Zoologische Ergebnisse einer reise in Niederländisch Ost-Indien.

Leiden,E.J. Brill,1890-1907.
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Earthworms from the Malay Archipelago

BY

Dr. R. HORST.

With Plates II, III and IV.

The earthworms, collected by Prof. WEBER, during his journey in the Malay Archipelago, form undoubtedly the first important collection of this group thence brought to Europe.

In the beginning of this century KUHL and VAN HASSELT, members of the „Natuurkundige Commissie voor Nederlandsch-Indie" also collected some earthworms in Java (f. i. the huge *Perichaeta musica*, afterwards rediscovered by Mr. VORDERMAN), which were forwarded to the Leyden Museum. In consequence of the premature death of those naturalists, these worms unfortunately remained undescribed till 1883, when they were examined by myself, together with some examples, collected during the „Sumatra-Expeditie" 1877—79. VAILLANT (1868) and PERRIER (1872) were the first naturalists, who described some worms from Java; afterwards ROSA examined the earthworms from Nias, collected by MODIGLIANI (1889) and MICHAELSEN described some species from Sangir (1891). The gigantic *Moniligaster* from Sumatra, handed over to me by Mr. VAN HOUTEN and two species of *Perichaeta*, collected during a journey in Billiton by Mr. VORDERMAN (1890), were described by myself. As proved by the foregoing enumeration, our information about the Malayan earthworms is very scanty. Naturalists generally did not pay much attention to this group; f. i. in Prof. MARTENS' elaborate description „die Preussische Expedition nach Ost-Asien" we find only the following remarks: „Regenwürmer, den unsrigen ähnlich aber durch schnittlich kleiner, fand ich auf den meisten der von mir besuchten Inseln des Archipels einschliesslich den eigentlichen Molukken, wo sie

mir als kolotili bezeichnet wurden" (p. 297). Likewise Dr. BLEEKER mentions having met with our common earthworms in different places of the Malay Archipelago. Among the numerous earthworms from this region however, examined by myself, I hitherto have not found a single example referable to our indigenous genera *Lumbricus* and *Allolobophora*. In view of the active commercial intercourse between Europe and the Malay Archipelago, this is a rather curious fact, for we know that *Lumbricus*-species occur in S. America and Australia, though they belong without doubt to the fauna of the Palæarctic and Nearctic regions.

In the following list are enumerated the species of earthworms, hitherto found in the Malay Archipelago (those collected by Prof. WEBER are indicated by an asterisc):

PERICHAETIDAE.

Perichaeta annulata Horst (Mal. Archipelago).
* „ *capensis* Horst (*operculata* Rosa) (Java).
* „ *dubia* n. sp. (Sumatra).
„ *ferdinandi* Mich. (Sangir).
„ *hasselti* Horst (Sumatra).
* „ *houlleti* Perr. (Sumatra).
* „ *indica* Horst (Java, Sumatra).
* „ *minima* n. sp. (Java).
„ *modiglianii* Rosa (Nias).
* „ *musica* Horst (Java).
* „ *posthuma* Vaill. (*affinis* Perr.) (Java, Celebes).
„ *quadragenaria* Perr. (East-Indies).
„ *racemosa* Rosa (Java, Borneo).
* „ *sangirensis* Mich. (Sangir, Sumatra?).
„ *sluiteri* Horst (Billiton).
„ *stelleri* Mich. (Sangir).
* „ *sumatrana* Horst (Sumatra, Java?).
„ *vordermanni* Horst (Billiton).
* „ sp. (Flores).

**Megascolex armatus* Bedd. (Sumatra, Nias).
Perionyx excavatus Perr. (Nias).
* „ *gruenewaldi* Mich. (Sangir, Java, Sumatra).
* „ *violaceus* n. sp. (Java, Sumatra).

ACANTHODRILIDAE.

**Benhamia annae* n. sp. (Java).
* „ *floresiana* n. sp. (Flores, Sumatra).
* „ *malayana* n. sp. (Sumatra, Celebes, Flores).

UROCHAETIDAE.

**Pontoscolex corethrurus* Fr. Müll. (Java, Sumatra, Nias, Celebes, Sangir?).

GEOSCOLECIDAE.

**Glyphidrilus weberi* n. g. and sp. (Java, Sumatra, Celebes, Flores).
**Annadrilus quadrangulus* n. g. and sp. (Sumatra).

CRYPTODRILIDAE.

Cryptodrilus insularis Rosa (Aroe-isles).

MONILIGASTRIDAE.

Moniligaster houtenii Horst (Sumatra).
* „ sp. (Flores).
**Desmogaster* sp. (Sumatra).

From the foregoing list we learn, that Prof. WEBER collected 21 species of earthworms, referable to 9 genera. Among them there are 2 new genera and 8 new species (3 are dubious).

As could be expected, the greatest number of species (10) belongs to the genus *Perichaeta*, which appears to be a predominant type in the Malay Archipelago. In that respect the Malayan fauna also goes with the fauna of India, in which country BOURNE asserts to have met with no less than 67 species of *Perichaeta*. Though some few *Perichaeta*-species are found in the Neotropical, Aethiopian and Australian regions, I believe that the true *Perichaeta*'s are specially characteristic for the Oriental region. In Japan, which belongs to the Palaearctic region, some species of *Perichaeta* appear to be indigenous; but it is known that in regard to its fauna of freshwater fishes and land- and fresh-water mollusca this country also agrees with the Indian continent. As to the *Perichaetidae*, recorded from Australia, I think a great deal of them, after a careful examination, will prove to be no true *Perichaeta*'s.

The agreement between the Malayan and Indian fauna is also confirmed by the presence of the genera *Moniligaster*, *Desmogaster*

and *Megascolex*, which hitherto are only found in the Oriental region. As to the genus *Perionyx*, we have five species from the Oriental region, while only a single one is described by MICHAELSEN from Sansibar. *Cryptodrilus insularis* forms a link between the fauna's of the Malay Archipelago and Australia, for which latter country this genus is characteristic. A remarquable phenomenon is the presence in the Malayan region of the genus *Benhamia*, of which three species are described in the present paper; they considerably augment the number of species, found out of Africa, where this genus appears to be indigenous. As we can hardly ascribe the presence of these worms to man's interference, MICHAELSEN's assertion „dass die *Benhamien* eine sehr geringe Verbreitungskraft haben" appears to be somewhat premature.

ACANTHODRILIDAE.

Though *Acanthodrilidae* are known from different parts of the world viz. Afrika, S. America, N. Zealand etc., no species are described hitherto from the Indo-Malayan regions.

The specimens, collected by Prof. WEBER, all are small worms, which must be ranged among the genus *Benhamia*, characterized according to MICHAELSEN's description, by having the setae placed at the ventral side, by the situation of the male pores in a fossa, by the presence (usually) of more than one gizzard, and of an excretory system in the forme of delicate tubules [1]). I am not quite convinced, however, that those characters are sufficient for a natural subdivision of the genus *Acanthodrilus*.

I cannot agree with MICHAELSEN that BENHAM's genus *Trigaster* ought to be cancelled and included into the genus *Benhamia*; provisorily it appears to me preferable to retain both generic names, for *Tr. Lankesteri*, as BENHAM has recently pointed out [2]), is distinguished from about all the *Benhamia*-species not only by the great extent of its clitellum (XIV to XL), but also by the absence of the intestinal coeca and the penial setae.

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1) Jahrb. der Hamburg. Wissens. Anstalten VI, 1889, p. 6; VII, 1890, p. 3.
2) Ann. a. Mag. of Nat. History, 1890, p. 414.

Benhamia Michaelsen.

1. *Benhamia Annae* [1]) n. sp.

Java: Buitenzorg, several specimens.

The lenght of the largest specimen is 30 mm.; the number of its segments amounts to about 85. The body is cylindrical, having nearly the same diameter over its total length. The skin is colourless and in the posterior region of the body so thin, that the segmental organs are visible through it.

The prostomium impinges only for a short distance into the buccal segment; the buccal region of the intestinal canal is everted in all specimens. The clitellum is very obvious and complete, extending from segment XIII (XIV) to XXI. The prostate-pores upon segment XVII and XIX, are situated on a transverse, oval area, that is somewhat elevated; a longitudinal groove, as in other species, connects the two orifices of each side (Pl. II. fig. 2). In transverse sections this groove can be seen situated at the internal side of a ridge-shaped thickening of the hypodermis (fig. 1); the area between these ridges wants the strong glandular development of the dorsal side of the body, nevertheless it has a somewhat convex shape. Therefore it appears to me not permitted to say, that the prostates open here in a pit or fossa, as in other *Benhamia*-species.

The first dorsal pore is situated in the intersegmental groove IV/V. The setae are arranged in four couples; they are situated at the ventral side of the body, at about an equal distance from each other. The two setae of each couple are placed quite close to each other and have the ordinary shape. However in the vinicity of each prostate there is a fascicle of two penial setae, which are very long and slender; they have the tip slightly curved und their distal half has an undulated appearance (Pl. II. fig. 3). By high power they appear to be furnished with blund, bud-shaped processes, giving them the appearance of a thorn-stick. The two penial setae have not the same length; the smallest of them, measuring only a fourth of the length of the largest one, may be considered as a reserve-bristle.

The longitudinal muscular layer of the body-wall shows the bipinnate arrangement of the fibres, frequently met with in earthworms; this

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1) I permit myself to dedicate this species to Mrs. A. Weber—van Bosse, who valiantly accompanied her husband on his wearisome journey through the Malay Archipelago.

is specially obvious in the segments, containing the male genital organs, while it is no more recognisable in the anterior body-region. The longitudinal muscle-fascicle, in the median dorsal area of each segment, considered by UDE [1]) as the opening-muscle of the dorsal pore, could be distinguished very clearly. I do not understand that CERFONTAINE, who lately admirably worked out the histological structure of the body-wall of *Lumbricus*, makes no remark upon those fascicle [2]).

The nephridia consist of a net-work of delicate tubules, spread over the whole internal side of the body-wall, except on a narrow median area at the ventral- and dorsal side. However there is some difference in their arrangement in the anterior and the posterior segments of the body; for in the anterior body-region they line the whole inner surface of the body-wall, whereas in the segments behind the clitellum they are confined to four groups on each side. The three external groups, having a roundish shape, are situated enternally to the dorsal series of bristles; the fourth internal group, of a more oblong shape, is for the greater part confined between the ventral and dorsal series of bristles.

The dorsal vessel is a single tube, which communicates with the ventral trunc through five pairs of commissural vessels, of which the posterior three are the largest.

The pharynx is covered by a compact mass of glands, dividing posteriorly in two symmetrical halfs. The gizzard lies in segment VI and VII and consists of two divisions; its muscular wall being interrupted by a narrow membranaceous interval.

In segment XV, XVI and XVII the tubular intestine is provided on each side with calciferous glands.

There are two pairs of spermathecae in segments VIII and IX; each of them consists of a tubular pouch, which is slightly curved and terminates in an enlarged extremity (Pl. II. fig. 4). Below its middle the spermatheca is furnished with a pyriform diverticulum, that is filled with spermatozoa.

As already pointed out by different authors, there exists some difference in the minute structure of the different parts of the sperma-

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1) Zeitschrift f. wissens. Zoologie, Bd. XLIII, 1886, p. 87, pl. IV.
2) Archives de Biologie, T. X, 1890, p. 327, pl. XI—XIV.

theca. Its enlarged terminal portion wants the thick muscular coat, which envelops the remaining part of the spermatheca and is lined with a layer of tall columnar cells, containing a fine granular protoplasma, which no doubt secrete the fluid with fine granules, found in this portion (Pl. II. fig. 5). The cells lining the tubular portion have a somewhat different appearance; they are not only narrower, but consist of a more homogeneous protoplasma, that contains no granules and is stained diffusedly. The diverticulum shows an epithelium of very low, quadrangular cells. I have not observed the curious alterations, described by BEDDARD in the epithelium of the spermathecae in sexually mature specimens of *A. georgianus* and *A. rosae* [1]).

A pair of rather large ovaries, containing numerous mature ova, occupy segment XIII; opposite to them the funnels of the oviducts are situated. The external apertures of these ducts however I could not find. The funnels of the sperm-ducts lie free in segments X and XI; the spermatozoida are contained partially in the body-cavity, partially they are enclosed in vesiculae seminales, occupying segments IX—XII. The prostates are long, tubular organs, consisting of pyriform glandular cells, which open between the tall columnar cells, lining their central canal.

2. *Benhamia floresiana* n. sp.

Flores: Maumeri, Kotting, Wukur, several specimens.

Sumatra: Fort de Kock, a single specimen.

The length of the largest specimens is 35 to 40 mm.; the number of their segments is about 125. The body is usually discoloured; only the region behind the clitellum is blackish, owing to the transparency of the body-wall and the consequent visibility of intestinal contents. The cephalic lobe is small, somewhat wedge-shaped, embedded into the buccal segment to about the half of its length (Pl. II. fig. 6). The anterior five segments have a greater longitudinal diameter than the succeeding ones. Each segment shows in its middle a circular ridge; beneath this ridge the skin appears to contain a double row of glands, visible through the body-wall in some specimens. The dorsal pores commence in the intersegmental groove VI/VII.

The clitellum is very obvious, occupying segment XIII—XXI; it is incomplete, its ventral side being not or not very glandular.

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1) Quarter. Journ. of Microsc. Science, Vol. XXX, p. 435, pl. 30.

The prostate-pores, situated upon segment XVII and XIX, are connected on each side by a groove, resembling a brace, a character, by which this species can be easily distinguished from other congeners (Pl. II. fig. 7). The oviducal pores lie together in a transverse, oval, glandular area on segment XIV.

The setae are arranged in four couples and have the ordinary shape; the distance between a dorsal and ventral couple measures three fourth of that between the two ventral couples. There are four fascicles of penial setae, each of them containing two or three setae. The largest seta, which is somewhat longer and stouter than the others, has its distal extremity undulated, with a few thorny processes and a small knob at the tip. The smallest seta is only faintly undulated (Pl. II. fig. 8).

There are two pairs of spermathecae; each spermatheca (Pl. II. fig. 9) is somewhat oblong, divided by a constriction in two compartments, the superior of which is the longest, while the inferior is globularly dilated; the superior compartment bears about in the middle of its length a small diverticulum, filled with spermatozoa.

There is a large gizzard, consisting of two divisions, separated by a membranaceous interval. The tubular intestine possesses three pairs of calciferous glands; the carbonate of lime contained in them, is not a milky fluid as that in the glands of *Lumbricus* a. o., but consists of rhombohedral cristals of different seize.

The nephridia consist of groups of delicate tubules, and are arranged nearly in four longitudinal series on each side.

3. *Benhamia malayana* n. sp.

Flores: Bari, Maumeri, Kotting, Wukur.

Sumatra: Singkarah.

Celebes: Makassar.

The length of the largest specimen is 20 to 30 mm., the number of its segments amounts to about 95. The body is discoloured; however its posterior region is usually blackish, owing to the visibility of the intestinal canal through the transparent body-wall. The body tapers in its anterior region; the anterior five segments have a greater longitudinal diameter than the succeeding ones. The cephalic lobe impinges with a round prolongation into the buccal segment (Pl. II. fig. 10).

The first dorsal pore lies in the intersegmental groove V/VI or VI/VII; on the clitellum neither pores nor intersegmental grooves are visible. The clitellum occupies segments XIII—XX, the first of them being very obvious. The prostate-pores on segment XVII and XIX, are connected on each side by a longitudinal oval groove; both grooves are surrounded by a distinct rectangular area, which appears somewhat elevated (Pl. II. fig. 11). In some specimens this area was interrupted in the median line. The space between the ventral setae of the posterior clitellar segments looks not glandular.

The setae are arranged in four couples; they have the ordinary shape and are also visible on the clitellum. The distance between a dorsal and a ventral couple is about equal to that between the two ventral couples.

There are four fascicles of penial setae, containing each a couple of them, with their reserve-bristles. The setae of each couple have a different appearance (Pl. II. fig. 12). In the longer one the distal extremity is ornamented with four faint thorny processes and its tip is hook-shaped; the smaller one has the extremity spoon-like dilated.

The spermathecae (Pl. II. fig. 13) have not such an oblong shape as those of *B. floresiana;* they too are divided by a constriction in two compartments, the superior of which bears a small diverticulum.

