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ANATOMICAL STUDIES ON NEW SPECIES OF OCNERODRILUS.

BY GUSTAV EISEN.

The genus Ocnerodrilus appears to be confined to the American continent, where it has a large geographical distribution, at least through the more temperate or tropical regions. The expedition sent out by the California Academy of Sciences to Baja California and Mexico brought home quite a number of earth and water Oligochæta, among others numerous specimens of at least two new species of Ocnerodrilus, for which I here propose the names of *Ocnerodrilus Beddardi*, and *sonoræ*. Other species were found by me in Central America several years ago. New specimens of *Ocnerodrilus occidentalis* have also come to hand from the old and only locality where it has been found to date, and I am able to add some points to our previous knowledge of this worm. Besides these species, another one has lately been described by Beddard, from British Guiana, which in one or two important points differs from those examined by me. Thus there are known in all ten species of Ocnerodrilus, all tropical or semi-tropical in their habits. The systematic position of this genus is a most interesting one, as showing affinities with both the water and with the land Oligochæta, with a closer relationship with the latter. Among these the new genus Gordiodrilus (Beddard) shows the most affinities with our worms. The additional species of Ocnerodrilus which I here describe will necessitate a change in the genus characteristics as lately formulated by Beddard, but will also further verify his remark that both Ocnerodrilus and Gordiodrilus are characterized principally by negative characters.

As regards the characteristics used to define the species a few words may suffice. The genus appears naturally divisible in two distinct groups, one in which the lower part of the sperm ducts (efferent ducts) is enlarged and shuttle-like, and one in which the duct throughout is of even width. The form and size of the spermatheca varies some, but within certain limits it appears constant. They are of the greatest value as species characteristics, especially so the presence or absence of rudimentary diverticula. The lower part of the prostate appears very constant as regards form and relative size. In some species the muscular differentiation has progressed considerably, in others it has hardly begun. It is interesting to note that the three species which belong to the latter class, also show other common characteristics, which bind them together in one group. The relative size and lobation of the septal glands, especially the one in somite v, is of the greatest importance in determining the species, and may be used to the best advantage. The relative size and form of the sperm-sacs, especially those in somite ix and xii, are constant within certain limits, and are species characteristics of no mean value. The relative thickness of the anterior septa is also constant and should be noted. As regards testes, ovary and oviducts, I have not been able to note any great or constant differences. They appear all very much alike, and are all constant in their location. The presence or absence of the setæ in the inner couple of somite xvii may also be used in determining the species. In some species both setæ are absent, in others only one is wanting, and there appears to be a constancy as regards which one of the setæ in the couple. In one species both setæ are present. The clitellum varies to some small extent. It is much shorter in some species than in

others, and may in such cases be used as an exterior characteristic. The interior characteristics are the best and surest. In the present state of our knowledge it can hardly be said that the exterior characteristics are of sufficient prominence to be used for determining the species, except when coupled with interior ones. To the already accustomed eye, almost every species shows certain peculiarities in shape, size and color, that may be useful in assorting the worms, but these peculiarities are not such as may be intelligently described and easily understood.

Ocnerodrilus Beddardi n. sp. Figs. 1, 14, 17, 18, 19, 20, 27, 28, 29, 30, 32, 37, 40, 49, 55, 56, 74.

External characters. The worm varies in length from one and a half to two inches when fully extended. My method to measure these and similar worms is to first kill them in very weak alcohol, a few drops being added to the water from time to time. When the worm is dead, it should be at once taken out of the weak alcohol, straightened out and then placed in a narrow glass tube with strong alcohol. In this manner the undue contraction and bending of the worm is prevented, and the medium contracted length may be measured. *Ocnerodrilus Beddardi* and *O. agricola* are the two longest species of the genus known so far. While their length is nearly double that of the smallest species, *O. occidentalis*, the width of the body is hardly wider than that species. Compared to this form *O. Beddardi* is more tapering towards both head and tail.

The *clitellum* extends from somite xiv to somite xix, encroaching on xiii, and sometimes not quite covering somite xix. It is very much thickened above and on the side, but in the immediate vicinity of the ventral ganglion it entirely disappears. The spermathecal pores,

one pair, are in somite xix. The ovipore, one pair, in xiv. The male pores are in somite xvii. The nephridio-pores open in front of all the ventral setæ. Seen from the exterior the posterior nephridia appear like heavy white masses, entirely filling the somites. The setæ resemble those of the other species of the genus, are not sculptured or bifid. They are present in all the somites except the first. In the inner couple of somite xvii the inner seta is wanting, there being only one seta in the immediate vicinity of the male pore. All the setæ are of equal size and form and distance from each other in each couple. The prostomium is well developed and narrower than in *O. occidentalis*, but of similar form as in most of the other species.

