certain general resemblances. A detailed comparison, however, readily distinguishes the two—in coloration and character of spermiducal apparatus; while the spermatheca has a well-marked duct into which the diverticulum opens. In a few general features, too, Rosa's *P. atheca* bears a resemblance.

* Bourne, Qu. Jour. Micr. Sci. xxxvi. pl. 28. fig. 55.

Perichæta malamaniensis.

In 1885, in my earliest contribution to the literature of Earthworms, I referred * (p. 256) to the fact that a species of *Perichæta* from the Philippine Islands presented "numerous nephridia" in each segment. Later †, in 1891, I gave the name *P. malamaniensis* to this species, and was guilty of an indefensible procedure in giving a name to a new worm without a diagnosis of it. This error I propose now to rectify. My attention was drawn to this worm, which I had so long neglected, by coming across some drawings of it, in which I recorded the fact (entirely forgotten) that the spermiducal gland is provided with an exceptionally large muscular sac. I at once concluded, in view of my discovery in *P. Arturi*, that here too I should find a 'penis' of the same character as in that worm.

I consequently re-examined the series of sections which I cut some eleven years ago, with the result that my expectation was confirmed.

PERICHÆTA MALAMANIENSIS, *Benham*, 1891.

The material at my disposal consisted of three worms and a piece, collected during the 'Challenger' expedition at Malamani.

The length of the worm is 90 to 100 mm. with a diameter of about 5 mm.; there are 104 segments.

The worm is dirty yellowish brown, nearly uniform ‡, without chætal bands.

The clitellum is distinctly brown.

The anterior end is rather obtuse; the prostomium is small.

The male pores are slit-like, on rather conspicuous and slightly prominent, but not extensive, "porophores," separated by 10 chætæ; there are no copulatory papillæ. There is a single pair of spermathecal pores between segments VII./VIII. in a line with the male pores. About 15 chætæ measured in segment VIII. lie between the lines joining the pores.

The dorsal pores commence between segments XII./XIII., and are visible on the clitellum, which is quite normal and presents no chætæ.

* Qu. Jour. Micr. Sci. xxvi.

† Qu. Jour. Micr. Sci. xxxii. p. 316.

‡ The worms were in glass-stoppered bottles, so that this colour has nothing to do with the "cork," as Michaelsen has suggested might be the case.

The chætæ are set in a prominent ridge—perhaps due to the excellent preservation of the worm. There is a small dorsal gap, but no ventral one. The chætæ are more closely set ventrally than dorsally.

There are 38 chætæ on segment II.
„ 40 „ „ V.
„ 54 „ „ XII.
„ 62 „ „ XXV.

Internal Anatomy.—There is nothing very striking in regard to the septa; septal glands occur in segments IV., V., VI.; the gizzard is relatively large, bell-like in shape, and appears to occupy segments VIII., IX., and X. The intestine is distinctly sacculated after the 14th or 15th segments, but narrows in the 26th and 27th. In the latter segment a pair of large cæca arise, and extend forwards into segment XX.; their lower faces are slightly notched. Behind the 27th segment the intestine again enlarges. Above the intestine, on each side of the dorsal vessel, after the 27th segment, is a pair of racemose ("glycogenic") Phagocytar organs * in each segment, containing abundant pseudonaviculæ.

There is a conspicuously large "heart" in segment XIII., and there are two smaller "hearts" in the preceding segments.

The genital organs present two interesting features, viz.: the very large size of the spermatheca, and the great development of the "muscular bulb" of the spermiducal gland.

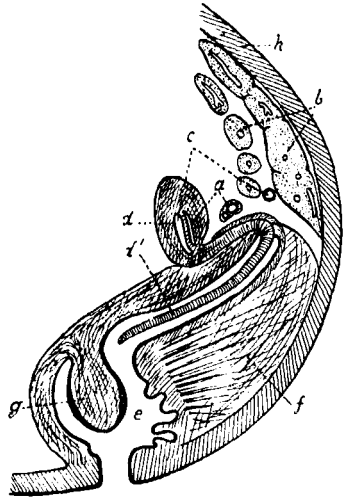
The sperm-sacs lie in segments XI. and XII., and the testes in the usual segments.