The buccal region of the alimentary canal (in front of the cerebral ganglia) is furnished dorsally with a rather broad, flattened diverticulum, lined with an epithelium, which differs from the epithelium of the remaining portion of the buccal cavity; its cells are not only broader than the ordinary buccal cells, but contain a granular protoplasma, giving them a glandular appearance. The cells on the floor of the pouch are shorter than those of the roof, and resemble the glandular cells of the hypodermis.

Michaelsen already observed such a diverticulum in *B. Bolavi* [1]).

This pouch is not to be confounded with a diverticulum of the pharynx, as that observed by Michaelsen and Beddard in several *Acanthrodilus*-species, and recently described by Benham in *Eminodrilus* [2]); according to this author's observations it is usually ciliated in its dorsal part.

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1) Jahrb. der Hamburg. Wissensch. Anstalten, VII, 1891, p. 9.
2) Journ. of the R. Microsc Society, 1891, p. 161, pl. 3 and 4.

The gizzard consists of two divisions, separated by a narrow membranaceous interval.

The *nephridia* in the posterior region of the body are arranged in three groups of delicate tubules on each side; the internal of them is situated near the dorsal setae.

The penial setae of our species much resemble those of *B. Bolavi* [1]), found by Mr. MICHAELSEN in a tannery near Hamburg. Mr. MICHAELSEN kindly forwarded me some individuals of this species, which is undoubtedly imported in Germany. *B. Bolavi* differs from *B. malayana*, by its more slender habit, its segments of the anterior body-region having all the same longitudinal diameter and by its incomplete clitellum, wanting the glandular modification at the ventral side; it has not but a single oviducal pore, surrounded by an oval wall, of which there is not any trace in our species. MICHAELSEN states, that the spermathecae of *B. Bolavi* have an ellipsoidal shape; this must be a slip of the pen, for as illustrated by fig. 14, they have a more retort-like appearance and show a constriction like those of other *Benhamia*-species.

GEOSCOLECIDAE.

Glyphidrilus n. g. [2]).

Setae of the common shape, arranged in four series of couples. Clitellum provided with a folded, crenulated ridge on each side. Two pairs of testes in segments X and XI; vasa deferentia opening in the intersegmental groove of segment XXVII and XXVIII, provided with a small prostate-gland. Ovaries in segment XIII; oviducal pores upon segment XIV. A large number of spermathecae, more than one pair in each segment.

4. *Glyphidrilus weberi* n. sp.

Java: Buitenzorg, in humid soil, several specimens.
Sumatra: Manindjau and lake of Singkarah, dredged at great depth.
Flores: Kotting.
Celebes: Luwu.

The length of the largest specimen is 120 mm.; the number of its segments amounts to about 250. Most individuals are t[illegible]orally disco-

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1) Jahrb. der Hamb. Wissensch. Anstalten, VII, 1891. p. 9.
2) Derived from ἡ γλυφίς (ίδος), notch and ὁ δρῖλος worm.

loured; their body appears to be very fragile, especially in the clitellar region. In the anterior region the body is cylindrical, its posterior region has a quadrangular shape.

The tail is pointed. The anal opening has a longitudinal triangular shape and lies dorsally. (Pl. II. fig. 19).

The cephalic lobe extends over a third of the buccal segment. The anterior segments are large; with the fourteenth segment their longitudinal diameter commences to decrease, measuring only two third of the length of the anterior segments.

The setae are situated at the dorsal and the ventral side, in four couples. In the anterior third portion of the body the setae of each couple are separated by a rather great distance, in the posterior region they approach each other closely; in the latter region the dorsal setae are situated at the edges of the dorsal side, the ventral ones at the edges of the ventral side. In front of the clitellum the distance between the setae of each ventral couple (1 and 2) measures about the half of that between the two ventral couples; the distance between the ventral and dorsal couples (2 and 3) is somewhat larger than that between the ventral ones. The distance between the two dorsal couples is somewhat larger than that between the ventral and dorsal one. The distance between the setae of each dorsal couple (3 and 4) is equal to half the distance between the two dorsal couples.

The setae have the usual shape, like in other Lumbricidae; in the clitellar region they are longer and straighter, measuring 0,35 mm., whereas their ordinary length is 0,28 mm.

The clitellum is characterized by a folded, crenulated ridge, 1 mm. broad, situated laterally, between the ventral and dorsal couples of setae (Pl. II. fig. 15). This ridge extends usually over ten segments, from XXIII to XXXII; sometimes it commences already in segment XXII. However the number of segments it occupies is not constant, varying from six or seven to fourteen; no doubt this depends on the state of sexual maturity of the worms, for in some specimens there is no trace of the ridge at all. The clitellum consists of glandular elements of about the same nature as in *Lumbricus*, viz. long, tubular cells containing a coarsely granular substance, deeply stained by alum carmine („glandes à gros corpuscules" de CERFONTAINE) and elongated, clubshaped cells, containing a finely granular substance, very slightly stained, except in its basal portion, within which the

nucleus is situated („glandes finement granulées" de CERFONTAINE). More over the clitellum appears also to contain unchanged hypodermis-cells, the nuclei of which lie in a continuous row, quite near the surface (Pl. II. fig. 17). The glandular thickening of the clitellum usually commences with the XVIIIth segment, but on transverse sections the first glandular cells are already visible in the XIIIth segment; therefore the clitellum appears to extend itself much more forward, as also visible externally in some specimens. The glandular layer has nearly the same thickness over the whole periphery of the clitellum, but the distribution of its glandular elements is not the same every where (pl. II. fig. 18). At the dorsal side there is a couple of peripherical layers of coarsely granular, tubular cells, followed interiorly by six to eight layers of finely granular clubshaped cells; at the ventral side the same arrangement is to be seen only in its median portion, between the ventral bristles. The lateral portion of the ventral side only consists of coarsely granular cells.

A similar arrangement is stated by CERFONTAINE to exist in the clitellum of *Lumbricus terrestris*; in this species he found also in the tubercula pubertatis modified club-shaped cells, containing a more coarsely granular substance.

The diagram (fig. 18) shows that the muscular layer does not enter into the substance of the ridge; its internal substance consists of a network of fine connective fibres and ramified cells. Several blood-vessels are also to be found therein.

External openings of the genital organs or of the nephridia are not visible; dorsal pores are absent.

In the vicinity of the clitellum curious oval grooves, with a dark protuberance in their centre, are visible (pubertätsgrübchen MICHAELSEN). Neither the arrangement nor the number of these puberty-grooves is constant. In the XXIIth segment they are usually to be found on each side in the series of the external ventral bristles, in segment XXIII, XIX and XX however in the series of the inferior dorsal bristles; they can also be met with in segment XXXII and XXXIV. These grooves often are situated assymetrically f. i. at the left side of the body in segment XVIII and XIX, at the right side in segment XIX and XX. In transverse sections (fig. 17) they appear to be cup-shaped organs, which are very obvious by their vitreous appearance and lie totally embedded in the glandular layer of the clitel-

lum, without projecting beyond its surface; their transverse and longitudinal diameter is about 0.24 mm. For the greater part they consist of slender, filamentous elements, each of them with an elongated, narrow nucleus; those nuclei form a continuous series with the nuclei of the hypodermis-cells, but they lie a little below the plane of them. It may be suggested, that these elements bear tactile hairs upon their tip, as stated with the sensory organs of other Oligochaetae, but I have not observed them. In the basal portion of the organ other club-shaped cells are to be found, traversing with their elongated, narrow necks the layer of filamentous cells; they consist of a finely granular substance and possess an oval nucleus.

Similar organs are already met with in other Lumbricidae. MICHAELSEN found in *Ac. georgianus* [1]) upon the Xth segment, two large papillae in the series of the ventral bristles. He describes them as clear, eye-ball-shaped organs, which lie between the layer of transverse muscles and the cuticula and consist of slender, spindle-shaped cells. The sinneszonen, observed by VEJDOWSKY in the segments of the middle body-region of some Lumbriculidae, seem also much to resemble the organs of *Glyphidrilus*; those organs however appear to be extrudible. Probably the glandular papillae, of which ROSA observed no less than 22 in *Bilimba papillata*, belong to the same category.

The intestinal canal of this worm is of a simple structure and wants the glandular coeca, found in many other Lumbricidae. The pharynx is situated in segment IV; then follows the oesophagus in segments V to VII, which in the VIIIth segment passes into the gizzard. The tubular intestine, then following, extends back to segment XV, where it passes into the sacculated intestine. A kind of typhlosolis appears to be present in segment XIX and XX; singular longitudinal folds also are to be seen here at the ventral side of the intestine.

The epithelium, lining the innerside of the pharynx, has not the same structure on the dorsal and the ventral side. In the first region it consists of tall columnar cells, provided with cilia and showing darkly stained nuclei, but in the lateral region the epithelium alters its character and becomes a layer, showing no distinct cells, but only a small number of irregularly scattered nuclei. The outer wall of

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1) Jahrb. der Wissensch. Anstalten zu Hamburg. V, 1888, p. 70, pl. 2, fig. 4*d*.

the pharynx and the oesophagus is covered at the dorsal side by a large mass of glandular cells. The muscular fibres radiating from the roof of the pharynx, and connecting this organ with the body-wall, perforate the septa and unite with the longitudinal muscular layer of the body-wall in the intersegmental region of the Vth, VIth and VIIth segment.

The vascular system presents the usual structure and agrees with that of some Acanthodrilus-species. There is a single dorsal vessel and a supra-neural (ventral) vessel, only the infra-neural vessel is absent. The tubular intestine, behind the gizzard, moreover is furnished with a supra-intestinal vessel, and two infra-intestinal vessels, communicating with the vascular plexus of the alimentary canal; these intestinal vessels are connected by mesenteries with the dorsal as well as with the ventral trunc. There are five pairs of commissural vessels in segment VIII to XII, communicating through a small branch with the dorsal as well as with the supra-intestinal vessel.

Nephridia are present except in the anterior fourteen segments; they are rather long and consist of several loops of perforated cells.

Genital organs. Two pairs of testes are situated at their usual place in segment X and XI, attached to the posterior side of the anterior septum; they lie free in the body-cavity, opposite to the funnels of the sperm-ducts and do not seem to be enclosed in the seminal vesicles. Of these organs there are four pairs in segment IX, X, XI and XII; the first pair of them depends on the anterior septum of the segment X, the second and third pair from the posterior septum of the same segment. The second pair of seminal vesicles arises from the dorsal half of the 10th septum and is directed forward; therefore this pair lies in the Xth segment. They are fused together on the dorsal side. The third pair of seminal vesicles, arising from the ventral half of the 10th septum, is directed backward, and occupies the XIth segment. The fourth pair of them, arising from the posterior side of the 11th septum, is the largest and not only fills out the total cavity of the XIIth segment, but also pushes far backward its posterior septum. In consequence of the described situation, the cells, thrown off by the testes in segment X, can get in the first and third pair of the seminal vesicles, while the cells arising from the testes in segment XI, can enter the second and fourth pair of them. We do not know the forces by which the spermmothercells are di-

rected into the seminal vesicles, in stead of entering the ciliated funnels of the sperm-ducts lying quite opposite them.

Both sperm-ducts of each side unite together in the middle of the XIIth segment and the common duct, deeply embedded in the longitudinal muscular layer, above the series of the external ventral bristles (2), passes straight back as far as segment XXVII; it then sharply bends itself to the ventral median line and opens on to the exterior in the intersegmental groove of segment XXVII and XXVIII, just in the series of the internal ventral bristles (Pl. II. figs 16 and 18).

In the vicinity of the external pore the sperm-duct unites with the excretory duct of a small prostate-gland; the structure of this gland could not be very well recognized, but it seems to consist of numerous pyriform cells, which convey their secretion into a central duct.

In the ventral portion of segment IX I met with a curious organ, (fig. 16, *x*) of which I cannot understand the meaning. It consists of a folded membrane, lined with a layer of ciliated cells, somewhat resembling the funnel of a sperm-duct; opposite to it a body, consisting of spherical cells, is attached to the posterior side of the anterior septum. Perhaps they represent a testis and funnel in a rudimentary state.

The ovaries have the usual position and are attached to the posterior side of the anterior septum of segment XIII; they have a grape-shaped appearance and contain eggs in all stages of development. Numerous bloodvessels traverse the ovaries. The largest eggs are situated at the periphery of the ovary and appear to lie in an obvious capsule; only a single nucleolus could be observed within them. At the posterior side of the posterior septum of segment XIII an organ is attached of about the same size as the ovary and containing also a number of eggs; this organ represents the receptaculum ovorum. Though in its appearance much resembling the ovary, it is distinguished from it by containing only large, mature ova, which are more coarsely granulated than the eggs in the ovary and ordinarily do not show a germinal vesicle; probably this represents a more advanced stage of maturity, as was before discussed in my paper on *Eudrilus* [1]). Like in other Lumbricidae the receptaculum ovorum represents a sac, whose cavity is subdivided by a large number of folds growing inwards from the wall; this wall consists of a connective membrane,

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1) Mém. de la Soc. Zool. de France, T. III, 1890, p. 223, pl. VIII.

lined with a low layer of naked cells. On those places, where the eggs are lying, the wall of the receptaculum becomes very dilated and represents only a delicate membrane. The receptaculum ovorum is not immediately connected with the oviduct, and its opening lies somewhat inward from the funnel of this duct (Pl. III. fig. 20).

There is a large number of spermathecae in segment XIV—XIX. Their number in different segments however is not constant and varies from 1 to 3 pairs, nor do we find in the same segment always the same number on both sides; sometimes the one side possesses two, the other side three of them. Usually I met with 1 pair in segment XIV and with 3 pairs in segment XV—XIX, the total number thus amounting to 32. The spermatheca of segment XIV corresponds to the middle one of the three in the succeeding segments (fig. 16).

The spermathecae are situated in the anterior region of each segment and open on to the exterior in the intersegmental groove of the segment and its preceding one. In some specimens the first spermatheca lies precisely at the place, where the septum between segment XIII and XIV arises, so the pouch is separated by a constriction in two diverticula, of which the anterior is situated in segment XIII, the posterior in segment XIV. A similar arrangement was observed by Mr. Beddard with some of the spermathecae of *L. complanatus* [1]). The two superior spermathecae of each side have their external opening next to the setae of the dorsal couple, the inferior of them opens on to the exterior in the middle of the lateral region.

Each spermatheca represents a globular pouch, lined with a single layer of columnar cells; at the median side of the pouch this epithelium appears to be lower than at the lateral side.

It is a curious fact, that in several specimens no spermathecae could be observed, though the clitellum was very obvious and the worm possessed well-developed seminal vesicles and ovaria.

A similar statement was made by Mr. Beddard with a specimen of *P. posthuma* [2]). Others of our specimens, with the clitellum scarcely visible and without puberty-grooves, showed on transverse sections only two spermathecae on each side, situated in segment XV—XVIII; they contained no spermatozoa. Only the segments XI and XII possessed developing seminal vesicles, containing unsegmented

1) Proc. Royal Society of Edinburgh, 1885—86, p. 451.
2) Annals and Magaz. of Nat. History, 1886, p. 94.

spermatoblasts; on the contrary mature eggs were already present in the ovaria and also in the receptacula ovorum.

This species distinguishes itself from all earthworms, hitherto described, by having its male pores situated so far backwards as segment XXVIII. In this regard it only bears some resemblance to *Kynotus madagascariensis*, described by MICHAELSEN, which has its male pores situated upon segment XXV. Though this species too possesses a great number of spermathecae like as *Glyphidrilus Weberi*, it, by its other characters — the incongruence of external and internal segmentation, the small laterally placed setae, the bursa propulsatoria etc. — differs so entirely from our species, that it appears rather dubious to me, whether both genera really are allied to each other, as suggested by MICHAELSEN. In *Diachaeta* too the male pores are rather far remoted from the oral extremity (XXII), and the setae are separated from each other by considerable intervals; this genus however does not possess a prostate-gland in connection with the male pores, as occurs in *Glyphidrilus*.

Annadrilus n. g.

Setae of the common shape, arranged in four series of couples. Clitellum provided on each side with a folded, crenulated ridge. Two pairs of testes in segments X and XI; vasa deferentia opening in the intersegmental groove of segment XXI and XXII, not provided with a prostate-gland. Ovaries in segment XIII; oviducal pores upon segment XIV. Small spermathecae, more than one pair in each segment.

5. *Annadrilus quadrangulus* n. sp.

Sumatra: in the lake, called Danau di atas, in the neighbourhood of Alahan Pandjang, six specimens.