Septa. The septa separating the somites begin between somites iv and v, and continue from there on to the posterior end of the body. In the segments of the clitellum they are much reduced. The septum between iv and v is very thin, the following four septa separating somites v–ix are much thickened, and thicker than those in any of the posterior somites. They increase in size posteriorly in such a way that the septum between somites viii and ix is the thickest of the four, although this septum supports only a very small septal gland. The succeeding four septa are much thinner and about equal to the one between somites iv and v, but thicker than those situated behind the clitellum. The septa between somites v–viii posteriorly, are sparsely covered with small glandulous cells, especially in the region of the œsophagus. A quantity of perigastric cells are seen floating around in all the somites. These cells are round, with granulated contents (fig. 9).

Septal glands (fig. 1, *s. gl.*, 45). Somites v–viii contain septal glands, which in the first four somites (v–

vii), are very large, filling the greater part of the cavity. The gland in somite viii is so much reduced in height that it is readily hidden in the folds of the septum. The anterior gland in somite v is much higher (fig. 45) than the other glands, and extended in the direction of the pharynx which it reaches and (when the worm is contracted) apparently partly overlaps.

The septal glands in somites vi, vii and viii are attached to the septum and the œsophagus. From this central base the gland extends in all directions, completely surrounding the œsophagus, while numerous muscular bands connect it with the body-wall of the next posterior somite. In a transversal section the gland is seen to be a composite one consisting of four or more lobes or parts (fig. 22, *O. occidentalis*), which are connected at œsophagus, but at their outer extremities are free. Each part is grouped around a muscular band, which passes through the gland and at the free apex of the gland passes into another muscular band which takes its origin on the surface of gland. Both pass then as one muscle through the posterior septum and connect with the parietes of the posterior somite.

The muscles of the two larger glands in somite v pass through a whole posterior somite and two septa before connecting with the body-wall. The upper, centrally located, glands in somite v differ from the other glands by being grouped around a pair of muscular bands which head on the pharynx and transversing the glands, penetrate the posterior septum and somite in a way similar to what takes place in the other glands. The effect of this arrangement is such as to cause the posterior glands to be flattened out against the septum, while the anterior gland is stretched out towards the pharynx in the opposite direction (fig. 45). This movement is con-

stantly taking place in the live worm. With every pulsating movement of the vascular system, the septal glands participate, being pulled backwards and forwards and side ways. In longitudinal sections of the worm, the gland in somite v appears as if almost connected with the salivary glands surrounding the pharynx, part of the latter being arranged around the same muscular band (fig. 2, *s. gl. m.*). All these septal glands are attached to the œsophagus and probably empty into it. The contents of the septal gland cells consist of dark irregular sphæroid bodies, almost completely hiding the nuclei and the cell-walls (fig. 6).

Alimentary canal (fig. 1 and 2). There are a buccal region, a pharynx, œsophagus, a tubular region and a sacculated intestine. Gizzard and typhlosole are wanting. The buccal region has very thin walls and is as usual reversible. Posteriorly it connects with the pharynx which is very large and muscular and ends in the end of somite ii. The pharnyx is exceedingly muscular, but developed only on the upper side above the œsophagus. A section through a contracted worm shows the pharynx folded back on itself forming a set of three sinuses of which the middle one is the longest (fig. 2), and the two others of varying length according to the exact region through which the section is made.

This muscular pharynx is supported by a large number of muscular bands, which connect the pharynx with the parietes of the somites iii–vii. The anterior ends of these muscular bands are arranged in three circular rows corresponding to the septal lines, the septa themselves here being wanting. In every such row there are from 3 to 4 pairs of muscular bands. In a longitudinal section one each of these bands comes in view, making 3 appear as upper and 3 as lower ones, while a fourth one

connects the anterior end of the pharynx with the body-wall of somite iv. Two more muscular bands run centrally backwards, around them being grouped the upper septal glands in somite v (fig. 2, *s. gl.*). At the place of attachment to the pharynx these muscular bands are straight and less separable in distinct bands, directly becoming more contractile and wavy before emerging from the pharyngeal region. These muscular bands are partly covered with large salivary glands (fig. 2, *sl. gl.*).