The spermiducal gland (Pl. 16. fig. 6 *a*) is in two distinct lobes, as in *P. Arturi*, and from each a delicate duct passes away to unite together to form a larger "penial duct," which, after passing some little distance backwards, bends upon itself and becomes much thicker and more muscular (*d*): it then runs forwards to open into the middle of the outer margin of a great glandulo-muscular sac (*b*); this extends from segment XV. to segment XIX. and presents three slightly marked subdivisions, namely, two terminal which contain each a great gland, and a smaller middle one, the "atrium." Sections through this structure show the same general arrangement as in *P. Arturi*—*i. e.*, the penial duct penetrates its wall, and projects freely as a "penis"

* Schneider, Zeitschr. f. wiss. Zool. lxi. 1896, p. 363, describes these organs for *P. indica*.

into the cavity of the "atrium" (text-fig. 4); but, so far as I have been able to make out, the protrusion of the penis is effected in a manner different from that in *P. Arturi*. I find no narrow duct, capable of being unwound in eversion, and I conclude that the sac itself must be everted, as in *Eudrilus*, so that the penis is carried outwards with it.

Fig. 4.



P. malamaniensis.—A diagram of about a third of a transverse section through the body, at the level of the male pore. *a*. Sperm-duct: on the right it is cut through as it passes from the body-wall to the penis, which it traverses to the tip (*cf.* text-fig. 3). *b*. The spermiducal gland. *c*. Its duct. *d*. Muscular penial duct, outside the muscular sac. *d'*. The continuation of this as a narrow, tubular, protrusible penis. *e*. Atrium, or cavity of the muscular part (middle region) of the glandulo-muscular sac (*cf.* Pl. **16**. fig. 6 *a*). *f*. Its muscular wall. *g*. Peculiar muscular pad projecting into the atrium. *h*. Body-wall.

Mr. Beddard, in a recent paper (P. Z. S. 1896), has described an arrangement of the sperm-ducts in relation to the penial duct of *P. Perkinsi*, which he rightly points out (p. 200) has not hitherto been observed. From the observations which I have made, I would suggest that the arrangement here is not so unusual as our lack of information on the microscopical structure of the worms inclines him to consider it to be; for in both the worms which I have recently examined I find essentially

the same thing. In *P. malamaniensis* the sperm-duct crosses the great glandulo-muscular bulb, as ordinary dissection shows, and passes apparently into the narrow duct of the gland (*a*, fig. 6 *a*); but in reality the two sperm-ducts together run alongside this penial duct for some distance, then unite together, and the single sperm-duct accompanies the duct of the gland *throughout the whole length of the penis*, only opening into the gland-duct close to the tip of the latter, where it undergoes a slight dilatation. The conjoined duct now opens by two pores, just below the tip of the penis.

The epithelium of the sperm-duct and gland-duct are quite different, as can readily be distinguished in section. In *P. Arturi* precisely the same thing occurs (text-fig. 3); but, owing to poor condition of preservation, the difference in the lining is not so readily recognized, and if it were not for the observation in *P. malamaniensis* might have been overlooked.

The spermatheca (Pl. 16. fig. 6 *b*) is of considerable size and lies in segment VIII. The sac is large and globular, with a thick muscular duct, nearly as long as itself; into it there opens a small diverticulum, consisting of a slightly undulating muscular duct, terminally dilated to form a small oval sac.

The present species may be diagnosed thus:—

PERICHÆTA MALAMANIENSIS, *Benham*.

Brown; 100 mm. × 5 mm., with 104 segments. Male pores slit-like, separated by 10 chætæ; no copulatory papillæ; a single pair of spermathecæ opening between segments VII./VIII., consisting of an enormous globular sac, with long stout duct, receiving a small diverticulum, terminally dilated. Dorsal pore XII./XIII. Chætal ring with dorsal gap; 50 chætæ in front of and 60 behind the clitellum. Spermiducal gland in two distinct lobes; a glandulo-muscular duct, containing a distinct tubular penis.

Hab. Malamani, Philippine Islands.

Perichæta Floweri and *P. Madelinæ*.