A small worm, in its external appearance much resembling *Glyphidrilus*. Its anterior body-region is cylindrical, the posterior segments are quadrangular. The tail is rather pointed, and the anal opening lies dorsally. The length of the largest specimen is 50 mm.; the number of its segments amounts to about 200. The individuals are totally discoloured.

The cephalic lobe is obtusely triangular, not narrowing posteriorly, with its convex posterior margin extending over a third of the buccal segment. The longitudinal diameter of the anterior segments is longer than that of the posterior ones.

The setae have the usual shape; the superior pairs are situated quite dorsally, the inferior ones at the ventral side of the body. In the anterior segments the setae of each couple are separated by a rather large distance, in the posterior segments they come nearer one to another and are situated at the edges of the quadrangular body.

The clitellum is characterized by a narrow, folded ridge along segment (XIX) XX—XXV, situated dorsally of the ventral series of setae; the structure of the clitellum shows the same glandular elements as in *Glyphidrilus*, it is only distinguished by its richness of bloodvessels. There are no copulatory papillae, and the external genital pores are not visible.

On transverse sections it could be stated, that the vasa deferentia open outwards in the groove between segment XXI and XXII, just in the series of the superior setae of the ventral couple; a prostate-gland appears not to be present. Three pairs of seminal vesicles are situated in segment IX—XII. Several small spermathecae lie in segment XIV, XV and XVI; in segment XIV there are four pairs of them, one pouch situated next to each seta. The following segment shows five pairs of them; besides the four pairs of the preceding segment, it possesses another one in the lateral field. In the XVIth segment only two pairs of spermathecae are present, situated next to the setae of the ventral pair. The epithelium lining the pouch consists of tall columnar cells, except at its median side, where the cells are much lower and flatter like those in *Glyphidrilus*. All spermathecae are densely filled with spermatozoa.

Nephridia are present, except in the anterior twelve segments. The gizzard lies in segment VIII. The intestinal canal of some specimens contained a large quantity of diatomaceae; it may therefore be concluded, that the worm lives in the soil below the water. The number of earthworms having this manner of life is rather small; besides *Criodrilus*, *Allurus* and *Glyphidrilus*, as stated above, two species of *Acanthodrilus*, *Ac. dalei* and *Ac. georgianus* do also belong to it, according to Mr. BEDDARD's statement [1]).

Though this worm agrees in its external appearance much with *Glyphidrilus Weberi*, it cannot be ranged in the same genus, as its male pores are not situated on the same segments as in *Glyphi-*

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1) Proc. R. Ph. Soc. Edinburgh, 1891, p. 208.

drilus, and its vasa deferentia want at their distal extremity the glandular bodies, present in this genus. By the absence of prostate-glands *Annadrilus* agrees with *Geoscolex* and its allied genera. Rosa recently described an earthworm from Birmah, *Bilimba papillata*, which has on each side of segment XVIII—XXIV a lateral ridge, like that in *Annadrilus*; this species however is characterized by a great number of copulatory papillae and the situation of its male pores is unfortunately unknown.

Moniligastridae.

This interesting family, distinguished from all other earthworms by the absence of a clitellum (except *M. sapphirinaoïdes* Bourne [1]), and by the situation and the structure of their genital organs, is only represented by two small worms, one belonging to the genus *Moniligaster*, the other probably referable to the genus *Desmogaster*. All the species of this family, hitherto described, being found in the Indo-malayan region (India, Ceylon, Luzon, Sumatra and Timor) it appears to be specially characteristic for this part of the world.

Moniligaster Perrier.

6. *Moniligaster* sp.

Flores: Kotting, one specimen.

A small worm, not measuring much over 18 mm. in length; the number of its segments is about 100. Beginning with the sixtieth the segments are probably regenerated, their longitudinal diameter being smaller than that of the preceding ones, and their series of dorsal setae not forming a continuous line with the dorsal series of the anterior sixty segments. The body is cylindrical, tapering towards the anal extremity.

The cephalic lobe does not extend into the buccal segment, which is very narrow. The distance between a dorsal and ventral couple of setae measures two thirds of that between the ventral pairs. The male pores are visible in the intersegmental groove X/XI [2]), mid-

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1) Proc. Zool. Society, 1886, p. 670.

2) In my description of the gigantic *M. Houtenii* (Notes Leyden Museum IX, p. 97) I stated the male pores to be situated between segment XI and XII; as it is now settled that in all other *Moniligaster*-species those pores lie between segment X and XI I reexamined they specimens, for it might be possible that I made the error of one segment in my enumeration, as was done by Beddard in his first description of *M. barwelli*.

way between the ventral and dorsal series of setae; at the left side a conical organ was everted through the pore. No trace of a clitellum could be detected.

The specimen being too small for dissection, it was cut in serial sections to examine it more thoroughly. The body-wall is very thin, so the blackish contents of the intestinal canal are visible through it; however this is not the case in the anterior thirteen segments, which present a whitish colour and glandular appearance. No doubt this is due to the much greater thickness of the muscular layers of the body-wall in the anterior segments, for there is not much difference between the epidermic covering of the anterior and posterior body-region, as also has been pointed out by BEDDARD for *M. barwelli*. The epidermic layer of our specimen however almost entirely consists of large, oval, glandular cells (goblet-cells), while the columnar hypodermic cells could scarcely be observed; the epidermis of *M. barwelli*, according to Mr. BEDDARD'S description [1]), seems not to show such a difference from that of other Lumbricidae. In the vicinity of the male pores I found large groups of pyriform cells (Pl. III, fig. 21), extending internally within the longitudinal muscular layer and opening externally with slender processes between the epidermic cells; they consist of a finely granular protoplasm and their nucleus is darkly stained by alum carmine. Perhaps those glandular cells may be considered as representing the failing clitellum; however they do not seem to be observed neither by BEDDARD nor by ROSA [2]).

The septa in front of the genital organs are very thick and muscular. The pharynx is on its dorsal side covered by a large mass of glandular cells, extending posteriorly along the lateral side of the beginning of the oesophagus; the monilated gizzard appears to commence in

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I however believe my statement to be correct, though it is very difficult to number the segments accurately, as the setae in the anterior body-region are not visible and my material is in too poor a condition to make sections of them. I now am inclined to to doubt, whether the large Sumatra-species really does belong to the genus *Moniligaster*; for it does possess characters, not to be found in the till now described *Moniligaster*-species: f. i. the position of oviducal pores on segment XIV and the shape of the prostata-gland, which are long and tubular like in *Acanthodrilus*. Moreover the male pores in *M. Houtenii* are situated in front of the dorsal setae, and not between the ventral and dorsal setae, as observed in *M. beddardi* and in our specimen of Timor.

1) Transactions of the Royal Society of Edinburgh, Vol. XXXVI, 1891, p. 1, with Plate.

2) Annali del Museo civico di Storia naturale di Genova, 2th Sér., Vol. IX, 1890, p. 3, pl. XII.

segment XI, but it is difficult to determine its exact position, the septa being much displaced and pushed backwards.

The spermathecae are lying in segment VIII and have the usual shape; their external orifices are situated in the series of the superior dorsal setae, and not in the same line with the male pores, as is the case with *M. Houtenii*. In the sections they could be observed, containing spermatozoa.

The male genital organs appear to resemble those of *M. barwelli* and *M. beddardii*. I however found the prostata (atrium) only in its internal and superior portion, surrounded by groups of glandular cells; its distal portion appears to be totally muscular. As mentioned before, at the left side of the body this portion of the prostata was everted, probably due to the violent contraction of the worm in the alcohol. The structure of the prostata-glands in my specimen is not quite in accordance with the description and figures of BEDDARD [1]); they consist of conical cells, containing a coarsely granular protoplasma and furnished with long, slender processes, which are not lying directly next to each other, but leave open spaces between them, as figured in fig. 22.

In the segment following that, which contains the male genital organs, viz. the XIth., the ovaries are observed, presenting ripe eggs; moreover several groups of eggs are found in the body-cavity of this segment and also in two large sac-like bodies, which communicate with another at the dorsal side, and extend into the three following segments. The eggs are not very large. In this same segment a large funnel-like organ is to be seen, extending from the dorsal to the ventral side of the body (Pl. III, fig. 23); its wall, consisting of a very vascular connective tissue, is lined with a ciliated epithelium. It opens on to the exterior in the series of ventral setae, and undoubtedly represents the oviduct as well as its funnel.

It is rather difficult to state, wether our specimen is identical with one of the species, hitherto described, as our knowledge of the characters of a good deal of them, specially of BOURNE's Indian species, is not sufficient to distinguish them with certainty from each other. No doubt our worm very closely agrees with *M. barwelli* and *M. beddardii*, two species which I believe to be identical. For BEDDARD in a

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1) Quarterly Journal of Microsc. Science, Vol. XXIX, 1888, p. 119, pl. XII fig. 11.

second paper on *M. barwelli* shows that his first statements about this species [1]) are not quite correct, and therefore ROSA's suggestion that *M. beddardii* should be distinguished from *M. barwelli*, by having only three gizzards and the funnels of its spermducts lying free into the vesiculae seminales, cannot be maintained.

Our specimen however differs from both species in the structure of its female genital organs. Though ROSA observed the ovaries in *M. beddardii*, neither he nor BEDDARD mentions the presence of the large egg-sacs, which in our specimen appear to be no less developed than those in *M. Houtenii* and *M. minutus*.

Desmogaster Rosa.

7. *Desmogaster* sp.

Sumatra: mount Singalang.

Among the earthworms, collected in Sumatra, I met with a specimen, in which there was neither any trace of a clitellum, nor of an external orifice visible; I therefore presumed it to be an immature individual of any known species. On opening it from the dorsal side however I recognized, that it probably belongs to the genus *Desmogaster*, only recently described by ROSA on specimens, collected in the village of Metelèo in Burmah. *Desmogaster doriae*, though agreeing in many respects with *Moniligaster*, is specially distinguished by having two pairs of male genital glands, and two pairs of vasa deferentia, furnished with large prostata-glands and opening by four distinct pores in the intersegmental groove XI/XII and XII/XIII. I regret that I could not recognize thoroughly the internal organisation of this worm, as the specimen was rather small and much contracted, and I did not like to spoil it too much.

The worm measures about 140 mm.; it has nearly 300 segments, but those behind the 126th. are regenerated. The body is cylindrical over its total length; its colour of the dorsal side is violet, at the ventral side whitish. No clitellum is visible. The cephalic lobe is not embedded in the buccal segment. The two anterior segments have their longitudinal diameter smaller than that of the succeeding ones; the 10th segment is the largest one. The setae are minute, arranged in four pairs; the distance between the dorsal and ventral couple measures the half of that between both ventral pairs.

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2) Annals and Magazine of Natural history, 1886, p. 94.

As to the internal anatomy it could be recognized, that the 6th., 7th., 8th and 9th septum are very thick and muscular, fitting like funnels one into another, and totally inclosing the oesophagus. The 10th. septum is absent, or is displaced to the limit between segment XI and XII.

The gizzard commences in segment XVII and consists of eight divisions; in *Desmogaster doriae* there are ten gizzards; the first of them lying in segment XX. The prostate-glands represent long, tubular organs, tapering towards their external extremity; their distal portion however is again broader and has a somewhat triangular shape. It seems to me, that the prostate-glands of our specimen differ in shape from those of *D. doriae* and I also believe to have observed, that the vasa deferentia do not open at the top of those glands, as described by ROSA.

Though only a single specimen was collected, it furnishes a new point of agreement between the earthworm-fauna of the Indian continent and the Malay Archipelago.

UROCHAETIDAE.

Pontoscolex Schmarda.
(*Urochaeta* Perrier).

By his recent examination of the type-specimens of *Lumbricina*, collected and described by SCHMARDA, BEDDARD [1]) has clearly shown, that the genus *Pontoscolex* [2]) is identical with PERRIER's genus *Urochaeta*. Now PERRIER himself in his first communication on *Urochaeta* [3]) has already pointed out the close resemblance of the two genera; as however SCHMARDA stated, that *Pontoscolex* possesses fourteen series of setae, alternating in the successive segments, instead of sixteen, PERRIER was quite right in believing the two genera to be different. However according to BEDDARD's investigation of *Pontoscolex*, SCHMARDA's enumeration was inaccurate, there being eight setae in each segment; the name *Urochaeta* therefore ought to be cancelled.

Pontoscolex appears to have a very wide geographical distribution,

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1) Annals and Magazine of Natural History, 1892, p. 113.
2) Neue wirbellose Thiere, II, 1861, p. 11, Taf. XVIII, fig. 157.
3) Nouv. Archives du Museum d'Hist. Nat. de Paris, T. VIII, 1872, p. 143.

being found in Brasil, British Guyana, Jamaica, Martinique, Mauritius, Singapore, Java, Sumatra, Nias, Celebes (Weber) and Queensland.

8. *Pontoscolex corethrurus* F. Müller.

Java: Buitenzorg, very common.

Sumatra: Padang, Singkarah, Manindjau, Pajakombo, Kajutanam, a great number of young specimens, under dead wood.

Celebes: near Makassar, several specimens in freshwater.

In a critical paper on the systematical characters of *P. corethrurus* Rosa [1]) has tried to demonstrate, that all the specimens of the above-named different countries probably belong to the same species, and that the differences in characters, mentioned for some of them, have no value, because they are based upon a different manner of enumeration of the segments. With regard to *U. dubia* from Sumatra [2]), described by my-self, I am quite prepared to agree with Dr. Rosa's opinion; the specimens at my disposal were in a very poor state of preservation and therefore the buccal-segment seems to have been overlooked. As to the specimens examined by Perrier, which came from different regions (Java, Martinique, Brasil) there still rests with me some doubt, whether they all are referable to one and the same species.

In all our specimens (a rather large number) the setae of the ventral couples commence to diverge in segment XI (Xth setigerous), the external of them (2) moving dorsally; the setae of the dorsal couples usually diverge in segment XII, in some individuals however upon segment XI or XIII, the divergence being not always symmetrical. Behind the clitellum the setae begin to alternate in position, the dorsal ones first, those of the ventral couples upon segment XXVIII or XXIX. The internal setae of the ventral couples (1), in the succeeding segments of a great portion of the body, remain situated in the same line.

In the specimens, examined by Perrier [3]), the superior setae of the dorsal couples commence, according to his description, to be displaced on segment XIII (XIV Perrier) and the external ventral ones not before segment XXIII (XXIV Perrier); he also found copu-

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1) Ann. del Mus. Civico di Storia Natur. di Genova, Vol. XXVII, 1889, p. 1.

2) Midden-Sumatra, Reizen en onderzoekingen der Sumatra-Expeditie, IV, Zoologie, XII, Vermes, p. 7.

3) Archives de Zoologie Expérimentale, Vol. XIII, 1874, p. 394.

latory bristles only upon segment XIX. BEDDARD's specimens from Queensland [1]) show a great resemblance of characters with those of the Malay Archipelago, BEDDARD however could not observe the bifurcation of the distal extremity of the setae; ROSA believes, that in those worms the bristles had lost their tips by being worn off. In support of ROSA's opinion I can state, that the bifurcation of the setae in several specimens is very difficult to observe, and by no means so obvious, as figured by PERRIER; on closer examination of the setae for this purpose, I found, that below the tip, at the concave side, some crescent ridges are present, just like in *Rhinodrilus* (Pl. IV, fig. 36). BEDDARD also found them in SCHMARDA's *P. arenicola*, but thought them to be absent in *P. corethrurus*, and suggests that the first species could be distinguished by this character from the latter one. Although this difference between the two species does not hold, nevertheless *P. arenicola* may be a distinct species, as it seems to have two pairs of reniform spermathecae.

The setae in *P. corethrurus* are situated upon a circular zone, in which, in the segments in front of the girdle, the ordinary glandular cells of the epidermis are nearly totally absent (Pl. III, fig. 33). In this region however other peculiar structures are to be found, at first observed by PERRIER in this species, and afterwards also met with by BEDDARD in the *Pontoscolex*-specimens from Queensland. Those bodies (Pl. IV, fig. 37), which are large in the anterior segments, consist of an obvious, highly refractive wall and a central body, deeply stained by alum carmine. In transverse sections of the body-wall they show a dome-like shape, and probably they are connected with the surface by a tubular canal; in the middle of their base the wall appears to be thickened and bears the spherical central body. In the centre of this structure a large, clear nucleus with a nucleolus is to be seen; the body is surrounded by another thin, unstained layer, connected with the wall by some large processes. The organ lies totally embedded in the epidermis.

