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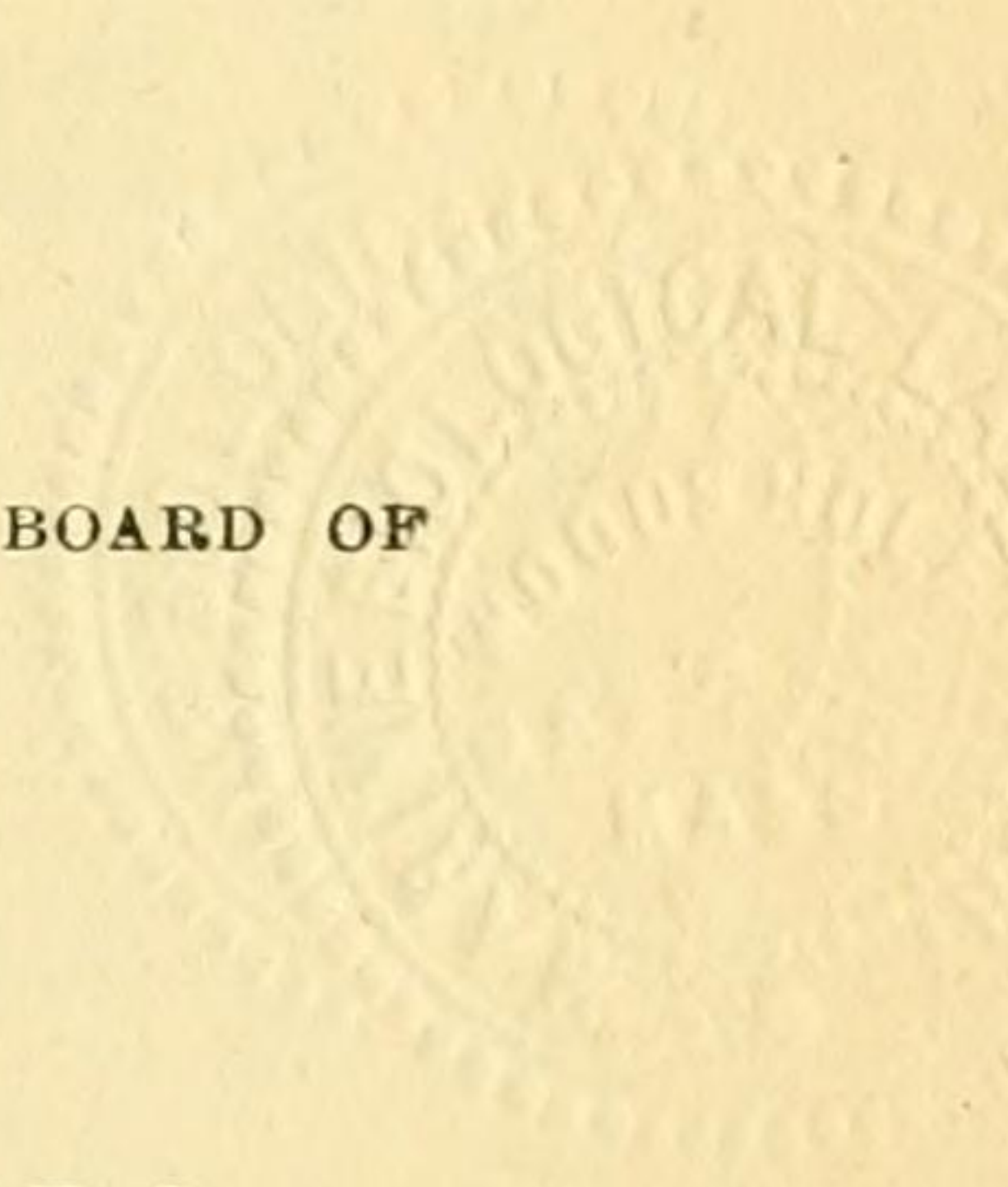
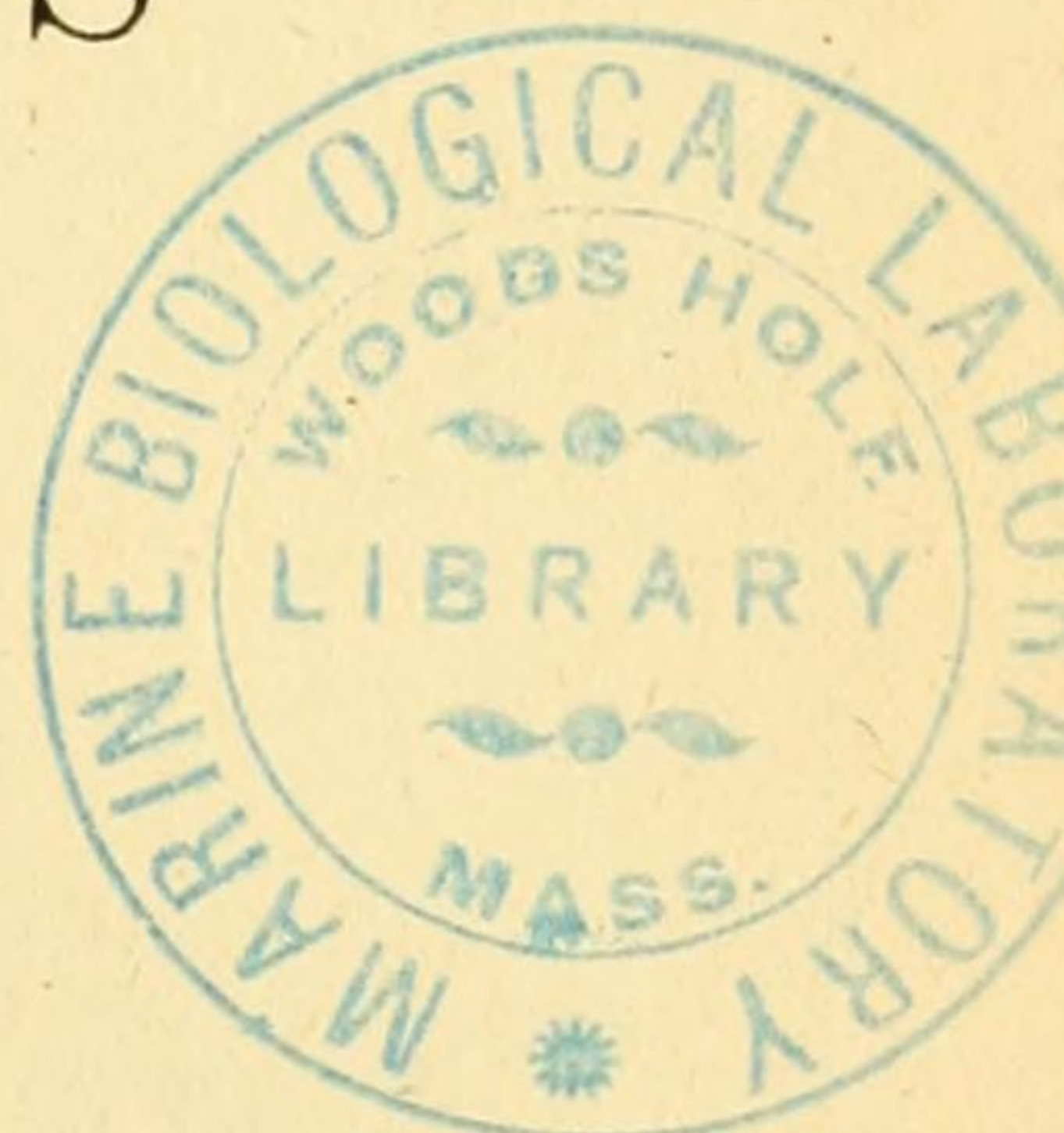
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by me in 1900 will show. There is, however, a special interest attaching to both these species, since they agree more closely with the species of *Notiodrilus* found at the Cape of Good Hope and at South Georgia, Falkland Islands, and Tierra del Fuego, than they do with the species of the genus occurring in New Zealand itself.

For explanation of the figures, see pp. 289, 290.

ART. XXXI.—*On the Old and some New Species of Earthworms belonging to the Genus Plagiochæta.*

By W. BLAXLAND BENHAM, Professor of Biology, University of Otago.