I take this opportunity of describing two other species of *Perichæta* which appear to be new to science. Both were received through the courtesy of Prof. F. J. Bell, for identification, and have been returned to the National Collection. My

thanks are due to the Director of the British Museum of Natural History for the opportunity of examining them.

PERICHÆTA FLOWERI, n. sp.

Three specimens of this worm were collected by a son of Sir W. Flower, at Bukit Timah, Singapore, in some rotting timber.

They were all in a rather poor state of preservation, and indeed one looked as if it had been swallowed by a frog. Of the two which were of use for identification, one measures 120 mm. × 4 mm., and consists of 116 segments; the other is slightly smaller.

In *colour* they are rich brown, though not very dark, with a violet iridescence and nearly white chætal rings. The pre-clitellian region is more distinctly purple than the rest; the clitellum is purplish brown; the ventral surface of the worm is lighter than the dorsal, as is usually the case.

The *male pores* are slit-like, with crenated lips, each on a flat rounded papilla, of a light (in fact nearly white) colour; there are 10 chætæ between these porophores. No copulatory papillæ are present, but one of the "penial ducts" is partially protruded.*

There are four pairs of *spermathecal pores* between segments V./VI., VI./VII., VII./VIII., VIII./IX.; having about 12 chætæ between, as counted in the 8th segment. The first dorsal pore is between segments XII./XIII.

The *clitellum* does not entirely cover the usual segments, as it does not reach the intersegmental groove at either end; there are about a dozen chætæ on the ventral surface of the 16th segment; there are none on the other clitellar segments.

The *chætal ring* is not quite complete, being interrupted by a small dorsal gap; but there is no perceptible ventral gap.

I counted 18 chætæ on segment II.

35	„	„	VI.
40	„	„	XIII.
45	„	„	XXVI.

The chætæ are rather closer together over the ventral surface than dorsally; but none are larger than the rest.

Internal Anatomy.—None of the septa are noticeably thickened; the gizzard and pair of cæca are normal.

* I had returned the specimen to the British Museum before I had examined *P. Arturi*, but from the absence of a muscular bulb I conjecture that there is no "penis."

There are two pairs of large and lobulated sperm-sacs in segments XI. and XII.

The ovisac in segment XIV. is rather large.

There are four pairs of spermathecæ (Pl. 15. fig. 3 *b*), in segments VI. to IX.; the sac is oval, with a very short duct, indeed scarcely recognizable; the diverticulum is characteristic, having a long, narrow, nearly straight duct, terminating in a globular dilatation.

The spermiducal gland (fig. 3 *a*) is somewhat kidney-shaped in outline, with three deep notches; the penial duct is moderately long, curved, and without a muscular bulb.

The characters of this worm may be summarized as follows:—

P. FLOWERI, n. sp.

Rich brown, with light chætal bands; anterior end purple. Measures 120 × 4 mm., with 116 segments. Male pores slit-like, with crenate lips, on lighter flat porophores separated by 10 chætæ. No copulatory papillæ. Four pairs of spermathecæ, VI. to IX., opening anteriorly. The sac is ovate, with very short duct; diverticulum long, narrow duct, with terminal globular swelling. Dorsal pore XII./XIII. Chætal ring with dorsal gap; 40 chætæ in front of, and 45 behind clitellum. Spermiducal gland oval, with three deep clefts; duct curved, short; no bulb.

Hab. Bukit Timah, Singapore.

Affinities.—There are a considerable number of species with four pairs of spermathecæ; some of these are manifestly different from the present worm. From others it differs in smaller and fewer points. It resembles in several points *P. Perkinsi*, Bedd., from the Sandwich Isles, which, however, has no chætæ on the 16th segment. The spermathecæ appear to be different, if I understand Beddard's description; and though the spermiducal gland bears some likeness, I have not observed the peculiar arrangement of the sperm-ducts described by him *. But in *P. Perkinsi* the chætæ differ in size in various segments, and are larger ventrally than dorsally.

From *P. padasensis*, Bedd., the present worm differs in its much smaller size; in the possession of a very short duct to the spermatheca; in having only two, instead of four pairs of sperm-

* I did not make sections of the worm, and had returned it before I had examined *P. Arturi* and *P. malamaniensis*.

sacs; and in the absence of a muscular bulb to the duct of the spermiducal gland.