VEJDOWSKY [2]) at first compared those bodies with the large, pear-shaped cells of *Anachaeta*, which substitute the bristles in this worm; BEDDARD of course shared this opinion, because it furnishes a support for his theory, according which the primitive Lumbricidae were furnished with a circle of numerous setae in each segment, like

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1) Proc. of Royal Soc. of Edinburgh, Vol. XIV, 1887, p. 160.
2) Monographie der Enchytraeiden, p. 21.

Perichaeta. In my opinion however, the supposed homology is not well founded, as the epidermis-organs of *Pontoscolex* do not show much resemblance neither in their situation, nor in their appearance with the bristle-cells of *Anachaeta*; the latter ones are large, glandular cells, which are not entirely embedded in the epidermis, but extend themselves at a distance into the body-cavity. Moreover it is clear, that a body lying in the circle of the setae, may not only for this reason be considered to be homologue with them. Beddard at first describing the epidermal structures, found in *Eudrilus*, considered them as representing rudimentary setae, afterwards however reexamining them in *Hyperiodrilus* and *Heliodrilus* [1]) he came to the opinion, that they must rather be regarded as of a sensory nature, which view nearly at the same time was put forward by myself with regard to those bodies in *Eudrilus* [2]). The sensory bodies of *Lumbricus*, according to the investigations of CERFONTAINE [3]), are also in many segments specially to be found in the elevated zone of the bristles, so being, in his opinion, far better situated for their sensory function. I observed that in much contracted specimens of *Pontoscolex*, the bristle-zone of the anterior segments also has the appearance of an elevated ridge. Though the finer structure of the epidermis-bodies of *Pontoscolex* is not sufficiently known, it seems to me more probable, that they too are of a sensory nature.

The different authors, who examined *P. corethrurus*, are not quite in agreement about the structure of the cephalic extremity of this worm. FRITZ MÜLLER [4]) says, that if the worm protudes the cephalic extremity, from out the first segment one or two other segments come in sight, besides a long-stalked, club-shaped cephalic lobe. PERRIER on the contrary states, that the cephalic lobe is totally absent, that the mouth is terminal and surrounded by the buccal segment, which is devoid of bristles; but that in front of this, another segment without bristles exists, and that both can be inverted. ROSA rightly pointed out, that if PERRIER's view were right, all organs in *Pontoscolex* would lie one segment more backward than in other Lumbricidae; but as this suggestion is not very probable, he believes the segment, which PERRIER calls the first, to be the everted portion of

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1) Quartl. Journ. Microsc. Science, Vol. XXXII, 1891, p. 235.
2) Mém. Soc. Zool. de France, Vol. III, 1890, p. 1, pl. VIII.
3) Archives de Biologie, T. X, 1890, p. 363.
4) Archiv. f. Naturgeschichte, Jhrg. XXIII, 1857. p. 113.

the buccal cavity (pharynx?), which also becomes visible in other Lumbricidae. BEDDARD [1]) and BENHAM [2]) too take to the view, that „the prostomium is absent and that the mouth opens terminally."

I cannot quite agree with this opinion. Although in the most of our specimens the cephalic extremity is inverted — the first segment with bristles thus lying foremost — such is not the case with all of them.

The examination of a longitudinal section of such a specimen (Pl. III, fig. 33) proves, that a lobe of the buccal segment extends dorsally beyond the mouth. Such a lobe was also observed in an other individual, (Pl. IV, fig. 35) and shows at its ventral side a pair of longitudinal grooves, which diverge towards the anterior extremity. In transverse sections too these grooves were visible; they show no particular structure, but their epithelial layer is not so high as in the surrounding.

I believe, that the figure of a longitudinal section of the anterior end of *P. corethrurus* (Quart. Journ. Micr. Sc. Vol. XXIX, Pl. XXIII, fig. 1) published by BEDDARD, is too diagrammatical, and does not represent a sagittal but a tangential section. Moreover another mistake has been made into this figure, as already indicated by ROSA, viz. that the pore of the mucous gland is figured in the third segment, furnished with bristles, instead of in the first. As the tubes of these mucous glands in their structure much resemble those of the nephridia, and moreover the latter organs are absent in segment II en III, PERRIER already made the suggestion, that the mucous gland would represent a highly developed nephridium; BEDDARD now believes to have demonstrated the perfect homology of both organs, by finding out the internal funnels of the mucous gland. For he observed „three or four funnels of considerable size and of a somewhat horse-shoeshaped form; two of them were situated at the distal extremity of the gland in the sixth (fourth? Bedd.) segment, the third more anterior in position, corresponding to the fifth." I quite agree with ROSA, that the exactness of this observation is not without doubt, for BEDDARD says: „the mucous glands occupy the first six segments, which contain no nephridia of the normal type; these latter do not commence until after." This must be a slip of the pen, for as visible in fig. 34, nephridia are

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1) Quartl. Journ. Micr. Sc. vol. XXXI, 1890, p. 159; Proc. R. Phys. Soc. Edinburgh, 1891, p. 235.

2) Quartl. Journ. Microsc. Sc. XXXI, p. 250.

present in segment IV, V and VI, and their proximal portion lies just next to the mucous gland and is so closely connected with it, that BEDDARD probably took the funnels of those nephridia for those of the mucous gland. Though my observations therefore do not confirm BEDDARD'S statements about the structure of the mucous gland, I will not assert, that his view as to the morphology of this organ is entirely disproved.

I never observed any alternation of the nephridial pores in this worm, as described for many other earthworms.

In his first communation about *L. corethrurus* FRITZ MÜLLER calls the attention upon the fact, that all larger specimens on a fourth of the body-length, in front of the caudal extremity, show a small region, where the body-wall is strongly dilated, and which in preserved worms looks as another clitellum. During life this enlarged spot is of a lively red colour, as if inflammation exists there; it consists of five to ten segments, which are devoid of bristles and are more or less distinctly separated from each other. These segments have the appearance of being recently formed, and the author therefore suggests, that in this spot a formation of new segments takes place. PERRIER in his elaborate paper on the ana tomy of this worm states, that his examination is not confirmatory of FR. MÜLLER'S view and he thinks the dilatation of the body only to be due to the bulging of the intestinal canal, because just on this spot the typhlosolis terminates and the intestine passes into the rectum. BEDDARD [1]), who some time ago also had the opportunity of examing living examples of this worm, cannot agree with PERRIER'S opinion. He found that in the dilated spot „the bristles are not always absent — as stated by FR. MÜLLER — but that they (when present) are extremely small and easily overlooked; this suggests that they are embryonic setae. Furthermore the epidermis in this region of the body is without the large oval glandular cells, which are so characteristic a feature of the integument in all Oligochaetae. All the cells are more or less alike. This, again, I take to be a embryonic feature. In the third place, the intestine in some individuals was very much contracted in diameter, and, as already mentioned, was empty of earth." His conclusion is: „it appears, therefore, to be likely that new segments in Urochaeta are

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1) Ann. and Mag. of Nat. History, 1891, p. 95. Quartl. Journ. Micr. Science, Vol. XXXI, p. 163.

formed at this point." In a subsequent paper on the anatomy of *Diachaeta* this opinion is also maintained.

The worms, collected by PROF. WEBER, being in an excellent state of preservation, I resolved to examine this curious spot accurately and to see if there really exists „a zone of growth," as suggested by FR. MÜLLER and BEDDARD.

In almost all our examples the caudal zone (it appears prefe rable to me to make use of such an indifferent term, which prejudices nothing about the morhological value of this body-region) is visible; as stated by FR. MÜLLER, it lies always on a definite distance, about 130 segments according to PERRIER, from the cephalic extremity. If therefore really a formation of new segments takes place on this spot, it can only be the case in the direction of the caudal region.

On examining the body-wall of the caudal zone on a glass-slide (fig. 38) as a flat preparation in glycerine, we see, that six segments are divided by a circular groove in two rings, which have each half their longitudinal diameter. This division is not equally obvious over the whole periphery of the body, because the grooves in the vicinity of the ventral median line grow more or less inconspicuous. Longitudinal sections prove also (fig. 39), that these grooves are most developed at the dorsal side, though even here they are sometimes nothing but a shallow depression of the epidemis-layer; in the ventral median region no signs of grooves are visible.

The most striking feature of the body-wall in the caudal zone, is the peculiar distribution of the bloodvessels; instead of the net-work of fine capillary vessels, which occurs in other segments, we find here in each segment two bands of large vessels closely crowded together, each of them corresponding to a half segment. In the ventral median region however this vessels are hardly discernible. Transversal and longitudinal sections (fig. 40) learn us, that those vessels are situated in the highly developed layer of connective tissue, found between the layers of circular and longitudinal muscles. Though I never detected bloodvessels in the epidermis itself, as stated by BEDDARD, the red colour of the caudal zone during life, is doubtless due to those bands of densely crowded vessels, and the suggestion arises that on this spot an active respiration takes place and that perhaps new elements are formed.

Examining the different layers of the body-wall, we find, that the epidermis in the caudal zone shows an entirely different structure as in other body-segments, by the absence of the large glandular cells. As proved by fig. 39 and 40, the epidermis on this spot consists of slender, columnar cells, with an oblong oval nucleus, situated at some distance from their base. I however cannot take this to be an embryonic feature, as was done by BEDDARD; for comparing it with the epidermis of the zone of growth in *Nais*, *Chaetogaster* and *Lumbriculus* f. i., we find there the epidermis modified in a layer of protoplasma, wherein a great number of roundish nuclei lie in several layers, densely crowded, no trace of cell-walls being visible. The muscular layers too do not show an embryonic feature at all; they are not so thick and more stretched out as in the normal segments, especially at the dorsal side, but this of course corresponds with the dilated state of the caudal zone. The ventral nerve-cord, which, as known, takes its origin from the ectoderm and in embryonic segments is connected with it, has a completely normal character and the same can be stated with regard to the wall of the intestinal canal. As to the bristles, they are for the greater part absent, and those which are present, are rather small; but it may be called in mind that in the normal segments the setae also drop and are replaced by new ones, and it may be suggested, that the dilated state of the caudal zone is not well adapted for the preservation of the bristles. The characteristic nephridial pores also did not show any signs of division or increase in number, neither did the nephridia themselves nor the septa, as was already pointed out by BEDDARD. Moreover I found in young examples, being only 20 m.m. in length, the number of segments nearly complete, about 200, viz. 130 segments in front of the caudal zone, and about 80 behind it. If really the increase of segments took place in the caudal zone, in such young examples the number of segments in the region behind that spot, ought to be much smaller.

Though I regret not to be able to express an opinion as to the real value of the caudal zone in *P. corethrurus*, I believe to have demonstrated, that there is no sufficient ground to accept the views of FR. MÜLLER and BEDDARD, who look at the caudal zone as a place of rapid growth; and I am quite agreeing with PERRIER, who says about this suggestion „ce serait une curieuse exception dans le groupe des Lombriciens terrestres."

In the region of the caudal zone the intestinal canal shows a pecularity, first pointed out by PERRIER, but as I believe overlooked by BEDDARD, viz. the termination of the lamellar typhlosolis on this spot. As above referred to, PERRIER thinks the dilatation of the body to be only due to this pecularity and I quite agree with him, that this region of the intestinal canal is always bulged by alimentary substance, in variance with BEDDARD, who found the intestine here empty of debris.

On examining the alimentary tract of *Urochaeta*, I observed another peculiarity, singularly, not noted neither by PERRIER nor by BEDDARD, viz. that it is spirally coiled; this spiral begins almost behind the clitellum and continues till the caudal extremity. Each coil of the spiral corresponds to four segments, so that in the anterior portion of the body, where the segments have a greater longitudinal diameter than farther backwards, the coils are also longer than in the posterior body-region. The intestine appears not to be coiled in a true spiral, but to move rather backward in a compressed zigzag line; for the dorsal vessel and the typhlosolis, which are connected with the dorsal median line of the intestine, remain in this situation. If it were a true spiral, the dorsal vessel and ty phlosolis in one half of the coils ought to be situated ventrally. SCHMARDA in his diagnosis of *Pontoscolex* also says: „der darm der einzige species ist schraubenförmig gewunden, mit ausnahme des oberen theiles." This confirms BEDDARD'S suggestion about the identity of this genus with *Urochaeta*.

A spiral condition of the alimentary canal is described in *Didymogaster* by FLETCHER [1]) and in *Plagiochaeta* by BENHAM [2]); BENHAM states, that in the latter worm it is a true spiral. I have however some doubt as to the exactness of this assertion, because the dorsal vessel, which from its origin is connected with the dorsal median line ot the intestine, appears to retain that position; unfortunately the typhlosolis is absent in this species.

PERICHAETIDAE.

Within the last years a considerable number of species are referred to the genus *Perichaeta*, which, though agreeing rather well with

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1) Proc. Linn. Society of N. S. Wales, 2e S. Vol. I, 1886, p. 554, Pl. XI, fig. 8.
2) Quartl. Journ. of Microsc. Science, Vol. XXXIII, 1892, p. 294, pl. XV. fig. 21.

each other in their external appearance, show so marked differences in their internal structure, that some of them, without any doubt must, be regarded as the types of new genera. ROSA already proposed to separate *Megascolex* from *Perichaeta*, and BEDDARD in a recent paper added the new genera *Diporochaeta*, *Anisochaeta* and *Hoplochaeta*. Though his modification must be looked on as a great improvement, I believe nevertheless, that it must be considered as only a provisional attempt to divide this family, for unfortunately the information on the structure of several species is very superficial and incomplete. The genus *Perionyx*, though presenting large paired nephridia, in my opinion, must not be separated from the *Perichaetidae*, as proposed by BENHAM; perhaps *Megascolex armatus*, which possesses tufts of nephridial tubules as well as large nephridia, will prove to form a link between the genera plectonephrica and meganephrica.

Perichaeta Schmarda (s. s.)
(*Megascolex* Baird, Horst).

Setae numerous, arranged in a continuous row round each segment. Clitellum consisting of three segments XIV—XVI. Gizzard posterior to segment VII. Intestinal coeca in segment XXVI [1]).

The confusion of *Megascolex* and *Perichaeta*, caused by SCHMARDA's and VAILLANT's misunderstanding of TEMPLETON's original description, and by BAIRD's inaccurate observations, was cleared up by BEDDARD, who had the opportunity of examining TEMPLETON's type-specimens.

9. *Perichaeta musica* Horst [2]).

Java: Tjibodas.

Of this huge worm, the largest known *Perichaeta*-species, several examples were collected at Tjibodas.

The largest specimen measures 440 mm. in length; the number of its segments amount to 124. In the description of this worm, in my earlier paper, I omitted to note, that the row of setae is not entirely continuous, but that there is a small gap in the dorsal mid-line, equal to the interspaces between 2 or 3 of the neighbouring setae;

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1) According to BEDDARD's recent investigations (Proc. Zool. Soc. 1892) in *P. taprobanae* the intestinal coeca should be absent.

2) Notes Leyden Museum, Vol. V, 1883, p. 193; Ibidem, Vol. XII, 1890, p. 236 Pl. X, fig. 6; A. G. Vorderman, Natuurk. Tijdschr. Ned. Indië, Vol. XLI, 1881, p. 1 Pl. I.; Ibidem, Vol. XLIV, 1884, p. 1.

the white ring, upon which the setae are situated, visible in some alcohol-examples, is also interrupted on this point. In the smaller examples I found the number of setae in a row not so great as in the larger worms, 60 à 70 instead of 100. The male pores lie in a line with the 16th seta, laterally from the median ventral line; the number of setae between these pores is liable to variation.

10. *Perichaeta indica* Horst.

Java: Buitenzorg.

Sumatra: Singkarah, Manindjau, Kaju tanam; only few specimens.

In my earlier papers on *P. indica* [1]), dealing with examples from Java and Sumatra, an elaborate description of this species was given. BEDDARD also mentions specimens from New-Caledonia [2]) and South-America [3]), so this species appears to have a very wide distribution. It is presently a common host of our hot-houses, being imported with tropical plants from abroad. According to the observations of Mr. FERGUSSON [4]) however, it appears only to be found in hot-houses where is kept up a temperature of 60°, but never in any of the cooler ones; on the contrary the worms should die out or disappear in those of lower temperature. Among the examples, collected by PROF. WEBER at Singkarah, some had a body-length of 160 mm., a dimension never observed by me before. The first dorsal pore appears to be situated one segment more backwards than in *P. Houlleti*, viz. in the intersegmental groove XII/XIII, as also observed by BEDDARD. In none of the examples, at my disposal, copulatory papillae could be found; however I my earlier paper I described two pairs of them on segments VII and VIII, and BEDDARD observed them also on segment VI in specimens from New-Caledonia. Moreover the latter author found in examples from S. America „in the first few segments of the body two specially large and distinct pairs of setae."