[*Read before the Otago Institute, 14th October, 1902.*]

Plates XXII.—XXVI.

DURING the four years in which I have resided in New Zealand I have been accumulating a considerable number of earthworms collected in various parts of New Zealand. Amongst other friends and gentlemen who have been good enough to make collections for me, or to send me those worms already in their collections, I have to thank Captain Hutton, who placed his collection at my disposal; Professor Dendy; Mr. H. B. Kirk; Mr. W. W. Smith, who on several occasions has, at my request, sent me particular species, and constantly sends me material as he meets with it; Mr. H. Suter, and others whose names appear in the following communications. I have as yet had time only to examine critically a small proportion of this material, and I have devoted this article to the description of four new species of *Plagiochæta*, together with remarks on Captain Hutton's species. As in a previous article, I here deal only with characters rendered evident by dissection. I reserve certain interesting and important details of microscopic structure for another paper.

It will be seen that the new species of the genus differ in various characters from the original species, and it will probably be necessary to subdivide the genus. But for the present I use the term "*Plagiochæta*" in a wide sense, to include endemic earthworms, which differ from typical Acanthodrilids (*Notiodrilus*, *Maoridrilus*) and from *Octochætus* in possessing numerous chætæ on each segment in place of the more usual eight. But it seems desirable to await further research in greater detail before the genus is subdivided. This matter, however, I hope to deal with in a forthcoming article elsewhere.

Plagiochæta sylvestris, Hutton, 1876 (= *P. punctata*, Benham, 1892).

In the year 1876 Captain Hutton* gave a brief account of the external anatomy of several New Zealand earthworms, amongst which were two species which he placed in the genus *Megascolex*—viz., *M. sylvestris* and *M. lineatus*. In the year 1892 I gave a detailed account† of the anatomy of a worm collected on Maungatua, for which it was necessary to create a new genus, and I termed it *Plagiochæta punctata*. At that time I was ignorant of Captain Hutton's article; but in 1892 Mr. Beddard‡ suggested that in all probability *M. sylvestris* belonged to this new genus. This supposition was confirmed by me when, in 1898, I had the opportunity of examining Hutton's types,§ preserved in the Otago University Museum, and in a note upon these types I pointed out that "it is difficult at present to determine whether *M. sylvestris* is or is not identical with *P. punctata*"; and I recognised that *M. lineatus* belonged to the same genus. A renewed examination of the type, and of other specimens collected in the neighbourhood of Dunedin, where the type was collected, has enabled me to establish this identity, and, further, to indicate the differences, external and internal, that exist between *P. sylvestris* and *P. lineatus* in a more detailed manner than was possible in my former note.

Habits.—*P. sylvestris* occurs in rotten logs in the remains of the bush country that forms the Town Belt around Dunedin, as well as on the slopes of Maungatua, and no doubt elsewhere. It is still pretty plentiful in our Town Belt, and I have found it especially in fallen *Griselinia* trees. The colour is chocolate, and closely resembles the vegetable mould—the digested wood—amongst which it lives. It is marked, as I noted in 1892, with white spots, in which the chætæ are inserted, while the nephridiopores are also indicated by still more conspicuous white spots, readily visible to the naked eye. The species is extremely active, and moves in a straight line with great rapidity, using its mouth as an organ of adhesion. It contracts its body to about half its length, then thrusts its head forward and extends itself fully; there is no wriggling or undulation of the body. When extended one specimen measured was 2 in. (50 mm.);

* Hutton: "On New Zealand Earthworms in the Otago Museum" (Trans. N.Z. Inst., ix., p. 352).

† Benham: "Notes on Two Acanthodriloid Earthworms from New Zealand" (Quart. Journ. Micros. Sci., xxxiii., p. 294).

‡ Beddard: "On some New Species of Earthworms from various Parts of the World" (Proc. Zool. Soc., 1892, p. 667).

§ Benham: "A Re-examination of Hutton's Types" (Trans. N.Z. Inst., xxxi., p. 156; and Ann. Mag. Nat. Hist. (7), iii., p. 137).

when contracted, $1\frac{3}{16}$ in. (25.5 mm.). It appears to move backwards with almost the same ease with which it moves forwards.

But what is most remarkable is its ability to climb up a vertical surface. I placed a specimen in a clean dry glass beaker 4 in. in height. It climbed up this in a straight line, and dropped over the edge on to the table. Here it remained without a wriggle for a few seconds, in the same position as it fell. I noted that it moved even more rapidly vertically up this smooth glass than along the horizontal surface of the table. On holding the beaker in various positions, it nearly always took a vertical direction.

The worm, when slightly pinched with forceps, readily breaks into two pieces. It is not difficult to imagine the value of these habits in the struggle for existence. The negative geotaxis is, of course, of importance in gaining its normal habitat. Its ready autotomy probably protects it if perchance it is touched by a bird probing the log for grubs, &c.

Anatomy.—The two species, *P. sylvestris* and *P. lineatus*, agree closely with one another in external form and in certain structural characters, and differ in some of these respects from certain other species to be described below. Each is about $1\frac{1}{2}$ in. to 2 in. in length, and contains from seventy to ninety segments. The body is relatively broad in proportion to the length, and is broadest in the middle.

The *chætæ* are about fifty in number, set in couples,* of which there are twelve or thirteen on each side. A distinct dorsal and ventral gap exists, the width of which in relation to the ordinary gap between couples is variable, being at least twice, or even thrice, the latter.

In my note of 1898 I laid some stress on the differences in the widths of these median gaps, but further comparison leads me to consider such differences as individual or even segmental variations.

The *clitellum* always covers segments 14 to 17, though the number of fully mature individuals available does not enable me to be certain as to any constant differences between the two species in this respect.

The *porophores* on 17th and 19th segments are set in a slight depression, capable of being converted into a narrow furrow on contraction, so that the porophores meet their fellows. This depression involves the ventral surface of segments 16 to 20. The porophores are in line with the lowest couple of *chætæ*; the male pore, on the 18th, is just outside this couple. There is no spermatic groove, such as

* As I have already stated (1898), Captain Hutton committed a *lapsus calami* in attributing to *P. lineatus* a "continuous circle" of *chætæ*.

exists in *Maoridrillus* and other Acanthodrilids, but the depression is limited laterally by a slight ridge just lateral of the porophores.

The *spermathecal pores*, between segments 7/8 and 8/9, are in line with the ventralmost couple of chætæ.

The *nephridiopores*, large and conspicuous, alternate in the greater part of the body (as I showed in 1892), being usually in front of the 4th and the 10th couple of chætæ, counting from below.

As will be seen below, the internal anatomy presents definite distinctive features in these two species.

P. sylvestris, Hutton.

The *prostomium* is "epilobic"—*i.e.*, it is prolonged backwards, or imbedded in the 1st segment for about two-thirds of its length (see Hutton's fig. E).

The *clitellum* in some of the specimens does not extend beyond segments 14 to 17, but in the type itself, as well as in the specimen named "*punctata*," it intrudes upon the 18th segment; and in another local specimen I note that it commences in the 13th. Possibly, therefore, when fully developed it covers the six segments—13 to 18.

Copulatory tubercles are present—at any rate, in some of my specimens—in the form of transverse oval glandular areas extending across the ventral surface of segments 11 and 12.

Of internal organs the following appear to be of diagnostic value:—

The *dorsal vessel* is double up to the 15th segment; the two vessels lie close together, and in my account of *P. punctata* I figured the vessel as single. It is, however, distinctly double in the intestinal regions. In the 14th segment the two canals still exist, but are bound together in one coat; in the 13th the fusion is complete, and a single vessel runs forwards.

There are three pairs of hearts, the last being in the 12th segment.

There is no gizzard recognisable on dissection. The oesophagus bears a pair of large glands in the 14th segment, and frequently these protrude into the 13th; indeed, in one case this portion was constricted off so as to form a small and apparently independent gland. The intestine commences in the 16th segment.

With regard to the *reproductive system*, there are four pairs of sperm-sacs even in the type, notwithstanding my statement (1898, p. 162) to the effect that there are only three pairs. My laboratory note, as well as a re-examination of the type, gives four as the true condition, as I described in 1892 for *punctata*.

