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XXIX. OLIGOCHAETA.

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(Plates xxvi–xxvii).

INTRODUCTION.

The interesting collection of earthworms here described was made in Assam and the Abor country, on the occasion of the recent Abor Expedition (1911–12), by Mr. S. W. Kemp of the Indian Museum, the naturalist with the expedition. The leading features of the collection may be briefly summarized.

Twenty-one species, and in addition one variety, are represented; of these no fewer than eighteen, and the variety just alluded to, are new. Ten of the new species are represented only by single specimens, or at any rate by single mature specimens. In addition, a few specimens were indeterminable, or determinable only as regards the genus.

The species are distributed among seven genera, *Drawida*, *Plutellus*, *Megascolides*, *Notoscolex*, *Perionyx*, *Pheretima*, and *Eutyphoeus*, all of which are known in India.

In the case of many of the species, the *habitat* presents no peculiarity; they were found in earth, under stones, while road-making, etc. The genus *Perionyx*, however, appears to choose other sites; the various species were frequently found in rotten wood, or under bark, while *P. depressus* was found at the base of the leaves of the plantain and screw-pine, ten, fifteen, or twenty feet from the ground. This peculiarity is not unknown in the genus, the name *arboricola* having already been applied by Rosa to a species from Burma. The two species of *Pheretima* were also found in rotten wood or under logs. One species of *Drawida* was found under a stone in water.

I may here draw attention to a peculiarity which occurs several times in the collection,—the forward displacement, by one segment, of the organs of the anterior part of the body. This has occurred in the single specimen of *Megascolides*, and in the specimens of both species of *Notoscolex*. With regard to the *Megascolides*, the peculiarity may be merely individual, since in the absence of other examples it is impossible to say whether it extends to the whole species or not; though, on the analogy of *Notoscolex striatus*, it may not improbably do so.

In the case of *Notoscolex* the value of the variation is also not easily to be determined. It occurs in the species *striatus* in three

different captures, and is therefore not merely an individual peculiarity; more than that, it occurs in the second species of the genus also, *N. stewarti*, and is therefore not even a specific peculiarity. The question naturally arises, whether in these circumstances the two species should not be separated from *Notoscolex* as a separate genus, to be derived from this latter by a shifting forwards of the organs to the extent of a segment. I have however adopted the more conservative course; the two species are evidently closely related, and have presumably become differentiated from an originally small stock of a few individuals which had suddenly developed the mutation in question,—a variation which would seem to be without functional importance.

From the point of view of *geographical distribution* the predominating occurrence of the genus *Perionyx* was to be expected, and so also the presence of a number of species of *Eutyphoeus*. The proper region of *Pheretima*, however, terminates, according to Michaelsen (3), in N. Burma, and in fact one of the species of this genus (*P. heterochaeta*) found in the present collection is a wanderer, and has been found in many parts of the world; the other species (*P. lignicola*) however seems to be endemic, representing perhaps with *P. anomala* from Calcutta (3, 4) outposts of this advancing and dominant genus.

The genera *Plutellus* and *Megascolides*, with their headquarters in the Australian region, occur also in S. India and (*Plutellus*) in Ceylon; they are, however, already known, by means of single species, from the E. Himalayas, and the present records serve to confirm the relationships thus indicated of the earthworm fauna of this region with that of S. India and Ceylon on the one hand, and with that of Australia on the other.

Here too the occurrence of *Notoscolex* in the present collection calls for comment. This genus is already known, by means of numerous species, from both S. India—Ceylon and Australia, and from these regions only. Hitherto it has been lacking from intermediate territories, and the present record of two species thus accentuates the above double relationship of the E. Himalayan fauna.

Finally, relationships of a similar nature are shown by the occurrence of *Drawida*, belonging to the Moniligastridae. The ancestral genus of the family, *Desmogaster*, is endemic in Lower Burma, Sumatra and Borneo; the headquarters of its descendant *Drawida* are in S. India and Ceylon; the genus has, however, been recorded a few times from other localities in India (Deccan, Central Provinces, Nepal), as well as from the Andamans, but these species are regarded by Michaelsen (3) as peregrine. It is therefore interesting to note that *Drawida* is one of the commonest worms in the present collection, and that, while one of the species is probably identical with a species of S. India (*D. pellucida*), the others are new, and in one case at least (*D. kempi*) not closely related to *D. pellucida*. The fact is here again exemplified that the relationships of the region have a double direction,—to S. India and

Ceylon on the one hand as before, and on the other in the Australian direction to Burma and the Malay Archipelago.

The spread of the above-mentioned genera (*Plutellus*, *Megascolides*, *Notoscolex*) of the Megascolecidae has been from the Australian region; the ancestral home of the Moniligastridae, to which *Drawida*, so abundant in S. India, belongs, is the Further India-Malayan region. The extension has thus been, in both families, towards India from outside. As Michaelsen (3, 4) has made abundantly clear, there must in the past have existed means of communication between Australia and India, though not necessarily by means of broad or permanent land bridges.

The view naturally first presents itself that India has been invaded by the representatives of the Megascolecidae by way of the Malay Peninsula round the head of the Bay of Bengal; and by the Moniligastridae from Burma (part of their original home) in the same way. Michaelsen however supposes a more direct means of communication, by way of a now submerged archipelago in the situation of the present Bay of Bengal (4):—"Die verschiedenen zwischen Neuseeland, Australien, dem Malayischen Archipel und Hinterindien einerseits und den verschiedenen Distrikten Vorderindiens samt Ceylon andererseits ausgespannten Landbrücken wurden gebildet durch einen Archipel (ähnlich dem Malayischen Archipel) an Stelle des jetzigen Golfes von Bengalen, dessen Teile ihre Gestalt und ihre Verbindungen mit einander mehrfach wechselten." To this he is led by a consideration of the close relationship between the earthworm faunas of Australia and Ceylon, as well as by the lack of endemic representatives of the Moniligastridae in the plains of India (4); "es ist zum mindesten unwahrscheinlich, dass die aus der hinterindisch-malayischen *Desmogaster* entsprossenen *Drawida*-Ahnen bei ihrer Ausbreitung nach Süd-Indien hin den in der Jetztzeit gangbaren Weg um den Golf von Bengalen herum eingeschlagen haben sollten. Dieser in Süd-Indien so üppig entwickelte Moniligastriden-Zweig würde in den Zwischendistrikten, in Bengalen, Orissa, etc., wohl Relikte Zurückgelassen haben; denn dies sind keine Distrikte, in denen besonders kräftige Formen wie *Pheretima* oder Lumbricidae herrschen. Es ist wahrscheinlich, dass den Moniligastriden ein anderer Weg von Hinterindien-Malakka-Sumatra nach Süd-Indien offen stand, ein weg, der jetzt vom Golf von Bengalen überflutet ist."

The fact that *Drawida* is one of the characteristic genera of the Abor country is therefore interesting, and may have some bearing on a future discussion of this question. The present records of the phyletically older genera of the Megascolecine branch of the Megascolecidae may be taken along with this occurrence of *Drawida*. On the alternative theory (invasion of India by Megascolecidae and Moniligastridae by a route round the head of the Bay of Bengal), these would represent traces, not yet obliterated by rival competitors, in the march of these invading genera from the south-east.

My best thanks are due to Dr. Annandale, Superintendent of the Natural History Department of the Indian Museum, for affording me the opportunity of examining this interesting collection.

LIST OF SPECIES REPRESENTED IN THE COLLECTION.

Drawida pellucida (Bourne).

Upper Rotung, alt. *ca.* 2000 ft., found road-making; 5-i-1912. A single specimen, not fully mature.

I give below some anatomical details of the specimen I have identified as above, since there may perhaps be some doubt as to the actual specific identity. The point is of some interest in view of the geographical distribution of the genus.

Length 3 inches; diameter 4 mm.; colour pale, non-pigmented. Segments 186.

Prostomium invisible. Clitellum not distinguishable.

Setae closely paired; $aa = 8ab = bc$ $ab = cd$, $dd = \frac{5}{8}$ of circumference; setae *a* and *b* are very minute behind segment XV, *c* and *d* are also small in the middle region of the body.

The male apertures are slits, in groove $\frac{10}{11}$, the margins of the adjacent segments bordering the apertures as slightly swollen lips; the centre of the slit is placed between the lines of setae *b* and *c*, rather nearer to *b*, and the inner end of the slit extends inwards almost as far as the line *b*.

The female apertures were not visible.

The spermathecal apertures are small, in furrow $\frac{7}{8}$, a little distance internal to the line of setae *c*.

The first distinguishable septum is $\frac{5}{6}$; this and the three following are extremely stout, the rest thin.

Five well-developed gizzards are present in segments xiv–xviii; the portion of the oesophagus in xiii, thick and muscular, might be described as a rudimentary gizzard.

The testicular sacs are subspherical, mainly situated in segment x, but slightly bulging forwards also on the other side of septum $\frac{9}{10}$, into segment ix. The duct could only be distinguished in segment x, not in ix. The prostate, perhaps not fully developed, appears as a small oval to circular elevation on the floor of segment x.

The spermathecae are small tubular or sausage-shaped sacs, attached to the posterior face of septum $\frac{7}{8}$; the curling duct bends outwards at its lower end. No trace of an atrium was visible.

Ovaries were apparently not developed. The egg-sacs, also probably incompletely developed, are small, tubular, and confined to segment xii.

The doubt that I have expressed above with regard to the identification of this specimen is caused by the fact that *D. pellucida* has hitherto only been found in Southern India (1600 miles distant from the Abor country), that the genus is rare in the intervening region, that the present specimen is immature, and that there are slight differences between it and the typical form of the species (e.g. in the setal intervals, and the presence or absence of a small atrium at the end of the spermathecal duct). But *D. pellucida* is apparently a species with a number of varieties (Michaelsen, 4), and if the present specimen does not actually belong to the typical form of the species it at least comes very near it, and can hardly be more than a variety. It does indeed, in the arrangement of the setae, the absence of the atrium at the end of the spermathecal duct, and possibly in the shape of the spermathecal ampulla, show some affinity to *D. pellucida* var. *bournei* (Mchlsn.); and it is mainly the absence of pigment that decided me against identifying it with this form, since the features of the spermathecal apparatus just referred to might perhaps be due to immaturity.

Drawida pellucida (Bourne) var. **stewarti**, var. nov.

Renging; 25-xi-1911; a single specimen, a fragment of the anterior end (*F. H. Stewart*).

Rotung, alt. 1300 ft., 24-xii-1911; a number of specimens, mostly immature (*F. H. Stewart*).

I propose first to describe the specimen from Renging and will then add a few lines on those from Rotung.

Length of fragment $1\frac{1}{2}$ inches; diameter $3\frac{1}{2}$ mm.; colour a faint olive-green throughout. Segments present 76.

Prostomium small, prolobous, under cover of segment i. There were no dorsal pores.

The setae, all of moderately large size, are closely paired; $ab = cd = \frac{1}{8}aa$; behind the genital region $aa = bc$, in front of the genital region however $aa > bc$; $dd = \frac{4}{7}$ of circumference. Setae *a* and *b* are absent on segments ix and x, present on xi.

A clitellum was doubtfully present, including segments ix, x, xi; in any case it was very indistinct.

The male apertures are on small papillae, in furrow $\frac{10}{11}$, between the setal lines *b* and *c*, and rather nearer to *b*; the papilla is bounded internally by the line *b*, while externally its limit is within the line *c*.

I cannot be absolutely certain, even after prolonged examination, of the situation of the female and spermathecal apertures; the female apertures appear to be just outside the line *b*, in furrow $\frac{11}{12}$, and the spermathecal apertures are apparently slit-like, the centre of the slit just within the line *c*, in furrow $\frac{7}{8}$

On segment ix, immediately in front of furrow $\frac{9}{10}$, a well-marked transverse ridge extends across the mid-ventral line. The ridge is slightly dumbbell-shaped, *i.e.* narrower in its centre; it extends outwards on each side to a point slightly beyond the line *b*. The grooves $\frac{9}{10}$ and $\frac{10}{11}$ are less deep ventrally than in the other parts of their circumference. The papillae of the male apertures are surrounded each by a fairly definite circular depression, and the surface of the body in the immediate neighbourhood of the papillae is irregular, and to the outer side somewhat puckered.

Septa $\frac{5}{6}$—$\frac{8}{9}$ are thickened; in front of this are a number of septum-like sheets of muscle, convex forwards and attached centrally to the pharynx, of which they act as dilators and retractors; but these are probably not homologous with septa. The rest of the septa are thin.

There are four gizzards, in segments xvi—xix, that in xvi being smaller than the rest. There are no calcareous glands or vascular bulgings of the oesophagus.

The last heart is in segment ix.

The nephridia are attached to the posterior face of each septum, arching dorsalwards on each side to near the middle line above the alimentary canal.

The testicular sacs are suspended but not constricted by septum $\frac{9}{10}$; the shape of each sac is pyriform, the pointed end, directed forwards and outwards, being in segment ix, the rounded end in x. The vas deferens originates in ix, is visible on both sides of the septum, is long and coiled; it ends by piercing the body-wall anterior and internal to the prostate.

The prostate is a comparatively small whitish hemispherical cushion-like mass on the ventral body-wall of x.

The ovaries are free, not enclosed in an ovarian chamber, conspicuous, attached beneath the arch of the nephridia to the posterior face of septum $\frac{10}{11}$. Funnels were not seen. The egg-sacs

were small, sausage-shaped, curved outwards at their hinder ends, and contained altogether in segment xii.

The spermathecal ampulla is attached to the posterior face of septum $\frac{7}{8}$, in the arch of the nephridium; it is egg-shaped, and almost meets its fellow, to which it is attached by a peritoneal band, in the middle line above the oesophagus. The duct is thin and much coiled, on the posterior face of the septum; it makes no appearance in segment vii, and on reaching the body-wall it bends outwards to end in a lateral position, without any atrial dilatation.

Of the specimens from Rotung, the longest was $2\frac{1}{2}$ inches, but specimens $1\frac{1}{2}$ inches long showed the male papillae distinctly; diameter 4 mm.; segments of one of the specimens about 165, very closely crowded together except the first few. The colour varies considerably; the specimen taken for dissection was pale, with an olive-green tinge in its anterior half; but in some of the smaller, immature specimens the olive colour was more pronounced and not limited to the anterior part. The prostomium was apparently zygolobous. No clitellum could be distinguished in any of the specimens.

The setae are strictly paired; $ab = \frac{1}{8} - \frac{1}{10}$ $aa = cd$; bc is slightly greater than aa; $dd = \frac{1}{7}$ of the circumference. Setae a and b are absent on segment xi, present on ix and x.

The male and spermathecal apertures are as in the previous specimen; the female apertures were not distinguishable. None of the specimens showed the genital markings described in the previous specimen.

Four well-developed gizzards are present, in segments xv—xviii, that in xv being smaller than the rest; the portion of the oesophagus in xiv may be described as a rudimentary gizzard.

In shape and position the sperm-sac shows an exact correspondence with that of the specimen first described; the duct is also exactly comparable in its course and ending. The prostate in the present example was slightly oval with its long axis transverse, cushion-like, and not much elevated.

The female organs also agree; and so too the spermathecal apparatus, except that the ampulla in the present example was very small, probably undeveloped.

The feature of the Rotung specimens which leads me to identify them with the Renging worm, is the characteristic shape of the testicular sac; and, in general, the close correspondence in the anatomy of the genital organs. It is quite possible that some of the differences are due to the Renging specimen being more fully developed; thus we may perhaps account for the absence of genital marks and of all trace of a clitellum in the examples from Rotung, as well as for the small size of the spermathecal ampulla. A difference of a segment in the position of the gizzards need cause no hesitation. There thus remains a slight difference in the ratio

of *aa* and *bc*, and the fact that while in the first described specimen setae *a* and *b* are absent on ix and x and present on xi, the reverse is the case in the second.

The positions of the genital apertures, and the absence of a spermathecal atrium, oblige us to include these specimens in that group of forms which are closely related to, or constitute mere varieties of, *D. pellucida* (Michaelsen, 4). The distinguishing features of the specimens here described appear to be the shape of the testicular sacs, and the presence (in some individuals, perhaps in all when mature) of the transverse ridge on the ventral surface of segment ix. Since I doubt whether these are of more than varietal value, I distinguish the specimens as *D. pellucida* var. *stewarti*.

Drawida rotungana, sp. nov.

Two specimens, one small, mutilated, softened and not fully mature, hinder end regenerated in both. Rotung, Abor country, alt. 1300 ft., under stones ; 8–iii–1912 ; with *Perionyx annulatus*.

Length $2\frac{1}{2}$ inches; diameter 4 mm ; colour whitish throughout, with a faint yellow tinge towards the anterior end. Segments 187, of which the last 49 have been regenerated ; all segments except about the first twelve extremely short.

Prostomium prolobous.

No dorsal pores.

Setae small, closely paired ; *ab*=*cd*, *aa* slightly less than *bc*, *dd*=$\frac{4}{7}$ of circumference, *aa* approximately=8 *ab*.

Clitellum not obvious, possibly includes segments x and xi.

Male apertures in intersegmental groove $\frac{10}{11}$, on small papillae midway between lines of setae *b* and *c*. Ventral setal couples absent in segment x.

Female apertures very minute, in groove $\frac{11}{12}$, just outside line of setae *b*.

Spermathecal apertures not actually seen ; there were however a pair of minute papillae in groove $\frac{7}{8}$, slightly internal to line of setae *c*, which probably represent their position.

A pair of small genital papillae are present, on segment ix, close to the posterior border of the segment in line of setae *b*.

Septum $\frac{4}{5}$ is thick and septa $\frac{5}{6}$—$\frac{8}{9}$ are extremely thick ; $\frac{9}{10}$ and $\frac{10}{11}$ are displaced backwards. Septa $\frac{10}{11}$ and $\frac{11}{12}$ are united dorsally, and the space contained between them had to be exposed by tearing open their line of junction ; the chamber so opened, which contains the ovaries and openings of the egg-sacs, has as its floor a thin peritoneal membrane which lies dorsal to the alimentary tube.

There were six well-developed gizzards, in segments xv to xx.

The last heart was in segment ix.