With regard to the internal anatomy it may only be mentioned, that some of our specimens show at the duct of the diverticulum

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1) Niederl. Arch. f. Zoologie, Bd. IV, 1879. p. 3, pl. VIII. Notes Leyden Museum, Vol. V, 1883, p. 186.

2) Proc. Zool. Society, 1886, p. 298.

3) ibidem, 1890, p. 57, Pl. IV, fig. 1, 2 and 3.

4) Note on P. indica by Rob. Service; Proc. R. Phys. Soc. Edinburgh. 1890, p. 396.

another coecum or small tube, already described and figured in my Sumatra-paper.

11. *Perichaeta posthuma* Vaillant.
(– *affinis* Perrier).

Celebes: Makassar, where this species seems to be rather common, 19 specimens.

Vaillant [1]) first published a description of this species, based upon a specimen from Java; four years afterwards Perrier [2]) gave a rather detailed account of the anatomy of a species from Cochinchina, named by him *P. affinis*. As I have demonstrated in an earlier paper [3]), this species must be considered to be identical with *P. posthuma*. Beddard mentions also examples of this species from Calcutta [4]), Manila [5]) and the Bahamas [6]).

P. posthuma, though agreeing in the number of spermathecae (4 pairs) with *P. indica*, appears to be distinguishable from this species at first sight, not only by the presence of a copulatory papilla in front of and behind the papilla of the male pores, but also by its bulky and compact appearance. Though this statement is made after spirit-specimens, I believe it must be visible in the living worm also, for it was to be seen in all the present examples, adult as well as young ones; the numerous specimens of *P. indica*, which I examined, on the contrary showed all a more slender feature. A specimen of *P. posthuma*, 60 mm. in length, has in front of the clitellum a breadth of $5\frac{1}{2}$ mm., whereas an example of *P. indica* of the same length, measures only 4 mm. in breadth. Also the longitudinal diameter of the segments differs remarquably in both species, for in a specimen of *P. posthuma*, 60 mm. in length, the number of segments amounts to 116, whereas an example of *P. indica* of a length of 120 mm. (twice as long therefore) possesses only 100 segments.

The cephalic lobe appears entirely to divide the buccal segment with its narrow posterior projection, like as in *Lumbricus*; the drawing of

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1) Ann. Sc. Natur., Zoologie, 5e Sér. T. X, 1868, p. 228, pl. 10.
2) Nouv. Arch. T. VIII, p. 106, pl. IV, fig. 66.
3) Notes Leyden Museum, Vol. v, p. 106.
4) Ann. a. Mag. Nat. Hist. 1883, p. 214.
5) ibid. 1886, p. 93, pl. II, fig. 7.
6) Proc. Zool. Soc, 1887, p. 389.

this organ, published by BEDDARD (Proc. Zool. Soc. 1890, pl. V, fig. 11) is inaccurate and probably has been made after a badly preserved worm.

The number of setae in each segment is much greater than in *P. indica*; in the segments, lying directly in front of the clitellum and behind it, I counted 90 of them in a row. This number however increases in the segments situated more anteriorly, amounting to 108 in segment X and to 140 in segment VIII; this is a curious exception of the general rule, that the number of setae decreases anteriorly, as is the case in most species of *Perichaeta*. Also upon the clitellum setae were invariably present, and not only confined to its ventral portion, as stated by BEDDARD, but continuous all round the body. Between the papillae of the male pores 25 à 26 setae are to be found.

The internal structure, though agreeing in its main characters with that of *P. indica*, shows also some differences. The fifth, sixth, seventh and ninth septum are more thickened as they are in *P. indica*; also the spermathecae have another appearance as in the lastnamed species. They consist (Pl. III, fig. 30) of a main pouch and a tubular diverticulum, of about the same length; sometimes this diverticulum is a little constricted in its middle and its distal half somewhat dilated.

At the same station a number of *Perichaetidae* were found, which are not in a state of sexual maturity and could therefore not be identified.

12. *Perichaeta capensis* Horst [1]).

(— *operculata* Rosa).

Java: Buitenzorg, where the species seems to be common, more than fifty specimens; Tjibodas, six specimens.

The largest of the examples measures about 130 mm., the number of its segments amounts to 110. Cephalic lobe rather broad, extending nearly till the middle of the buccal segment, where a faint groove is visible. The buccal segment is not very distinctly separated from the succeeding one, as pointed out by ROSA; the intersegmental groove however really exists. The male generative pores (pl. III, fig. 26) upon segment XVIII, are situated on a papilla, and show in many examples the appearance of somewhat obliquely directed fissures.

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1) Notes Leyden Museum, Vol. V, 1883, p. 195.

The oviducal pore is single. No copulatory papillae occur. In the segments directly behind the clitellum; there are 56 à 60 setae, arranged in a continuous row; in the region of the spermathecae only 40 are to be found, their number usually decreasing in the anterior and posterior segments. Between the male pores 12 setae are present; on the clitellum they are not visible.

The situation of the first dorsal pore shows some variation in different examples, for in some of them I found it lying respectively in the intersegmental groove VI/VII, VII/VIII or VIII/IX, in other ones even between segment XII and XIII. Two pairs of pores of the spermathecae are visible between segment VII and VIII, and VIII and IX.

Concerning the internal anatomy can be stated, that the first septum lies between segment IV and V, and that those between segment VIII, IX, X and XI are absent. The oesophagus occupies segment V—VII; the gizzard is situated in segment VIII and IX. Next to it follows the tubular intestine, which shows its wall glandularly thickened in segment XI—XIII; the sacculated intestine commences in segment XV and is provided in segment XXVI with a pair of long coeca, extending themselves as far as the prostata. Spirally coiled, tubular glands occur in segment V and VI. The dorsal and ventral vessel communicate through four pairs of commissural vessels in segment V, VI, VII and IX; abdominal hearts are situated in segments X—XIII.

Two pairs of seminal vesicles in segment XI and XII, the first pair reaching into segment X.

There are two pairs of very large spermathecae, occupying segment VIII and IX; in one example however I observed three of them at the right side of the body, the anterior one in segment VII. Each spermatheca consists of a large pouch, showing an obtuse coecum at its external side, and of a tubular diverticulum, which is more than twice as long as the pouch and spirally coiled; at some distance from its free extremity the diverticulum shows a constriction and ends in a small oval sac (pl. III, fig. 25). The diverticulum of the spermatheca, belonging to segment VIII, is often lying in the preceding segment.

The prostates (pl. III, fig. 24) are large, lobated bodies, thrice as long as broad, occupying segments XV—XXIV and provided with a S-like bend excretory duct.

Of this species a short description (without figures) was published

by my-self in an earlier paper and drawn up after a single, badly preserved specimen, collected by VON HORSTOCK at the Cape of Good Hope. I believe, that the specimen from Java, described by ROSA as *P. operculata* [1]), must also be referred to this species, for it agrees with our specimens in its main characters, specially in the peculiar appearance of the spermathecae.

13. *Perichaeta Houlleti* Perrier.

(— *campanulata* Rosa).

Sumatra: Singkarah, six specimens.

The longest example measures 200 mm. in length. The appearance of this species is not so slender as that of P. *indica*.

The circle of bristles is noticeable by its white colour. The clitellum shows no setae nor intersegmental grooves to the naked eye. There are 50 à 52 setae in the segments immediately behind the clitellum; they are arranged in a continuous row. Upon segment XVIII, in the space between the male generative pores, 12 setae are to be seen. Those of the clitellum have a bifid extremity and the rudimentary appearance, first observed by BEDDARD [2]) and confirmed by BOURNE [3]). It is proved by this fact, that BOURNE's suggestion [4]), „that all the species of one genus should behave in the same way" with regard to the presence or absence of setae is entirely erroneous; for in adult specimens of *P. indica*, I never observed bristles upon the clitellum, while on the contrary in *P. affinis* they are present. I therefore quite agree with BEDDARD, that this is a characteristic of a given species, that should be carefully noted [5]); for it is difficult enough to discriminate the numerous species of *Perichaeta*. I will not deny that in young examples of *P. indica* setae probably are also present on the clitellar segments, but this it no impediment for making use of their total absence in the adult worm in our diagnosis. Though lion's whelps have a spotted skin as most felidae, the adult animal is characterized by the absence of spots.

The cephalic lobe extends over half the buccal segment; the first dorsal pore lies in the intersegmental groove XI/XII.

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1) Ann. K. K. Naturh. Hofmuseums, Bd. VI, 1891, p. 398, pl. XIV, figs. 6 and 6bis.
2) Proc. Zool. Society, 1887, p. 389.
3) Journ. Asiat. Soc. of Bengal, T. LVIII, 1889, p. 110.
4) Quartl. Journ. Micr. Science, T. XXXII, 1891, p. 54.
5) Proc. Zool. Soc., 1890, p. 64.

Concerning the internal anatomy can be stated, that the first septum is situated between segment V and VI; this and the two succeeding dissepiments are specially thickened and connected with each other by numerous muscle-fascicles. The 8th and 9th septum are absent; the 10th, 11th, 12th and 13th are however rather thick.

The pharynx reaches till segment IV; it is entirely covered with glands and muscular fibres, radiating in all directions to the body-wall. Next to it follows the oesophagus, which extends as far as the posterior septum of segment VII. In segment V and VI there occur on each side of the oesophagus large groups of spirally coiled glandular tubes (PERRIER mentions them also of segment VII); in both segments I found also on each side of the dorsal vessel, situated around a muscular band, connecting the anterior and the posterior septum of the relative segments, a conical glandular body, the so-called „blood-gland" of BEDDARD.

The segments VIII—X are occupied by the gizzard, which is somewhat barrel-shaped; on its dorsal side, nearly at two thirds of its length a row of longitudinal muscles are inserted, which pass backwards to the next septum and undoubtedly act as retractors of the intestinal canal. The tubular intestine has its wall glandularly thickened in segments XI—XIV; the sacculated intestine commences in segment XV, and is in segment XXVI provided with a pair of long coeca, extending forwards till the prostate.

The shape of the spermathecae, situated in segment VII, VIII and IX, very well agrees with the drawing [1]) published by PERRIER; afterwards they have been figured also by BOURNE [2]) and BEDDARD [3]). Each spermatheca consists of (1) a long, tongue-shaped pouch, with short duct, (2) a tubular diverticulum coiled in a zigzag line, nearly half as long as the pouch, and (3) a small long-stalked globular body. In the present examples I found that the first pair of spermathecae possesses only one globular body, but the two other pairs have a greater number of them, viz. 3, 4 or 5. PERRIER only mentions a single „poche glandulaire bilobée," as also figured by BOURNE; BEDDARD however sometimes found a pair

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1) Nouv. Arch. Museum T. VIII, Pl. III, fig. 58.
2) Journ. Asiat. Society. T. LVIII, pl. III, fig. 5.
3) Quartl. Journ. Microsc. Science, Vol. XXX, 1890, Pl. XXIX, fig. 6.

of them. As to the structure of these bodies I can entirely confirm BEDDARD'S observation, that they are of quite a different structure as the diverticula; they are solid and consist of a number of large cells, which contain a finely granular mass and a small nucleus. Wether however they have the function of capsulogenous glands, preparing the albuminous fluid of the cocoon, as suggested by this author, I dare not decide; for even with regard to our common earthworms, we as yet cannot state with certainty the function of the different generative organs in the process op copulation. Moreover the fact, that such forms, as *Criodrilus*, which have large cocoons, appear to possess neither capsulogenous glands nor even spermathecae, is not in favour of BEDDARD'S views.

Small seminal vesicles are present in segment XI and XII. A pair of large lobated prostate-glands occupy segments XVI—XXII.

According to ROSA'S description, his *P. campanulata* [1]) should be specially distinguished from *P. houlleti* (1) by the shape of the gizzard, which should not be bulb-shaped as in the last-named species, according to PERRIER'S figure, but rather bell-shaped (forma campanulata), and (2) by having the oesophagus dilated in front of the gizzard. Now I find, that in our examples the oesophagus really is somewhat widened out, before passing in the gizzard and that the gizzard more resembles the figure, published by ROSA, than that of PERRIER; I believe however the latter one not to be very correct, for in his description he says, that the gizzard does not present any particularity. As to the number of the globular bodies of the spermathecae, of which *P. campanulata* should possess three, instead of a single one, as figured by PERRIER in *P. houlleti*, this cannot be a character of much value, because, as I stated before, this number is not even constant for all spermathecae in the same individual.

Therefore I presume, that *P. campanulata* from Burmah is identical with *P. houlleti*. This species is already known from Calcutta, Dehra Dun, Cochinchina, Philippines and Bahama's.

14. *Perichaeta minima* n. sp.

Java: Tjibodas, four specimens.

The length of the largest example is only 25 m.m.; the number of its segments amounts to about 80.

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1) Ann. Mus. Civ. Stor. Nat. Genova, 2d Ser., Vol. X, 1890, p. 9, Pl. I, fig. 9 and 10.

The colour of the worm is greenish yellow, except on the clitellum, which is whitish and very noticeable. Through the transparent body-wall the prostata-glands and ventral nerve-cord are visible.

The prostomium is inverted and could not be recognized.

The male generative pore is situated upon a papilla; a depressed median ventral area exists upon segment XVII, XVIII and XIX, bounded laterally by a glandular ridge, in the middle of which the papilla of the male pore is situated. A single female pore on an obvious glandular area. A pair of papillae upon the anterior margin of segment VII, on a short distance from the ventral median line.

About 44 setae, arranged in a continuous row, in the segments in front of and behind the clitellum; this number increazes forwards, so that upon segment VII 60 bristles are to be found. In the anterior segments however it decreazes gradually; on the clitellum no setae were observed, except upon segment XVI, where there occur five on each side of the ventral median line.

The intestinal canal resembles that of other *Perichaetae*; the pharynx is covered with glands and a narrow oesophagus occupies segment VI and VII, widening out in segment VIII, where it passes into the gizzard, situated in segment IX and X. The intestinal coeca are short and obtuse.

There is one pair of spermathecae in segment VII; they consist (Pl. III, fig. 27) of a long and tubular pouch, somewhat dilated at its internal extremity, and a slender diverticulum, that measures about twothirds of the length of the main pouch, and consists of a small sac with a long and narrow excretory duct. The pores of both spermathecae are probably situated upon the papillae of segment VII. The prostata is a well-developed gland, opening externally by a S-like bended duct, without muscular bulbus. The nephridia are diffuse.

As far as I know of, this is the smallest *Perichaeta*-species hitherto described; the examples however appear to be in a state of sexual maturity.

Three *Perichaeta*-species, possessing only a single pair of spermathecae, are already described from the Malayan region, viz. *P. quadragenaria* Perr. [1]), *P. sangirensis* Mich. [2]) and *P. racemosa* Rosa [3]). The

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1) Nouv. Arch. T. VIII, p. 122, Pl. IV, fig. 69.
2) Jahrb. Hamb. Wissensch. Anstalten, T. VIII, 1891, p. 36.
3) Ann, K. K. Naturh. Hofmuseums, T. VI, 1891, p. 399, Pl. XIV, fig. 8.

last-named species, from Java and Borneo, has only 46 setae in segment VIII, and its spermathecae consist of a globular pouch and a ramous diverticulum. *P. quadragenaria* may perhaps be identical with *P. sangirensis*, but this cannot be decided, without examining the type-specimens; our examples can in no case be identified with one of them. *P. minima* is sufficiently distinguished by its small size, by the presence of papillae upon segment VII, and by the shape of its spermathecae.

15. ? *Perichaeta sangirensis* Michaelsen.

Sumatra: Manindjau.

A small *Perichaeta*-specimen, measuring only 27 mm. in length, was collected at Manindjau. There are two pores of spermathecae visible in the intersegmental groove VII/VIII. The spermathecae, situated in segment VIII, consist of a globular sac, with a rather long, muscular, excretory duct and of a pyriform diverticulum, communicating with the main sac by a short, non-coiled duct. The 8th and 9th intersegmental septa appear to be absent. The prostata-glands are not well developed. Perhaps the specimen is identical with *P. sangirensis*, one of the malayan species, with only a single pair of spermathecae; the other ones (*P. quadragenaria* and *P. racemosa*) having a diverticulum of quite another appearance.