The *penial chætæ* are especially diagnostic. Each is a long gently curved bristle practically smooth on its shaft, and terminated in a blunt point, which is not upturned.

The *spermatheca* is globular, with a short wide duct, into which opens a single tubular diverticulum, which invariably, as far as my observations on several individuals go, is præseptal.

P. lineatus, Hutton.

Hutton's original specimen was obtained at Queenstown, on Lake Wakatipu, in Otago. I have been able to examine other specimens, collected by Mr. Malcolm Thomson on Ben Lomond, a mountain 5,747 ft. in height overlooking the town. The differential characters are as follows:—

The *prostomium* is tanylobic—*i.e.*, its prolongation completely cuts through the 1st segment, as Captain Hutton shows it in his fig. F (1876).

The *clitellum* appears to be limited to segments 14 to 17, and I have observed no copulatory tubercles; but in both of these characters I must for the present reserve judgment, owing to lack of sufficient material.

The *dorsal vessel* is single; and the hearts are in 10, 11, and 12.

There is a small *gizzard* in segment 6, recognisable on dissection.

The *œsophageal gland* is in segment 14, projecting slightly into the 13th segment.

There are only three pairs of sperm-sacs, in segments 9, 11, and 12.

The *penial chætæ* are longer and more delicate than in *P. sylvestris*, and the tip is bent upwards and slightly excavated, so as to be spoon-shaped, though in side view the tip is pointed. But, further, the shaft is marked by numerous distinct but fine, interruptedly transverse, low ridges, finely serrated.

The *spermatheca* is ovoid, with a short and comparatively narrow duct, into which there open two short and somewhat globular diverticula, the lower of which is præseptal. One of these diverticula—perhaps both—is lobed—*i.e.*, its free extremity is notched by one or two furrows. In the type it is the lower which is thus notched; in the Ben Lomond specimen it is the upper one.

These two characters—the *penial chætæ* and the *spermathecæ*—are very definite differential features of these closely similar species.

Plagiochæta lateralis, n. sp.

Locality.—The shore of Lake Thompson, 1,100 ft. above sea-level, on the track from Lake Te Anau to George Sound. Collected by Mr. J. Mackenzie.

Colour.—Pale-greyish, with dark-brown clitellum.

Dimensions.—The longest of the dozen specimens measures 55 mm., with a diameter of 5 mm. The body is rather depressed, with a slight groove along the median dorsal and ventral surfaces. The number of segments is 100.

The *prostomium* is half epilobic, with a transverse furrow before the end of the longitudinal furrows.

The *chætæ* are twenty-four (about) in each segment. They are not in couples, but are arranged in two groups on each side, an upper and a lower, separated by a distinct lateral gap, which peculiarity suggested the specific name. The lower group consists of five *chætæ*, the upper group of seven *chætæ*; the latter are further apart than the former. The dorsal gap is greater than the ventral, and each is greater than the lateral. The arrangement may be represented by the following formula, in which the vertical lines represent *chætæ* and the numerals indicate the relative distances, as measured by an eye-piece micrometer on the flattened skin. V, L, and D are the ventral, lateral, and dorsal gaps respectively.

$$\begin{array}{cccccccccccccccc} 9 & | & 2\frac{1}{2} & | & 2 & | & 2\frac{1}{2} & | & 2\frac{1}{2} & | & 5\frac{1}{2} & | & 3 & | & 3 & | & 4 & | & 4 & | & 3 & | & 4 & | & 12. \\ V & a & b & c & d & e & L & f & g & h & i & j & k & l & D \end{array}$$

No doubt the actual distances vary, not only in different specimens, but in different parts of the body.

The *clitellum* covers segments 14 to 17 inclusive; it does not extend over the ventral surface, but ceases at about the level of the porophores.

Genital Pores, &c.—The porophores are feebly developed on 17 and 19, and are in line with about *chætæ e*—*i.e.*, almost laterally placed. There are four *chætæ* below each, and four *chætæ* below the male pore in 18th segment; and sections show a 5th *chætæ* close to the pore in each of these segments. These *chætæ* are further apart on these segments than elsewhere. There is a distinct and curved spermatic groove, convex outwards. In some of the specimens copulatory tubercles exist, but asymmetrically on the right or left of segments 18 or 20. In none are they fully developed, when, no doubt, they will be paired.

The oviducal pores are in line with the gap *b/c*, the spermathecal pores between 7/8, 8/9, in line with the *chætæ* gap *e/f*; and in several of the individuals there is a pair of pitted tubercles on the 8th segment, just behind the *chætæ* ring, in line with the gap *d/e*.

Dorsal pores are present, at any rate, behind the clitellum ; I see no nephridiopores on the skin, but in section I find them in the lateral gap.

Internal Anatomy.

There are four stout *septa* behind segments 9, 10, 11, and 12; those behind segments 6, 7, and 8 are thin and much pouched backwards.

Vascular System.—The dorsal vessel is double, but united at the *septa*, as far forwards as the 12th segment. In the 11th the two vessels are bound together in a common envelope, though the canals are separate; but in the 10th they have united, and the single vessel thus formed continues forwards. The last heart is in the 13th segment. Both this and the heart in the 12th are unconnected with the dorsal vessel; they are therefore “enteric hearts,” being connected probably (for I have not examined this point) with a supra-enteric vessel. But the two hearts in 10 and 11 are “lateral hearts,” being connected with the dorsal vessel.

Alimentary System.—The gizzard is large, and occupies segment 6, and pushes back the next three *septa*. The œsophagus remains very narrow, but thick-walled, as it passes backwards to the 19th segment; there is no enlargement to form a gland. The gut becomes thin-walled in the 20th segment, and dilates to its full size in the next, whence it becomes apparently spiral.

Excretory System.—The worm is meganephric.

Reproductive System.—The testes, funnels, ovaries, and oviducts occupy the usual position. There are only two pairs of sperm-sacs, in segments 9 and 12 respectively, the intervening segments being occupied by a mass of loose sperm. The spermiducal glands are thick, convoluted, and confined to their proper segments. The muscular duct is short and narrow.

There are no penial chætæ. In segment 18 there are a series of stout muscles, which start from each side of the nerve-cord and pass outwards and upwards to be inserted in the body-wall on the dorsal surface of each side. These “transverse muscles,” as they may be termed, are probably employed during the process of copulation. The effect of contraction, as seen in preserved specimens, is to cause a deep depression of the ventral surface of segments 17 to 19, and at the same time the porophores become more prominent. Such “transverse muscles” are known in other earthworms—*e.g.*, *Octochætus*—and their presence seems to be associated with the absence, or, at any rate, small size, of penial chætæ.

There are two pairs of spermathecæ, in the usual segments. The chief part, or “copulatory sac,” is relatively large,

transversely ovate, and the duct is scarcely distinguishable on dissection, but receives right and left a small ovate diverticulum with a long narrow duct.

Plagiochæta rossii, n. sp.

Locality.—Five specimens were collected in the bush on the shore of Lake Te Anau in 1900. I name this species after the collector, Mr. Donald Ross.

The *colour*, in formol, is purplish-brown, with a darker-brown median dorsal stripe. The preclitellar region is greyish-brown.

Dimensions.—The mature individuals vary from 105 mm. to 165 mm. in the preserved condition. In a specimen measuring 158 mm. its greatest diameter is 7 mm. at segment 8, and also behind the clitellum. The preclitellar region is 20 mm. and the clitellum 11 mm. in length. This worm consists of 112 segments.

The *prostomium* is epilobic (three-quarters), without a posterior groove.

The *chætæ* are about thirty-two to thirty-six in each segment, not in couples. Each chætæ is implanted in a light spot. There is no perceptible diminution anteriorly, for I count thirty-two on the 7th segment and thirty-four on the 3rd segment. There are small ventral and dorsal gaps, but no lateral gap, the series of sixteen or eighteen chætæ on each side being practically equidistant.

The *clitellum* extends from 13th to 17th segment, and in the largest individual the 18th segment differs in colour from the 19th, and looks as if it, too, would become part of the clitellum. The organ is continuous ventrally in its anterior region, but on segments 16 to 20 is a white transversely oval genital area, containing the genital pores.