The testicular vesicles are situated on septum $\frac{9}{10}$, projecting as large, compact-looking, rather rectangular masses forwards into ix and backwards into x ; they are considerably constricted by the septum. On opening one, the funnel was seen, large and

iridescent, as a flattish bowl-shaped structure, its margin thickened and recurved but not puckered or folded. The vas deferens is long and much coiled; it passes down the posterior face of the septum, and pierces the body-wall close to the antero-internal margin of the prostate. This latter organ is a hemispherical white mass, sessile on the ventral body-wall of segment x; it is covered by a peritoneal investment. There was no vestigial prostate in ix.

The ovaries are comparatively large and folded masses, attached to the anterior septum of segment xi, and contained in the chamber described above. The egg-sacs open on the posterior wall of the chamber in a funnel-shaped depression with a prominent upper lip; each extends back through xii and xiii into xiv. There were numerous ova free in the ovarian chamber, adhering to its anterior and posterior walls; I did not identify the ovarian funnels and oviducts.

The spermathecae are in segment viii; each is an ovoid sac, attached to the posterior face of septum $\frac{7}{8}$, and situated beneath an arch formed by the curve of the nephridium, which is also attached by a mesentery to the posterior face of the septum. From the lower end of the ampulla a fine white much coiled duct descends to the ventral body-wall; its terminal portion is directed outwards and pierces the body-wall some distance towards the side; even when followed into the body-wall it shows no perceptible thickening or muscular glitter, and it has no appendages. No part of the apparatus gets into segment vii.

The present species is nearly related to the group of forms which have been subsumed by Michaelsen (4) under *D. pellucida*. Besides the slight differences in the position of the genital apertures with regard to the setal lines, and the shape of the testicular sacs, the comparatively large number of gizzards and the presence of genital papillae will serve to distinguish the present form.

Drawida decourcyi, sp, nov.

Upper Rotung, Abor country, alt. *ca.* 2000 ft.; 11-i-1912 (*M. de Courcy*). A single specimen.

Renging, 24-xi-1911 (*F. H. Stewart*). Two specimens, one immature, both incomplete posteriorly, and one small fragment.

Same place, 25-xi-1911 (*F. H. Stewart*). A fragment, probably the hinder end of an example of this species.

Length 7 inches; greatest diameter 8 mm.; colour pale green ventrally and laterally, a dark bluish green dorsally, except at anterior end where the dorsal surface is pale green, like the ventral.

Segments 226; those of the middle and posterior parts of the body are very short. The posterior end of the body is as if truncated, not tapering; the last three segments show on the flat posterior end. Segment v is faintly biannulate; vi faintly, vii and viii markedly triannulate; ix biannulate, with a very

deep groove all round; x and xi biannulate dorsally; and segments from xii onwards biannulate as far as the middle of the body; the rest consist of a single annulus. The posterior two inches of the body are marked by a ventral groove which includes the interval between the ventral rows of setal bundles.

The prostomium was invisible.

There are no dorsal pores.

The clitellum was not distinguishable.

The setae are closely paired; they begin on segment ii; *aa*=*bc*=approximately 10 *ab*; *ab*=*cd*; *dd*=$\frac{4}{7}$ of circumference.

The male apertures are in furrow $\frac{10}{11}$; they are of large size, and slit-like, the inner end of the slit being in the line of setae *a*, the centre of the slit a little distance outside *b*, and its outer end halfway between *b* and *c*. The slits are curved, their chief convexity being directed posteriorly and somewhat internally. The male pores lie within a deep rectangular depression, which includes more of segment x than of xi; the anterior border of xi slopes down into the hollow, the floor of which is constituted by the posterior $\frac{2}{3}$ of segment x, while the anterior of the three annuli of x forms its prominent anterior margin; laterally the depression extends to the outer ends of the male apertures.

The female pores are minute, in furrow $\frac{11}{12}$, in the line of setae *b*, or (Renging specimen) between *a* and *b*.

The spermathecal apertures are moderately conspicuous, in furrow $\frac{7}{8}$, internal to the line of setae *c*, about $\frac{1}{3}$ of the distance from *c* to *b*.

The first distinguishable septum is $\frac{3}{4}$, which, laterally a well-defined broad sheet, is however broken up mid-dorsally into two or three separate broad muscular bands; this structure may be a sheet of pharyngeal muscle only, and not morphologically a septum. Septum $\frac{4}{5}$ is thick, concave backwards, and approximated to $\frac{5}{6}$, which it joins dorsalwards. Septa $\frac{5}{6}$—$\frac{8}{9}$ are much thickened; the rest are thin. Septa $\frac{9}{10}$ and $\frac{10}{11}$ are bulged backwards, the former especially; in segment ix I noticed a distinct dorsal mesentery.

Well-developed gizzards are present, one in each segment from xviii to xxv, eight in all. Several septa behind the last gizzard are bulged far backwards by it; and the septa of segments xxi to xvi are bulged forwards, some of them considerably. In xvii the alimentary tube is rather softer than in the segments behind; its diameter is the same however, though it is divided by a constriction from the gizzard in xviii. I think that the portion of the tube in xvii should be reckoned as an additional gizzard, though in some degree rudimentary; this would bring the total number up to nine. In xvi and forwards the tube is seen to consist of well-marked longitudinal muscular bundles continuous from segment to segment, and presents no intersegmental constrictions; its diameter diminishes in xvi (working forwards), its walls become progressively less resistant, and in xiv are quite soft.

The last hearts are in ix.

The testicular sacs are of moderate size, rather rectangular in shape, in segment x, attached to and depending backwards from septum $\frac{9}{10}$. Each sperm-duct is a fine tube, which forms a relatively immense close-packed coil, larger than the testicular sac; it occupies a portion of segments ix and x, lying in front of the sac in ix, and on its outer side, to which it is applied, in x. Its great length reminds one of the description given by Bourne (1) of the duct in *D. grandis*; it must be at least as long in this species, relatively to the smaller size of the animal. The duct enters the prostate at a point which would be, in the natural condition of the parts, at the upper and posterior part of its inner surface (on its upper surface, towards its posterior end and near the outer margin, as the specimen lies pinned out).

The prostate is oval in shape, with its long axis antero-posterior, cushion-like, sessile on and firmly attached to the body-wall; its surface is shining, due to distinct bundles of longitudinal muscular fibres, and its anterior half is again covered over by a separate layer of transverse muscular bundles. It is situated in segment x (reckoning by the septa); but it corresponds externally to segment xi, overlapping furrow $\frac{10}{11}$ only by its anterior end; septum $\frac{10}{11}$ is bulged backwards by it, and is attached to the body-wall round its posterior end.

The ovaries are of considerable size, massive, not branched or folded, and are situated in an ovarian chamber which also contains the nephridia of segment xi, and out of which open the egg-sacs. The chamber arches over the alimentary canal; its limits are defined dorsally by the fusion of septa $\frac{10}{11}$ and $\frac{11}{12}$; this fusion takes place, not at the insertion of the septa into the dorsal body-wall, but along a line some distance below this, between their parietal insertion and the alimentary tube. Between this line of fusion and the dorsal body-wall the two septa are not fused, but merely adherent, and can be separated without tearing.

The egg-sacs are elongated, with irregular bulgings; they extend backwards into segment xiv, where they bend inwards and slightly overlap in the middle line. Septa $\frac{11}{12}$ and $\frac{12}{13}$ are fused together round the stem of the sac where this passes through them; the sac is narrow in xiii, swelling out just behind $\frac{13}{14}$.

The ampulla of the spermatheca is subspherical in shape, and is situated under the arch of the nephridium on the posterior face of septum $\frac{7}{8}$, to which both it and the nephridium are attached. The duct is thin and moderately coiled; it passes down the posterior face of the septum to the body-wall, and piercing the septum enters segment vii; its extreme terminal portion becomes a little stouter and firmer, and joins the atrium at its base. The atrium is an oval sac, which lies on and partly in the body-wall of segment vii, its free rounded end directed forwards; the length of the atrium is about half that of the segment in which it lies.

Drawida kempi, sp. nov.

Egar stream, between Renging and Rotung, under stone in water; 9-i-1912. A single specimen.

Length 3 inches; diameter 5 mm. Colour light olive green. Segments 125; no secondary annulation.

Prostomium small, under cover of segment i, prolobous.

No dorsal pores.

Setae closely paired; anteriorly $aa=8ab=bc=8cd$, $dd=\frac{4}{7}$ of circumference; in the posterior part of the body the ventral pairs of setae become approximated, *aa* being reduced.

No clitellum was visible on the dorsal surface; it was possibly represented ventrally by a slight apparent thickening of segments x and xi.

The male apertures are situated on small papillae in intersegmental groove $\frac{10}{11}$; the centre of each papilla is just within the line of setae *c*. Around each papilla is a slightly darker area of skin, which extends on each side in a transverse direction from the line of setae *b* outwards to beyond the line of *d*; in a longitudinal direction each area extends over the greater part of segments x and xi, being however longer (antero-posteriorly) at its outer than its inner limit. Each area is slightly depressed along its anterior and posterior borders, so as to form a couple of shallow grooves.

The female apertures are minute, in $\frac{11}{12}$, in the line of setae *b*.

The spermathecal apertures are one pair, small, in groove $\frac{7}{8}$, between the lines *c* and *d*, or perhaps rather in *c*; the setae in this region in the specimen are few, and exact estimation of the position difficult.

The first septum is $\frac{5}{6}$; in front of this the retractor muscles of the pharynx have the arrangement in successive transverse sheets which has been noticed in the previous species. Septa $\frac{5}{6}$, $\frac{6}{7}$, $\frac{7}{8}$, $\frac{8}{9}$ are thickened, the last most so. The rest of the septa are thin (or, in this specimen, softened from defective preservation).

There are no calcareous glands. There are four gizzards, in segments xvi—xix; of these the three posterior are large, round, and well-developed, while that in xvi is smaller. In xv a thickened portion of the oesophagus, with strong longitudinal muscular fibres, marked off by a slight constriction from the gizzard in xvi, might rank as a rudimentary gizzard Even in xiv the oesophagus is still thicker than normal.

The last heart is in segment ix.

The nephridia have the same arrangement in relation to the septa as has been described in previous species.

The sperm sacs are large yellowish masses, suspended and constricted by septum $\frac{9}{10}$; approximately equal portions of the sac are situated in each segment (ix and x). The vas deferens is a fine tube, not very much coiled, running down the posterior face of the septum to the body-wall; it then enters the prostate at the lower and inner margin of the latter (in the position in

which the organs appear in the dissection), nearer its anterior than its posterior border.

The prostate is a large cuboid milky white mass of soft consistency, with a granular surface, with a narrow attachment to the body-wall.

Segment xi constitutes a large egg-chamber, with a mass of eggs lying dorsal to the alimentary canal. The funnels appear to be of unusual size, with fringed margins prolonged upwards on the anterior face of septum $\frac{11}{12}$.

The egg-sacs have a relatively narrow neck which passes through segments xii and xiii; the sacs swell out to a large size in xiv; in the present specimen that of the right side does not extend beyond xiv, while that on the left side reaches back into xv. The sacs touch each other in the mid-dorsal line, completely overlapping the intestine. Numerous brown granules, the size of a pin's head, were present in the egg-sacs and egg-chamber (cf. *Perionyx depressus*).

The spermathecae are in segment viii. Each has a considerable ovoid ampulla, which overlies the nephridium on the posterior face of septum $\frac{7}{8}$, the nephridium being between ampulla and septum, and thus not arching over the ampulla as in the previously described species. The duct is much coiled as it passes down the septum; on arriving at the ventral body-wall it runs outwards, still slightly coiling. It terminates on the left side, in the present specimen, in a small slightly dilated portion, which however is by no means marked, being only about twice the ordinary diameter of the duct; on the right side even this slight dilatation was not discoverable.

Megascolides oneilli, sp. nov.

(Pl. xxvi, figs. 1, 2.)

A single specimen, in a poor state of preservation. Janakmukh, Abor country; 13-xii-1911 (*J. S. O'Neil*).

Length $7\frac{1}{2}$ inches; greatest diameter 6 mm.; colour light olive green, darker on and in front of clitellum. Segments, *ca.* 244.

Prostomium proepilobous.

Dorsal pores very obvious (due to state of preservation), first in groove $\frac{10}{11}$, present on clitellum.

Segments i–iii consist of a single annulus, iv is biannulate, v–xi more or less obviously quadriannulate; xii is triannulate. Behind the clitellum the intersegmental grooves themselves are not distinguishable (in the present specimen).

The setae are very small, difficult to see, and almost indistinguishable over the greater part of the body. They are rather widely paired; $aa = 2ab$ anteriorly, $= 2\frac{1}{2}ab$ behind clitellum and $= 3ab$ further back; $ab = \frac{2}{3}bc$; bc slightly or obviously $> cd$; $dd =$ approx. $\frac{2}{3}$ circumference. Setae are present on the clitellum; but the ventral setae of segments xvii and xviii are absent.

The clitellum extends from xiii—$\frac{2}{3}$ xvi = $3\frac{2}{3}$. The animal is thicker here, and there is no indication of intersegmental furrows; two oblique cracks are present on the ventral surface. In dissection the clitellum is very friable.

The male apertures are on segment xvii, between the lines of setae *a* and *b*, but perhaps rather nearer *a*; they are fairly close together, near the middle line; each has tumid and folded lips. The orifices are connected by a transverse groove, which is continued outwards on each side for a short distance external to the apertures, then turning at right angles and becoming longitudinal it runs backwards on each side for a distance equal about to the length of a segment; its margins are sharp-cut throughout (fig. 1).

Parallel to the longitudinal limbs of this groove, and just internal to these, is on each side a second groove; these latter become deeper in the posterior part of their extent; they are about equal in length to the longitudinal limbs of the first groove, projecting back slightly behind them, and not quite reaching the transverse groove in front. The intervening ridge between the two longitudinally running grooves on each side is cut in two by a narrow cleft (fig. 1).

Over the midventral area between these grooves is a series of wrinkles,—three distinct transverse furrows and a number of smaller and less marked longitudinal wrinkles. Anterior to the male apertures, between them and the posterior boundary of the clitellum, is an elongated depression, transverse in direction, and deepest at its ends (fig. 1).

The female apertures are moderately conspicuous, on the anterior part of the clitellum, in line with the setae of segment xiii. They are close together near the middle line, and apparently take the place of setae *a* in this segment though closer together than the setae *a* of most segments.

The spermathecal apertures are two pairs, in grooves $\frac{6}{7}$ and $\frac{7}{8}$, in the line of setae *a*.

The first septum is $\frac{4}{5}$, behind the massive pharynx; $\frac{5}{6}$ is thin, $\frac{6}{7}$–$\frac{10}{11}$ are all thickened, $\frac{11}{12}$ and $\frac{12}{13}$ are slightly thickened, and the rest are thin. Septum $\frac{5}{6}$ is very oblique, being attached to the alimentary canal at a level much posterior to its insertion into the parietes; and the same is the case, and even more markedly with $\frac{6}{7}$.

There is a large, elongated, cylindrical and very firm gizzard in segment vi.

The calciferous glands are four pairs, in segments ix–xii. Those in ix are oval in shape, situated dorso-laterally on the oesophagus, and attached to the anterior face of septum $\frac{9}{10}$ within the curve of the heart; internally their structure is lamellar. A similar pair of structures is present in x, and another in xi; the latter are rather larger, and bulge backwards into xii through a rounded aperture with a well-defined margin in septum $\frac{11}{12}$. The glands of segment xii lie posteriorly in the segment, and are hemispherical

in shape, the flat face looking forwards; they lie, and strongly bulge backwards, against septum $\frac{12}{13}$; internally their structure is lamellar. The glands of segments x and xi contained large calcareous masses.

The intestine begins in xiv.

The last heart is in xii.

In addition to numerous micronephridia on the inner surface of the body-wall, there is also in each segment in the posterior part of the body a pair of large meganephridia. A large mass of micronephridia is attached on the anterior face of septum $\frac{5}{6}$; owing to the obliquity of the septum, the mass is narrowly included between the septum on its outer and the oesophagus on its inner side; there are also a number of micronephridia on the posterior face of the same septum. A fluffy tuft of micronephridia is situated on and posterior to a softish white pad just internal to the prostatic aperture; the pad is ovoid, not much raised, and extends transversely from the prostatic duct to the ventral nerve cord.

A pair of male funnels were seen lying free in segment x; testes were not distinguished. Neither were found in xi.

The vesiculae seminales are two pairs; one in x, of moderate size, flattened, their edges cut up into lobes, and attached to the posterior face of $\frac{9}{10}$; and one in xi, attached to the posterior face of $\frac{10}{11}$. On the left side the posterior of the two seminal vesicles appeared to perforate septum $\frac{11}{12}$ and enter the anterior part of xii.

The male ducts were not distinctly seen. The prostates are lobular; that on the right extends through segments xiv–xvii, that on the left through xv–xvii. The prostatic duct is bent once or twice in its course, and narrows towards its end.

The ovary is large, in segment xii; also in this segment is a moderate-sized funnel. A minute folded structure in xiii was examined microscopically, but was found not to be ovarian in nature.

The spermathecae are two pairs, situated near the middle line in segments vi and vii. Owing to the obliquity of the septa, the anterior spermatheca is at the level of the middle of the micronephridial mass in v, and the posterior is at the level of the anterior part of the gizzard. Each spermatheca is directed backwards, is tubular in form, bent on itself several times, its inner end rather dilated; ampulla and duct are not distinguishable. A small subglobular diverticulum is attached close to its external termination (fig. 2).

No penial setae were seen.

Though the segments were difficult to count with certainty, on account of the secondary annulations being in places of equal distinctness with the primary, and the setae small or absent, I convinced myself that, for the present specimen, the above numbering of the segments is correct. The specimen is therefore evidently abnormal, and to obtain a correct idea of the species to which it belongs it is necessary to suppose the organs shifted

one segment back. The calciferous glands will thus, in a normal specimen, occupy segments x–xiii, and the intestine would begin in xv; the last heart would be in xiii, the testes in xi, vesiculae seminales in xi and xii, spermathecae in vii and viii. The gizzard seems to have the normal position for the genus.

Notoscolex striatus, sp. nov.

(Pl. xxvi, figs. 3–5.)