P. trinitatis, Bedd., has a clitellum like that of *P. Floweri*; but the "loose" character of the spermiducal gland and the shape of the spermatheca, as well as other characters, serve to distinguish the two.

P. eoa, Rosa, agrees in many points, but the spermiducal gland has a muscular bulb, and is otherwise different; so too is the spermatheca.

P. Floweri agrees in many points with *P. enganensis*, but differs in the chæta-formula, character of cæcum, spermatheca.

P. bosschæ reminds one of the present worm in its general external characters, but there are three pairs of sperm-sacs; the spermiducal gland is different, and the spermathecal diverticulum is only half as long as the main sac.

The other species with four pairs of spermathecæ are mostly characterized by more definite peculiar features, serving to mark them off from the present worm.

PERICHÆTA MADELINÆ, n. sp.

This handsome worm was collected by Mr. Everett on Mt. Kina Balu, Borneo, but it does not appear to be identical with any of those described by Beddard * from the same locality.

The worm (of which I only received a single specimen, which was not fully mature) measures 135 × 6 mm., and consists of 110 segments.

The plan of colouring is similar to that of *P. pulchra*, Mich., *P. zebra*, Benham, and many other species from this part of the world, in having alternate rings of dark and light colour. In the present instance the darker bands, on removal of the cuticle are rich chocolate-brown; the light chætal bands are dead bluish white, without any yellowish tone.

The dark bands, widest dorsally, extend right across the ventral surface as narrow streaks of lighter brown.

At the hinder 18 segments of the worm, as is again very frequently the case, the dark bands are so wide as to meet, sending narrow outgrowths between the individual chetæ and almost obliterating the white bands; on the ventral surface of this region the dark bands are wide, so that the "tail" is darker than the anterior end. The prostomium is margined by white,

* Ann. & Mag. Nat. Hist. (6) xvi. 1895, p. 69.

and the mouth is surrounded by a white ring at the anterior part of segment I.

A dark streak traverses the mid-dorsal line, behind the clitellum, indicating a dorsal gap in the ring of chætæ.

There is nothing to note in respect of the male pores, which are separated by 16 chætæ. There are no special copulatory structures; but the worm was not fully mature, although probably fully grown.

There are four pairs of *spermathecal* pores at the anterior margins of segments VI. to IX., with about 20 chætæ between.

The first *dorsal pore* is between segments XII./XIII., but is small.

The ring of *chætæ* is not complete, there being a dorsal gap equal to about twice the normal interchætal space; but there is no perceptible ventral gap. The chætæ, though showing no difference in size, are closer together ventrally than dorsally; they number

36	in segment	II.
56	,,	V.
56	,,	X.
66	,,	XX.
60	,,	XXV.

Internal Anatomy.—There are no remarkably stout septa, though the four following the gizzard are thicker than the rest. The cylindrical gizzard lies in segments VIII. and IX., *i. e.*, there is a portion of œsophagus between it and the septum X./XI.

The cæcum is slightly notched on its ventral surface.

The sperm-sacs present a slight peculiarity, which I do not remember to have noticed before; there is a pair in each of the segments XI., XII.; the "Samenblasen," as usual, being in segments X., XI. Each sperm-sac (Pl. **16**. fig. 5 *c*) is constricted into a larger ventral and medial portion, and a smaller, round, outer portion, which is provided dorsally with a narrow, pointed, finger-shaped prolongation (*f*), quite suddenly and distinctly separated from the rounder sac.

The four pairs of spermathecæ, which are all alike, lie in segments VI. to IX.: each is a pyriform sac (fig. 5 *b*), with a short wide duct, into which opens the duct of the diverticulum: this terminates in a globular swelling.

The spermiducal gland (Pl. **16**. fig. 5 *a*) is nearly square and occupies segments XVI., XVII., and XVIII. Its margin is greatly

incised, so as to be divided up into a number of variously sized lobules. The muscular penial duct (*d*) is S-shaped and opens into a muscular sac or bulb (*b*).