16. *Perichaeta dubia* n. sp.

Sumatra: Mount Singalang, five specimens; Paninggahan, in the forest, three specimens.

Among the *Perichaetidae*, collected in Sumatra, there are some specimens, which, though agreeing with *P. Houlleti* in the number of spermathecae (four pairs) cannot be referred to this species, because their spermathecae do not show the characteristic appendicles, and the clitellum wants the peculiar rudimentary setae.

The largest of the examples, collected in the Paninggahan-forest, measures 140 mm. in length; the number of its segments amounts to about 120. The cephalic lobe extends nearly to the middle of the buccal segment. First dorsal pore in the intersegmental groove XII/XIII.

The apertures of the spermathecae are very obvious, situated in the intersegmental grooves of segment VI/VII, VII/VIII and VIII/IX, and are surrounded by a white, glandular area.

The rows of bristles are very noticeable; there are about 40 setae upon each segment in a continuous row. No setae present upon the clitellum. The internal structure resembles that of other *Perichaeta*-species; the seminal vesiculae, occupying segment X, XI and XII, are rather highly developed. There is a much lobated prostata, opening with a very thick excretory-duct on a large muscular bulbus. Each spermatheca (Pl. III, fig. 29) consists of a rather large, globular pouch, with a short, thick, muscular duct, which is completely invested with nephridial tubes, and of a single, small diverticulum, connected with the main pouch by a coiled duct. The examples collected at the Mount Singalang, in a rather indifferent state of preservation, are smaller of size, about 80 mm. in length; the number of setae in each segment appears to be also not so great as in the foregoing, 30 à 36 in a row.

A large incomplete example, from Singkarah, must also be identified with this species.

Among the „species dubiae" of *Perichaeta*, collected by the Sumatra-Expedition, described and figured by my self, there was one example, which undoubtedly belongs to this species [1]). Though we know other species of *Perichaeta* from the Indo-malayan region, which possess three pairs of spermathecae, I believe, that the present examples cannot be referred to one of them. *P. birmanica* Rosa [2]) appears to be distinguished by a greater number of setae upon each segment, as well as by the shape of its spermathecae; *P. peguana* Rosa [3]), *P. carinensis* Rosa [4]) and *P. bournei* [5]) are characterized by the presence of copulatory papillae.

17. *Perichaeta sumatrana* Horst [6]).

Java: Buitenzorg.

Two examples from Buitenzorg probably must be identified with this species. There are no copulatory papillae. The number of setae in the segments in front of and behind the clitellum amounts to 40 à 44. Two pairs of spermathecae are present in segment VIII and IX; each

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1) Reizen en Onderz. d. Sumatra-Expeditie, Vermes, p. 7, Pl. I, fig. 5.
2) Ann. Mus. Civ. Stor. Nat. Genova, 2d Ser., Vol. VI, 1888, p. 164, Pl. III, figs. 7—9.
3) id. id. Vol. X, 1890, p. 113, Pl. I, figs. 6—8.
4) id. id. p. 107, Pl. I, figs. 1 and 2.
5) id. id. p. 110, Pl. 1, figs. 3—5.
6) Reizen en Onderz. d. Sumatra-Expeditie, Vermes, p. 5, Pl. I, fig. 2*a* and *b*.

of them consists of a large globular pouch and a rather long, coiled, tubular diverticulum.

18. *Perichaeta* sp.

Flores: Kotting and Wukur.

Celebes: Luwu.

In the isles of Flores and Celebes some examples of *Perichaeta* were collected, which are not in a state of complete sexual maturity and therefore could not be identified. Among them there is one specimen from Flores with only a single spermatheca of a peculiar shape at the rigth side of segment VII. It is a rather long, slender worm, with the cephalic and caudal region much dilated; it measures about 120 mm. in lenght. The buccal cavity is everted, therefore the cephalic lobe could not be recognized

The setae are arranged in a continuous row, on a prominent ridge; each segment shows one or two transverse grooves in front of and behind the row, except on the clitellum. The male pores are situated on prominent papillae. The dorsal pores commence in the intersegmental groove XII/XIII; they are also visible upon the clitellum.

The 5th, 6th and 7th dissepiment are much thickened, connected with each other by several muscle-fascicles and entirely hide the oesophagus; the 8th and 9th septum are absent.

The single spermatheca (Pl. III fig. 28) is a rather large oval pouch, with a long excretory duct and somewhat resembles a scotch bagpipe; a tubular diverticulum, coiled in a zigzag line, is connected with it. The internal structure shows no particularity and agrees with that of other *Perichaeta*-species.

Megascolex Templeton.

Setae numerous, arranged in a row round each segment, interrupted in the median dorsal and ventral lines. Clitellum consisting of more than three segments. Gizzard in front of segment VII. No intestinal coeca. Diffuse nephridial tufts present.

Presently only three [1]) species of this genus are known with certainty, though I have no doubt, that before long more Perichaetidae will prove to belong to it; perhaps *P. intermedia* Bedd. [2]) must be

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1) *M. brachycyclus* Schmarda is a dubious species, there being nothing but the colour to distinguish it.

2) Quartl. Journ. Microsc. Science, Vol. XXX, p. 467.

referred to it. The three species may be distinguished by the following characters:

Penial setae	1 pair of spermathecae	*M. cingulatus* Schmarda (Ceylon).
	3 pairs of spermathecae	*M. armatus* Beddard (Madras, Calcutta, Mandalay, Singapore, Sumatra).
No penial setae		*M. coeruleus* Templeton. (Ceylon).

19. *Megascolex armatus* Beddard.

Sumatra: Padang, 10 specimens.

This species is very well known by the descriptions of Beddard [1]) and Rosa [2]).

The largest of our examples measures about 125 mm. in length.

The cephalic lobe is obtusely triangular, and extends with a narrow appendix over about half the length of the buccal segment (Pl. III, fig. 31). In specimens, in a state of sexual maturity, the papillae, bearing the male pores, are surrounded by an oval glandular area, in which a crescentic groove in front of and behind each papilla is visible (Pl. III, fig. 32). In the segments directly preceding the clitellum I found 44 setae, but this number decreases in the anterior and posterior segments. There is a broad median ventral gap in the row of setae, about thrice as broad as the dorsal gap; the latter one measures one and a half of the interval between the neighbouring setae.

The first dorsal pore lies in the intersegmental groove XI/XII, as stated by Rosa; when Beddard in his description of *M. cingulatus* [3]) says „dorsal pores commence, as in *M. armatus* between segments V and VI", this must be a mistake.

There are in this species – as first pointed out by Rosa and subsequently confirmed by Beddard [4]) – in the segments succeeding to that containing the male pores, a pair of large, coiled nephridia, provided with an internal ciliated funnel, but without external aperture; moreover the numerous tufts of nephridial tubules, characteristic for the Perichaetidae, are also present; in the anterior segments they are scattered about irregularly over the body-wall, in the posterior ones I found them more confined to the neighbourhood of the inter-

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1) Ann. a. Mag. Nat. Hist. 1883, p. 216, Pl. VIII, fig. 5—7.
2) Ann. Mus. Civ. Stor. Nat. Genova, Sér. 2, Vol. VI, 1888, p. 159.
3) Loc. cit., 1892, p. 122, Pl. VII, fig. 9—13.
4) Quartl. Journ. Microsc. Science, Vol. XXIX, p. 266.

segmental septa. According to BEDDARD's and BOURNE's observations, *M. coeruleus* appears to possess only the minute nephridial tubules; as to *M. cingulatus*, Beddard mentions nothing about the excretory system.

Perionyx Perrier.

Setae numerous, arranged in a continuous row, which is hardly interrupted. Male generative pores closely approximated, situated in median ventral pit. Large, paired nephridia. Gizzard rudimentary.

Five species of this genus are hitherto known; a sixth one *P. violaceus* is described in the present paper. They may be distinguished by the following characters:

- Two pairs of spermathecae
  - Penial setae . . . . . *P. gruenewaldi* Mich. [1] (Sangir, Java, Sumatra).
  - No penial setae
    - Spermathecae without diverticulum *P. excavatus* Perr. [2]. (*P. M'Intoshii* Bedd.) (Saigon, Burmah, Philippines, Nias).
    - Spermathecae with a single diverticulum *P. violaceus* n. sp. (Java, Sumatra).
- Three pairs of spermathecae
  - Each with a single diverticulum . . . . *P. sansibaricus* Mich. [3] (Sansibar).
  - Each with two diverticula . . . . . *P. saltans* Bourne. [4] (India).
- Four pairs of spermathecae . . . . . *P. arboricola* Rosa [5] (Burmah).

20. *Perionyx violaceus* n. sp.

Java: Buitenzorg, very common; Tjibodas.

Sumatra: Singkarah, very common; Manindjau; Paninggahan, in the forest.

The largest example measures 55 mm. in length; the number of its segments amounts to about 115. The dorsal side of the body is violet-brown, except on the clitellum, which is of a paler colour; the ventral side is yellowish-white, only the region in front of the clitellum is of

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1) Jahrb. Hamburg. Wissensch. Anstalten; Vol. VIII, 1891, p. 33.

2) Nouv. Arch. Mus. d'Hist. Nat. T. VIII, p. 126, Pl. IV, figs. 73 and 74. Proc. Zool. Society, 1886, p. 308. Ann. a. Mag. Nat. History, 1883, p. 213, Pl. VIII, figs. 3 and 8. Ann. Mus. Civ. Stor. Natur. Genova, 2d Ser. Vol. VI, 1888, p. 157.

3) Jahrb. Hamb. Wissensch. Anst. Vol. IX, 1891, p. 4, Pl. I, fig. 1.

4) Proc. Zool. Society, 1886, p. 669.

5) Ann. Mus. Civ. Stor. Natur. Genova, 2d Ser. Vol. X, 1890, p. 119, Pl. I, fig. 11.

a violet tint. As proved by transverse sections this colour is due to a dark pigment, which occurs in larges quantities in the intermuscular connective tissue, as well in the tranversal as in the longitudinal muscular layer, even in that under the peritoneal membrane.

The longitudinal diameter of the segments in front of the clitellum is nearly equal, however that of the clitellar segments is larger. The first and second segment are not so distinctly separated from each other as the following ones, which is also the case with *Perich. capensis.*

The cephalic lobe extends with a broad appendix over about the half of the buccal segment. The clitellum occupies segment XIII—XVII and the ventral region of the next one. The male pores are situated in an obvious pit. The pores of the two pairs of spermathecae, situated in segment VIII and IX, next to the median ventral line, are not visible externally. The dorsal pores commence in the groove between segment IV and V; on the clitellum they are very noticeable, as are also the nephridial pores.

The number of setae upon the segments in the vicinity of the clitellum amounts to 40 à 50; they are also present on the clitellum. At the dorsal side the setae are separated by an interval about twice as large as that at the ventral side; there is a narrow gap on the median dorsal line.

In regard of the internal anatomy can be stated, that the alimentary canal of this species much resembles that of *Megascolex.* The oesophagus extends till segment VI, which is occupied by the gizzard; the gizzard however is imperfectly developed, for as proved by transverse sections, it is only distinguished from the remaining portion of the intestinal canal by the presence of a thick layer of transverse muscular fibres; its epithelium has no peculiar structure and it wants the thick cuticular investment, found in the gizzard of *Perichaeta* and *Megascolex.*

From the various statements about the gizzard of *Perionyx*-species it may be concluded, that besides by other characters (above referred to) *Perionyx* also differs from its congeners by a rudimentary gizzard in segment VI (and VII?). Perrier believed, that in *P. excavatus* the gizzard was situated in segment XII; however it is stated by Rosa that „il vero ventriglio occupa i segmenti 6 e 7; esso è piccolo e ha figura di un tronco di cono rovesciato. In segmento XII egli non ha trovato che un semplice rigonfiamento stomacale." *P. arboricola*, according to the

same author, possesses „il ventriglio molto piccolo, cilindrico, poco piu lungo che largo, situato nel segmento V." About *P. sansibaricus* is recorded by MICHAELSEN „einen Muskelmagen konnte ich nicht finden, im Segment XIII zeigt der Oesophagus eine fast kugelige Erweiterung." As to the intestinal canal of *P. gruenewaldi* MICHAELSEN mentions „der Darm modifiziert sich vorne zu einem drüsig-muskulösen Schlundkopf. Auf diesen folgt ein langer, enger, von einem Blutsinus innig umspülter Oesophagus. Im XIIIem Segment zeigt der Oesophagus eine fast kugelige Erweiterung, die sich durch die zottige Struktur der Wandung und den Blutreichthum auszeichnet. Eine Ansammlung von Kalkkonkrementen zwischen den Zotten der Wandung zeigt, dass man es hier mit einem Homologon der Kalkdrüsen andrer Terricolen zu thun hat. In XIVem Segment ist der Oesophagus auffallend glatt und arm an Blutgefässen; zugleich zeigt sich die Muskulatur der Darmwandung hier etwas verstärkt, etwa bis zu einem Viertel der Epitheldicke. Zweifelsohne is diese Modification des Oesophagus als ein rudimentärer Muskelmagen anzusehen." I cannot entirely agree with MICHAELSEN'S statements, for I found in the examples of *P. gruenewaldi*, which I could examine, also a rudimentary gizzard in segment VI, and I believe, that it was overlooked by him; as to the presence of lime-concretions in the dilated region of the intestine in segment XIII, I can quite confirm his observations. In *P. violaceus* the intestinal canal shows also an annular dilatation in segment XIII, but I did not observe any lime-concretions therein; however on tranverse sections a wide blood-lacuna is visible here in the intestinal wall, which is highly folded and covered with a low epithelium.

Each spermatheca consists of a large oval pouch, with a short muscular duct, and a small, stalked, pyriform diverticulum; their microscopical structure agrees with that of other allied worms, and corresponds to the detailed description of the spermathecae of *Plagiochaeta*, recently published by BENHAM. The main pouch is totally filled with a finely granular matter, produced by the tall columnar epithelium; at the side, lying next to the intestinal canal, the columnar cells are not so high as those in the remaining portion of the pouch. This fact, which I observed also in other spermathecae, is not recorded by BENHAM. The diverticulum is entirely filled with spermatozoa.

The prostata is a narrow, tongue-shaped body, superficially divided in lobes, not extending beyond the XVIIIth segment; its

microscopical structure is similar to that of other *Perichaetidae*. The pit, in which the spermiducal pores lie, is due to the absence of the clitellar elements in the epidermis and the faint development of the longitudinal muscular layer in this area.

The nephridia consist of several loops and open externally with a slender excretory duct, without a coecum; their external pores do not alternate with each other. The nephridia, situated in the segments anterior to the XVIIIth., have their loops higher developed than those situated more backwards.

21. *Perionyx gruenewaldi* Michaelsen.

Java: Tjibodas.

Sumatra: Manindjau, Singkarah, Fort de Kock.

This species, first described by Michaelsen from Sangir, and characterized by the presence of penial setae, can at once be distinguished from the foregoing species by its colour; the violet-red tint of its dorsal side is obviously separated from the yellowish colour of the ventral and lateral sides, whereas in *P. violaceus* the tint of the dorsal and that of the ventral side gradually pass into each other. Again in this species the pores of the spermathecae are very noticeable, situated upon a glandular area; in some examples they were surrounded by a brown ring and visible even to the naked eye, whereas in *P. violaceus* they are not distinguishable externally. On the contrary the dorsal pores, very obvious upon the clitellum in *P. violaceus*, appear to be hardly discernible in this species. *P. gruenewaldi* also appears to be of a larger size than *P. violaceus*; the largest example from Sangir measured 85 mm. in length. Our largest specimen had a length of 75 mm. *P. excavatus*, agreeing with *P. gruenewaldi* and *P. violaceus* in the number of spermathecae, appears to be distinguished by a smaller number of setae (36 à 40), by its spermathecae without diverticulum and by its globular, undivided prostata.

EXPLANATION

OF

PLATES II—IV.