Genital Pores.—The porophores are prominent. There is no true spermatic groove, but a ridge passes from 17th to 19th segment on each side, having a rather peculiar arrangement. Starting from the 17th porophore, the ridge curves down the posterior face with an outward sweep and reaches the intersegmental furrow, where it disappears. A similar ridge occurs on the anterior face of the porophore on the 19th segment. Then in the 18th is a curved ridge, convex outwards, connecting the two other ridges. The ridge is a rounded prominent structure, forming the outer boundary of an indistinct furrow whose inner boundary is formed by the glandular tissue of the body. This ridge seems to contrast with the definite groove found in many Acanthodrilids, for in them the groove is the conspicuous structure; here, in *Plagiochæta*, it is the external (and only) ridge that catches the eye. How far we may distinguish these two things is uncertain, but the

structure just described may, for convenience, be termed a "spermatic ridge," and we meet with it in other species of this genus.

The oviducal pores are close together in front of the ventral gap, enclosed in a definite pale oval patch.

The spermathecal pores are in line with chætæ *c* and *d*. On the ventral surface of each of the segments 9 and 10 is a pair of copulatory tubercles, and indications of another pair on the 11th segment.

Dorsal pores are distinct from the clitellum backwards.

Internal Anatomy.

The six *septa*, behind segments 10 to 15, are especially stout, and the two in front of these less so.

The *dorsal vessel* is double right up to the pharynx, being connected only at the *septa*. The hearts are in segments 10, 11, 12, and 13.

Alimentary System.—The gizzard lies partly in the 6th but chiefly in the 7th segment, the septum, 6/7, being inserted on its walls. The œsophagus is dilated in segment 15 to form, apparently, a gland, though it is not well defined externally. The lining of the œsophagus as it passes through segments 12 to 15 is raised up into numerous closely set, laterally flattened vascular villi, but no distinct lamellæ such as are usually associated with an œsophageal gland occur. In the 16th segment the gut becomes paler and diminishes in size, and does not become dilated to form the intestine till segment 20 is reached, after which it is deeply constricted as it passes through the *septa*.

The worm is *micronephric*, the excretory organ being represented in each segment by a vertical series of small tufts of tubules passing upwards along the body-wall.

Reproductive System.—The testes, ovaries, and their ducts have the usual position. There are four pairs of sperm-sacs, lying in segments 9, 10, 11, and 12. The spermiducal glands are confined to their proper segments. The glandular part, tubular as usual, is convoluted and coiled into a ball. The muscular duct is long, very narrow, and undulating.

No penial chætæ appear on dissection. Transverse muscles are well developed in segment 18 and partly in the neighbouring segments.

The *ovaries* are noticeably large, passing along the septum from near the ventral vessel upwards for nearly one-third the semi-circumference of the septum. The funnels of the oviducts are also unusually prominent.

The *spermathecæ* are large ovoid sacs, with short ducts. The duct of each sac is beset with groups of small somewhat botryoidal diverticula, so that when viewed from above they appear as a fringe round its neck.

Plagiochæta ricardi, n. sp.

Locality.—Four specimens of this fine worm were obtained by Mr. Richard Henry on Resolution Island, at the south-west corner of the South Island. In a note he writes, "A common worm, living 6 in. down in peaty soil, mostly on the shady side of a hill. It is a favourite food of the roa (*Apteryx haastii*), which, when hunting for food, walks slowly, with gentle tread, and its head held as if listening. When the bird gets hold of a worm it breaks the latter up to get rid of the gut."

Colour (in formalin) dark purplish-brown—in fact, almost purple dorsally. When transferred to alcohol the purple tint becomes sienna-brown.

Dimensions.—This species is of considerable size and bulk in life. The four specimens are from 180 mm. to 290 mm. in length, with a diameter ranging from 10 mm. to 14 mm. in the middle of the body; but this is not the greatest diameter. Of these only two—measuring 260 mm. and 290 mm.—are mature. The former of these two contains 173 segments.

The *prostomium* is epilobic (half), without a posterior groove.

The *chætæ* are not in couples, nor in paler spots. There are from fifty-two to sixty-four *chætæ* in the post-clitellar region, separated into a right and left series by a dorsal and a ventral gap of about thrice the width of an inter-*chætal* gap. There is no sensible diminution in number of *chætæ* anteriorly. In the clitellar region the more ventral *chætæ*, *a-d*, are further apart than elsewhere.

The *clitellum* occupies segments 14 to 20, and even the 21st is slightly glandular. The organ is incomplete ventrally, ceasing at the level of the porophores.

Genital Pores.—The porophores and "spermatic ridge" are similar to those of *P. rossii*, but the latter is here less curved. The pores are in line with *chæta c*, which is absent, though *a* and *b* are present on segments 17, 18, and 19. The oviducal pores are in line with the gap *a/b*. The spermathecal pores are indistinguishable externally. It appears that formol, though excellent as a temporary preservative of colour, causes earthworms to shrink a good deal, and the pores become closed.

Internal Anatomy.

The seven *septa* behind segments 8 to 14 are thick, but especially those of 9 to 13. The septum 14/15, as well as the two following *septa*, are pouched forwards, so that the cavity of the 17th segment is increased beyond its usual size.

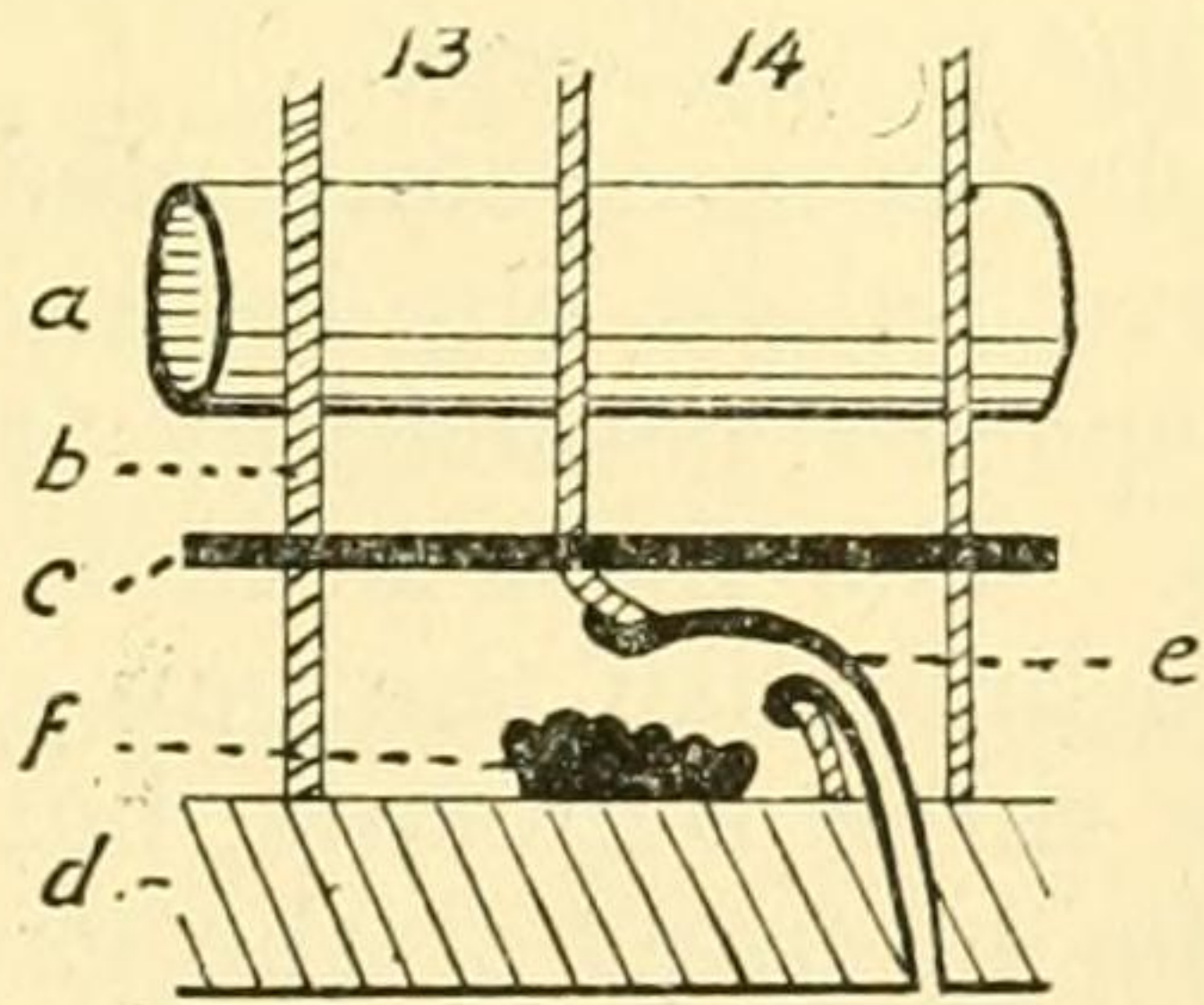
The *dorsal vessel* is distinctly double, right up to the pharyngeal region. The last heart is in segment 13.