Rotung, alt. 1300 ft.; under stones; 21-xii-1911. Four specimens, one much smaller than the rest.

Upper Rotung, alt. *ca.* 2000 ft.; found in earth when road-making; 4-i-1912. A single specimen, the hinder end incomplete.

Same locality, 5-i-1912. Several specimens, some headless or tailless.

Three specimens were examined and dissected, one from each capture.

Length 8½ inches; diameter max. 5–6 mm.; colour pale yellowish or pale grey throughout, except clitellum which is light brown. Segments 297.

Prostomium relatively minute, prolobous, under cover of segment i. The first three segments consist of single annuli; iv and v are biannulate; vi–xii are triannulate, though there may be slightly marked subsidiary annulation in addition; and the same may be said of the post-clitellial segments.

The first dorsal pore is in furrow $\frac{9}{10}$; all are conspicuous.

The setae are all ventral; they are small, considering the size of the worm. Behind the clitellum *ab* are moderately closely paired, *cd* less closely; $ab = \frac{2}{7}$–$\frac{1}{3}$ *aa* (more posteriorly $= \frac{1}{4}$ *aa*) $= \frac{2}{5}$–$\frac{1}{2}$ *bc*; *bc* slightly $> cd$. In front of the clitellum the setae are often difficult to see; in vii the ratios were *ab* slightly $> \frac{1}{2}$ *aa*, $bc = cd = 1\frac{1}{3} ab$, but these latter ratios are variable; $dd = \frac{4}{7}$–$\frac{2}{3}$ circumference.

The clitellum embraces segments xiii–xv = 3; dorsal pores and setae are present.

A very characteristic genital area is present over the ventral portions of segments xvi, xvii and xviii (fig. 3). In shape it is rectangular, extending longitudinally from the level of the setae of xvi to those of xviii, and transversely embracing the region between the lines of setae *c* of each side. In colour it is brown, the pigmentation being best marked all round the borders of the area and over a longitudinal midventral tract. The centre of the area,- the midventral portion of segment xvii,—is depressed.

Next to the pigmentation, the most conspicuous feature of the area is the presence of a pair of longitudinal grooves. They are narrow, with definite margins and a rather wavy course; they traverse segment xvii in the line of setae *a*, or between *a* and *b*, and at or just beyond both the anterior and posterior limits of the segment they bend outwards, thus taking an oblique course,—more transverse than longitudinal,—for a short distance before terminating near the border of the pigmented area.

A third characteristic feature of the area is the presence of four small papillae, or nodular wart-like projections immediately lateral to the anterior and posterior limits of the longitudinal portion (not the oblique portion) of each of the grooves. Comparing what was said above as to the extent of the grooves, it will be seen that these wart-like projections occupy approximately the situation of furrows $\frac{16}{17}$ and $\frac{17}{18}$, in the position *ab*. A number of setae are absent on segments xvii and xviii.

The above description of the genital area is taken from the specimen first examined (Upper Rotung, 5-i-1912). A few differences in detail characterized the specimen selected for examination from Rotung, 21-xii-1911 (fig. 4); the oblique portions of the grooves were shorter and more directly transverse in direction; the warts were larger, and might indeed be described as 'tags', i.e. they were more or less rounded bodies attached by a narrow base; and the pigmentation was less intense; only setae *a* and *b* of xvii were missing.

The male apertures were not discoverable in the first specimen; in that last referred to they were minute pores, in the course of the grooves and in the situation of the missing setae *a* of segment xvii.

The female apertures appeared to be paired, and situated in minute grooves just in front of setae *a* of xiii; but this was only made out in one specimen, and is doubtful.

The spermathecal apertures are very minute, in furrows $\frac{6}{7}$ and $\frac{7}{8}$, in or (Rotung, 21-xii-1911) well internal to the line of setae *a*.

In front of the first definite septum is a series of muscular layers and bands extending between the body-wall and pharynx, of which latter they act as dilators and retractors. Septa $\frac{6}{7}$–$\frac{10}{11}$ are all much thickened; $\frac{6}{7}$ and the succeeding two or three are attached to the alimentary canal at a level much posterior to their parietal insertion. After $\frac{10}{11}$ the next few septa are slightly and diminishingly thickened, and the rest are thin.

The gizzard is large, barrel-shaped, in front of septum $\frac{6}{7}$, but corresponding externally to segments vii, viii and ix; thus septum $\frac{6}{7}$ is attached to the oesophagus at the level of furrow $\frac{9}{10}$.

Calcareous glands are present in segments ix, x, xi and xii (absent in x in one specimen); they are transversely elongated, somewhat sausage-shaped, and attached to the anterior faces of the septa $\frac{9}{10}$–$\frac{12}{13}$ within the curve of the hearts. The intestine begins in xiv.

The last heart is in segment xii.

The excretory organs are micronephridia; these are very small, and are best seen in the anterior part of the body as tufts in and in front of segment vi. They are scattered irregularly on the body-wall; apparently few occur between segments vii and the clitellum. There are no meganephridia in the posterior part of the body.

There are two pairs of testes, situated in segments ix and x; these are placed deeply in the segment, and each consists of a

number of fine, relatively long thread-like processes, arising from a common base on the posterior face of the septum ($\frac{8}{9}$ and $\frac{9}{10}$). The funnels, in the same segments, are small, not fringed, and somewhat iridescent.

The vesiculae seminales are paired, in segments x, xi and xii; each is a lobulated mass, flattened antero-posteriorly, lying on the posterior face of the corresponding septum, to which it is attached by a broad base.

The vas deferens was not distinguishable in any of the specimens dissected. The prostate is a small lobed organ, confined to segment xvii or extending also into xviii, and lying flat on the body-wall; the duct leaves the inner side of the gland, and forms a single U-shaped loop, the bend of the U being internal.

There are no penial setae.

The ovaries, of moderate size, are in segment xii; each consists of a number of finger-like processes. The funnels are small, the outer edge of each being much produced laterally, so that each funnel constitutes a transversely situated groove bordered by upper and lower lips.

The spermathecae (fig. 5) are two pairs, situated by the side of the nerve cord in segments vii and viii. Each is a small simple ovoid sac, with a short duct, not sharply marked off from the ampulla, opening near the middle line in grooves $\frac{6}{7}$ and $\frac{7}{8}$ respectively. Each has a single tubular diverticulum, slightly dilated at its free end, and as long as or slightly longer than the ampulla; the diverticulum is on the anterior side of the ampulla, against which and on the upper surface of which it reposes. A peculiarity of the diverticulum is that it arises from the duct within the body-wall. In one of the specimens examined a spermatheca was found without diverticulum.

Notoscolex stewarti, sp. nov.

(Pl. xxvi, figs. 6–8.)

Rotung, alt. 1300 ft.; 24-xii-1911. Two specimens, of which one was small and immature (*F. H. Stewart*).

Length $3\frac{1}{2}$ inches; diameter maximum $3\frac{1}{2}$ mm.; colour pale olive green, first few segments colourless. Segments 216.

Prostomium small, prolobous. Segments i–iii consist of single annuli; iv is faintly triannulate, v–xii fully so.

The first dorsal pore was in furrow $\frac{9}{10}$ in the small specimen, in $\frac{10}{11}$ in the larger; the pores are not visible on the clitellum.

The setae are paired, and behind the clitellum the pairs are situated on small white transverse ridges. Behind the clitellum $ab = \frac{2}{5}aa$ (more posteriorly $\frac{1}{3}aa$) $= \frac{1}{2}bc = cd$; in front of the clitellum the ratios are the same, except that $ab = \frac{1}{2}aa$; dd is very slightly less than $\frac{2}{3}$ of the circumference.

The clitellum is white in colour, ring-like, with well-defined margins, extending over segments xiii–xv = 3. The body is

wider in this region; grooves, secondary annulations, and dorsal pores are absent, but setae are present.

The genital field (fig. 6) is reminiscent of that of *N. striata* as regards the longitudinal grooves and wart-like papillae; though at first glance the appearances seem markedly different. Thus there is no yellow or brown pigmentation; the whole ventral surface of segments xvi–xviii, from the line of setae *d* on one side to the same line on the other, is whitish in colour and appears thickened, thus resembling the clitellum; the intersegmental furrows are obliterated, and a number of short transverse fissures or grooves make their appearance. The longitudinal grooves, bent outwards at their ends, have very much the position described in *N. striata*. The four wart-like projections are also present, but not quite so close to the grooves. In addition, a couple of transverse shallow groove-like depressions, without definite margins, join the longitudinal grooves of opposite sides across the middle line, between the situations of the bends, near their extremities. Seta *a* is present, but not *b*, on both sides in segments xvi and xviii; both *a* and *b* are absent in xvii.

The male aperture, minute, was seen on the right side within the longitudinal groove, at the middle of its length; it was not certainly distinguished on the left side.

The female apertures are paired, small and not easy to see, on segment xiii just in front of and internal to setae *a*.

The spermathecal apertures were also difficult to distinguish; they are small, slit-like, in furrows $\frac{6}{7}$ and $\frac{7}{8}$, approximately in the line of setae *a*; though as the setae have fallen out or are indistinguishable in this region, the exact location is impossible.

The first septum is $\frac{6}{7}$, which, as in the previous species, is strongly concave forwards. It and the two following septa are considerably thickened, though much less so than in *N. striata*; septa $\frac{9}{10}$, $\frac{10}{11}$ and $\frac{11}{12}$ are only slightly thickened.

The gizzard is barrel-shaped, and situated in front of septum $\frac{6}{7}$: its walls are of moderate thickness, though rather soft. Calcareous glands are present in segments x, xi and xii. The intestine begins in xiv.

There are numerous micronephridia attached to the body-wall; at the sides of the anterior part of the gizzard they constitute large tufts of fairly long tubes.

The last heart is in segment xii.

The testes are in segments ix and x; they lie deeply, close to the ventral nerve cord, and each consists, as in the previous species, of numerous fine thread-like processes, arising close together from a circumscribed base. The funnels, in the same segments, are relatively large and iridescent.

The vesiculae seminales are two pairs, in segments x and xi; they are flattened antero-posteriorly, elongated in shape and arching up from below so as nearly to meet dorsally above the oesophagus; their edges are slightly lobulated; each is attached to the posterior face of the respective septum for a considerable length.

The prostate (fig. 7) is large and conspicuous. It occupies two segments, xvii and xviii, and is almost cut into two by a deep indentation in the situation of septum $\frac{17}{18}$; each of these two principal lobes forms a compact mass with its surface somewhat indented into secondary lobes. The two chief lobes are connected ventrally by a narrow junction from which arises the duct. The vas deferens joins the anterior of the two chief lobes not far from the origin of the prostatic duct. The latter is short, consists of a single U-shaped bend, and ends in segment xvii.

The ovaries are situated in segment xii; they are large, and consist of a number of finger like processes. The funnels are small.

The spermathecae (fig. 8) are two pairs, in segments vi and vii, opening in furrows $\frac{6}{7}$ and $\frac{7}{8}$, i.e. in the furrow behind the segment in which they lie; they are situated in the middle of large tufts of micronephridia. Each is a subspherical or rather pyriform sac, of moderate size, narrowing to be implanted on the body-wall, with scarcely anything that can be called a duct. There is a single diverticulum situated on the anterior side of the ampulla, to which it is about equal in length; the diverticulum is club-shaped, being rather wider at its inner than at its outer end, and arises from the duct of the main sac in the substance of the body-wall.

The presence of the same grooves, and the same wart-like projections, on the genital area, as well as the similarity of the spermathecal apparatus, indicate a near relationship between the two species just described. On the other hand the considerable difference in size, the presence of only three pairs of calcareous glands and two pairs of seminal vesicles, and the characters of the prostate in the second form, appear to justify the distinction of the two forms as separate species.

Plutellus aborensis, sp. nov.

(Pl. xxvi, figs. 9, 10.)

Rotung, alt. 1300 ft., on path; 26-xii-1911. A single specimen.

Length 4 inches; diameter relatively small, at anterior end 3 mm., posteriorly only $1\frac{1}{2}$ mm. Colour pale throughout. Segments 385.

Prostomium small, prolobous, under cover of segment i. Segments i–iv consist of single annuli, v of two annuli; and the rest of three; this secondary annulation however is lost towards the posterior end.

The dorsal pores are large and conspicuous; the first is in furrow $\frac{9}{10}$.

The setae are in general very small and inconspicuous, and in front of segment xi it is very difficult and for the most part impossible to distinguish them; those most easily visible are between segments xiv and xxi. The following ratios were estab-

lished:—$aa=4ab=\frac{5}{4}bc$; $ab=\frac{2}{3}cd$; $dd=\frac{1}{2}$ circumference. Setae *a* and *b* are absent on segment xviii.

The body is rather constricted from segment xiii to xix, but there is no other sign of a clitellum.

The male apertures are situated on small papillae on the middle annulus of xviii. The papillae embrace the interval *ab*; the interannular grooves, which bound the papillae in front and behind, are rather more marked at this place than elsewhere. Around and for a small distance internal to the papillae the skin is coloured a faint yellowish brown; and between the papillae the ventral surface of the segment is gently hollowed.

The female apertures were not seen.

The spermathecal apertures are small, in furrows $\frac{7}{8}$ and $\frac{8}{9}$, between the lines of setae *a* and *b*.

The first septum is $\frac{5}{6}$; it forms a deep cup, concave forwards, in which the gizzard lies. Septa $\frac{5}{6}$–$\frac{9}{10}$ are all thick, the rest thin.

The gizzard is in front of the first septum; it is short, and square in outline. There are no calcareous glands.

The excretory system is meganephric.

The last heart is in segment xiii.

Two pairs of small seminal funnels were found free in segments x and xi; testes were not distinguishable in x, and not certainly in xi. The seminal vesicles are two pairs, in xi and xii, attached to the anterior faces of the septa ($\frac{11}{12}$ and $\frac{12}{13}$); they are of moderate size, rather flattened in an antero-posterior direction, their surface incised (deeply in the case of the posterior pair) so as to present a number of small lobes.

The prostate is a coiled tubular structure, of small size though extending through several segments. In segment xviii is scarcely more than the duct; the gland itself reaches back into xxi. The duct is a muscular shining tube, forming a single rather elongated loop in segment xviii, thicker at its termination than elsewhere.

No female organs were identified, except possibly an ovarian funnel on the left side of segment xiii.

The spermathecae (fig. 9) are situated in segments viii and ix. The ampulla forms a straight or bent cylinder, lying on the body-wall, to which it is rather adherent, in an oblique position, its anterior end being also internal. There is a small finger-shaped or club-shaped diverticulum at its internal end. The duct is very short, almost absent, and is situated on the under surface of the ampulla nearer the inner than the outer end of the latter. The situation of the diverticulum is thus some distance removed from the duct.

The penial setae (fig. 10) are ·88 mm. long, 11 μ broad, and without ornamentation; they are almost straight for the greater part of their length, but show a gentle wavy curve at their distal extremity, the point of which is sharp.

Perionyx excavatus, Perrier.

Dibrugarh, N.E. Assam, in rotten wood; 20-xi-1911. A number of specimens, many of small size and immature.
Sadiya N.E. Assam, under logs; 25-xi-1911. Ten specimens, a number mature.
Same place and date, under logs; two other specimens.
Again same place and date, under logs; two other specimens.
Rotung, alt. 1300 ft., in rotten wood; 28-xii-1911. Numerous immature specimens, probably of this species.
Renging, Abor country, under bark; 19-xii-1911. Six specimens.
Upper Rotung, alt. *ca.* 2000 ft., under bark; 9-i-1912. Numerous specimens, a young brood probably of this species.

The Renging specimens were extraordinarily small, their maximum length being one inch, and maximum breadth 2 mm.; male apertures and genital setae were however present. Compare Michaelsen's remarks on variability in size (3, p. 175).

The clitellum in the Dibrugarh specimens was only distinguishable by its rather lighter colour; it extended over segments xiv–xvi = 3. In the specimens from Sadiya and Renging it was absent altogether.

The midventral break in the setal ring varies in different specimens; it may be absent altogether, or may be well-marked (*aa* = 2*ab*).

In the specimen which I dissected (one from Dibrugarh), I found that the nephridia pierced the body-wall at approximately, but not quite equal distances from the mid-ventral line. The prostates were compact, and sessile on the body-wall. The spermathecae were large ovoid sacs, with short and narrow ducts, and without diverticula.

Perionyx annulatus, sp. nov.

South of Yembung, Abor country; 11-ii-1912. A single sexually mature specimen.
Rotung, Abor country, alt. 1300 feet, under stones; 8-iii-1912. Several specimens, but only one mature.

The specimens show many individual differences. The single example from the first locality, though mature, was abnormal in many respects; the mature specimen from the second locality was much softened and broke in two before the examination was completed. Though the male apertures were indicated in a third specimen, their position here too was abnormal, and internally sexual organs were found not to have developed Of three other immature specimens, one was much softened, one was mutilated in the anterior part of its body, and one had its hinder end regenerated. The description which follows applies to the mature specimen from the second locality, supplemented, on account of its bad preservation, by the examination of the abnormal specimen from the first locality (with the necessary allowances for the extra segments in the latter).

Length 4–6 inches; diameter 4–6 mm. Ventral surface pale; dorsal surface in general a dusky purple, but when examined more

minutely, the intersegmental grooves are seen to be pale, as are also the crests of the ridges along which the setae are set, while the intervening areas, constituted mainly by the slopes of the setal ridges, are a deep purple; a cross-striped or annulated appearance is thus produced. Segments 198–230; no secondary annulation, except, behind the clitellum, that constituted by the keel-like ridges bearing the setae.

Prostomium large, broad, epilobous $\frac{3}{4}$.

First dorsal pore in furrow $\frac{4}{5}$; all very distinct.

Clitellum xiii-xvii = 5; segment xii slightly modified also. Intersegmental grooves not obliterated, and circles of setae present. The characteristic colouring maintained over the clitellum, only rather paler than elsewhere.

The setal rings are continuous or nearly continuous ventrally behind the clitellum; and in front of the clitellum also, though there is some irregularity with occasional gaps here and there, there is no regular midventral interval. Dorsally the median interval is more constant ($zz = 1\frac{1}{2}$–$2yz$); but the arrangement is not absolutely regular. The intersetal distances are on the whole a little greater dorsally than ventrally, but the difference is not marked. Numbers of setae:—55/iv, 74/ix, 82/xiii, 70/xix, 70/xxvi.