P. MADELINÆ, n. sp.

Alternate bands of purplish chocolate and white. Measures 135 × 6 mm.; 110 segments. Male pores separated by 16 chætæ; no (?) copulatory papillæ. Four pairs of spermathecæ in VI. to IX., opening at the anterior margin. A pyriform sac, with small diverticulum. Dorsal pore XII./XIII. Chætal ring with dorsal gap; 56 chætæ in front of, 60 behind clitellum. Spermiducal gland rectangular, occupying three segments; much and deeply incised: penial duct S-shaped, opening into round muscular bulb.

Hab. Mt. Kina Balu, North Borneo.

Affinities.—Two worms from Kina Balu, viz. *P. Everetti* and *P. kinabaluensis*, are naturally recalled to mind as being, one or the other, possibly identical with the present worm; but in both there are several small spermathecæ in each of the segments VI., VII.—much as in the genera *Kynotus* and *Microchæta*. Further, the normal intestinal cæcum is absent in both; and there are thus fundamental differences. The absence of copulatory papillæ in *P. Madelinæ* must not be taken into account in referring to other worms, for it is not mature, and possibly they may develop late. Only one of Beddard's Bornean species has four pairs of spermathecæ, viz. *P. padasensis*; but in many particulars the two worms differ. I have been unable to find any species which is very near to the present one in the totality of its characters.

Remarks on Michaelsen's Criticism of the value of certain Specific Characters of the Genus Perichæta.

In a short paper dealing with new species of *Perichæta* from Java * I insisted on the necessity for the careful description of certain characters which all lumbricologists recognize as of value in the discrimination of species of this genus, and on the need of careful figures in illustration of these specific characters. In a recent contribution Dr. Michaelsen † discusses my remarks, and

* Ann. & Mag. Nat. Hist. xvi. 1895, p. 40.

† "Oligochæten aus Kükenthal. Ergebn. zool. Forschungsreise in d. Molukken und in Borneo," Abhandl. Senckenb. Gesell. xxiii. Hft. 2, 1896.

to a certain degree appears to have misunderstood the relative value which I set upon these "specific characters."

In writing of *P. capensis* (p. 229) he refers to two new "species," *P. sexta* and *P. Willeyi*, which I founded, but which I pointed out differed but very slightly from *P. capensis* and *P. operculata*. Michaelsen, rightly I think, now unites these and certain other "species" with *P. capensis*, but I see little need for the formation of "subspecies." If they are sufficiently distinct, it seems to me that the term species is as good as a subspecies; and seeing that *P. sexta* and *P. Willeyi* were each founded on one specimen, I should go further than Michaelsen and leave out "subspecies." I suggested (p. 46) that possibly *P. sexta* was a "hybrid" or an abnormal specimen. As Michaelsen has had a greater abundance of material he is in a better position than I was to determine the matter, and the names I used for these two worms must be dropped.

Now, with regard to Michaelsen's criticism of the "specific characters." He takes them, one by one, and shows that each may vary. This, no doubt, is true; but I never intended that any *one* of these characters *by itself* is sufficient to diagnose a species. I merely wished to insist upon special attention being paid to *all* these points, *because they do vary*; and until more trouble is expended on an accurate description of each presumed "new species" we shall not be in a position to decide whether it is or is not a mere variation.

I agree with him fully that colour, or size, or number of segments, and so on, *must be taken with certain anatomical characters*. He points out that colour is no safe guide since it is variable; it may fade on being affected by the discoloration of the spirit by the cork. Quite so. On p. 42 I wrote "no doubt the colours will soon fade in spirit," in referring to the fact that we did not know the colour of the living worm. But I do not believe that the colour-pattern—the characteristic alternate banding of many species—will fade rapidly: the worms we have to deal with now have not usually been in spirit very long; and one can generally see whether fading has or has not taken place to any extent.