The Alimentary System.—The gizzard is elongated, but wholly confined to segment 6. There is a large œsophageal gland in segment 12, behind which the gut is noticeably reduced in size—not only in breadth but also in length—owing to the reduction of the segmental cavities already referred to. It does not commence to dilate till the 18th segment to form the intestine.

The worm is *micronephric*, the tufts of tubules being concentrated near the nerve-cord. I have been unable to trace the nephridium to the surface, but there are well-developed funnels.

Reproductive System.—The position of the gonads is altogether unique. Both testes and ovaries are situated not on the septa bounding the segments, but *on the floor of the body*. Each testis is elongated in a direction parallel with the long axis of the body, and extends backwards to the posterior wall, terminating below the corresponding funnel. In the case of the ovary the same arrangement obtains; but the cavity of the 13th segment is greatly reduced, except below the ventral vessel, where the septum 13/14 is pouched backwards to form a tunnel-like pocket, which reaches nearly as far as septum 14/15. It is on the floor of this pocket that the two ovaries are placed; and, as the funnel of the oviduct is carried forwards by the overarching septum, the ovary comes to lie underneath the lip of the funnel.

Diagrammatic longitudinal section through segments 13 and 14.



a, gut; *b*, septum; *c*, ventral blood-vessel; *d*, body-wall; *e*, oviduct; *f*, ovary.

There are four pairs of sperm-sacs in the usual segments. The spermiducal glands are somewhat flattened and undulating.

There are no penial chætæ, but “transverse muscles” occupy segment 18.

Each of the spermathecæ (in segments 8 and 9) is a sub-conical sac, with short duct, and around the latter is a nearly

complete circle of short, sessile, globular diverticula, hiding the duct when viewed *in situ*.

Plagiochæta montana, n. sp.

Locality.—In bush soil near Lake Thompson, 1,100 ft. above sea-level, on the track from Lake Te Anau to George Sound. They were collected by Mr. Mackenzie during the formation of this track.

Dimensions.—The collection contains a considerable number of individuals, ranging from 36 mm. by 5 mm. up to 190 mm. by 12 mm. Of these only a few are mature, and the smallest possessing a clitellum is 140 mm. by 8 mm. A specimen measuring 182 mm. contains 145 segments. The body is rather broader than high.

Colour.—Brick-red, browner anteriorly, with a brown clitellum. The chætæ are inserted in white rings girdling the segments.

The *prostomium* is epilobic, with a posterior groove half-way along the 1st segment.

The *chætæ* are about thirty-six to forty per segment, not in couples, but form a right and left series on each side, separated by a dorsal and ventral gap of about three times the interchætal gaps, which, as in other species, are by no means constant in their width. The number of chætæ diminishes somewhat, but not materially, anteriorly. I counted thirty-two on segment 4 and only twenty-four on segment 11. As usual, the ventral chætæ on the hinder clitellar segments are rather more widely spaced than elsewhere.

The *clitellum* covers segments 14 to 20, the limits of the organ being very distinct. It is incomplete ventrally, ceasing at about the level of the porophores.

The large porophores are connected by a "spermatic ridge." The body here bulges out laterally and is depressed mesially, as in other species, possessing "transverse muscles" in the 18th segment. The male pore is on a slight papilla. The three pores are in line with the gap *c/d*. Chætæ *a* and *d* are present on these three segments, but *b* and *c* are absent. The oviducal pores lie in front of the gap *a/b*; the spermathecal pores in front of the chætæ *d*, in the intersegmental furrows 7/8 and 8/9.

Dorsal pores are evident behind the clitellum.

Internal Anatomy.

There are eight stout *septa* behind segments 9 to 16 those of 10th, 11th, and 12th segments are especially stout. All are much thicker than in *P. rossii*.

The *dorsal vessel* is double up to the 4th segment; the two are connected by short transverse vessels præseptally. The

last heart is in segment 13; it and the heart in 12 are "enteric," while in 10 and 11 are "lateral hearts."

The Alimentary System.—The gizzard is large, occupies segments 6 and 7, the septum 6/7 being attached round its middle. The œsophagus bears a dilatation in segment 15, which is not constricted from the main tube. The gut then narrows, but in the 18th commences to increase in diameter till it has reached its full diameter in the 23rd segment.

The worm is micronephric.

Reproductive System.—The testes and ovaries are situated on the hinder wall of their segments, in each case underneath the funnel of the duct, as in *Octochætus multipores* and other species. There are four sperm-sacs. The spermiducal glands are closely zig-zag, confined to their segments.

There are no penial chætæ, but transverse muscles are present in these segments.

The spermathecæ are provided with a single lobulated spherical diverticulum.

EXPLANATION OF PLATES XXII.-XXVI.

PLATES XXII.-XXV.

The illustrations of the anatomy of the earthworms described in this paper are purely diagrammatic, indicating only the segmental position of the various organs, the worm being supposed to be slit up along the dorsal line and the body-wall pinned aside.

A group of three diagrams refer to each worm herein described. The left-hand diagram in each of the groups referring to a species represents the external features. The location of the various genital pores is represented as round black dots (if on a papilla this is left white), the clitellum is obliquely shaded, the tubercula pubertatis are vertically shaded.

In addition, the arrangement of the chætæ—labelled *a*, *b*, *c*, *d*—is indicated in two or more segments in each case, usually in the 5th and the 22nd; they are omitted in the remaining segments for clearness' sake. The true relative spacing of the chætæ is shown, except where they are very numerous.

The position of the nephridiopores is indicated by the small circles on one side of the figure.

The middle figure represents the alimentary canal and so much of the vascular system as is diagnostic. The latter is black. The gizzard is indicated by vertical shading, the œsophageal glands by more or less horizontal lines. The intestine is not represented as being constricted, which is, however, the case in most worms.

The right-hand figure shows the reproductive system. The gonads are in black. The sperm-sacs are dotted. The sac with penial chætæ when present is indicated, and the muscular duct of the spermiducal gland is transversely striped. The transverse muscles in the 18th segment are shown.

No attempt is made to give the relative sizes of the worms or of the various organs. Nor has it been considered necessary to label the various organs, since to any one who is familiar with the anatomy of any earthworm the structures here indicated will be sufficiently intelligible.

PLATE XXVI.

The Spermathecæ of the Earthworms described.

- Fig. 1. Spermatheca of *Megascolex laingii*.
 Fig. 2. " *Notiodrilus aucklandicus*.
 Fig. 3. " *N. macquariensis*.
 Fig. 4. " *Plagiochæta sylvestris*.
 Fig. 5. " *P. lineatus* (of type example).
 Fig. 6. " *P. lateralis*.
 Fig. 7. " *P. rossii*.
 Fig. 8. " *P. ricardi*.
 Fig. 9. " *P. montana*.
 Fig. 10. Penial chæta of *Notiodrilus aucklandicus*.
 Fig. 11. " *N. macquariensis*.
 Fig. 12. " *Plagiochæta sylvestris* (type).
 Fig. 13. " *P. lineatus* (type).

ART. XXXII.—*A List of the Hymenoptera of New Zealand.*

By P. CAMERON.

Communicated by Captain Hutton.