Male apertures moderately close together, distant from each other about $\frac{1}{8}$ of the circumference (about $\frac{1}{6}$ in the softened specimen, where the ventral depression has become flattened out), at the middle of the lateral boundaries of a mid-ventral rectangular depression on segment xviii. The depression extends the whole length of the segment, from the anterior to the posterior limiting groove, and is about $1\frac{1}{4}$ times as broad as long. The floor of the rectangle, and the lateral walls of the depression, are wrinkled by small fissures, mainly longitudinal and transverse in direction. No genital setae were visible, and there were no setae on the floor or the lateral walls of the depression.

The female pore or pores were not visible.

The spermathecal apertures are three pairs, minute and difficult to see, in furrows $\frac{6}{7}$, $\frac{7}{8}$ and $\frac{8}{9}$; they are distant from each other about $\frac{2}{11}$ of the circumference, and the posterior pair were opposite the ninth seta from the midventral line.

There are no other genital marks.

A large number of septa in the anterior part of the body are more or less thickened, as compared with the very delicate dissepiments of the post-clitellar region. The septa from the anterior end as far as $\frac{9}{10}$. and $\frac{17}{18}$–$\frac{18}{19}$, may be called slightly thickened, and $\frac{13}{14}$–$\frac{16}{17}$ moderately thickened. After the first few segments none are missing.

A gizzard is present in segment vii; it is soft, and flattened dorso-ventrally, thus differing from the firm ovoid or barrel-shaped mass seen in allied genera; and, though of some size, it must be called rudimentary. The oesophagus is much bulged in segments xiii, xiv and xv; the anterior of these bulgings have

their walls strongly ridged internally. The oesophagus is narrow between the prostates. The intestine begins in xix. The intestinal walls are very delicate and transparent; there are no caeca, nor lymph-glands on the intestine.

The last heart is in segment xiii.

Meganephridia exist in all segments as far forwards as ii; in addition, in the post-genital segments, there are a number of minute micronephridia in regular transverse lines on the body-wall, especially ventrally, in the neighbourhood of the meganephridia. In the softened specimen the micronephridia are barely indicated, through disintegration.

The testes are two pairs, in x and xi; the funnels, in the same segments, are large, iridescent and much folded rosettes. The vasa deferentia were not traceable

The vesiculae seminales are two pairs, in xi and xii, depending from the anterior septa of their respective segments. They are large, and fill up the whole length of the segment, those in xii causing a backward bulging of septum $\frac{12}{13}$. Those in xi are completely fused in this situation.

The prostates take up segment xviii; each is a hemispherical mass, the flat surfaces facing inwards and apposed to each other. Each gland is made up of a large number of small lobules; the appearance of the whole is thus roughly granular. The gland is of considerable size; hence the septa in front and behind are bulged forwards and backwards respectively, and the segment containing the prostates encroaches on its neighbours. The duct is long and coiled, the coils closely applied to each other on the inner face of the gland; the last portion of the duct is thicker, and has a vertical position in the segment, running downwards to the external opening not far from the middle line.

The ovaries are of moderate size, in segment xiii. The funnels are small; I could not trace the oviducts.

The spermathecae are three pairs, in segments vii, viii and ix. They are large, sausage-shaped, and immediately obvious on opening the specimen, since they fill up the greater part of their segments at the side of the oesophagus, and, being placed with their long axes vertically, each almost or quite meets its fellow of the opposite side dorsally to the alimentary tube. The duct is short and moderately stout. Two or more very small diverticula spring from the lower part of the ampulla, on which they are sessile, above the duct; these small diverticula may or may not be themselves divided into minute lobes.

The abnormal specimen already referred to showed the following peculiarities. The dorsal process of the prostomium was limited posteriorly by a transverse groove; the first dorsal pore was in furrow $\frac{5}{6}$, the gizzard in segments vii and viii, and the last heart in xvi. The male apertures were on segment xx; there were three pairs of testes and of large folded funnels, in segments xii, xiii and xiv; and two pairs of well-developed

ovaries, with funnels, in xv and xvi. The spermathecae were four pairs, in segments viii–xi, and their apertures were, correspondingly, in grooves $\frac{7}{8}$-$\frac{10}{11}$.

The third specimen which was examined, though it showed the male pores, was however quite immature. The male pores were near the ends of a transverse groove on the ventral surface of segment xix; the groove took up more than one-third of the length of the segment (antero-posteriorly), and also rather more than one-third of its breadth (transversely) as seen from the ventral surface. There were no setae in the groove, nor, curiously, any in the middle of the ventral surface of segment xx, over an interval nearly equal to the length of the groove on xix. Internally no sexual organs had been developed; the gizzard was mostly contained in segment viii, but extended into ix; the last heart was in xv. Segment xvii, as seen externally from the dorsal side, was abnormal in being partly double; there was an extra dorsal pore in the middle of the segment; the complete ring of setae was situated in front of the pore, while behind and to the right of the supernumerary pore was a short, rather obliquely placed additional row of setae.

The remarkable features of this worm appear to be (1) its variability in regard to the position of the organs of the anterior part of the body, and in the number of the reproductive organs including the spermathecae; that the variability in position of the organs does not depend merely on the intercalation of one or two additional segments is seen from the situation of the gizzard and of the last heart in the three specimens dissected; (2) the association of micro- and meganephridia, as in the genus *Lampito*; between which and the bulk of the species of *Perionyx* the present may be regarded as a connecting form.

Perionyx kempi sp. nov.

(Pl. xxvi, fig. 11.)

Five specimens, in tube along with *P. koboensis*; in rotten wood; Kobo, Abor country, alt. 400 ft.; 30-xi-1911 and 8-xii-1911.

Length 3 inches; breadth nearly 3 mm; colour light brown, paler ventrally and at anterior end. Dorsal vessel appears as a dark stripe; the specimens are flattened dorso-ventrally, especially behind the clitellum, the ventral surface appearing as a shallow longitudinal groove. Segments 164; except the first two and the clitellar segments, each is 3-annulate (indistinctly so posteriorly).

Prostomium epilobous $\frac{1}{2}$; a transverse groove at the hinder end of the tongue-like process of the prostomium cuts off this latter altogether from the first segment. A longitudinal mid-dorsal groove extends from the tip of the prostomium to some distance behind the clitellum; it is well marked as far as the clitellum, and also on the first and last segments of the clitellum itself; it is faint, over the middle segments of the clitellum, and towards the posterior limit of its extent.

The clitellum embraces segments xii–$\frac{1}{3}$xix = $7\frac{1}{3}$; the region is swollen, but the intersegmental furrows are not obliterated. In dissection this portion of the body-wall is very thick and friable.

The first dorsal pore is in furrow $\frac{5}{6}$; no pores are however visible on the clitellum.

The setal rings are unbroken ventrally; the setae are very close together in the mid-ventral region; the intervals become wider towards the sides, and laterally and dorsally are three times as wide as mid-ventrally, or even more. The ring is broken in the mid-dorsal line ($zz = 2\frac{1}{2}$–$3yz$); but the dorsal setae are extremely difficult to see, and are so small that I was at first uncertain whether or not any existed posterior to the clitellum. There are no setae between the male pores on the ventral surface of segment xviii; otherwise the setae of the clitellar segments have the usual distribution. The number of setae per segment is about 50. There are no penial setae.

The male pores are situated on the lateral margins of a square depression which occupies the mid-ventral portion of segment xviii. The size of the depression is such that it occupies the length of the segment from the anterior to the posterior limiting groove. The margins of the pores themselves are puckered or nodular.

The female pore is single, and minute, situated in the middle of a slightly depressed whitish patch mid-ventrally in the anterior part of segment xiv.

The spermathecal apertures are two pairs, inconspicuous, in grooves $\frac{6}{7}$ and $\frac{7}{8}$, about $\frac{1}{7}$ of the circumference apart.

There are no other genital papillae or markings.

No septa are specially thickened.

There is not even a rudimentary gizzard. The oesophagus is rather dilated in segment x; the intestine begins in xix; there are no intestinal caeca.

The last hearts are in xiii, the first, which are small, in vii.

The nephridial system is purely meganephric; all the organs on each side are in the same line.

The sperm-funnels are large and iridescent, free in segments x and xi. The vesiculae seminales are paired, in xi and xii, depending backwards from the anterior septum of their segments; they are large, compact masses, only indistinctly cut up into lobes. The vas deferens, thin and fine, joins the prostate gland on the lower part of its inner face, close to where the ejaculatory duct leaves it. The prostate occupies segments xvii and xviii, and septum $\frac{18}{19}$ is bulged backwards by the gland; it is a solid-looking massive compact body, elongated antero-posteriorly, not distinctly lobulated on the surface; its duct is thick, short, and **S**-shaped.

The ovaries are large, like bunches of grapes.

The spermathecae are in segments vii and viii, their apertures in grooves $\frac{6}{7}$ and $\frac{7}{8}$. The shape of the ampulla is very irregular, and not quite the same in all (fig 11); on the whole it is triangular.

The duct is equal or nearly equal in length to the ampulla, and is swollen at its upper end, where it is delimited from the ampulla by a deep constriction. The dilated portion of the duct contains spermatozoa, and may thus be considered as a rudimentary diverticulum.

Perionyx koboensis, sp. nov.

(Pl. xxvi, fig. 12.)

Numerous specimens; in rotten wood, Kobo, Abor country, alt. 400 ft., 30-xi-1911 and 8-xiii-1911.

Length 4 inches; breadth 4 mm.; colour, on the dorsal surface dark purple anteriorly, more pinkish posteriorly, on the ventral surface light grey; markedly iridescent on the dorsal surface anteriorly. Segments 144.

Prostomium epilobous $\frac{1}{2}$. The rows of setae are implanted on circular ridges, but there is no other secondary annulation.

The setal rings are almost complete, the mid-dorsal and mid-ventral intervals corresponding to the omission of a single seta in each case. The intervals between neighbouring setae are a little wider on the dorsal than on the ventral surface. No setae are specially enlarged. Numbers of setae: about 51/vii, about 49/xvii, about 53/xxv, and 54 more posteriorly.

The first dorsal pore is in furrow $\frac{8}{9}$.

The clitellum is represented only by a deeper shade of colour on the dorsal surface of segments $\frac{1}{2}$ xiii–xvi = $3\frac{1}{2}$.

The male pores are on xviii, near together, in the line of the setae. They appear as small transversely situated slits, in a transversely elongated whitish field; this field is not raised beyond the level of the setal ridge, of which it is a slight broadening, and with which it is continuous at each side. There are no setae between the male pores, which are separated by a distance equal to about four intersetal intervals; immediately lateral to the male pores there is a space, equal to about three such intervals, which is also destitute of setae The penial setae are described below.

The female pore is a minute transverse slit near the anterior border of segment xiv.

The spermathecal apertures are two pairs, in furrows $\frac{7}{8}$ and $\frac{8}{9}$; they are minute pores, near the middle line, the distance between the apertures of a pair being about equal to that between the male pores.

There is a slight thickening, of a whitish appearance, along the anterior border of segment xix in the mid-ventral region; I found no other genital markings.

Septa $\frac{6}{7}$, $\frac{7}{8}$, $\frac{8}{9}$, are slightly thickened.

A gizzard is present in segment vi; though its walls are somewhat thickened it is nevertheless a distinctly rudimentary structure. The oesophagus is narrow in vii, considerably bulged

in viii; also bulged in xiv, and more slightly in xv, xvi and xvii; folds project into the cavity as longitudinally placed lamellae in xiv, and similar folds are present in xv, as well as, though less abundantly, in xvi and xvii. The intestine has neither caeca nor typhlosole.

The last heart is in segment xii.

The nephridial system is meganephric. The tubes pierce the body-wall at varying distances from the mid-ventral line; since all intermediate positions are found between the extremes, the organs cannot be arranged in two series, as for example in *P. sansibaricus*. The tubes present no terminal vesicle.

The testes and funnels, in x and xi, are both fairly large organs, free in the coelomic cavity. The vesiculae seminales are contained in x, xi and xii, those in x and xi being attached respectively to the anterior and posterior faces of septum $\frac{10}{11}$, that in xii to the posterior face of $\frac{11}{12}$; each is a single mass, continuous from side to side dorsally over the alimentary canal The prostates, in xviii, are solid-looking, somewhat rectangular masses, not cut up into lobes, with a stout straight duct coming off from the middle of the inner face.

The ovaries and their funnels have the usual situation; the ovaries are large, the funnels comparatively small structures.

The spermathecae lie in segments viii and ix, and open to the exterior in furrows $\frac{7}{8}$ and ^{8}, near the middle line. They are oval in shape, with a broad duct, as long as and nearly as broad as the ampulla itself, and not marked off from the ampulla; there are no diverticula.

The penial setae (fig. 12) are present in a group of four or more at each male aperture. They measure up to 880 μ in length, and 22 μ in thickness; they have a slight sabre curve, and end distally in a point. The distal fourth of the shaft is ornamented by about 20 rings of extremely fine teeth.

Perionyx aborensis, sp. nov.

(Pl. xxvii, fig. 13.)

Renging, in rotten wood; 19-xii-1911. Two specimens.

Length 3 inches; diameter 4 mm. Colour, dorsally brown with a purplish tinge, ventrally light brown. There is a slight mid-dorsal groove from the prostomium to the clitellum; the ventral surface is flattened, with a shallow mid-ventral groove for the greater part of its extent. Segments 125.

Prostomium epilobous $\frac{2}{3}$.

Dorsal pores begin from furrow $\frac{5}{6}$; they are present on the clitellum.

The setae are rather larger in the anterior part of the body; behind segment xvii they are very small; they are largest in segment viii and the few segments immediately in front of and

behind this. Dorsally the ring is not quite complete, $zz = 2yz$; mid-ventrally the ring may be unbroken, and the interval *aa* is in any case very small. The setae are closer together ventrally, the distances increasing towards the lateral margin; dorsally the intervals are about twice as large as on the ventral surface. In number they were counted as ix/63, xx/65.

The clitellum apparently embraces segments xi--xiii = 3. It is indistinct dorsally, and is not visible ventrally; the furrows are not obliterated, and setae and dorsal pores are present.

The male apertures are not far apart, on segment xviii. The whole length (antero-posteriorly) of this segment is depressed in the mid-ventral region, the depressed area being limited in front and behind by the neighbouring segments, and laterally by conspicuous lips (fig. 13). Just internal to these lateral lips is, on each side, the deepest part of the depression, and here can be seen a small transverse groove, in the outer part of which is situated the male aperture, distant from its fellow about $\frac{2}{11}$ of the circumference. The setae end on the lip-like margin; none are present in the depression, and no genital setae were discovered.

The female aperture is indicated by a slight depression, pale in colour, in the mid-ventral line on the anterior portion of segment xiv, between the setal ring and the intersegmental furrow.

The spermathecal apertures are conspicuous, in furrows $\frac{6}{7}$ and $\frac{7}{8}$, about $\frac{2}{7}$ of the circumference apart.

The first distinguishable septum is $\frac{5}{6}$; none are markedly thickened.

The gizzard is rudimentary, in segment v; its diameter is slightly greater than that of the succeeding part of the canal. The oesophagus is marked by transverse vascular rings (recognized by their dark colour) in segments viii, ix and x. The intestine begins in xiv.

The last heart is in xii.

The excretory system is meganephric; the terminations of the nephridia are in the same longitudinal line.

The testes were not certainly identified. The seminal funnels are free, in segments x and xi. The vesiculae seminales are two pairs, in segments xi and xii; they are attached to the anterior septum, and appear as flocculent masses, filling up the length of the segment and nearly meeting dorsally over the gut. The prostate is confined to segment xviii; it is a small lobed mass, with a duct which is moderately long relatively to the size of the gland, several times bent on itself, and wider towards its termination.

The ovaries are in segment xiii; funnels were not identified.

The spermathecae lie in segments vii and viii; they are small and of simple form, short, stumpy and rounded, with a short, very broad duct, not sharply marked off from the ampulla, and without diverticulum.

Perionyx depressus, sp. nov.

(Pl. xxvii, fig. 14.)

Rotung, alt. 1300 ft.; from wet earth at base of plantain leaves ten feet from the ground; 28-xii-1911. Three specimens.
Same place and date; from dry earth at base of screw pine leaves 16 feet from the ground. Six specimens, some quite small and immature.
Same place; from base of leaves of screw pine 15 feet from the ground; i-i-1912. Three mature specimens, two small and immature, and a few fragments.
Same place; in bamboo; Jan., 1912. A single specimen.
Upper Rotung, alt. *ca.* 2000 feet; at base of plantain leaves 20 feet from the ground; 5-i-1912. Two complete specimens and six fragments.

Length, average 3–4 inches, max. $4\frac{1}{2}$–5 inches; diameter 3 mm. Colour a uniform dusky purple dorsally, rather lighter ventrally; clitellum rather lighter than the rest, and of a pink tinge. Segments 156.

The body is flattened dorso-ventrally. The ventral surface is hollowed so as to present the appearance of a shallow groove along the whole or the greater part of its length. A mid-dorsal groove is also present but variable; it may be narrow and visible throughout the length of the animal, or narrow on the prostomium and segment i, shallow and ill-defined for some distance behind this, and absent posteriorly.

Prostomium epilobous $\frac{1}{2}$.

First dorsal pore in furrow $\frac{5}{6}$, in the specimem first examined; in another, the first pore, smaller than the rest, was in furrow $\frac{4}{5}$.

The setae are arranged in rings with a regular small middorsal interval (zz = a little more than $2yz$), but unbroken ventrally. They are set rather closer together ventrally than dorsally: in number (counted in segments ix and xiii) they are about 70 per segment.

The clitellum extends over $\frac{1}{2}$ xii–$\frac{1}{3}$ xviii = 6 nearly (estimated by the pink colouration). The body is slightly swollen in this region. The setae are present, the dorsal pores doubtfully so; the slight ridge on which the setae are placed is less obvious or absent here.