Salivary Glands. While yet in the pharyngeal region the pharyngeal muscles are covered with large salivary glands, in many respects similar to the septal glands already described. The salivary glands are situated in somites iii and iv and partially in ii. They form apparently one connected mass, exteriorly and posteriorly differentiated into a number of broad and narrow lobes, some of which appear to be constant in shape and position, or at least vary but little. On the upper surface of this pharyngeal mass there are thus seen two long narrow glands (fig. 2, *sl. gl.*), one on each side of the median line, and running backwards through somites v, vi and vii. The lobes of the other more lateral salivary glands are broader and more or less multi-lobed. This part may again be distinguished as one lateral and one inferior part, the latter one being the smallest, and, as regards its position, almost resting on the upper part of the œsophagus. Towards the muscular pharynx all these glands diminish in thickness, and in the immediate vicinity of the pharynx proper they are entirely crowded out by the muscular bands which closely cover the pharyngeal surface. On the uppermost part of the pharynx, under the cerebral ganglion, and in front of it another group of salivary glands is seen, but of diminished size. The whole mass of glands and muscles project considerably

beyond the point of the beginning of the œsophagus in somite ii. A beautiful vascular network is interspersed between the muscles and in the glandular mass, originating principally from the lateral vascular trunks coming from the diverticula of the œsophagus. Only with a very strong staining of eosine do these minute vessels become clearly visible (fig. 2, *v*.).

The *œsophagus* consists of a long, comparatively narrow cylindrical duct, beginning at the boundary between somites i and ii, and extending to the diverticula in somite ix. Its inner epithelial walls are much folded. Exteriorly the œsophagus is of even width, neither contracted nor swollen at the septa nor at the place where the diverticula enter it. In *Ocnerodrilus Eiseni*, lately described by Beddard, the œsophagus appear to be considerably enlarged at the junction with the diverticula. In *Ocnerodrilus Rosæ* the swelling is somewhat less, but in other species it is almost entirely wanting. If this character is constant, or if it changes according to the contractions of the worm, remains yet to be seen.

Diverticula of œsophagus. In somite ix the œsophagus is furnished with one pair of diverticula, or pouches resembling the calciferous glands in other genera. These diverticula are found in all the species of the genus, they vary a little in form, and are of various lengths, according to the state of contraction, and are hardly constant enough to be used as species characteristics, although in different species a difference in form may be noticeable.

The pouch in Gordiodrilus which is median and single, differs considerably from the corresponding, but paired, organ in Ocnerodrilus. In the former genus the blood vessels traversing the pouch form a network, or at least anastomose with each other, which is not the case in Ocnerodrilus. In the various species of the genus the

pouch is of the same general structure, and as far as I can see varies only slightly as to form and number of parellel blood vessels. The description given here of the pouch in *Ocnerodrilus Beddardi* may therefore in a general way be applied to those of the other species too, Ocnerodrilus occidentalis has of all species the simplest diverticala furnished with the least number of blood vessels.

The pouch contains only one single room, widest at the middle, or near the middle, and tapering towards both ends, but especially so towards the distal end. But this interior cavity of the pouch does not exactly correspond in form to the exterior form of the organ, which tapers more towards the distal end than the inner cavity does (fig. 12). The wall of the pouch is traversed longitudinally by a number of ridges consisting of blood vessels, which lie close enough to almost touch each other, but which do not anastomose (fig. 20). They collect in the distal end (fig. 20, *c. l. v.)* and emerge as one single vessel *(c. l. v.)*, the lateral vascular blood vessel which longitudinally traverses the body (fig. 1, *l. v)* from the pouch towards the prostomium and somite i. The distal end of the pouch is directed forward and downward, resting heavily on the anterior septum between somites viii and ix, pressing the septum forward. The longitudinal blood vessels originate from a single stout blood vessel in the tubular intestines. This vessel does not appear to emanate directly from the dorsal vessel above it, as I have not been able to see a direct connection, but it comes apparently from a very short sub-dorsal vessel which connects the two hearts in somites x and xi, and which is partially or entirely covered by the intestine. This vessel, first described by Beddard, does not exist in all species, but owing to its fragility it is difficult to determine its presence except in live specimens.

The main vessel in the pouch (fig. 20, *æ. v.*) branches in several parts close to the entrance of the pouch, the various vessels running longitudinally and parallel to the distal end. These vessels group themselves into about six bunches (fig. 20), and throughout the greater length of the pouch the vessels of each branch keep together, forming elevated, longitudinal and parallel ridges, which encroach on the upper but especially on the inner surface of the pouch. On the inner surface these ridges are prominent and sometimes so large as to almost divide the pouch in several parallel chambers. No such division takes place, however, the inner large cavity being only one. At the distal end these ridges come together, and the inner cavity ends between them in various narrow sinuses, one each between two ridges (figs. 19 and 12). These sinuses continue forward and again unite with an inner system of lacunary cavities (fig. 12, *i. l.*) very much as is the case in the pouch of Gordiodrilus, as described by Beddard. In that genus these cavities connect with the nephridium through a narrow tube. In none of the sections I made of Ocnerodrilus could I find with certainty a similar arrangement, but I am strongly inclined to believe that one really exists, as close to the concave side of the outer wall of the pouch I frequently found a comparatively broad tube with a clear and large, glandulous lumen which seemed to end on the outside of the pouch near its distal end, just opposite to where the inner cavities begin. A possible connection with the nephridium I could not establish. The inner lining of the pouch is ciliated and very thin. It is strongly striated, consisting of flattened cells with round nuclei. This striation is also seen in the lining of the inter-lacunary cavities, but not in the inter-vascular tissues in which the blood vessels are imbedded. The nuclei are of the same form