[Read before the Philosophical Institute of Canterbury, 3rd September, 1902.]

Family SIRICIDÆ.

Xiphydria.*Xiphydria*, Latr., Gen. Ins. et Crust., iii., 304.

- X. DECEPTA, Smith. *Derecyrtia deceptus*, Smith, Trans. Ent. Soc., 1876, p. 474, pl. iv., fig. 6. *Xiphydria flavopicta*, Smith, *l.c.*, 1878, p. 1. *Brachyixiphus deceptus*, Kirby, Trans. Ent. Soc., 1881, p. 49.

Family CYNIPIDÆ.

Anacharis, Dal.*Anacharis*, Dalman, Ann. Entomol., 1823, 95.

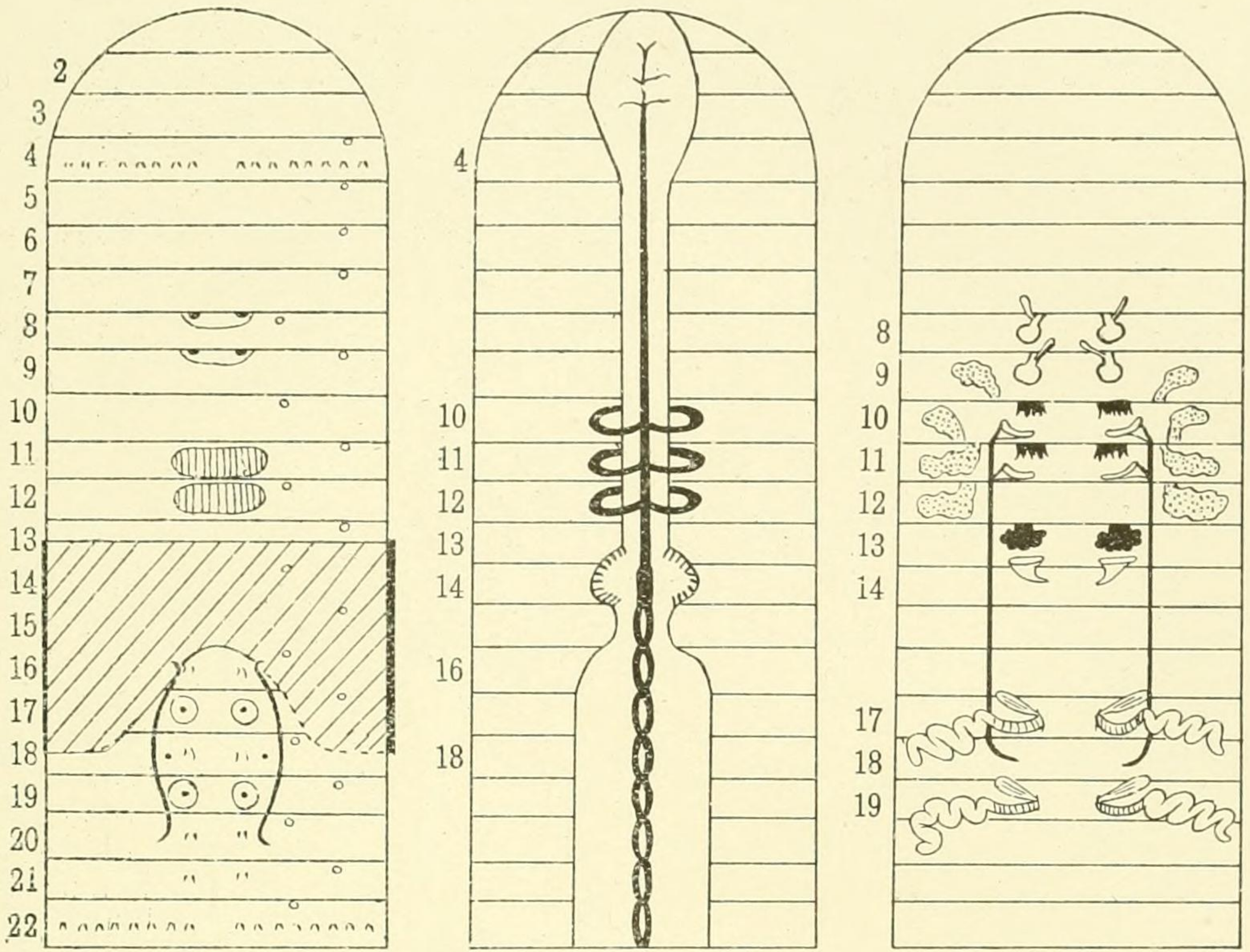
- A. ZEALANDICA, Ashmead, Proc. Linn. Soc. New South Wales, 1900, 329.

Family TENTHREDINIDÆ.

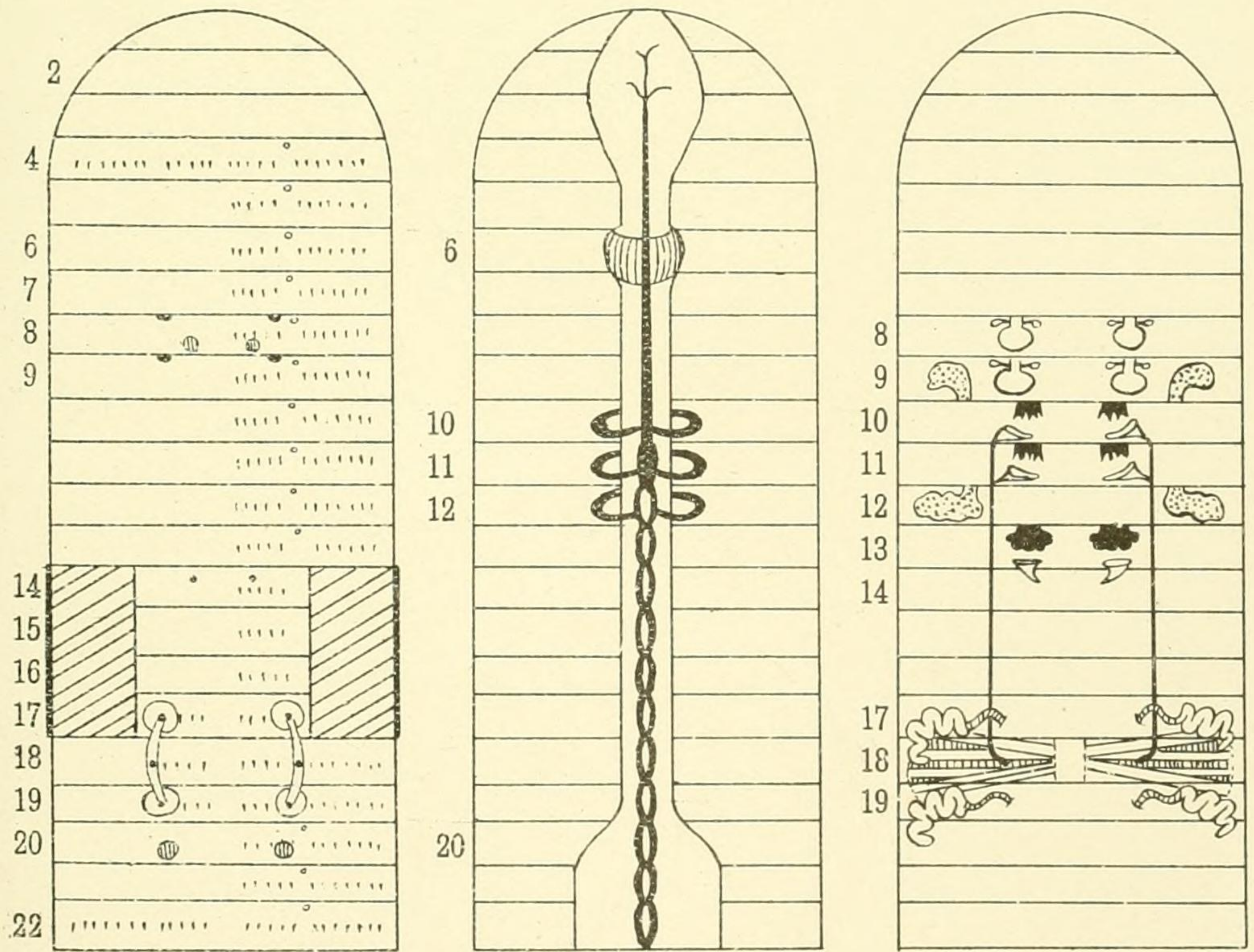
Eriocampa, Hartig.*Eriocampa*, Hartig, Die Fam. der Blattwespen und Holzwespen, 279.