The male apertures are on segment xviii, distant apart about $\frac{1}{5}$ of the circumference. Each is situated in a depression which occupies the whole length of the segment antero-posteriorly, and which is about equal in transverse extent to the non-depressed area between the two (fig. 14). The depressions and intervening area are pale in colour. The male aperture at the bottom of the depression is accompanied by a couple of narrow grooves, one in front and one behind it, which extend transversely across the whole breadth of the depression. The aperture, represented in the figure as a rounded pore, has in some specimens rather the form of a slit. There are no setae in or between the depressions.

The female aperture is minute, in the centre of a small slightly darkened area near the anterior border of segment xiv.

The spermathecal apertures are two pairs, in grooves $\frac{6}{7}$ and $\frac{7}{8}$, near the lateral borders of the animal and distant from each other about $\frac{1}{3}$ of the circumference. They are conspicuous round pits, each surrounded by a paler lip.

No septa are notably thickened; the first is $\frac{6}{7}$. A number of small brown particles, spherical in shape, were found attached to the body-wall and to the organs in the anterior part of the body. On breaking one up it was found to consist of granular yellow matter with an entire seta embedded in it; they are thus similar to the brown bodies found in the coelom in many Lumbricidae.

The gizzard is very rudimentary; it is situated in front of septum $\frac{6}{7}$, and is hardly broader than the preceding part of the oesophagus. The oesophagus is swollen and darker in colour in segment ix, and its walls are here rather hard and brittle; internally a number of ridges are seen, but no well-developed lamellae. The intestine swells out in xvii.

The last heart is in segment xii.

The excretory system is meganephric; the nephridia pierce the body-wall in approximately the same longitudinal line.

The testes, in segments x and xi, were in one of the two specimens dissected comparatively very large and folded. The funnels are in the same segments.

The vesiculae seminales when fully developed are large white masses occupying segments x, xi and xii; all are continuous from side to side dorsally over the alimentary canal. That in x is not lobed, is free or at least easily separable from septum $\frac{10}{11}$, but is more intimately attached to $\frac{9}{10}$. That in xi is slightly lobed, and is attached to septum $\frac{10}{11}$. That in xii is the largest, and is lobed; it is attached to septum $\frac{11}{12}$, and, by bulging back septum $\frac{12}{13}$, it appears to occupy segment xiii also, and even extends to the level of $\frac{14}{15}$. In a specimen at a younger stage of maturity (the one in which the testes were notably large), seminal vesicles were only present in xi and xii; those in xi were united to a single sac, as above, while those in xii were still separate.

The prostates are massive, rather rectangular blocks, not much cut up into lobes, occupying segment xviii; they bulge forwards septum $\frac{17}{18}$ so as apparently to occupy xvii also. The duct, on the under surface of the gland, is bent a few times so as to have a sinuous course; it is broader towards its end. The female organs have the usual situation.

The spermathecae are ovoid sacs in segments vii and viii, situated with their long axis transversely. They appear prominently at the sides of the alimentary canal when the specimen is opened; they are without diverticulum, and the short duct is extremely wide,—a half or three quarters of the diameter of the ampulla itself. The sac has a transparent appearance, due to its containing a hard ovoid yellowish glassy mass, which under the microscope shows no structure.

The genital setae are present as a considerable bunch, contained in a sac between prostate and intestine. In length they are 2 mm., in breadth 18 μ. They are straight except for a slight curve towards the tip; the extremity is pointed, and the distal part of the shaft shows a number, 20 or more, of circlets of small spines; the circlets are closer together near the distal end. They thus closely resemble those of *P. koboensis*.

Perionyx foveatus, sp. nov.

(Pl. xxvii, figs. 15, 16.)

Renging, in rotten wood; 19-xii-1911. One complete specimen and two fragments together composing a second specimen.
Same place and date. Four specimens.
Rotung, alt. 1300 ft., in rotten wood; 28-xii-1911. A single specimen.
Upper Rotung, found road-making; 5-i-1912. A single specimen.

Length max. 2 inches; diameter max. 3 mm. Colour, dorsally dark brown to dark purple, ventrally paler. The ventral surface behind the clitellar region is concave in transverse section. Segments 112.

Prostomium epilobous $\frac{1}{2}$; it shows a slight median longitudinal groove. There is no intersegmental furrow between segments i and ii.

The first dorsal pore is either in furrow $\frac{4}{5}$ or $\frac{5}{6}$.

The setae are disposed in rings which are unbroken ventrally. Dorsally there is an interval, *zz* averaging 2-2$\frac{1}{2}$*yz*, but it is irregular, its limits being about 1$\frac{1}{2}$–3*yz*. Ventrally the setae are set much closer than dorsally. In number about 48 were counted in segment x, about 45 in xx; they are difficult to distinguish dorsally owing to the dark colour of the worm.

The clitellum includes segments xiii–xvii or $\frac{1}{2}$xviii = 5–5$\frac{1}{2}$; the body was constricted here in most specimens, but swollen in one of the batches from Renging. Setae are present but dorsal pores absent. In the Renging specimens just mentioned the clitellum showed a secondary annulation, due to the appearance of a groove round the middle of each segment in the situation of the setal ring.

The male pores are on segment xviii, rather posterior to the line of the setal ring. They are rounded apertures of some size, with indistinct circular lips, and distant from each other about $\frac{1}{5}$ of the circumference. In furrow $\frac{17}{18}$, in front of and slightly internal to the male apertures, are situated a pair of rather irregular somewhat puckered depressions, or pits, connected with each other across the middle line by a groove which is convex backwards (fig. 15). The mid-ventral region between the pits and apertures of each side is depressed. Complete rings of setae are present on segments xvii and xix; the ring is interrupted on xviii by the male pores; mid-ventrally

however, in the depressed area between the pores, there is a row of about eight setae.

Variations in the appearance of the pits are found; thus they vary in depth, being occasionally quite shallow, and in the amount of puckering of their sides; they may appear, with the furrow connecting them, as a transverse groove occupying a position between the setal rings of xvii and xviii. The condition shown in fig. 16 is to be derived from that first described by lengthening the posterior angles of the puckered pits till they reach the male pores; in the specimen there figured, the pores thus come to lie at the posterior angles of a rectangular depression with irregular lateral walls, a smooth anterior wall, and no posterior wall, i.e. the depression here shades off into the concave ventral surface of the body. It will be seen from the figure that the pores are well behind the setae in the floor of the depression.

The female pores appear to be paired, close together (separated only by an interval less than *2aa*) and just behind groove $\frac{13}{14}$.

The spermathecal apertures are prominent, round, and laterally placed, near the margins of the flattened ventral surface. They are three pairs, in furrows $\frac{6}{7}$, $\frac{7}{8}$ and $\frac{8}{9}$. Most of the apertures in the various specimens are occupied by a yellow glutinous mass, which projects from them.

The first septum is $\frac{5}{6}$. The extremely rudimentary gizzard is in front of this, i.e. in segment v; it manifests itself as a slightly wider portion of the oesophagus, but its walls are quite soft and not thickened. There are no calcareous glands.

The last hearts are in segment xiii.

The nephridia form a regular line on each side.

Testes were not seen; there are two pairs of funnels, in segments x and xi, free, large and markedly iridescent, and much elongated transversely

In one of the two specimens dissected (from Rotung) the vesiculae seminales were a single pair only, in segment xii, attached to the posterior face of septum $\frac{11}{12}$; they were small, lobulated, and dorsally placed, abutting on the dorsal vessel and on each other in the middle line. In the other (from the batch of four from Renging) there were two pairs, in segments xi and xii, on septa $\frac{10}{11}$ and $\frac{11}{12}$ respectively; those in xi were small, and flattened on the septum, those in xii were larger; the appearance of both pairs was peculiar,—they were glancing and iridescent like the funnels, and the lobules of which they were composed were small, close-set and hemispherical, so that the surface might be described as mammillated, or better shot-like or beady.

The prostates vary in size, occupying segments xvii--xx (right side of Rotung specimen), xviii--xx (left side of same), xvii--xix (Renging specimen). Each forms a compact firm mass of large size, bulging forwards or backwards the limiting septa; the surface is slightly indented into lobes. The duct is stout

and straight, of considerable length, running (in the natural condition of the parts) in a transverse direction outwards, or outwards and forwards, to its termination; it begins in xix and ends in xviii.

The ovaries, in xiii, are relatively very large; the funnels also are of moderately large size.

The spermathecae are three pairs, appearing in the Rotung specimen as very large rectangular blocks, hard, yellow, and semi-transparent, in segments vii, viii and ix. The rectangular shape is due to their mutual pressure, since they fill up all the available space in their segments The duct is very stout (half the diameter of the ampulla), of some length (as long as the ampulla) and contains in its lumen a cord of white glancing material, continuous with the yellowish translucent material which fills the ampulla, and the similar material which plugs the external aperture A diverticulum is present as an extremely minute chamber, on the anterior side, connected with the uppermost part of the duct immediately below its junction with the ampulla: its contents are iridescent. The diverticulum was absent from one of the organs.

The above describes the specimen from Rotung which was dissected; in that from Renging the spermathecae were white, not yellowish, and were not quite as bulky or as closely pressed together.

There are no penial setae.

I have no doubt as to the specific identity of three out of the four batches of specimens, i.e. of all except the batch of four from Renging. The fact that the clitellum was broader than the rest of the body, and that each clitellar segment was more or less distinctly and completely divided into two annuli by a secondary groove, caused me to make a more thorough examination, and a dissection of one of these specimens. Besides the differences just mentioned, the clitellum was slightly less extensive (5 segments exactly), the first dorsal pore was in furrow $\frac{5}{6}$, the dorsal break in the setal ring was rather more widely variable ($zz = 1\frac{1}{2}$--$3yz$), the two pits on the ventral surface of segment xvii were confluent across the middle line and so appeared as a transverse groove, while internally the prostates were smaller, and there were two pairs of seminal vesicles With the exception of the last feature the differences do not appear to be important; and the similarity in the proportions and relations of the duct and diverticulum of the spermathecae, and in the rather characteristic male funnels, justify the union of these specimens with the others.

In addition to the above species of *Perionyx*, a single specimen, evidently belonging to the genus, but indeterminable on account of its immaturity, was taken at Rotung, alt. 1300 ft., in rotten wood; 26-xii-1911. Similarly indeterminable

was a batch of three specimens with a fragment of a fourth, taken at Upper Rotung, alt *ca.* 1000 ft., 11-i-1912.

Pheretima heterochaeta (Mchlsn.).

Kobo, Abor country, alt. 400 ft., in rotten wood; 30-xi-1911 and 8-xii-1911. Two specimens, in a tube with *Perionyx koboensis* and *Perionyx kempi*.

Sadiya, N. E. Assam, under logs; 25-xi-1911. A single specimen, in a tube with *Perionyx excavatus*.

This species appears to be variable. In one of the two specimens from Kobo the typical characters and arrangement of the setae were easily recognizable; in the other these were by no means evident, and all that could be said was that the ventral setae of segments iii--viii were enlarged and rather irregularly arranged. In this second specimen the setae of segments x and xi were much smaller than those of neighbouring segments; in the first the setae of x were perhaps rather smaller than those of ix, but not smaller than those of the following segments. In the Sadiya specimen, the arrangement of the setae on the ventral surface of the preclitellial segments was very irregular,—due possibly in some cases to setae having fallen out; where they were sufficiently regular to permit of description, the arrangement approximated to that of typical specimens.

In the Sadiya specimen, the clitellum encroached slightly on segments xiii and xvii ($=3\frac{1}{3}$). Genital papillae, small, nearer together than the spermathecal apertures, and situated about midway between the setal ring and the anterior limiting groove of the segment, were found on segment viii in one of the specimens from Kobo, on vii and viii in the other, and on vii, viii and ix in the specimen from Sadiya.

Prostates were entirely absent in the specimen from Kobo which I dissected, and in the one from Sadiya; the terminal part of the duct was strongly curved in the shape of the letter S.

As further variations from the condition described by Michaelsen (2) may be mentioned the beginning of the dorsal pores from furrow $\frac{11}{12}$, their absence on the clitellum in the Kobo specimens (but not in the other), and the origin of the intestinal caeca in segment xxvii.

Pheretima lignicola, sp. nov.

(Pl. xxvii, fig. 17.)

A single specimen, in a tube with *Perionyx excavatus*. In rotten wood; Dibrugarh, N.E. Assam; 20-xi-1911.

Length $4\frac{1}{4}$ inches; breadth 4--5 mm.; colour olive-green, slightly darker dorsally in the anterior region. Segments 90. Body tense, as if distended; intersegmental furrows absent as grooves behind the clitellum, present in front of clitellum. Setae implanted on circular ridges, especially prominent in front of clitellum; no other secondary annulation.

Prostomium epilobous, almost tanylobous, marked by a longitudinal median groove running its whole length. The first segment shows numerous longitudinal grooves; surrounding the mouth opening are a number of papillae, from the intervals between which the grooves on the first segment are continued backwards; the grooves do not quite reach the furrow $\frac{1}{2}$ (? some part of the appearances due to commencing eversion of the buccal cavity).

The setal ring is unbroken ventrally, and almost unbroken dorsally ($zz = 1\frac{1}{2}yz$). On v and vi, however, a much wider interval exists mid-dorsally. The setae of the preclitellar segments are larger than those behind the clitellum, especially than those towards the posterior end. On the clitellum can be seen faint whitish lines indicating the position of the setal rings, but these do not project as ridges, and are not to be distinguished on the dorsal surface; a few minute setae appear to be imbedded in the clitellum ventrally in xiv, but I could not definitely say that they were present on the other segments. Number of setae: 22/vi, 44/ix, 47/xii. 65/xxiii.

Clitellum xiv--xvi = 3; almost without setae, though showing whitish lines ventrally in the situation where setal rings would be (v. sup.). The clitellar area is smooth, without a trace of annulation.

The first dorsal pore is in furrow $\frac{12}{13}$, slit-like. There are no pores on the clitellum, though they are present on the anterior and posterior limiting furrows.

The male apertures are in the line of the setae of xviii. They are situated in large conspicuous circular depressions; these depressions are surrounded anteriorly, posteriorly, and especially externally by a prominent semicircular lip or ridge, which is absent on the inner side. Including the lips, the whole area extends nearly over the interval between the setal ring of xvii and that of xix. The apertures are distant from each other about $\frac{2}{7}$ of the circumference; 12 setae intervene. There are no genital setae.

The female aperture is single, in a shallow depression in the line of the setae of xiv. I at first thought that the aperture was paired, since the specimen shows a second, rather smaller, depression by the side of the first. But this second depression has no pore in its centre; and dissection confirms this.

The spermathecal apertures are scarcely visible; internal examination shows that they are four pairs, in $\frac{5}{6}$, $\frac{6}{7}$, $\frac{7}{8}$ and $\frac{8}{9}$. Those of the same pair are separated by an interval equal to $\frac{2}{7}$ the circumference.

There are no other genital marks.

The body-wall is very thin, except in a few of the anterior segments.

Septum $\frac{5}{6}$ is thickened, septa $\frac{6}{7}$ and $\frac{7}{8}$ much thickened, $\frac{8}{9}$ and $\frac{9}{10}$ absent, $\frac{10}{11}$ and all succeeding septa are thin.

The oesophagus is narrow in vi, bulged but thin-walled in vii; the cask-shaped gizzard occupies viii; and between the gizzard and septum $\frac{10}{11}$. the oesophagus is soft-walled though voluminous. The intestine begins in xiv. The caeca originate in xxvi, and extend forwards to the anterior limit of xxiii; their ends are folded under the intestine, and when pulled out the caeca, now appearing much elongated, extend forwards so as to overlap the hinder end of the prostate There are no lymph-glands on the intestine.

The last heart is in xiii.

The nephridial system is micronephridial; the innumerable minute nephridia occur on the body-wall especially in the neighbourhood of the septa. Large tufts of similar tubes, blackish in colour, occur on the anterior face of septum $\frac{5}{6}$, and also, yellowish-grey in colour, on the anterior face of $\frac{6}{7}$.

The specimen being single, the organs were disturbed as little as possible, and the presence of two pairs of testes and funnels, in segments x and xi, is inferred from the vasa deferentia coming from these segments, and joining in xiii. The vesiculae seminales are paired, in xi and xii, comparatively small, and of a yellowish colour. The vasa deferentia become rather thicker towards their posterior ends, and bend outwards to join the prostates. Each prostate is a large gland, extending forwards into xvi, and backwards so as to occupy the whole extent of xx; it is much cut up into lobes. The prostatic duct leaves the gland at the point where the vas deferens joins it, in xviii, and after many windings reaches the exterior at a point not far from its origin; it becomes thicker and more muscular as it proceeds towards its end, its last coil being very stout, smooth and shining.

Both ovaries and funnels, in xiii, are conspicuous; the latter are much elongated, owing to a remarkable drawing out of the margin of the funnel on its outer side.

The spermathecae are four pairs, opening in the grooves $\frac{5}{6}$–$\frac{8}{9}$. The ampulla is oval; the duct, of about equal length, is shining, very stout and muscular, rather broader in its distal two-thirds than near the ampulla. The diverticulum is long, narrow, sometimes rather twisted, and lies flat on the body-wall; its external portion (distal) is shining and muscular, like the duct of the ampulla; in the greater part of its extent its walls are thin and marked by numerous and close-set small sacculi (fig. 17).

Eutyphoeus kempi, sp. nov.

(Pl. xxvii, figs. 18, 19.)

A single specimen. Kobo, Abor country, alt. 400 ft.; in earth; 2-xii-1911.

Length approx. 10 inches (the specimen was much coiled); breadth 6 mm. Colour light olive-green ventrally, a dusky bluish-grey (slate-colour) dorsally. Segments 254.

No prostomium was visible. Segments i–iii consist of a single annulus; iv–v are biannulate, with the setae on the anterior annulus; vi is triannulate, the setae on the middle one; vii–viii have four annuli, the setae on the second; ix has three principal annuli, each slightly subdivided into two; the remainder are fundamentally triannulate, the posterior annulus being sub-divided in the segments in front of the clitellum, but not in those behind it.

The first dorsal pore is in furrow $\frac{11}{12}$.

The setae are paired, but not very closely. In general they are larger in the anterior part of the body than in the posterior, but they become progressively smaller from segment vii forwards. and no ventral setae could be seen in the first four segments. In front of the clitellum $aa = 2ab$, on the clitellum $= 2\frac{1}{2}ab$, posteriorly $= 3ab$ (just behind the clitellum however $= 4ab$); cd is rather greater than ab; aa is rather greater than bc; dd is more than half the circumference.