Again, with regard to size, I expressly wrote "within certain limits" (p. 47). I meant that, for example, a worm of the size of *P. indica* is not likely to belong to a species which in size is about that of *P. musica*. And there is no doubt that it is some

guide to the identification of a worm to know *about what size* other presumed similar forms may be. The spermatheca is another organ that is of general diagnostic value. Michaelsen remarks, no doubt with truth, that it contracts in spirit. So does the whole body and every organ of the worm; but, nevertheless, the general shape and proportions of sac to diverticulum would not greatly alter. Of much greater importance is the fact that the size depends on the presence of spermatozoa; for we know that in *Lumbricus herculeus* the worm may have fully-developed sperm-sacs and clitellum, but the spermathecæ are frequently extremely minute, even in the freshly-killed worm. Very probably they would be invisible if that worm had been preserved in alcohol; and it is quite within the bounds of probability that *P. atheca*, *P. acystis*, and others, which have been described as being without spermathecæ, are in the condition of the *Lumbricus* just referred to, *i. e.* that the spermathecæ are not yet functional.

Michaelsen also objects to the value of the position of the spermathecæ, whether they lie, for example, in the 7th or the 8th segment, and open to the exterior between these segments. Here, again, variability may occur: a worm with its spermatheca normally in segment 8 may sometimes have it in 7. Several authors have described such variations. Nevertheless, out of the hundreds, or more probably thousands, of specimens of *L. herculeus* that have been opened under my supervision, and have been drawn by students, so that I have been able to note any departures from the normal, I have only noted such variation in the position of the spermathecæ some two or three times. Until we know more of the variability of the animals we are justified in regarding a given position as fixed, if any considerable number of specimens reveal it; and it appears to me that all lumbricologists describing new species should state explicitly the number of specimens they have examined, and should be in a position to state how far such and such an organ is subject to any alteration in size and position.

Too frequently no mention is made of the number of specimens upon which a species is founded; still more frequently a new species is founded for one single specimen. I have done this myself; and it serves to call attention to some new permutation of characters which, later on, may be proved to be mere variations from some well-known "type" species. Michaelsen,

in the paper under review, does note these variations, and makes "subspecies" for what other zoologists, if they had not had a series of specimens to examine, would have termed "new species." With regard, again, to the position of the spermiducal gland and the gizzard. These organs usually appear to occupy more than one segment, but how many segments—if more than one—are morphologically occupied by them is unknown. It appears to me, from my own observations, that each belongs to a single segment—the gizzard to the 8th (as Rosa has suggested), the spermiducal gland to the 18th,—but that each may push the septa limiting the segment backwards and forwards or in both directions. And when we state in a description that the spermiducal gland "occupies three segments," we do so with an idea of conveying the relative size of the organ, and do not intend—as Michaelsen appears to think—to convey the idea that it *belongs morphologically* to these segments. Certain things are postulates of the genus: this is one.

This organ, too, is liable to variation, as I myself have pointed out (*l. c.* p. 43). Again it becomes most necessary to have really careful description and figures of the organ; for there is probably a very fair constancy in the *general* characteristic appearance of the gland, which is more readily expressed by a figure than in words. The minuter lobulation of course varies, but in some species it is very much more extensive than in others; and this is too often expressed by vague terms, such as "compact" or "loosish," without even a statement as to the general outline of the gland, which I still believe, in spite of slight variations, to retain its character. It appears to me, in view of the great number of species in the genus *Perichæta*, that the time has come to insist on these matters. Comparison of "new species" with old ones, and of individuals of the same species with one another, will, I doubt not, reduce the aggregate number of species as more specimens are carefully examined.