in the lining epithelium as in the inter-vascular cell tissue. As in Gordiodrilus, the nuclei are less in number than the cells and of unusually large size for so narrow cells. At the entrance of the narrow part connecting the pouch with the tubular intestine the epithelial lining is thicker than in the main cavity of the pouch. In one specimen the left pouch was forked and a lateral vascular trunk issued from each pouch, but on account of the nature of the section I could not follow its course forward.

The pouch is supported by a heavy muscular band which attaches to the center of the convex or outer part of the pouch and thence runs through the posterior septum connecting with the parietes of somite x.

The position of the pouch on somite ix appears entirely constant, none of the 10 species known differing in this respect. With the pulsating of the bloodvessels the pouch expands or contracts following the same beat as the hearts. In alcoholic specimens the pouch may be more or less contracted in the same species. There is no gizzard and no typhlosole.

The tubular intestine which extends from the pouch in somite ix to the sacculated intestine in the xii resembles (fig. 19), greatly the œsophagus in form. It is tubular, neither wider nor narrower and its inner epithelial lining is strongly ciliated. At the junction with the sacculated intestine it is sometimes slightly contracted, but there is no real narrowing of the tube as indicated in Beddard's figure of *Ocnerodrilus Eiseni*, nor is there any swelling at the junction of the diverticula as in that species. The vessel furnishing the blood for the diverticula first enters the tubular intestine from the hearts.

In *O. Rosæ* the œsophagus and tubular intestine are much nipped by the septa and enlarged at the diverticulum entrance, more so than in most other species, but not to

the extent that it is figured by Beddard in the species described by him. The narrowing or swelling may be to some extent the result of contraction, but it appears at least to be partially a character of the species, as some species do not show it, even in a series of specimens.

The sacculated intestine commences with somite xii (fig. 1, *s. i.*). It is wider in this somite than anywhere else. In the following clitellial somites the swellings are are smaller and in those posterior to somite xix it has reached its normal form, only gradually diminishing towards the caudal end (fig. 1). The muscles supporting the sacculated intestine and connecting it with the parietes start half way between the septa. Upon the strength and size of these muscles depend the greater or smaller sacculation of the intestine.

Vascular System. There are two primary longitudinal vessels, extending from one end of the body to the other. The dorsal pulsating vessel and the ventral non-pulsating vessel (fig. 1, *d. v.* and *v. v.*). These vessels are connected in the usual way in somite ii, and in the posterior somite, forming respectively the pharyngeal and caudal commissure.

In somites x and xi these two vessels are also connected by secondary vessels, forming one pair of hearts in each of the above somites. These hearts are the most prominent features of the vascular system, whether the worm is alive or cut up in sections. The two pairs are alike. Emanating in the posterior part of the somite, they form large sack-like vessels, especially wide and sack-like close to the dorsal vessel, and tapering downwards to the junction with the ventral vessel. These hearts are strongly pulsating, expanding and contracting in harmony with the dorsal vessel and the vessels of the pouch.

In somites x and xi these hearts are connected by a sub-dorsal vessel, which enters the tubular intestine probably in somite xi, and in somite ix passes directly into the diverticulum of the tubular intestine.

Except through these four hearts the two vascular trunks do not directly connect in the central somites. The ventral vessel emits one pair of secondary non-connecting vessels in each somite. A corresponding non-connecting vessel (figs. 1 and 30) is also emitted by the dorsal vessel in all the somites except ix, x and xi. In the latter two somites they are replaced by hearts. This secondary dorsal vessel is emitted in the posterior portion of the somite, close to the septum. It runs at once straight out through the body cavity, in almost right angles with the dorsal vessel, until it strikes the body wall, where it branches and forms a dermal system, especially developed in the inferior part of the body, sending out ramifications which extend along the longitudinal muscular layer below the neural ganglion, but which do not connect or form any sub-neural longitudinal system (fig. 30), all the vessels being strictly transversal. In somites x and xi these transversal vessels have been replaced by the hearts.