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bc. buccal cavity; *bl.* bloodvessels; *c.* supra-oesophageal ganglion; *lc.* cephalic lobe; *d.* diverticulum; *dv.* dorsal vessel; *e.* eggs; *g.* gizzard; *gl.* glandular layer of clitellum; *lm.* longitudinal muscles; *mg.* mucous gland; *ml.* muscular layer; *n.* nephridium; *nc.* ventral nerve-cord; *np.* nephridial porus; *o.* ovary; *od.* oviduct; *oe.* oesophagus; *ph.* pharynx; *pr.* prostata; *ro.* receptaculum ovorum; *s.* seminal vesicle; *sd.* spermduct; *si.* sacculated intestine; *sp.* spermatheca; *sv.* supraneural-vessel; *t.* testis; *tm.* transversal-muscles; *ts.* typhlosolis; *vv.* ventral-vessel; *x.* problematical organ.

PLATE II.

Figs. 1—5. *Benhamia Annae* n. sp.

Fig. 1. Transverse section through the body-wall of the eigtheenth segment. × 28 diam.

Fig. 2. Ventral view of the clitellar segments, to show the area of the prostate-pores. × 10 diam.

Fig. 3. *a.* Penial seta. × 175 diam. *b.* Extremity of the same seta, highly magnified.

Fig. 4. Spermatheca. Magnified.

Fig 5. Longitudinal section through the spermatheca. Magnified.

Figs. 6—9. *Benhamia floresiana* n. sp.

Fig. 6. Dorsal view of the anterior segments. Magnified.

Fig. 7. Ventral view of the clitellar segments, to show the area of the prostate-pores. × 10 diam.

Fig. 8. Penial setae. × 175 diam.

Fig. 9. Spermatheca. Magnified.

Figs. 10—13. *Benhamia malayana* n. sp.

Fig. 10. Dorsal view of the anterior segments. Magnified.

Fig. 11. Ventral view of the clitellar segments, to show the area of the prostate-pores. × 10 diam.

Fig. 12. Penial setae. Highly magnified.

Fig. 13. Spermatheca. Magnified.

Fig. 14. Spermatheca of *Benhamia Bolavi* Mich. × 90 diam.

Figs. 15—19. *Glyphidrilus Weberi* n. sp.

Fig. 15. Latero-ventral view of the anterior end of an individual, showing the shape of the clitellar ridges and the distribution of the setae. × 3 diam.

Fig. 16. General view of the internal organs of the worm, opened from the dorsal side. × 6 diam.

Fig. 17 A portion of a transverse section through the modified epidermis of the clitellum, to show the structure of a puberty-groove. × 90 diam.

Fig. 18. A transverse section through the body-wall of segment XXVII, to show the structure of the clitellar ridges and the distal extremities of the spermducts. × 18 diam.

Fig. 19. Dorsal view of the anal extremity. × 10 diam.

PLATE III.

Fig. 20. *Glyphidrilus Weberi* n. sp.

A portion of a longitudinal section through Segment XIII, showing the position of

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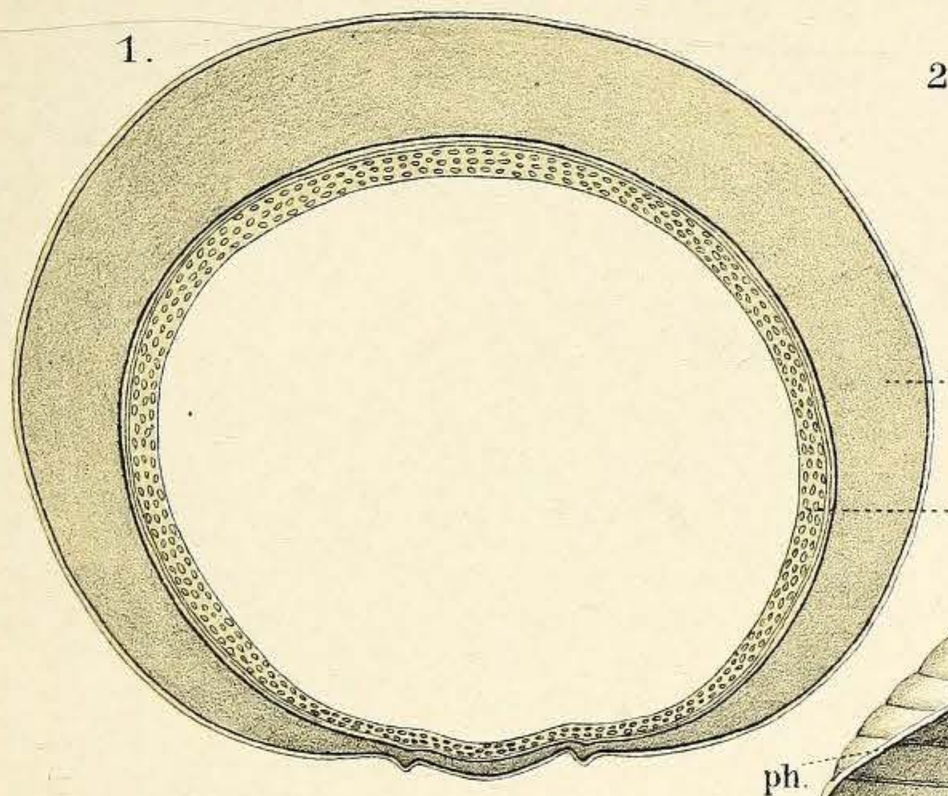

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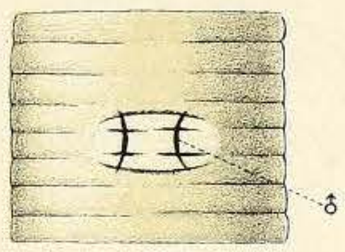

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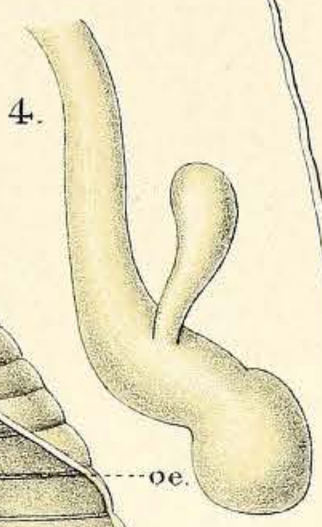

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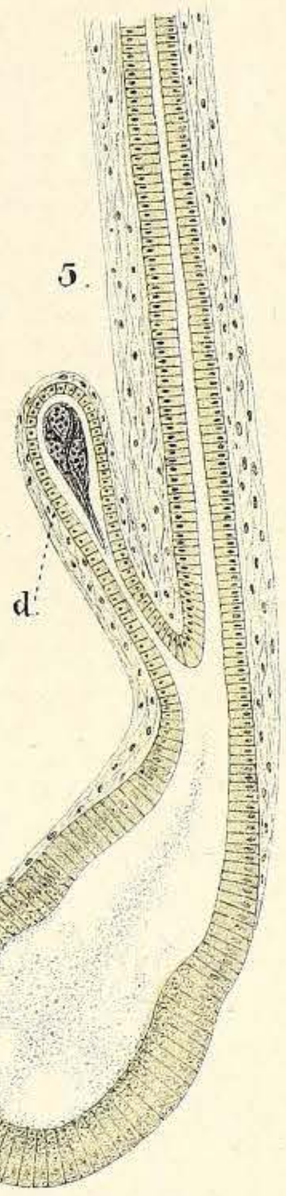

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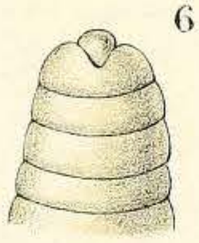

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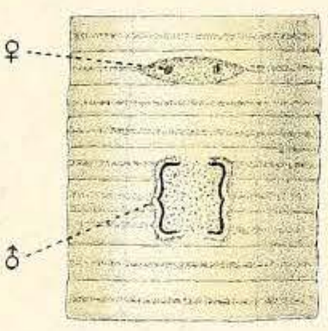

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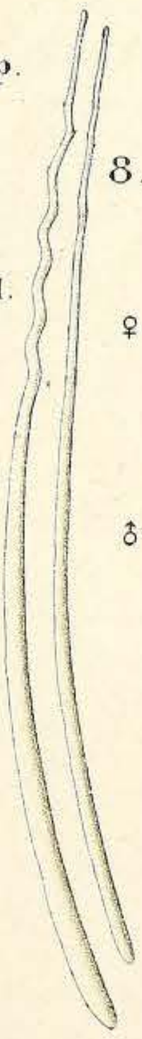

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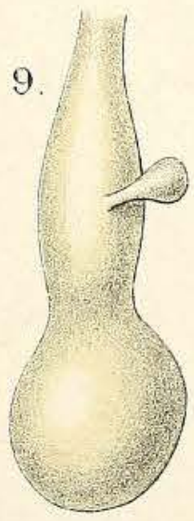

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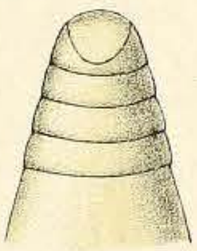

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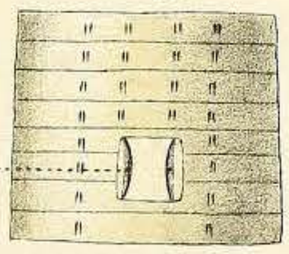

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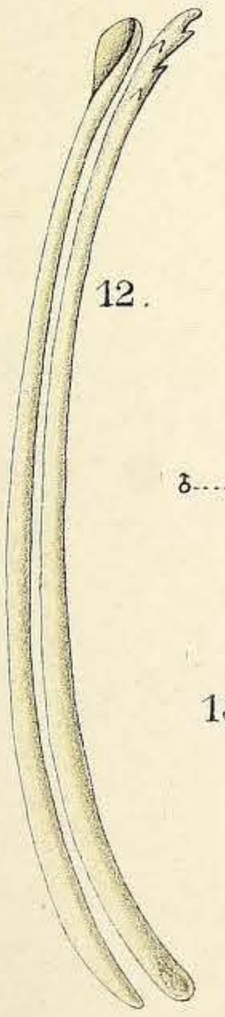

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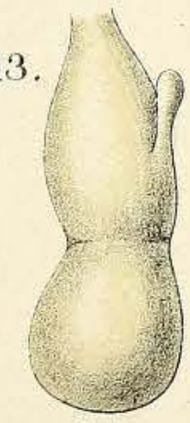

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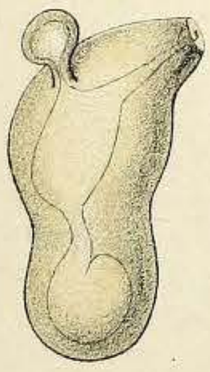

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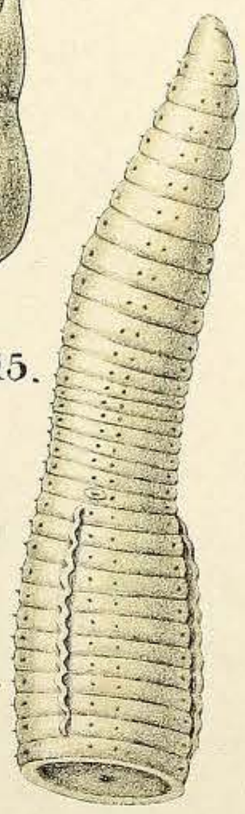

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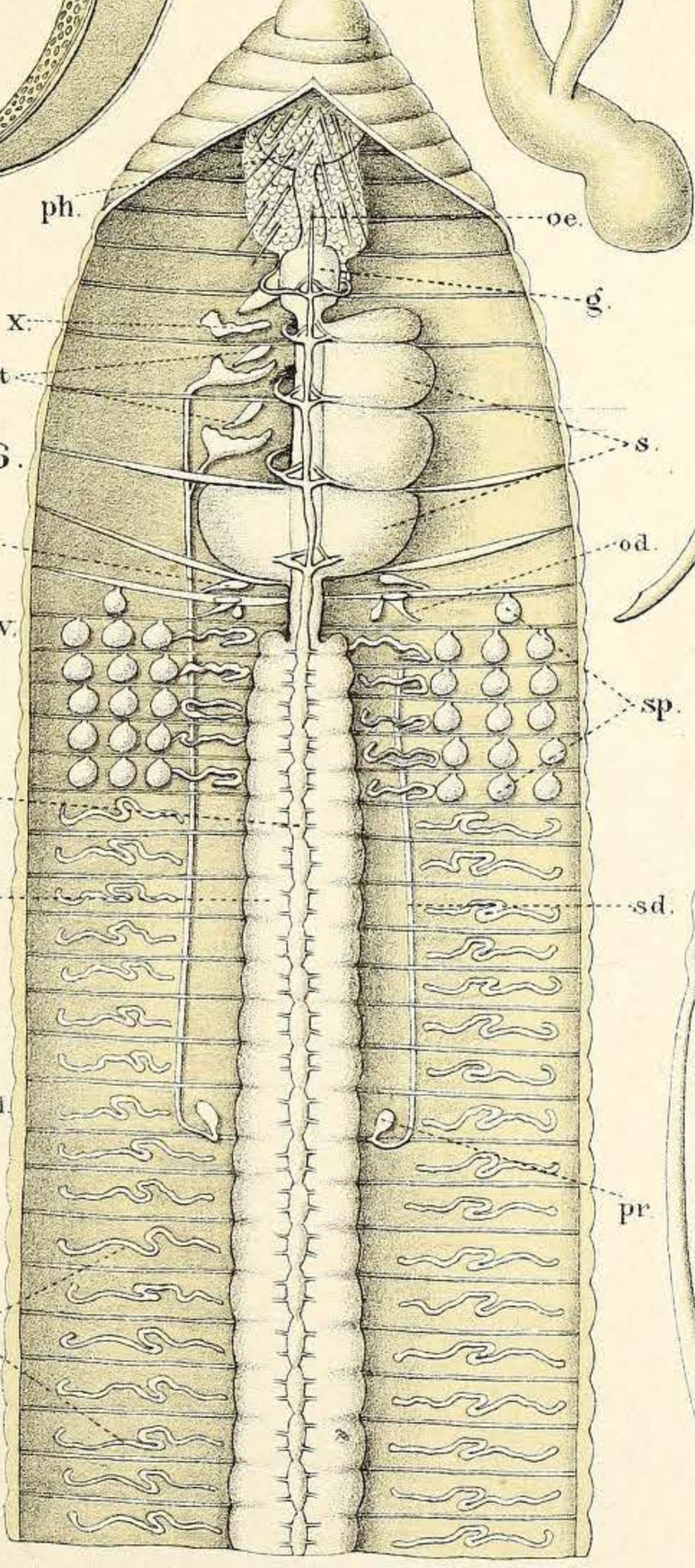

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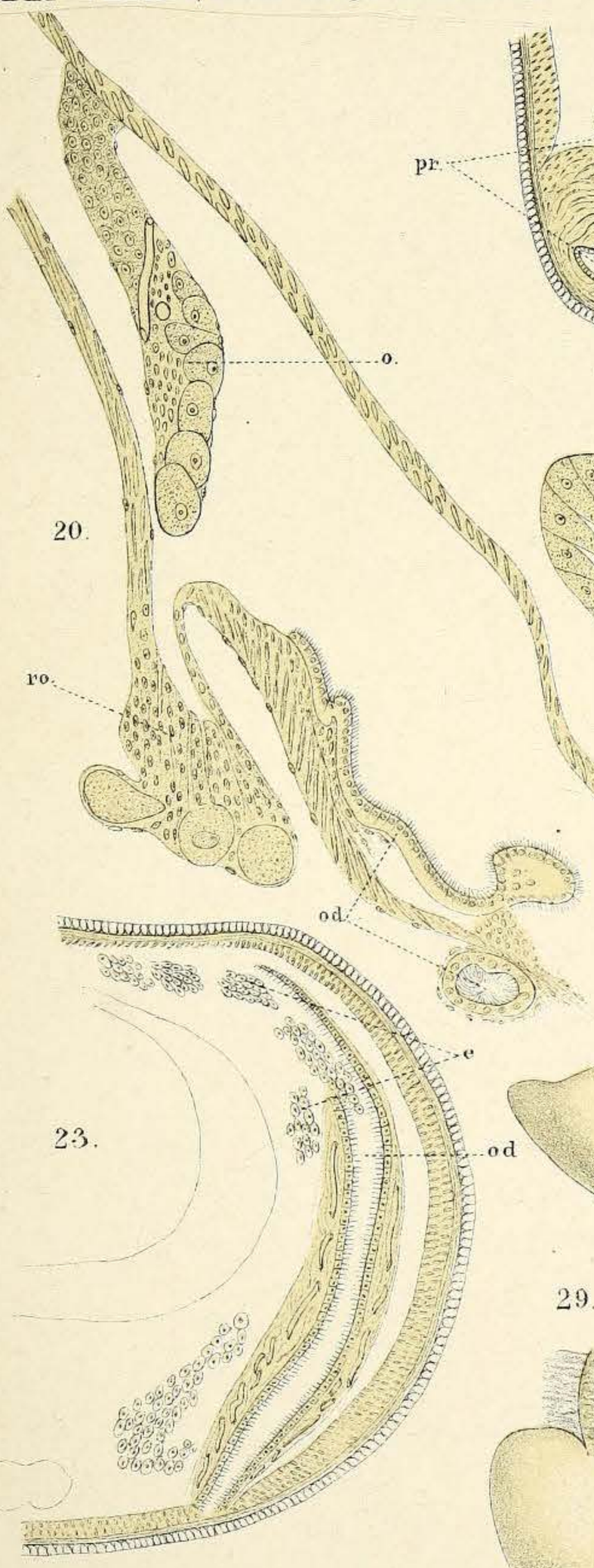