The clitellum extends over $\frac{1}{3}$ xiii–xvii $= 4\frac{1}{3}$, and includes the whole circumference. Its dorsal surface is marked out by a series of parallel oblique lines into a number of rectangular areas. Grooves and annuli are obliterated, except towards its posterior limits; setae are present, and also the dorsal pores; the latter however are indistinct.

The male apertures are a pair of deep pits on segment xvii, the centre of the pit in line of setae b, the inner margin of the pit in a. Deeply within the pit can be seen an upwardly (in this position) directed tube, with an aperture at its summit from which project one or two genital setae; the tube and its aperture are compressed antero-posteriorly, and thus have their greatest diameter in the transverse plane. Between the two pits, on the ventral surface of segment xvii, are a few transverse groovings.

The spermathecal apertures are one pair, conspicuous, in furrow $\frac{7}{8}$; the centre of the aperture is outside the line b, but not half-way between b and c (nearly as far beyond b on the outside as a is on the inside).

For a dozen segments or so behind the male apertures the ventral surface is flattened, and in the anterior part of this region depressed, so as to form a wide ventral groove between the ventral setal bundles. Lying within the margins of this depressed region, in furrow $\frac{22}{23}$, are a pair of horseshoe-shaped depressions, their outer margins convex outwards; the inner, open portion of the horseshoe is prolonged inwards to meet its fellow in the middle line, and a dumbbell-shaped area is thus produced, shallow in the middle, deeper at its extremities; the lateral limits of the area are between the lines a and b; antero-posteriorly it takes up about half the posterior annulus of xxii and half the anterior annulus of xxiii (fig. 18). There is a similar horseshoe-shaped depression in furrow $\frac{21}{22}$, but on the left side only.

Septum $\frac{4}{5}$ is thick, $\frac{5}{6}$ is very thick, produced backwards as a much elongated muscular cone, so that its insertion into the alimentary tube is far posterior to its parietal attachment. Septa

$\frac{6}{7}$ and $\frac{7}{8}$ are absent; $\frac{8}{9}$, $\frac{9}{10}$, and $\frac{10}{11}$ are stout, the last especially so. Septum $\frac{11}{12}$ is apparently represented only by a sheet of connective tissue which attaches the inner surface of the seminal vesicle to the alimentary tube, i.e. it does not exist between the seminal vesicle and the body-wall; this is liable to cause a temporary confusion in estimating the sequence of the segments and the organs contained in each; the number and position of the hearts in this region however will indicate the true numbering. Behind this the septa are thin.

The firm globular gizzard is situated in the space between septa $\frac{5}{6}$ and $\frac{8}{9}$.

The last heart is in segment xiii.

The nephridial system is micronephric. There are numerous small nephridia on the body-wall; large bunches of nephridial tubes are attached to the dorsal body wall in segment iii.

The testes and funnel of each side are enclosed in a sac, which apparently communicates with the one of the other side beneath the gut. The sac is situated in segment xi, and is attached to the posterior face of the very stout and muscular dissepiment $\frac{10}{11}$, deeply ventral in the segment. The testis is small, the funnel large and iridescent; the vas deferens is of moderate thickness, and passes back on and attached to the ventral body-wall, swelling out to form a small sac at its termination in segment xvii.

The vesiculae seminales are granular-looking elongated laterally compressed bodies, lying one on each side of the gut in segments xii and xiii. They are limited behind by septum $\frac{13}{14}$, which is bulged back by them; they almost meet each other along the mid-dorsal line, the dorsal vessel intervening. They are connected with the side of the gut by a broad connective tissue stalk towards their anterior end.

The prostate has the form of a long thick coiled tube; it is of large size, occupying segments xvii–xxi. In the last portion of its course it is, with many windings, directed inwards, its terminal portion being rather smaller in diameter than the main part of the tube; it ends close to the end of the male duct, in front of and internal to the latter, which passes underneath the prostatic tube just before its termination.

The ovary is of moderate size, with numerous branches, and is attached to the posterior face of septum $\frac{12}{13}$. The funnel lies internal to the male duct.

The spermathecae are irregularly massive in shape, firm and solid, lying against the body-wall in a region which corresponds externally to segment viii; the anterior part gets into the region of vii. The longer axis of the ampulla is antero-posterior; the duct is short and broad, terminating in furrow $\frac{7}{8}$. At the junction of ampulla and duct, between ampulla and body-wall, is the lobed iridescent semi-circular diverticulum; the appearance may be described by saying that it appears to be constituted by a semi-circular row of small diverticula, close together and fused marginally with their neighbours.

The genital setae appear to be variable in size and form. In length they measure from 2·3 to 3·9 mm., in breadth 34 μ. The shaft is gently curved in an S-shape, and its distalmost portion is ornamented with numerous short rows of dots, placed transversely to the long axis of the shaft. The point is always somewhat spoon-shaped, but the degree of curvature of the extremity varies (fig. 19).

Eutyphoeus koboensis, sp. nov.

(Pl. xxvii, figs. 20, 21.)

A single specimen. Kobo, Abor country, alt. 400 ft.; in earth; 2-xii-1911. A whitish flocculent mass adhered to the ventral and lateral surfaces of the animal a short distance behind the clitellum; on microscopic examination this was found to consist of sperm-morulae (not developed spermatozoa).

Length 10 inches; diam. maximum 7 mm.; colour slaty-blue dorsally, light olive-green ventrally and laterally. Segments *ca.* 195.

Prostomium retracted under first segment, apparently prolobous.

The first three segments consist of a single annulus, iv–v are biannulate; vi also biannulate, with however indications of other rings also; vii–viii are 4-annulate, ix–x 5-annulate, xi–xiii 4-annulate; behind the clitellum the segments are triannulate.

The first dorsal pore is in furrow $\frac{10}{11}$; pores are present on the clitellum.

The setae are small, and fairly closely paired. In front of the clitellum *aa* averages about $2\frac{1}{3}ab$; aa = or slightly > bc; $ab = cd$; $dd = \frac{1}{2}$ circumference. Behind the clitellum $aa = 4ab$ nearly; $aa > bc$, $ab = cd$.

The clitellum includes $\frac{1}{3}$xiii–xvii $= 4\frac{1}{3}$; furrows and annuli are obliterated; setae and dorsal pores are present.

The male apertures are a pair of conspicuous deep pits in the line of the setae of xvii; setae *a* and *b* are absent. The middle of the pit corresponds with seta *b*, but it is of such a size as to overlap the line of setae *a* internally. Between the pits the surface is depressed.

The female apertures are a pair of transversely elongated slits bordered by lip-like margins, the whole sunk in a common transversely extended depression, with well-defined margins; this common depression is rather narrower (antero-posteriorly) in the middle line, i.e. in the interval between the slit-like apertures. The whole is situated in the position of the (absent) groove $\frac{13}{14}$. Each slit has its centre between lines *a* and *b*, and overlaps these lines considerably (fig. 20).

The spermathecal apertures are small and slit-like, in furrow $\frac{7}{8}$, outside the line of setae *b*, but nearer to *b* than to *c*.

Genital markings are present in furrows $\frac{20}{21}$ and $\frac{21}{22}$ (fig. 20). In the latter groove is situated a narrow white ridge, slightly broader at its ends than in the middle, and not projecting beyond

the level of the neighbouring annuli; it extends across the middle line from just outside the line *b* to a corresponding point on the other side. In $\frac{20}{21}$, on the left side only, is a small ridge of apparently the same character, its centre just internal to the line *a*, its length a little greater than the distance *ab*.

On the dorsal surface of the clitellum and the anteclitellial region there are a number of minute black dots, simulating setae; they are sometimes arranged in rows, with fairly regular intervals, round the middle of the segment; they are also found numerously and irregularly scattered quite out of any possible position of setae.

Septum $\frac{4}{5}$ is much thickened, of conical form with apex backwards; $\frac{5}{6}$ is extremely thick, and is also elongated to form a cone, so that its attachment to the oesophagus is at the level of the spermathecal apertures, i.e. furrow $\frac{7}{8}$. Septa $\frac{6}{7}$ and $\frac{7}{8}$ are absent; $\frac{8}{9}$–$\frac{10}{11}$ are much thickened; $\frac{11}{12}$ is not a definite septum, and is represented probably by the connective tissue between the testis sac and vesicula seminalis. Behind this the septa are all thin.

The oesophagus is thick and muscular. A hard, almost globular gizzard lies in the interval between septa $\frac{5}{6}$ and $\frac{8}{9}$, behind the level of the spermathecae. A pair of large dark-brown lateral swellings of the oesophagus occur in segment xii; their transverse striation denotes their vascularity during life. The intestine begins in xvi, but it is at first compressed between the prostates.

The last heart is in xiii. That in xi is deeper in position and smaller, or at least less conspicuous, than those of neighbouring segments; and as it has to be searched for, may cause temporary confusion in the numbering of the segments, especially as the corresponding septum is absent.

The excretory system consists of micronephridia, very numerous and of moderate size, scattered over the body-wall.

The testis sacs are in segment xi, attached fairly firmly to septum $\frac{10}{11}$, but capable of being separated without injury. Each is apparently separate from its fellow, but is attached to the corresponding vesicula seminalis. When opened, the sac is seen to contain a large, tightly packed and iridescent funnel. The vas deferens leaves the testis sac posteriorly, and can be traced for some distance; it disappears on or in the body-wall, but becomes distinct again posteriorly, where, slightly thickening, it passes to the outer side of the terminal portion of the prostatic duct, just behind which it ends, after finally swelling to form a sac-like dilatation.

The vesiculae seminales are a pair of granular-looking, yellowish, laterally compressed masses, at the sides of the alimentary canal in segments xii–xiv. They are attached to the sides of the alimentary canal in xii; their margins are lobed, and the anterior end of each is covered with numerous minute white (nephridial?) loops.

The prostates are tubular, much coiled, in segments xvii–xx; they become more shining and muscular towards their outer end.

The sac of the penial setae, in length about 2 mm., of loose texture and not very definite shape, projects inwards on each side between prostate and intestine; its outer termination is situated mesially to the end of the prostatic duct.

Ovaries and ovarian funnels are situated in xiii.

The spermathecae are compact, firm, subspherical in shape, with short thick duct. On the posterior aspect, at the junction of ampulla and duct, is a series of six small iridescent diverticular chambers; the individual chambers being fused on each side with their neighbours form together a semi-circular rosette.

The penial setae (fig. 21) are several in each bundle, about three fully formed and three immature. Their length is 3·5 mm., diameter 31 μ. The shaft is gently curved, with a sharply marked hook at its free extremity; the shaft itself is slightly swollen just proximal to the hook, the hook itself is narrower. The distal portion of the shaft is ornamented with numerous rows of minute dots, which may extend across the visible surface of the shaft, or may be shorter, and convex distalwards. In an older seta the hook was not so sharp nor so narrow; in one of two setae that had not yet escaped from their sheath, the hook was small, but well marked, in the other very faintly marked.

Eutyphoeus aborianus, sp. nov.

(Pl. xxvii, fig. 22.)

A single specimen, in a rather poor state of preservation, in a tube with *E. koboensis*. Kobo, Abor country, alt. 400 ft.; in earth, 2–xii–1911.

Length 9 inches, diameter, max. 6 mm. Colour pale, with greyish patches mainly on dorsal surface.

Prostomium minute, just visible, withdrawn under cover of the first segment. Segments i–iii consist of single annuli, iv–v of two, vi of three with slight indications of two others, vii–viii of five, ix of five principal annuli, each divided, giving ten in all; x–xii have five annuli, and behind the clitellum the segments are triannulate, but of the three annuli the first and last may be more or less distinctly sub-divided, giving four or five in all. All annulation and segmentation was lost over the middle region of the body owing to the state of preservation.

The first dorsal pore was at the posterior border of the clitellum, i e. in groove $\frac{17}{18}$.

The setae are small, and paired, —rather widely in the case of the lateral couples. In front of the clitellum $aa = 1\frac{1}{3}ab$; bc slightly $> aa$, $= 1\frac{1}{2}ab$; cd about $= aa$. Behind the clitellum $aa = 2ab$, or further back $= 3ab$; $bc = 1\frac{2}{3}ab$; $cd = 1\frac{1}{2}ab$. No setae were discoverable on segments ii, iii and iv.

The clitellum includes $\frac{2}{3}$ xiii–xvii $= 4\frac{2}{3}$; setae are present, but there is no external annulation.

The male apertures are a pair of deep pits, oval in superficial outline, with one or two curved genital setae projecting from them. The centre of each pit is in the line of setae *b*; from this the pit extends inwards as far as the line *a*, and outwards for an equal extent.

The female aperture (?) of the right side was possibly represented by a shallow perfectly circular depression with a clearly cut margin, in the situation of groove $\frac{13}{14}$ on the anterior part of the clitellum. The size of the depression, which was present on the right side only, was such that while its centre corresponded to the middle of the interval *ab*, it overlapped the lines *a* and *b* by its inner and outer margins respectively.

The spermathecal apertures are a single pair, small, in furrow $\frac{7}{8}$, the centre of each midway between the lines *b* and *c*.

Under the head of genital marks may be mentioned a pair of small oval depressions, their long axis transverse, which occur in the course of groove $\frac{9}{10}$. On the left side the depression extends accurately between the lines *a* and *b*; on the right it reaches a little further outwards, passing the line *b*.

Septum $\frac{4}{5}$ is stout, $\frac{5}{6}$ very stout and conical, with apex posterior; the next septum is $\frac{8}{9}$, and this, $\frac{9}{10}$, and $\frac{10}{11}$ are all stout, and situated close together; $\frac{11}{12}$ is apparently absent, the condition being the same as in *E. koboensis*; the rest of the septa are thin, $\frac{12}{13}$ being especially delicate and fenestrated. The three thick septa behind the gizzard ($\frac{8}{9}$–$\frac{10}{11}$) are closely connected together; they have their separate insertions into the body-wall, but are united to each other by a thick muscular sheet placed longitudinally.

Behind the buccal cavity is a slight constriction of the alimentary canal at the insertion of septum $\frac{4}{5}$; then succeeds a dilatation (pharynx), which with a narrower but still firm and muscular portion of the tube is contained within the cone of septum $\frac{5}{6}$. The gizzard is ovoid, in the interval between $\frac{5}{6}$ and $\frac{8}{9}$; the oesophagus enters it on its upper surface; i.e. the gizzard projects forwards underneath the oesophagus. The tube is narrow in segments ix, x and xi; in xii it presents a pair of lateral swellings which have a lamellar structure internally. The intestine begins in xv; the canal is however again narrowed between the prostates, finally swelling out in segment xxi.

The last heart is in segment xiii; that in xi is small, and the corresponding septum is represented only by a sheet of connective tissue between testis sac and vesicula seminalis.

The excretory system is micronephridial; there is a row of numerous micronephridia along the body-wall in each segment, and a large tuft anteriorly on each side, by the side of the buccal cavity in segment iii.

The testis sac of each side, in segment xi, is large, and unconnected with its fellow; it bulges forwards the septum in front of it ($\frac{10}{11}$), which is rather thinner over the anterior end of the sac; this anterior end can thus be shelled out of a recess in the substance of the septum.

The vesiculae seminales are one pair, in appearance resembling those of the other species of the genus described above. They occupy segments xii and xiii, overlap the testis sacs anteriorly, and bulge back septum $\frac{13}{14}$ posteriorly. They are attached internally to the alimentary canal near their anterior ends; their margin is slightly lobed.

The prostates, occupying segments xvii–xx, are tubular and much coiled; the prostatic tube becomes narrower and more glistening towards its end. The vas deferens, passing to the outer side of the termination of the prostate, curves inwards round it and ends behind it in a sac-like widening. A long setal sac is present between the prostate and the gut.

The ovaries were not seen. The ovarian funnels are in xiii.

The spermathecae are a pair of compact white masses, somewhat ovoid in general outline, with the long axis antero-posterior, and margin slightly lobed. They are placed in front of the gizzard, opposite the posterior portion of the conical septum $\frac{5}{6}$. The duct is very short and moderately stout, passing to the exterior from the under surface of the ampulla. From the posterior side of the junction of duct and ampulla arises the fan-shaped iridescent diverticulum, consisting of seven or eight lobes arranged in two or three groups; the groups are tolerably well separated from each other.

The genital setae were found to be numerous, but mostly immature; one or two were fully formed and projecting. In length these measured 3·3 mm., in breadth 32 μ. The shaft has a gentle **S**-shaped curvature, the distal end is bluntly pointed, and flattened and slightly excavated on one face, so as to give a spoon-shaped appearance (fig. 22*a*); in the bowl of the spoon were seen small longitudinally directed ridges. The immature setae differ considerably from this description (fig. 22*b*).

Eutyphoeus magnus, sp. nov.

(Pl. xxvii, figs. 23, 24.)

Upper Rotung, alt. ca. 2000 ft., found in earth when road-making; 4-i-1912. A single specimen.

Length 11 inches; diameter 8 mm. Colour light slaty-grey dorsally, rather darker in anterior third of body; pale ventrally; clitellum a dark grey. Segments 263.

Prostomium small, prolobous, under cover of segment i. The first three segments consist of single annuli, segments iv–v of two, vi of four, vii of five, viii–x of six, xi of five, and xii of three; behind the clitellum the segments are triannulate.

The first dorsal pore is in groove $\frac{11}{12}$.

The setae are paired, the intervals being expressed by the following ratios:—$ab = \frac{1}{3}aa = \frac{1}{2}$–$\frac{3}{5}bc = \frac{2}{3}cd$; $dd = \frac{5}{7}$ of the circumference.

The clitellum extends over $\frac{1}{2}$ xiii–$\frac{2}{3}$ xvii $= 4\frac{1}{6}$. The secondary annulation is obliterated, but the intersegmental furrows are dis-

tinct, except $\frac{16}{17}$ ventrally. Dorsal pores are absent, but the setae are present, except the ventral pairs of segment xvii. The body is slightly constricted in the clitellar region.