In somite ix one pair of lateral blood vessels pass from the sub-dorsal vessel and the hearts through the diverticula forming the lateral trunks (fig. 1, *lv.*), which extend forward on either side of the worm to the peristomic region. In each of somites v to viii, each one of these trunks sends out one secondary vessel, which enters the septal glands in the somite (figs. 1 and 2), and one vessel which supplies the dermal and sub-dermal parts of the somite. The main lateral trunk is branched in somite v or vi, one branch going forward and upward, supplying the prostomic and peristomic regions, while the other branch furnishes the pharyngeal glands and muscles with the

necessary blood. In the anterior somites these trunks branch repeatedly, forming in somite i and in the anterior part of somite ii a perfect network of capillary blood-vessels, which connect with the capillaries from the dorsal and ventral vessels, both above and below the pharynx and œsophagus. The vessel supplying the œsophageal diverticulum branches in the organ into numerous parallel vessels, which again collect into one trunk, as has been already mentioned. There are no dark epithelial pigment cells on any of the vessels, but the muscular part of the dorsal vessel and of the hearts is thick.

The ventral main longitudinal vessel emits one secondary vessel in each somite (fig. 30, *l. v. v.*). This vessel starts out anteriorly to the dorsal secondary vessel (fig. 30, *l. d. v.*), and is parallel to the latter. It branches as soon as it reaches the body-wall into two distinct trunks, one smaller descending, and one larger ascending. The former one is very short, and extends, with branches, below the neural-ganglion, but does not anastomose with the vessels from the dorsal branch. The ascending branch again divides in two parallel branches, which closely follow the parietes and again branch, forming a wide meshed capillary network on the dorsal side of the body-wall. This secondary ventral vessel is present in all the somites, even in ix, x and xi. The secondary branches of the dorsal and vental vessels are of about equal length and thickness, but the branch from the ventral vessel is much more branched than the dorsal secondary vessel, which is almost entire, and even in the ventral region emits few branches. A similar arrangement is found in Sparganophilus, lately described by Benham. (Quart. Journal Micr, Sc., Nov., 1892.)

These secondary vessels are similar in the various species, except in *Ocnerodrilus limicola* and *Hendriei*, in

which species the dorsal secondary vessel in somite ix is transformed to a connecting vessel between the ventral and dorsal vessel, similar to a heart (figs. 31 and 38, *c. vl.*) but of less thickness and more cylindrical throughout its length. A gastric secondary vessel supplies the saccu-lated intestine. It leaves the dorsal vessel anteriorly to the other branches almost in the center of the somite, or half-way between the septa. It develops into a large gastric system, especially prominent in the somites of the clitellum.

There are no blood-vessels on the nephridia.

The septal glands are furnished liberally with blood-vessels, emanating in each somite from the lateral vas-cular trunks (fig. 1, *v.*). As will be seen, the vascular system in Ocnerodrilus resembles greatly that of Gordio-drilus, especially in having the dorsal and ventral vessels only connected in somites x and xi (or in ix, x and xi).

Nephridia. The nephridia are present in all the somites, commencing with somite iv. The anterior four nephridia are very small, degenerate, devoid of or with very few peritoneal cells. The nephridium in somite iv is the smallest, the one in the vi is larger and the one in somite viii the largest of all the anterior nephridia. The nephridium in somite ix is always very large and fur-nished with copious masses of peritoneal cells. This may possibly be in some way dependent upon the supposed connection between this nephridium and the diverticulum in this somite.

The nephridia in somites x and xi are smaller, some-what degenerate, but not to the extent as described by Beddard in *O. Eiseni*, but still covered with peritoneal cells which stain differently from the surrounding sperm-sacs. The nephridia posterior to somite xii are all cov-ered with peritoneal cells. They rather increase in size

towards the caudal end, the largest nephridia being found a comparatively short distance from the tail end (figs. 5, 10, 14). The size and quality of these peritoneal cells vary considerably in different specimens; sometimes they are perfectly transparent with no dark cell contents, at other times they are so filled with a granulated mass or sections that the nuclei are not visible. Quite frequently the anterior nephridia show some peritoneal cells, the anterior ones always less than those in somite viii which nearly always possesses a few of them. As has been already stated the nephridia in somite ix show a large mass of peritoneal opaque cells as many as any of the largest nephridia behind the clitellum. This is not the case in all species. For instance, in *Ocnerodrilus Rosæ* the nephridium in somite ix is entirely destitute of peritoneal cells. Still this nephridium is larger than any of the nephridia anterior to the clitellum (fig. 23, *n. ph.*).

The upper part of each nephridium contains the greatest quantity of peritoneal cells. In the middle part the number diminishes, again increasing in the part nearest the nephridio pore. These pores open between the setæ and the anterior septum in line with the inner row of setæ. In the lower part of the nephridium the peritoneal cells cover the canal on one side, while in the upper part the canal is entirely hidden by the cells. From the outside the nephridia appear like very large whitish masses almost entirely filling the somites. The quantity of peritoneal cells vary in different species. In some, as in *Ocnerodrilus occidentalis*, the peritoneal cells even in the posterior nephridia are comparatively few.