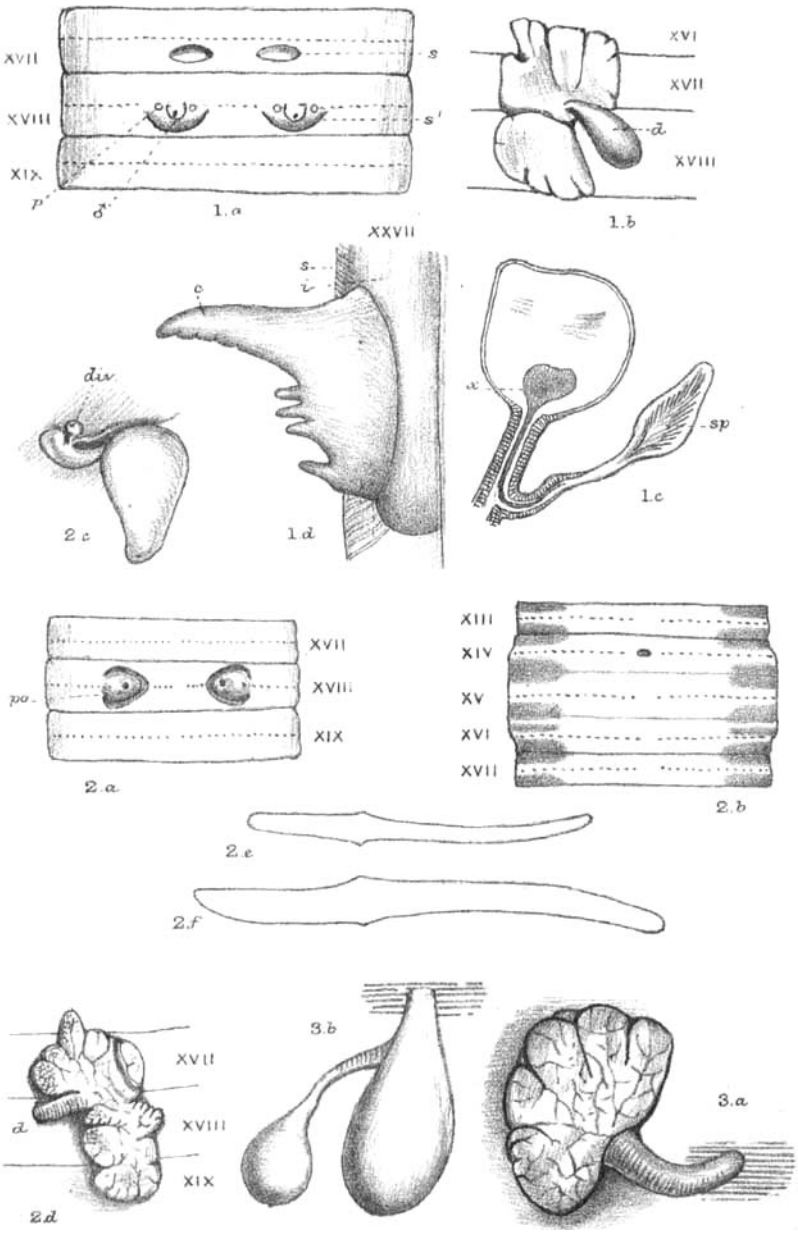
EXPLANATION OF THE PLATES.

Plate 15.

Fig. 1. *Perichæta novæ britannicæ*, n. sp.

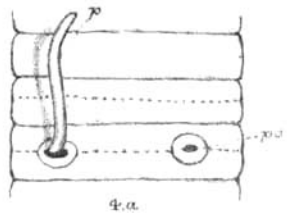
Fig. 1 *a*. View of the male pores and copulatory structures. *s*. Anterior sucker-like organ. *s'*. Posterior sucker-like organ limiting the "porophore," which bears the male pore (♂). *p*. One of the copulatory papillæ, of which there is one each side of each pore.

Fig. 1 *b*. Spermiducal gland. × 4. *d*. Penial duct.

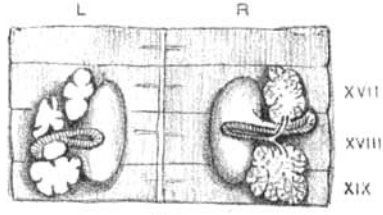


WB.B.del. C.Berjeau.lith. West, Newman imp.

NEW SPECIES OF PERICHÆTA.