The male apertures are a pair of conspicuous transverse slits, situated in a slight depression on segment xvii. The depression is lighter in colour than the neighbouring clitellum, and the surface around and between the apertures is wrinkled by a number of small cracks. The slits extend internally beyond the line of setae *a*, and externally beyond that of *b*, the centre of the slit being between the two lines.

The female apertures were doubtfully represented, on the left side only, by an ovoid depression anteriorly on segment xiv, immediately in front and with its centre in the line of setae *a*.

The spermathecal apertures are minute, in furrow $\frac{7}{8}$, in (on the right) or just external to (on the left) the line of setae *b*.

Septum $\frac{5}{6}$ (?) is exceptionally thick, even for this genus; it is conical in shape, with the small end backwards. After a considerable interval follow septa $\frac{8}{9}$, $\frac{9}{10}$, and $\frac{10}{11}$, all of which are also thick. Septum $\frac{11}{12}$ is missing, as in some of the species previously described; its position is indicated by a pair of hearts only.

The gizzard, subspherical in shape, occupies the anterior part of the space between septa $\frac{5}{6}$ and $\frac{8}{9}$. A pair of large calcareous glands occupy the whole of the elongated twelfth segment; these are dark, hard and brittle, with internally a lamellated structure.

The last heart is in segment xiii.

The micronephridia behind the clitellum are arranged in regular rows on the body-wall; in segments xi–xvi they are irregularly scattered, though numerous; they are few in front of xi, till the anterior end of the body is reached, when they occur again as numerous close tufts in segments iii and iv.

The testes and funnels are enclosed in a pair of testicular sacs, which are apparently not connected with each other; the parts were very stiff, and the point was not definitely cleared up. The sacs are in segment xi, attached to the posterior face of septum $\frac{10}{11}$; the contained funnels are large and iridescent; the vas deferens leaves the sac posteriorly.

The vesiculae seminales are a pair of flattened structures, with a granular surface, lying between the body-wall and gut, and occupying segments xii and xiii. With regard to their extent, they are not bounded anteriorly by any septum, $\frac{11}{12}$ being absent; and posteriorly they cause a backward bulging of $\frac{13}{14}$, thus appearing at first to occupy segment xiv as well. They are attached closely to the alimentary canal, and, in the specimen examined, were hard and brittle, especially the anterior portion.

The vas deferens is fairly easily followed on the body-wall; posteriorly it passes beneath the S-shaped part of the prostatic duct, to be described immediately; it ends posterior to the termination of this latter, after dilating and taking an inward turn.

The prostate is tubular, and occupies three segments, xvii–xix. The duct is not of greater diameter than the rest; it has an

S-shaped course. The setal sac of the penial setae lies between the gland and the intestine.

The female organs were not identified, owing to the stiffness of the parts.

The spermathecal ampullae (fig. 23) are pear-shaped, with the small end directed forwards; they are situated at the level of the attachment of the first septum ($\frac{5}{6}$) to the oesophagus. The small end of the pear-shaped ampulla is not continued into the duct,—indeed a duct can hardly be described; if described, it would be said to be very short and broad. The ampulla is, in fact, attached to the parietes on its under surface, the site of attachment constituting the duct.

On each side of this area of attachment are two or three small diverticula, sessile at the base of the ampulla; those on the outer side are closely connected together, and similarly those on the inner side.

The penial setae (fig. 24) have a maximum length of 2·35 mm., and a diameter of 33 μ. Each when fully developed is gently curved in the form of an **S**; the extreme tip, which is blunt, varies somewhat in its curvature, either merely continuing the very gentle curvature of the shaft, or being bent into a rather sharper curve; while still in the sheath, the tip is sharply bent into a hook. An extremely fine pattern of dots, in close-set short rows, is present towards the distal extremity; but the extreme tip is free from the ornamentation, which extends only a short distance along the shaft.

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EXPLANATION OF PLATE XXVI.

FIG. 1.—Genital area of *Megascolides oneilli*, sp. nov. *c.*, clitellum; *t.*, transverse depression; ♂, male aperture. The only setae seen in this region are indicated.

,, 2.—Spermatheca of the same, of segm. vi, left side; *a.*, *in situ*; *b.*, main portion turned backwards.

,, 3.—Genital area of *Notoscolex striatus*, sp. nov. The shading on the ventral surface of the three segments indicated shows the extent and intensity of the brown pigmentation. Male apertures not seen; *n.*, small nodular elevations at bend of grooves.

,, 4.—The same, another specimen; *n.*, nodular or tag-like projection; ♂, male aperture.

,, 5.—Spermatheca of the same.

,, 6.—Genital area of *Notoscolex stewarti*, sp. nov. *n.*, nodular projection; *t.*, transverse depressions; ♂, male aperture.

,, 7.—Prostate of the same. *d.*, prostatic duct; *v.d.*, vas deferens.

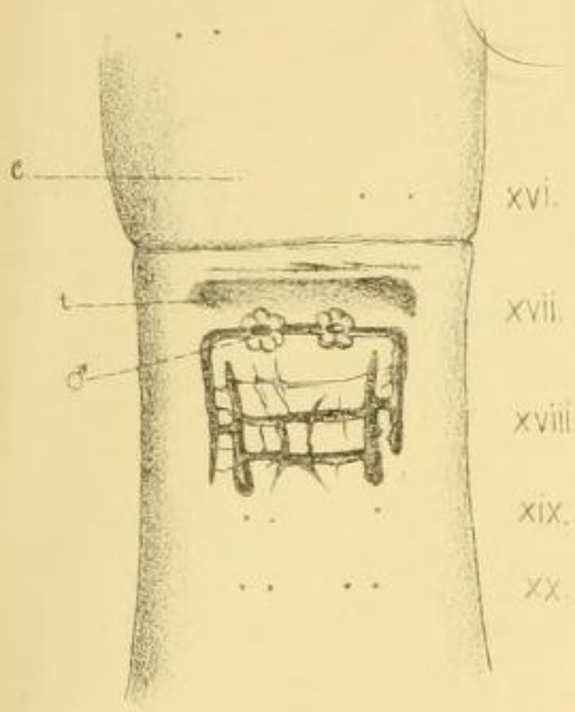
,, 8.—Spermatheca of the same.

,, 9.—Spermathecae of *Plutellus aborensis*, sp. nov. *a.*, segm. ix, right side; *b.*, segm. viii, right side. *x* indicates position of duct, not visible from above.

,, 10.—Genital seta of the same, × 132.

,, 11.—Spermathecae of *Perionyx kempi*, sp. nov. *a.*, segm. vii, right side; *b.*, segm. viii, right side.

,, 12.—Distal end of genital seta of *Perionyx koboensis*, sp. nov., × *ca.* 400.



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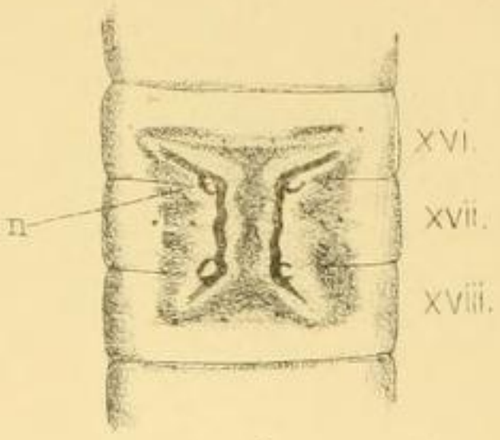

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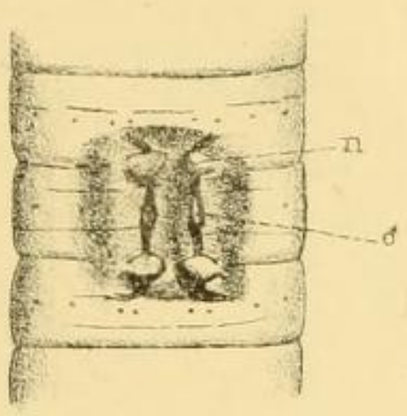

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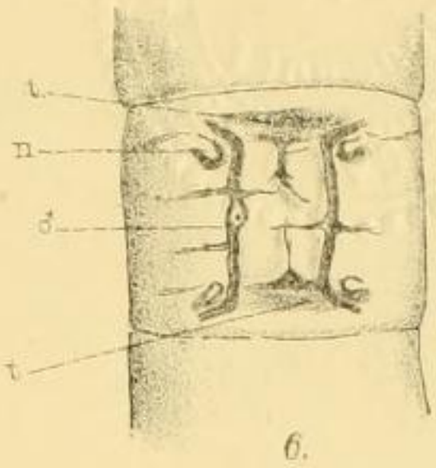

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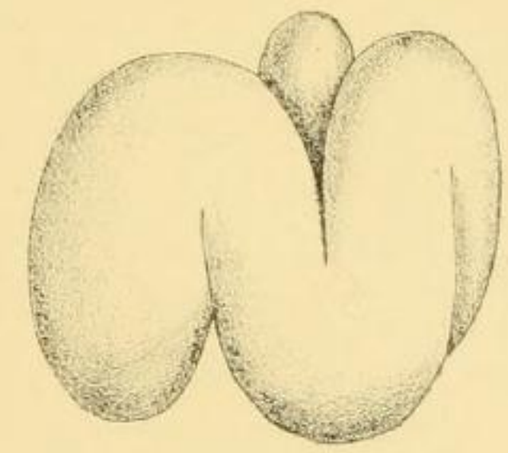

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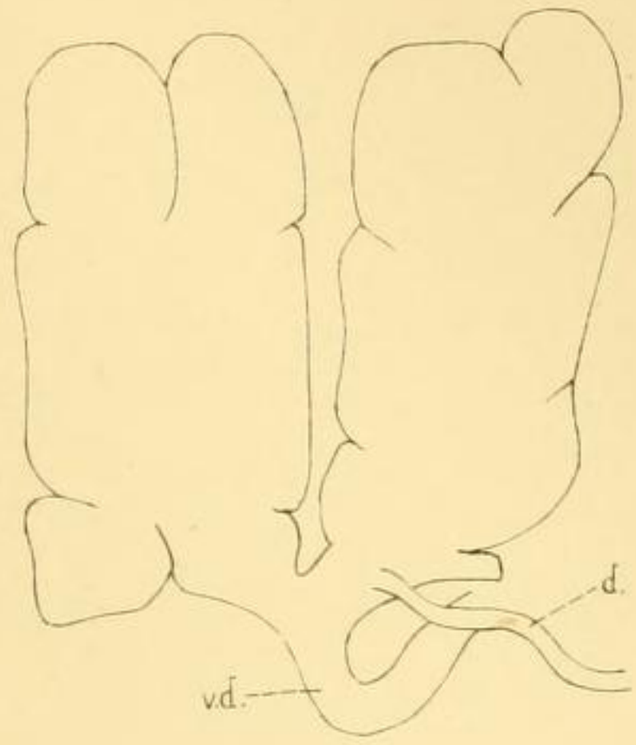

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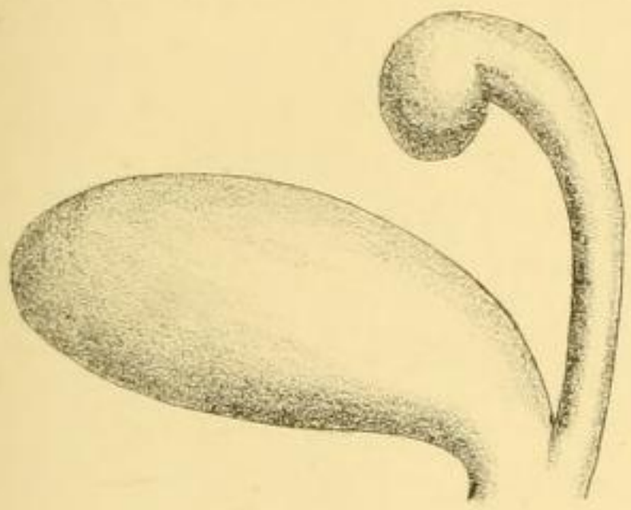

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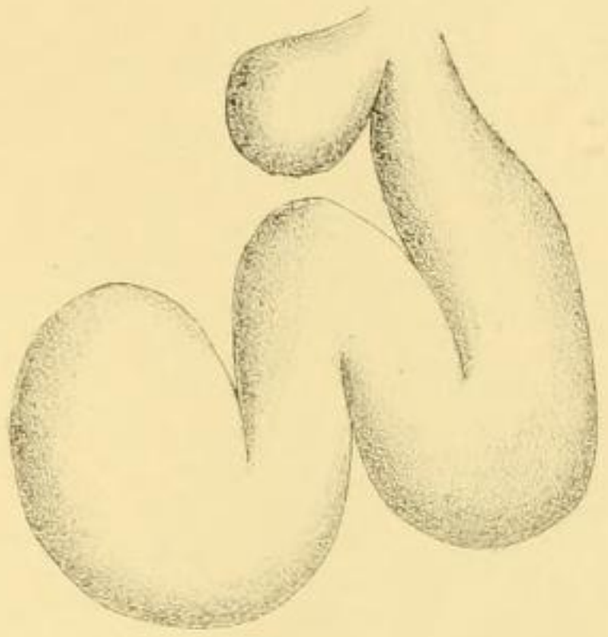

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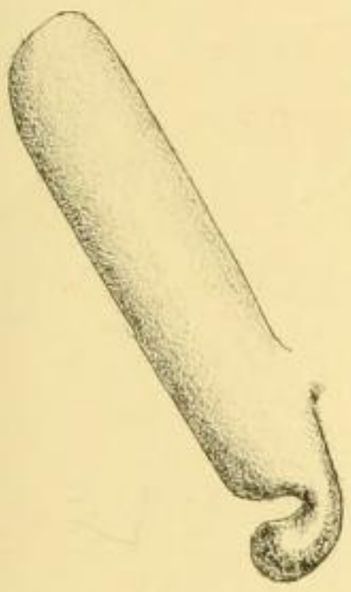

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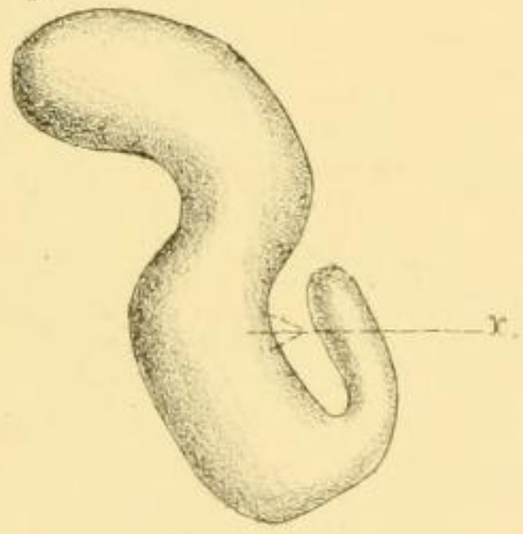

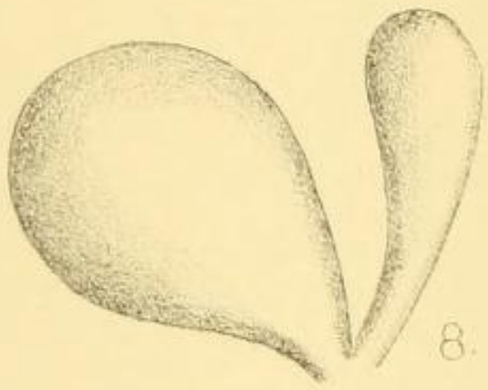

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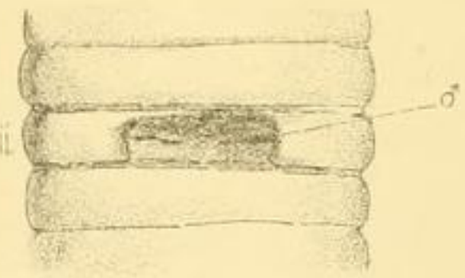

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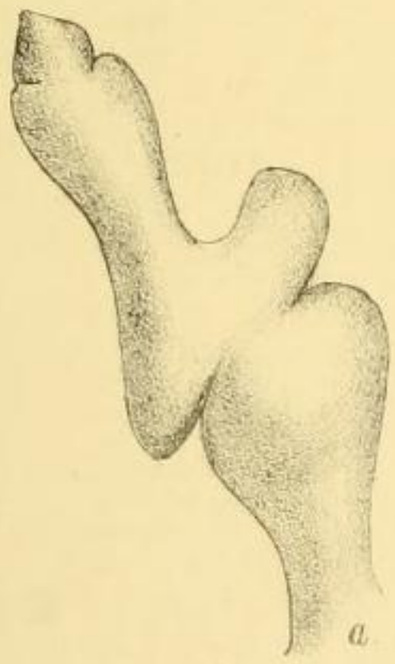

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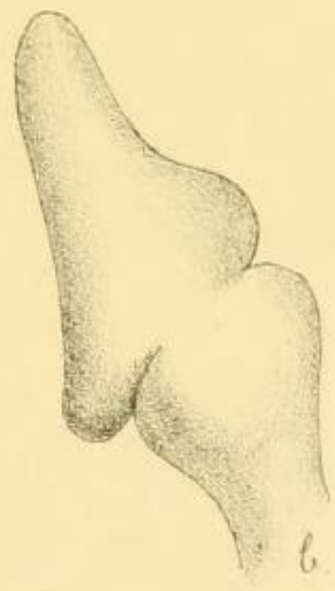

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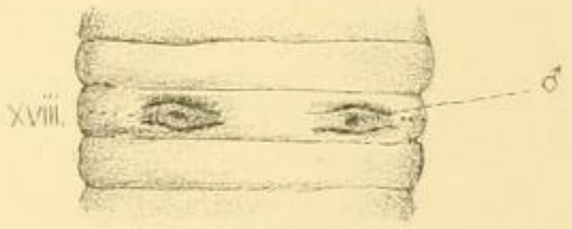

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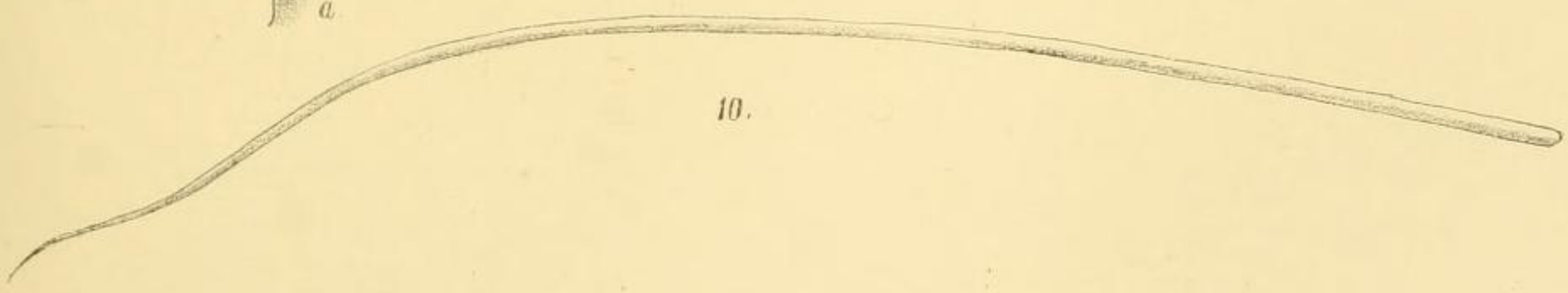

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J. Stephenson, del.