Testes. There are two pair of testes, one in somite x and one in xi. This being the rule in most species. They are attached to the ventral side of the anterior septum against which they are generally pressed flat.

The testes in somite x are much more lobed than those in somite xi the latter being entire or heart-shaped while the former are multi-lobed.

While this appears to be rather constant, I do not think any great specific value should be placed on the shape of the testes, the lobes varying in form and number (fig. 3 and 4).

Sperm-sacs (fig. 1, *ssl.* and *ss.*). There are two constant and two pairs of variable sperm-sacs. The constant sperm-sacs are found in somites ix and xii; the variable ones in x and xi. These latter sperm-sacs vary much as regards their size. All the sacs are situated principally in the upper part of the body. The sperm-sacs in somites x and xi are connected, but those in ix and xii appear entirely isolated, neither connected with the other sacs or with each other.

The sperm-sac in somite ix, consists of a heavy globular mass attached to the posterior septum, between somites ix and x above the œsophagus. It is lobed, there being at least four or six large lobes and several smaller ones. It is connected by very narrow tubes following the septum, with the testes in somite x. The sperm-sac in somite xii is of a different and very characteristic shape. It is much lobed and covers the upper and front part of the sacculated intestine in this somite like a well-fitting collar. It is attached to the anterior septum separating somites xi and xii. The lobing of these sperm-sacs is much greater than those in the somite ix. These sperm-sacs are not connected with those in somite x and xi. The latter sperm-sacs are entire, not lobed. They are only present in very mature worms and are of variable size. When fully developed they fill the larger part of these somites, which are besides crowded by the hearts, testes, ciliated rosettes, etc., found in them. The presence or

absence, relative size or form, of the sperm-sacs in somites ix and xii appear to afford good species characters. In *Ocnerodrilus occidentalis* they are entirely wanting in somites ix and xii. In the other species described here as new these sperm-sacs are present, their lobation at least in its general traits, being characteristic of the species.

Sperm duct and *ciliated rosette.* There are two pairs of ciliated rosettes, one pair in somite x and one pair in xi, corresponding to the testes (fig. 18). The rosettes are placed behind and close to the testes, and their structure offers nothing unusual. They resemble each other in all the species, are very large and delicate, spreading over the lower parts of the hearts, but free of the septa. The inner cells are large rectangular, with large oval nuclei and long cilia. The sperm ducts pass backwards and unite imperfectly with each other in somite xi or xii, and continue from that on as one duct to somite xvii, where are situated the male or spermiducal papillæ, and in which also opens the prostate gland (or atrium). The sperm ducts are closely following the body wall, do not run straight, but in a wavy, snake-like way, but are not coiled. (In fig. 1 they are represented as straight in order to make the fig. clearer.) The male papillæ, of which there is one pair, occupy the same place as the inner setæ in the respective somites. There is only one seta left, the other, the outer one, being abortive. The single remaining seta is not differentiated. In three of the species, the penial setæ are wanting, while in *Ocnerodrilus occidentalis* and other species they are either both present or one is wanting. The sperm ducts which in some species are enlarged in the vicinity of the male pore, are in this species of even width throughout their length. The ducts are only imperfectly joined.

While forming one single tube as far as their outward form is concerned, they still remain separated, the ciliated lumen of each being readily visible even close to the papillæ (fig. 57). The absence or presence of a enlarged and differentiated lower part of the sperm ducts is of the greatest importance as a species characteristic. A similar modification of the sperm duct is found in Pygmæodrilus. The *prostate gland* is smaller than in most other species, except in *Ocnerodrilus guatemalæ*. In *Ocnerodrilus occidentalis* it passes from somite xvii to xxiv, or further yet; but in *Ocnerodrilus Beddardi* it occupies only two or three somites, and in *Ocnerodrilus guatemalæ* only one. It is bent several times on itself (in this there is no constancy) and ascends first upward. The inner epithelial lining consists of only one layer of tubular cells similar as in the other species and as in Gordiodrilus.

There exists in the prostates of the various species two more or less differentiated parts. Generally there is an upper only glandular part and a lower part which is muscular and which connects with the male pore. In these species, *Ocnerodrilus sonoræ* and *guatemalæ*, this lower part is much less differentiated, containing tubular glandulous cells, and this part of the prostate differs only in the addition of two muscular layers. In the other species the muscular part of the prostate is much differentiated and entirely void of the tubular glandulous cells, so characteristic of the upper part of the prostate in all the species.