- ERIOCAMPA ADUMBRATA, Klug. *Tenthredo adumbrata*, Klug, Berl. Mag., viii., 64, 36. *Monostigia antipoda*, Kirby, Trans. Ent. Soc., 1881, p. 50.

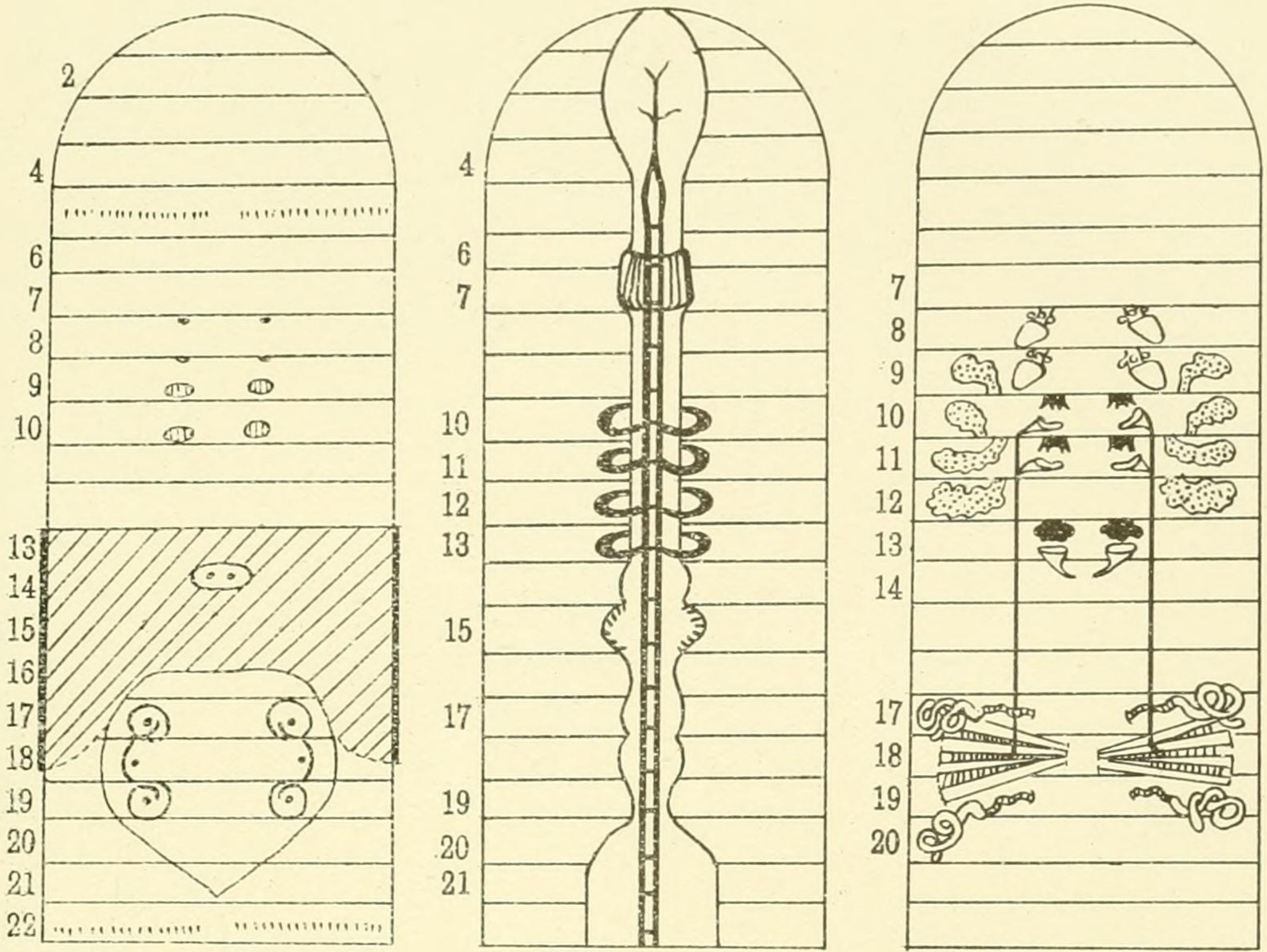
A European introduction.



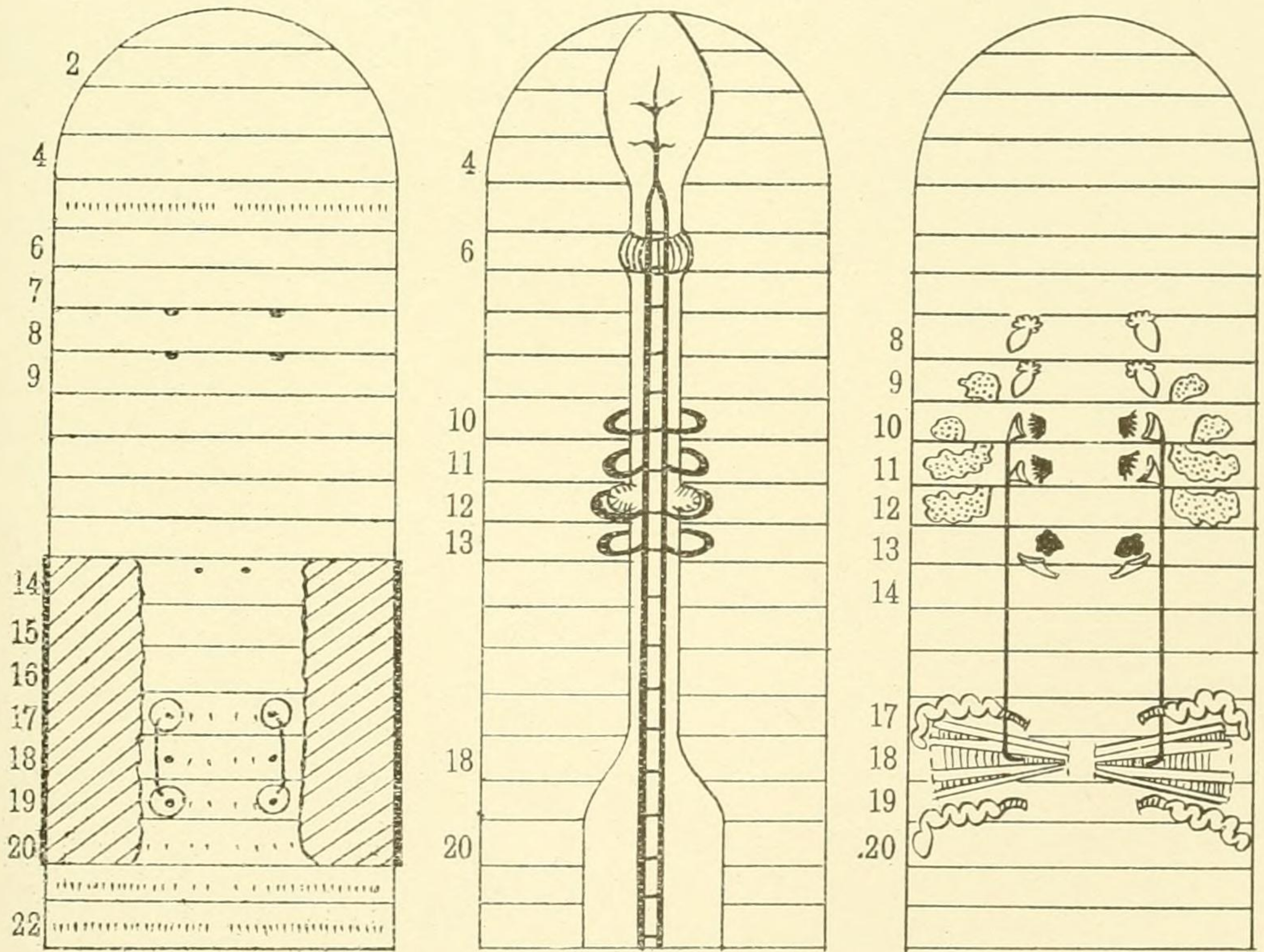
Plagiochaeta sylvestris, Hutton.