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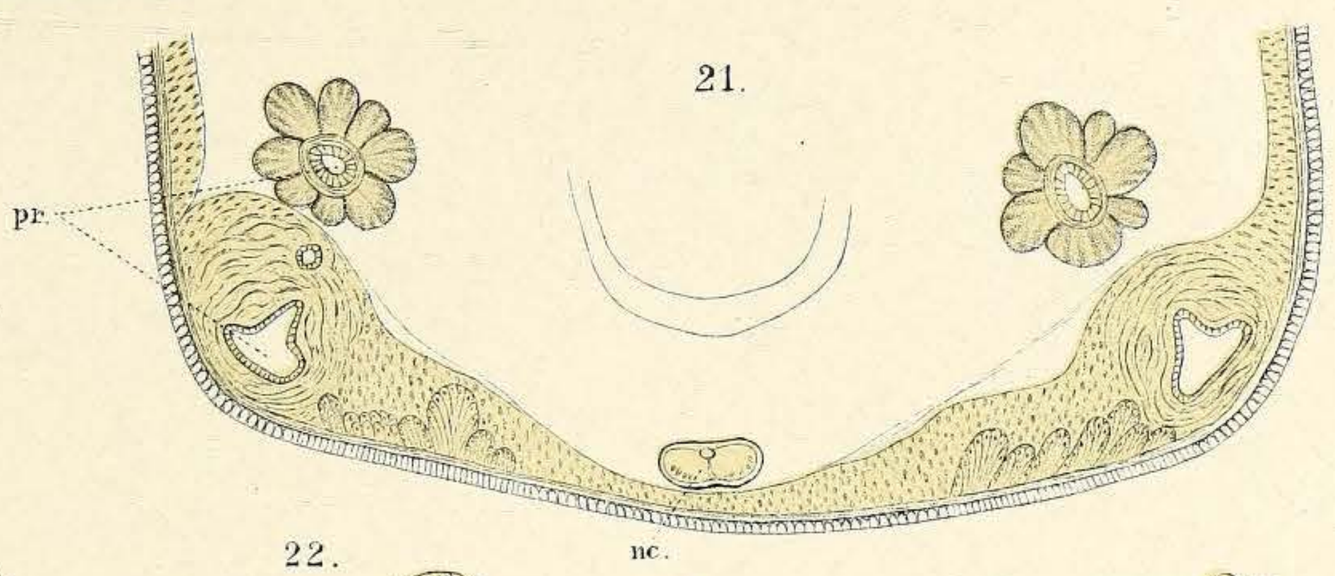

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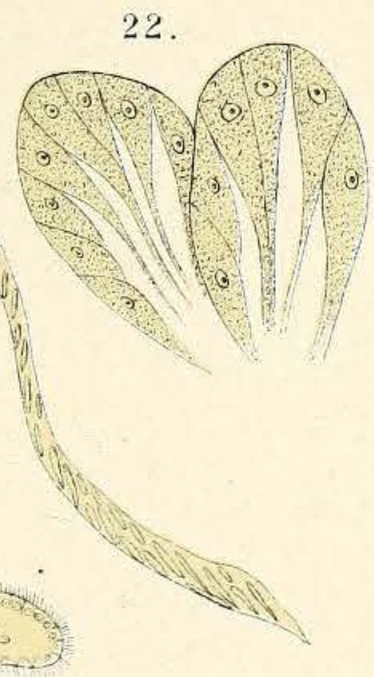

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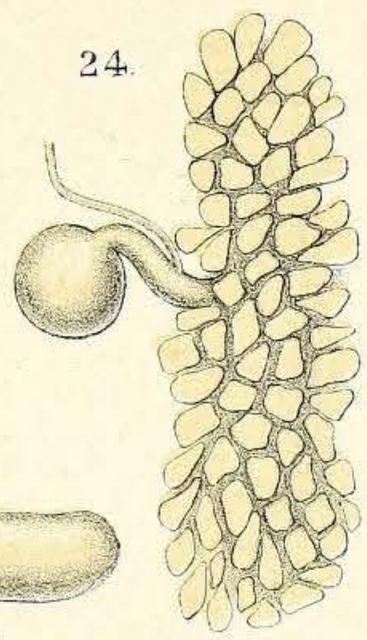

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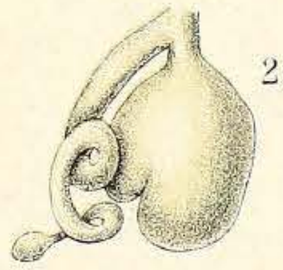

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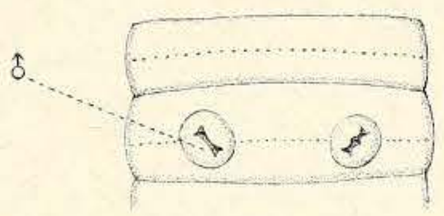

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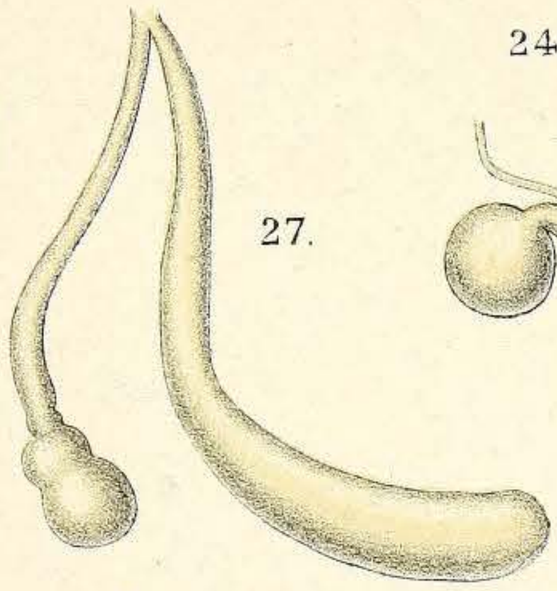

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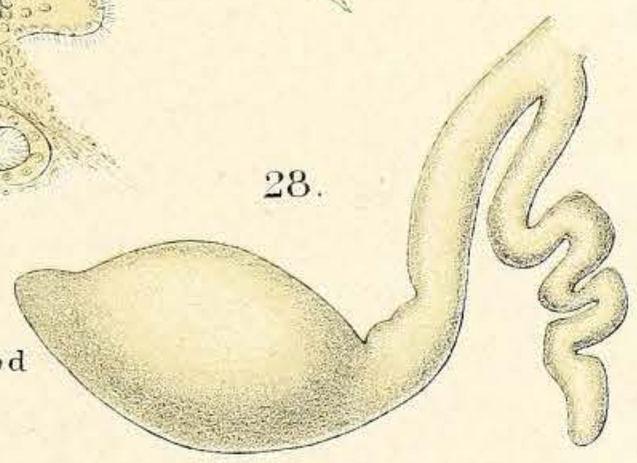

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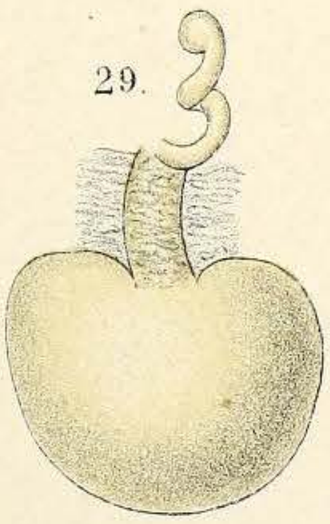

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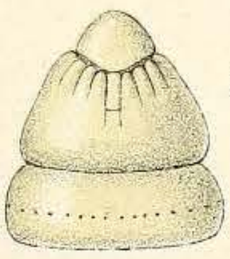

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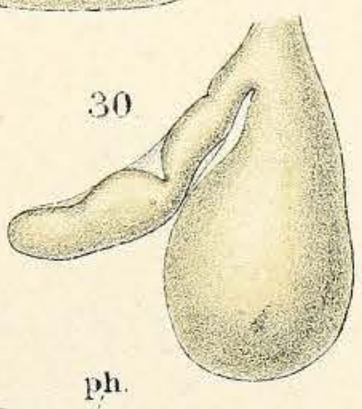

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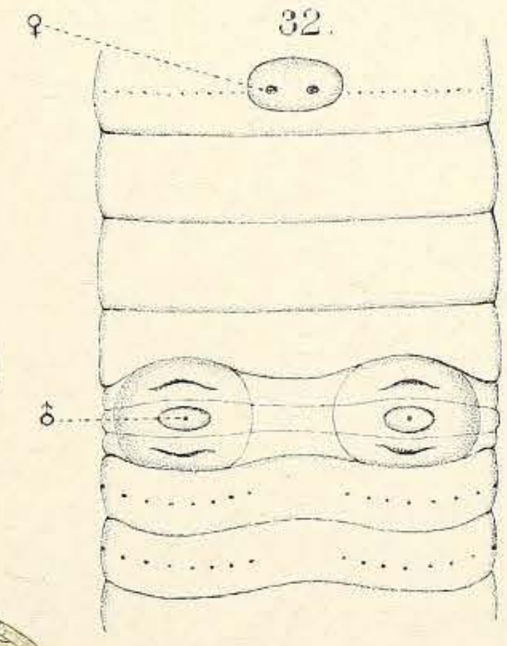

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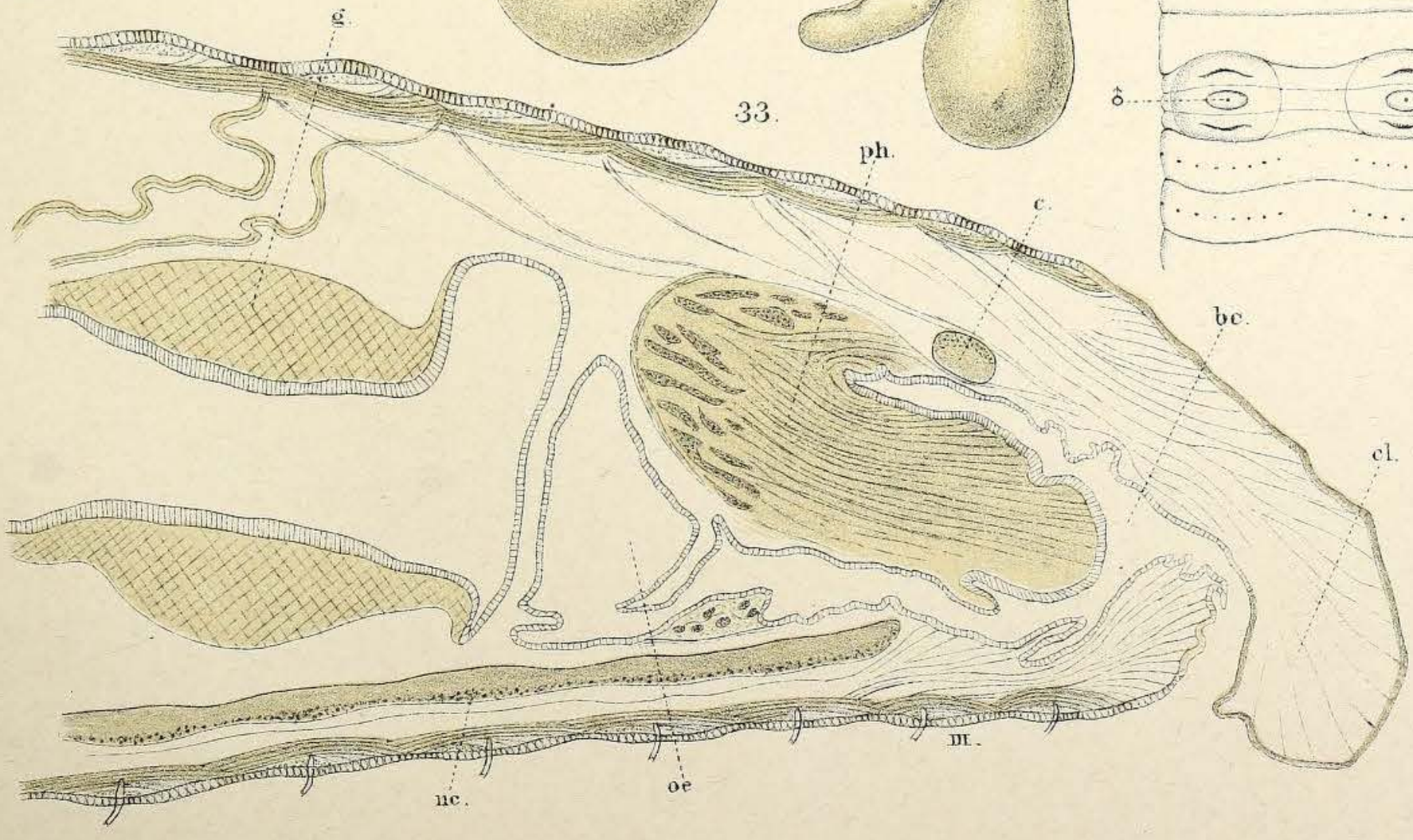

the ovary and the receptaculum ovorum. × 90 diam.

Fig. 21—23. *Moniligaster* sp. from Flores.

Fig. 21. The ventral portion of a transverse section through segment X. × 36 diam.

Fig. 22. A portion of the prostata-glands Highly magnified.

Fig. 23. The lateral portion of a transverse section through segment XI, to show the funnel-like organ. × 36 diam.

Fig. 24—26. *Perichaeta capensis* Horst.

Fig. 24. Prostata. × 5 diam.

Fig. 25. Spermatheca. × 5 diam.

Fig. 26. Ventral view of segments XVII and XVIII. × 4 diam.

Fig. 27. *Perichaeta minima* n. sp. Spermatheca. Magnified.

Fig. 28. *Perichaeta* sp. from Flores. Spermatheca. × 16 diam.

Fig. 29. *Perichaeta dubia* n. sp. Spermatheca. × 6 diam.

Fig. 30. *Perichaeta posthuma* Vaill. Spermatheca. × 15 diam.

Figs. 31—32. *Megascolex armatus* Bedd.

Fig. 31. Dorsal view of the buccal segment. Magnified.

Fig. 32. Ventral view of segments XIV—XX.

Fig. 33. *Pontoscolex corethrurus* Fr. Müll. A sagittal longitudinal section through the anterior body-segments, with protuded cephalic extremity. × 16 diam.

PLATE IV.

Figs. 34—41. *Pontoscolex corethrurus* Fr. Müll.

Fig. 34. Lateral view of the internal organs of the cephalic region (buccal segment inverted), to show the position of the mucous gland and the first three nephridia. × 5 diam.

Fig. 35. Ventral view of the cephalic extremity. Magnified.

Fig. 36. A seta, to show the crescentic ridges near the tip. × 90 diam.

Fig. 37. An epidermis-organ of the anterior body-region. Highly magnified.

Fig. 38. Surface-view of the body-wall of the caudal zone, to show the bands of bloodvessels. × 20 diam.

Fig. 39. A sagittal longitudinal section through the caudal zone. × 15 diam.

Fig. 40. A longitudinal section through the body-wall of a segment of the caudal zone. × 175 diam.

Fig. 41. A longitudinal section through the body-wall of a segment in front of the caudal zone. × 175 diam.