In *Ocnerodrilus Beddardi* the lower part of the prostate is narrower, slightly tapering towards the purely glandular part (fig. 55). In *O. sonoræ* (fig. 59) the lower muscular part is thicker than the upper glandular part, gradually decreasing in size towards the distal end. The prostate of *O. guatemalæ* is only half as long and about one-third

or one-fourth as wide as this organ in any of the other species and very characteristic in appearance (figs. 65 and 66). At the apex of the male papilla there is a small gland without any visible lumen.

The *ovary* is situated in somite xiii, as is generally the case in Oligochætæ. It is attached to the anterior septum. The disposition of the ova is the general one, the larger ones being on and towards the outside and upper margins of the ovary with the smallest ones further in. The ovary is pressed close to the parietes of body.

The *oviduct* consists of one pair of trumpet-shaped organs in somite xiv, one for each ovary. The ovipore is situated in this somite, opening outwardly in front of the inner setæ. The interior funnel opens into somite xiii, in close proximity to the ovary, and is engaged in the septum between somite xiii and xiv. It offers no great peculiarities in its structure, but is more rounded than in *Ocnerodrilus occidentalis* (fig. 17).

The *spermathecæ* (fig. 1, 27, 28, 29) consist of one pair of flask or club-like bodies, situated in somite ix, opening externally behind the anterior septum in the intersegmental groove between that septum and the viii. The shape is flask or club-like, thickest at the inner free end, gradually tapering towards the spermathecal pore. It is narrowed at the middle and furnished with a varying number of diverticula, from two to six. These diverticula are short, of various length, but never as long as the width of the spermatheca at the point of attachment. The smallest ones are wartlike. They are mostly situated at the upper broader end of the organ, and rarely more than one is found further down. In the diverticula the spermatozoa are seen massed. The inner lining of the spermatheca consists of tubular cells, which in cross-section appear circular, with large round nuclei. The

outer lining is very thin, with few nuclei. The lower part of the spermatheca is muscular, and appears to be constructed as in Gordiodrilus. There are a few minute oblong glands at the base of the spermatheca, at its junction with the body wall. The external spermathecal papilla is, at full maturity, quite large and prominent. The form and existence of the spermathecæ offer important characteristics of specific value. In *Ocnerodrilus Beddardi* and *limicola* there are small diverticula. In *O. agricola*, *O. Rosæ*, etc., the spermatheca is round, or cylindrical, with no diverticula, while in *Ocnerodrilus occidentalis* the spermathecæ are entirely wanting. In all the species examined by me the spermathecal porus is situated in somite ix, but in the species described by Beddard the porus, as well as the organ itself, appears to be in somite viii.* The structure of the spermathecæ in the various species is very much the same; in *O. sonoræ* the muscular part is wanting.

The *spermatozoa* are found with moderately long, straight, not wavy or screw like, tails.

Nervous system. The chephalic ganglion is about four times broader than high, emitting a large, generally three-forked branch, towards the prostomium. A network of bloodvessels emanating from the upper branches of the lateral vascular trunks and from the dorsal vessel, is spread over the cephalic ganglion in a way similar to what is found in *Ocnerodrilus occidentalis*. The ventral ganglion emits one pair of lateral ganglia in each somite. The pharyngeal plexus emits one pair of ganglia upwards to the pharynx, and one pair laterally towards the body wall.

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* There is some uncertainty as to its location. Beddard says once that it is found in somite ix, while three or four times the statement reads in viii. The former probably is a misprint.

Ocnerodrilus guatemalæ *n. sp.* Fig. 61, 62, 63, 64, 65, 66, 76.

The *clitellum* is small from somite xiv to xviii. The body is long, slender, of even thickness throughout, with a glossy lustre, and of dark opaque brown when preserved in alcohol. In this it differs from *O. agricola*, which always preserves its light and semi-transparent color. The size is about one and a fourth inch by three-fourths line long, of course with some variations. It is one of the longer and slender worms.

The septal gland in somite v is almost twice as long as the one in somite vi. It is deeply lobed; this is also the case with the other glands. The size of the anterior gland is very characteristic. The gland in somite vii is much smaller, and resembles, in its proportions to the surrounding glands, those of *Ocnerodrilus Hendriei*, from which it, however, differs in the lobing of the glands. In *O. Hendriei* they are almost entire, while in the present form they are deeply lobed. The glands in vii and viii are small, of almost equal size, but the one in vii, as usual, is the smallest of the four.

The *spermatheca* is very small, the smallest found in any species. In fully matured specimens the height of the spermatheca is not quite equal to the width of the œsophageal diverticulum. The form is very much like that of *O. sonoræ*, but the size is even smaller, and as it is generally lying flat against the parietes, it may be easily overlooked. The lower part of the spermatheca is narrower than the corresponding part in *O. sonoræ*, and the whole organ is darker and more opaque. There is only a trace of diverticula, the wall being slightly sacculated. This species stands near *O. Beddardi*, *sonoræ* and *Hendriei*, but its characters appear very constant, in specimens collected several hundred miles apart, and I do not hesitate to classify it a well-defined species.