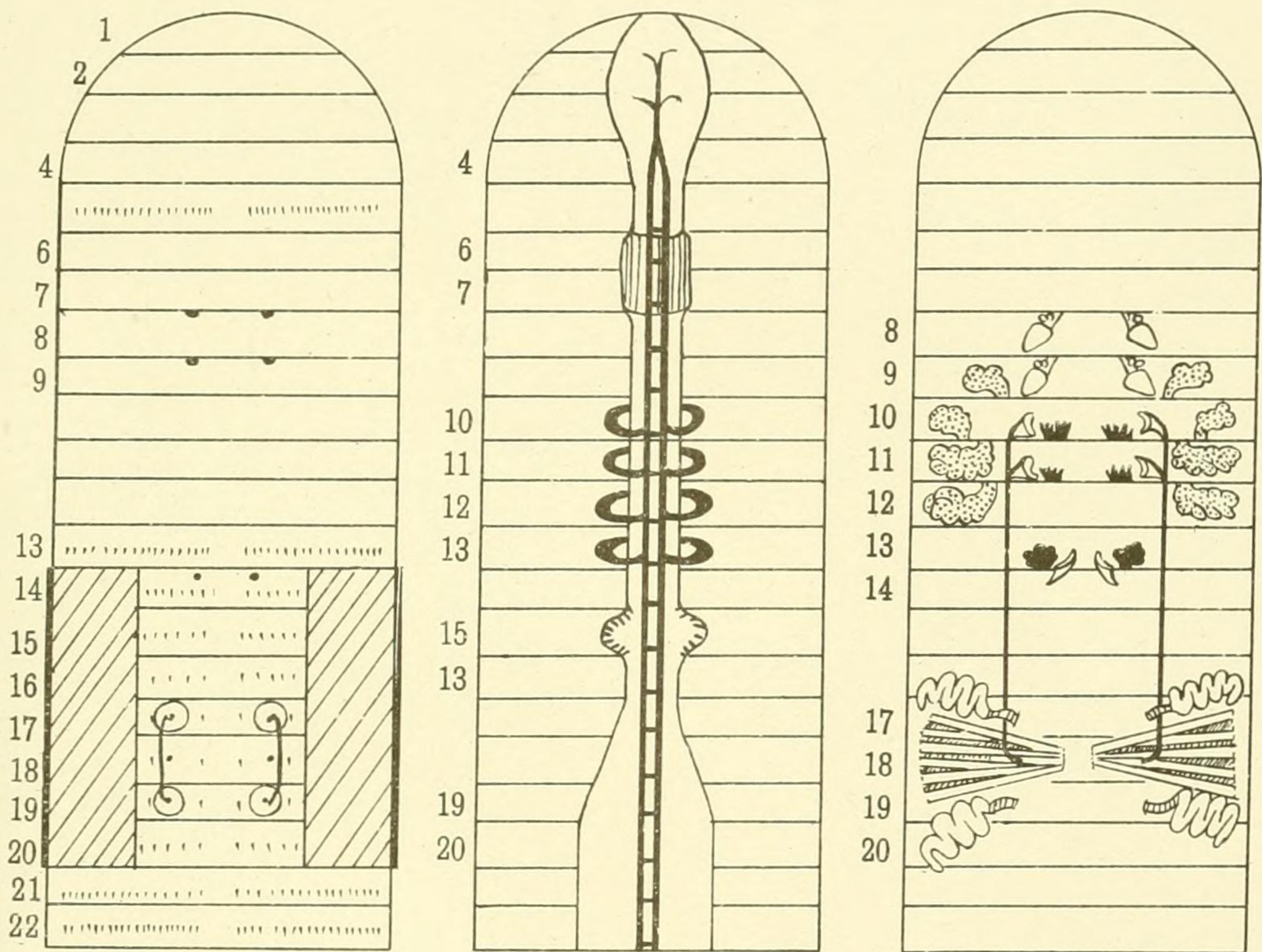
Plagiochaeta lateralis, n. sp.



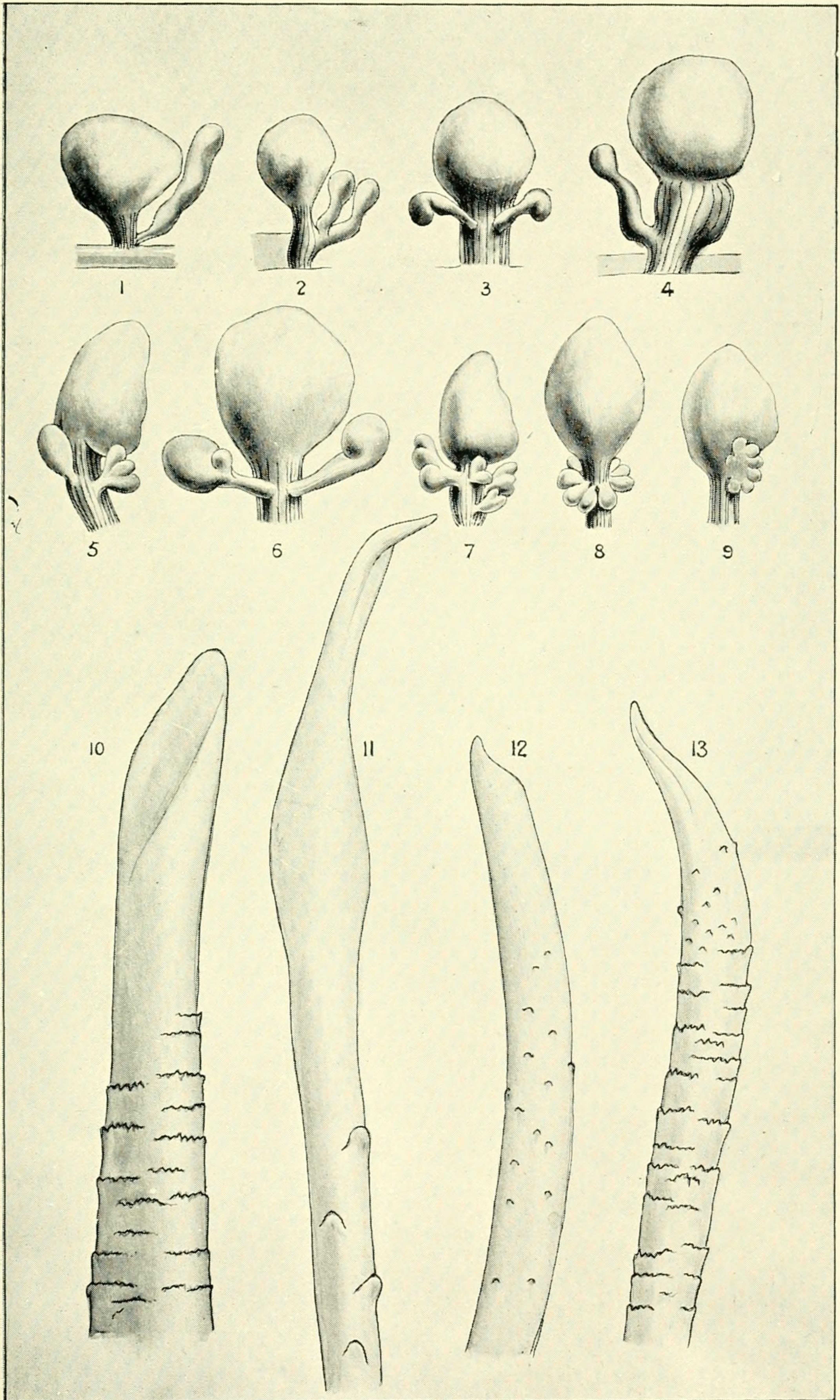
Plagiochæta rossii, n. sp.



Plagiochæta ricardi, n. sp.



Plagiochæta montana, *n. sp.*



Earthworms.—Benham.