D. Bagchi, lith.

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EXPLANATION OF PLATE XXVII.

FIG. 13.—Genital area of *Perionyx aborensis*, sp. nov. Setae not indicated; ♂, male aperture.

,, 14.—Genital area of *Perionyx depressus*, sp. nov. Setae of segm. xviii indicated; ♂, male aperture.

,, 15.—Genital area of *Perionyx foveatus*, sp. nov. Setae not indicated; ♂, male aperture.

,, 16.—The same, another specimen; setae indicated.

,, 17.—Spermatheca of *Pheretima lignicola*, sp. nov. The ampulla was relatively more elongated in the other spermathecae of the same side.

,, 18.—Segments xxi–xxiii of *Eutyphoeus kempi*, sp. nov.; ventral surface, showing depressions in the course of the intersegmental grooves.

,, 19.—Genital setae of the same; × *ca.* 175.

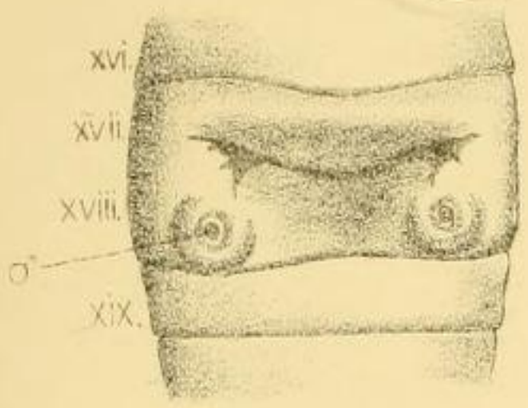
,, 20.—Genital area of *Eutyphoeus koboensis*, sp. nov. (diagrammatic). *c.*, clitellum; *g.*, genital ridges; *x.*, posterior limit of clitellum; ♂, male aperture; ♀, female aperture.

,, 21.—Genital seta of the same; × *ca.* 175.

,, 22.—Genital setae of *Eutyphoeus aborianus* sp. nov. *a.*, fully formed; *b.*, still within the sac; × *ca.* 200.

,, 23.—Spermatheca of *Eutyphoeus magnus*, sp. nov. *d.*, diverticula on one side of duct, the others being underneath; *v. n. c.*, ventral nerve cord; *x* is not the duct, which is hidden from view beneath the ampulla, but a strand attaching ampulla to body-wall.

,, 24.—Genital seta of the same. *a.*, whole seta, to show its shape, × 25; *b*, distal end, × *ca.* 150.



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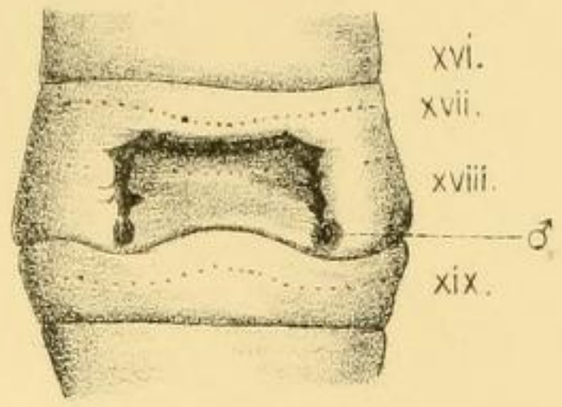

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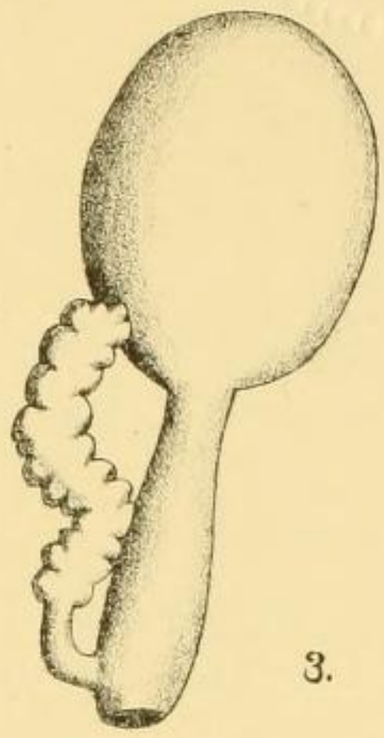

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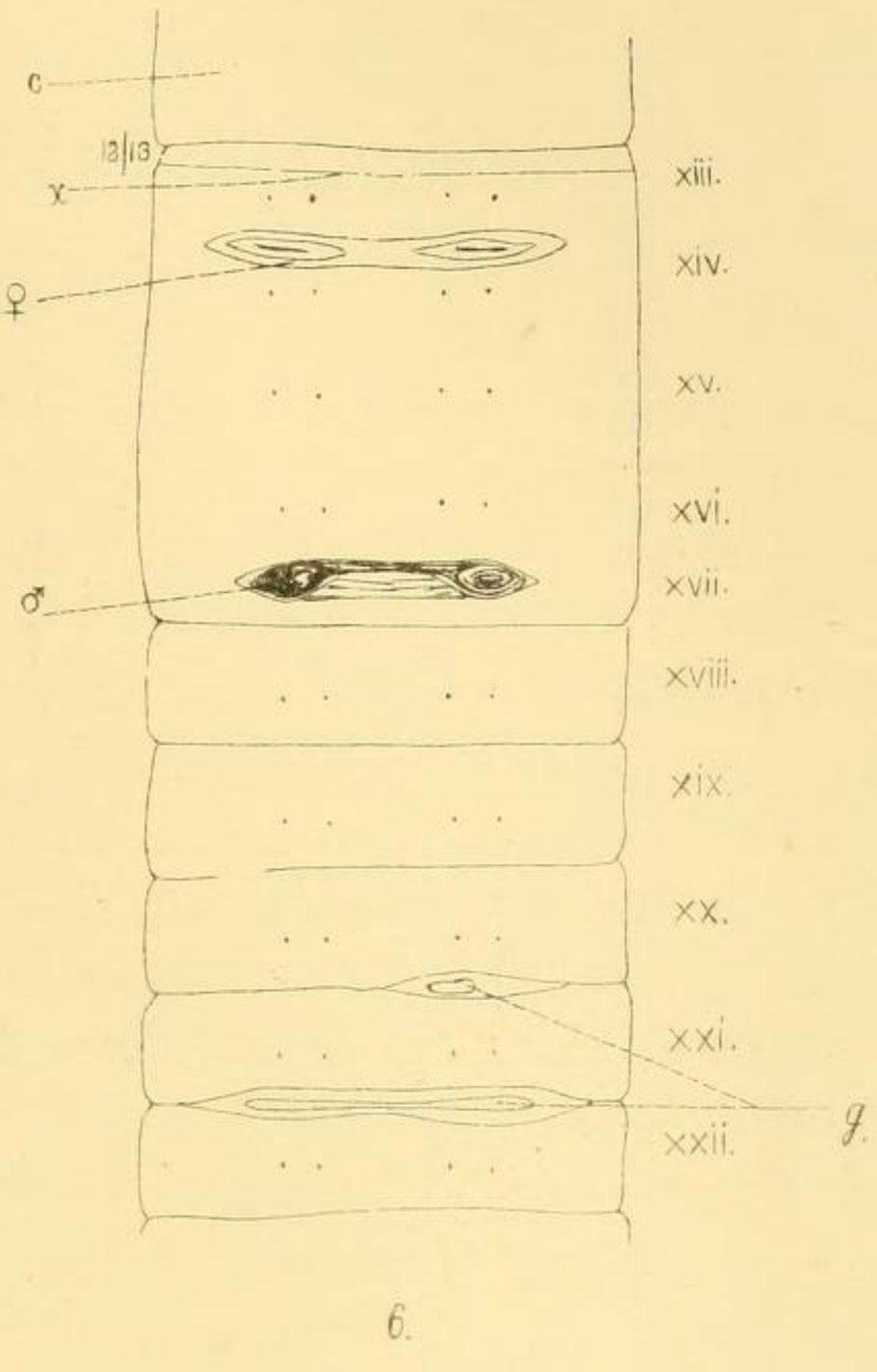

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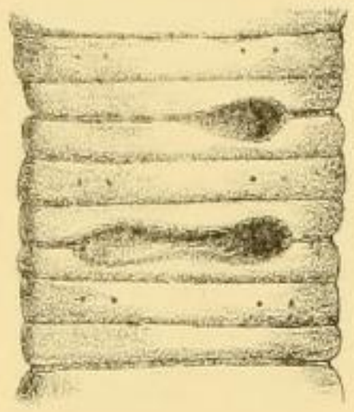

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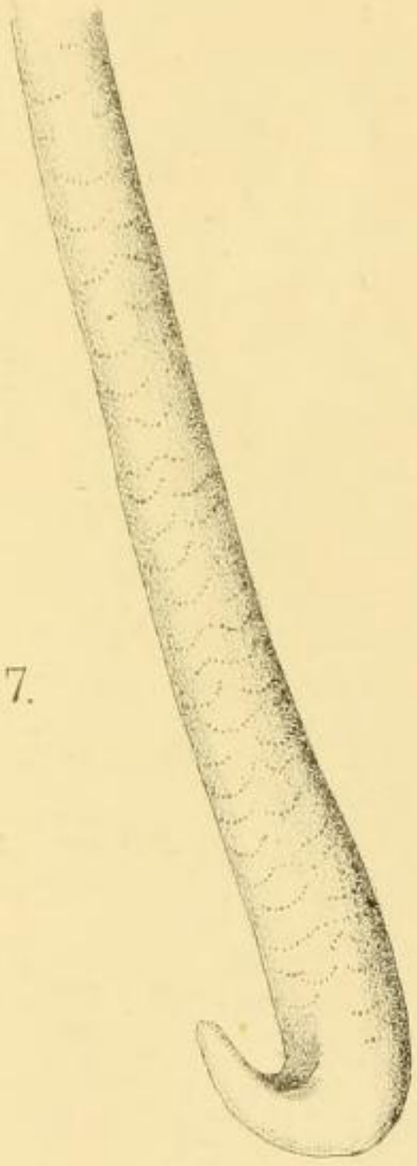

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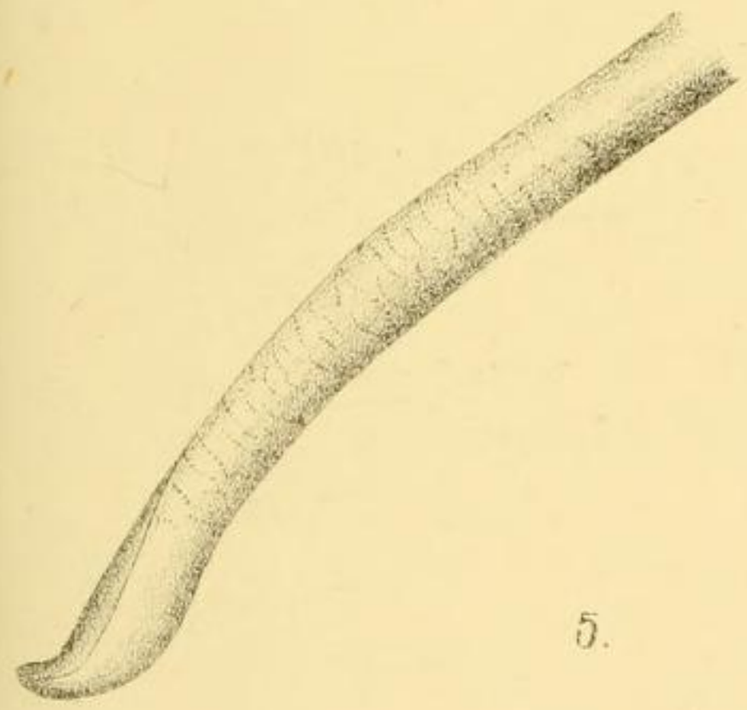

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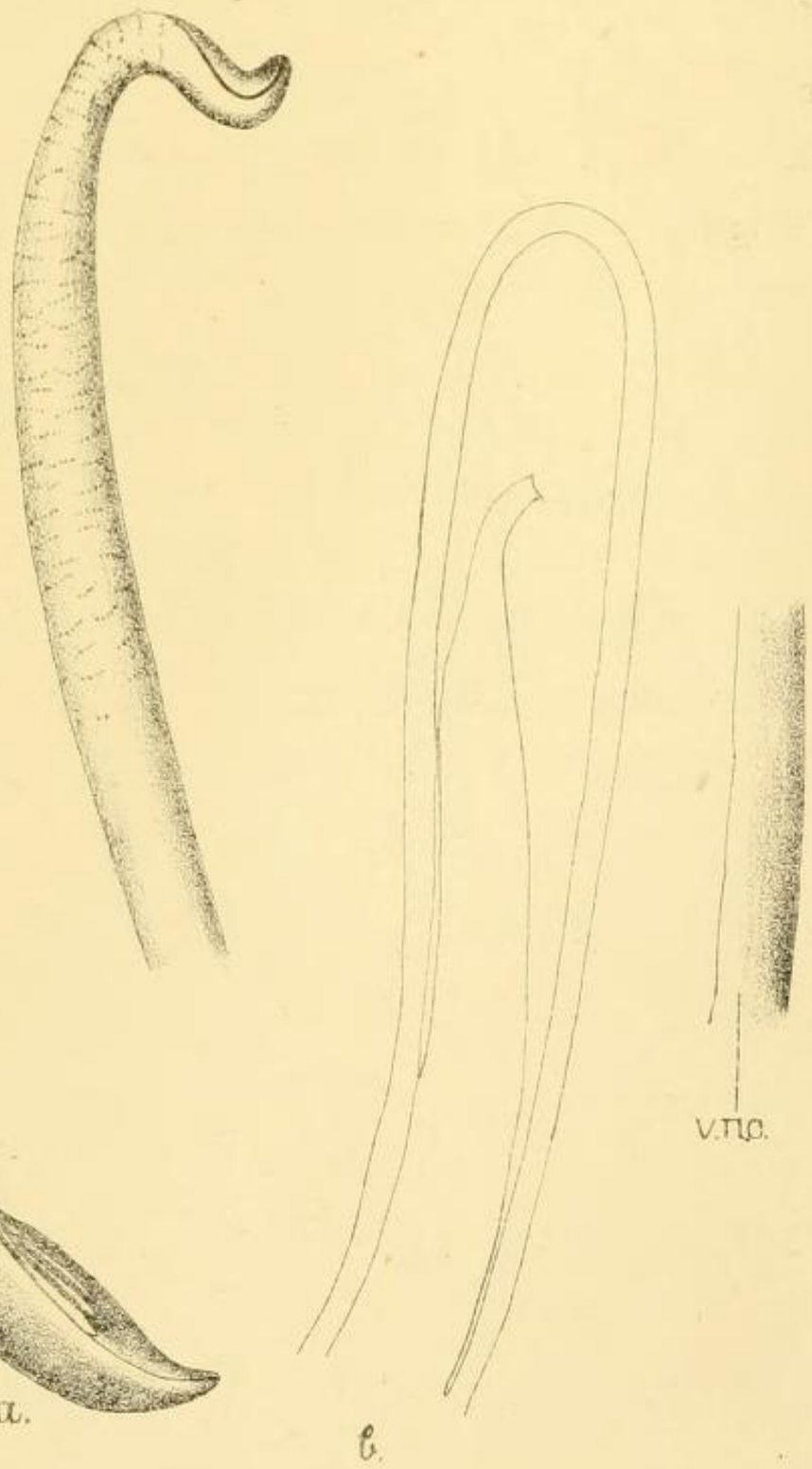

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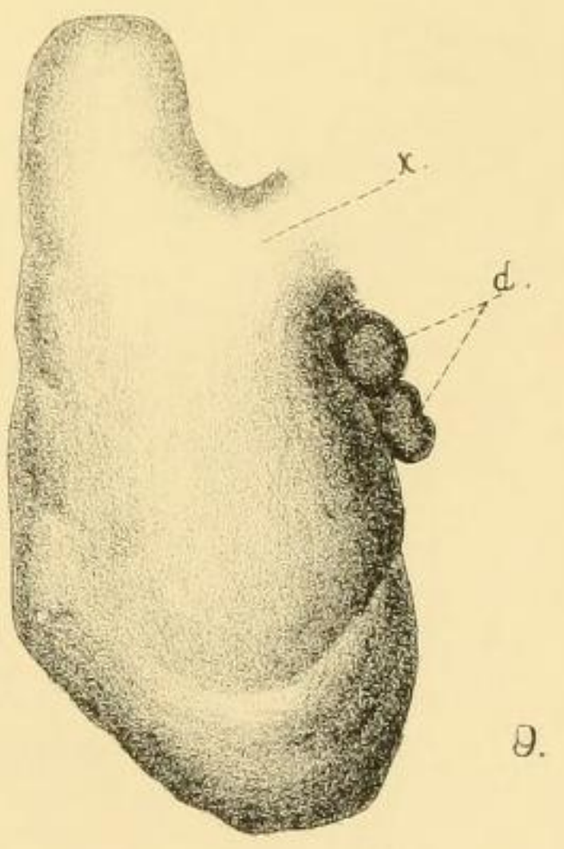

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a.

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