4.a



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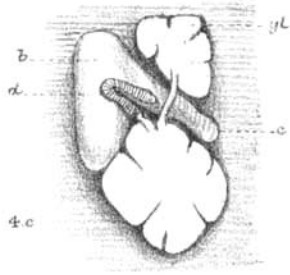
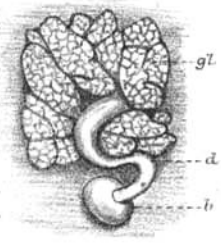
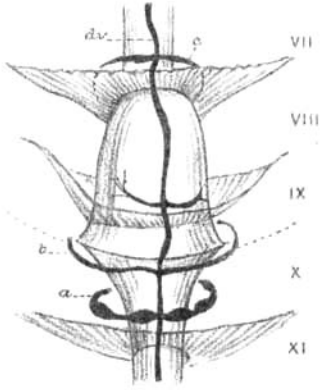


4.c

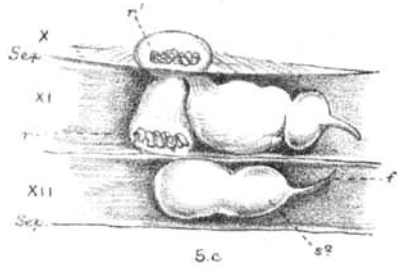
4.d



5.a

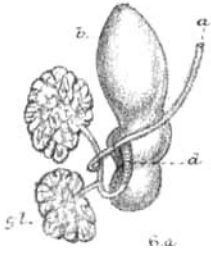


4.e



5.c


5.b



6.a


6.b

WEB del C.Berjeau lith West,Newman imp

NEW SPECIES OF PERICHÆTA.

Fig. 1 *c*. Spermatheca. *sp*. Spermatozoa in diverticulum. *x*. Coagulated mass in main sac.

Fig. 1 *d*. Cæcum: side view of the intestine (*i*) in segment 27, showing origin and lobulation of the cæcum (*c*). *s*. Septum.

Fig. 2. *Perichæta Sedgwickii*, n. sp.

Fig. 2 *a*. View of male pores. *po*. Porophore surrounded by grooves: the actual pore of sperm-duct is very small.

Fig. 2 *b*. Ventral view of the clitellum. × 3. The body-wall has been slit up and spread out; the "limited" nature of the organ is shown, as well as the existence of complete rings of chætæ in each of its constituent segments.

Fig. 2 *c*. Spermatheca. × 6. *div*. Small, sessile diverticulum.

Fig. 2 *d*. Spermiducal gland. × 4. *d*. Penial duct.

Fig. 2 *e*. Normal chæta from segment XII. × 110.

Fig. 2 *f*. Large chæta from seventh segment. × 110.

Fig. 3. *Perichæta Floweri*, n. sp.

Fig. 3 *a*. Spermiducal gland.

Fig. 3 *b*. Spermatheca.

PLATE 16.

Fig. 4. *Perichæta Arturi*, n. sp.

Fig. 4 *a*. View of the 18th segment, showing the male pores, with the penis (*p*) portruded from one pore. *po*. Porophore. × 6.

Fig. 4 *b*. The pair of spermiducal glands of one specimen in which the penis is at rest. × 4. On the right side is shown the normal shape of the gland: that on the left is abnormal.

Fig. 4 *c*. The spermiducal gland (× 6) of a specimen in which the penis is protruded. *b*. Glandulo-muscular sac. *c*. Its externally directed finger-shaped prolongation, or "penial sac." *d*. The U-shaped penial duct (cf. *a* in text-figs. 1, 2) penetrating the wall of this prolongation. *gl*. The gland.

Fig. 4 *d*. A spermatheca. × 4. *div*. Diverticulum.

Fig. 4 *e*. The gizzard and vascular system of its neighbourhood. A thin but complete septum between segments VIII./IX. is inserted close to the hinder border of the gizzard. *a*, *b*, *c*. Commissural vessels. *d*. Dorsal vessel.

Fig. 5. *Perichæta Madelinæ*, n. sp.

Fig. 5 *a*. The spermiducal gland. × 4. *gl*. Gland. *d*. Penial duct. *b*. Muscular bulb (or sac).

Fig. 5 *b*. Spermatheca.

Fig. 5 *c*. The sperm-sacs—to show the peculiar filamentous prolongation (*f*). s^2. The second sperm-sac. *sep*. Septa. *r*, r^1. Ciliated rosettes in the "capsules" (Samenblasen).

Fig. 6. *Perichæta malamaniensis*.

Fig. 6 *a*. Spermiducal gland. *a*. Sperm-duct. *b*. Glandulo-muscular sac or "atrium." *d*. Penial duct. *gl*. The gland.

Fig. 6 *b*. Spermatheca.