The *prostate gland* is one of the most characteristic parts of this species, but unhappily all the specimens were considerably macerated, and the finer structure could not be made out. Specimens from Tamaju, in the highlands of Coban, showed the same characteristics as the specimens from Guatemala city, and I believe the form and size of the prostate constant. In structure the prostate gland agrees with the same organ in *O. Beddardi*, *sonoræ* and *Hendriei*, but in size it is quite distinct, being even smaller than the prostate in *O. Hendriei*. At the male papilla it is only about four times as wide as the width of the seta, and at the inner apex it attains double that size. It gradually increases in size from the male pore, but still it is very slender, and compared to the prostate of *O. Beddardi*, is not half as long and less than one-third as thick. It is entirely confined to one somite. The structure appears to resemble that of *O. Beddardi*, the lower or narrower part being furnished with tubular glands, resembling those of the upper muscular part only smaller.

There is a seta close to the male pore. The outer one in the pair is wanting. In this it differs from *O. Beddardi*, in which the inner seta of the couple is wanting, but resembles *O. sonoræ*. It also differs in this respect from *O. Hendriei*, in which species both setæ of the inner couple in somite xvii are wanting. There is no enlargement of the sperm duct at the male pore.

Habitat. In garden soils in the city of Guatemala, Central America, April, 1882. Also at Tamaju, on the river Polochic, on the Atlantic side of the same republic. In Guatemala city it occurred in the same locality as *O. agricola*, but was found about a month later. It is a real soil species, and I never found it in wet places.

Ocnerodrilus sonoræ, *n. sp.* Fig. 57, 58, 59, 60, 71, 73, 75.

This species comes nearest *Ocnerodrilus Beddardi*, *guatemalæ* and *Hendriei*. Some ten specimens collected agreed in the following characteristics:

The *septal gland* in somite v is of almost the same size as the one in somite vi and this one again is only little larger than the one in vii. The septal gland in somite viii is higher than in *O. Beddardi* and is only little smaller than the gland in somite vii. All the glands are less lobed than in *O. Beddardi*.

The *spermatheca* (fig. 71, *spth.*), is of about one-half the size as in *O. Beddardi*, almost bag-like, very much flattened and with no trace of diverticula. There is no differentiated muscular part of the lower portion of the organ, the whole being of the same structure. The spermatheca is about as long as the diverticulum is wide. It is very transparent, and shows much smaller and more irregular cells than the same organ of *O. Beddardi*.

The *sperm-sac* (fig. 71, *s. s.*), in somite ix is large and somewhat lobed. The sperm-sac in somite x is the smallest of the four. The one in xi is larger, but not as large as the one in ix. The sperm-sac in somite xii is very large, much larger than the others. It is lobed and fills the whole of the somite. In no other species is the sperm-sac in somite xii of such size; the size appears to be constant.

The *sperm duct* has no enlargement at the male pore.

The *prostate* is short as in *O. Beddardi*, but it is more cylindrical and the muscular part is not tapering toward the glandular part, but on the contrary the prostate is gradually increasing in size from the inner apex towards the male pore, and the muscular part is in no way differentiated as regard outline. This I consider a good species characteristic of small variability. The prostate is

much twisted and confined to two somites. In the inner couple of setæ in somite xvii the outer seta is wanting.

The *œsophagus* is greatly nipped by the septa, is much sacculated and is wider than in any of the other species. The *clitellum* is very short comprising xiv, xv, xvi, xvii, as in *O. agricola*.

The most characteristic features of *Ocnerodrilus sonoræ* are: the very large sperm-sac in xii; the sacculated œsophagus; the form and size of the spermatheca.

Habitat. In moist soil near irrigation canals in San Miguel de Horcasitas, Sonora, Mexico. As *Ocnerodrilus Beddardi* appears to be confined to the Cape region of Baja California in the vicinity of San José del Cabo, so is *O. sonoræ* to date only found on the mainland of Sonora, Mexico.

Ocnerodrilus Hendriei, *n. sp.* Fig. 38, 39, 72, 77, 83.

Clitellum begins at the center of xiii and extends to center of xviii, thus comprising four whole and two half somites.

Size of worm about 1½ inches by ¾ line.

Spermathecal pore in somite ix as usual.

Ovipore in xiv and *spermiducal pore* in xvii as usual.

The inner couple of the setæ in somite xvii is wanting.

The *septal glands* differ from those of other species described in this paper. The anterior one in somite v is large, much larger than the one in somite vi. This again is much larger than the one in somite vii which again is of nearly the size as the one in somite viii, both being very small. The characteristic points in these glands are thus the unusually small size of the two posterior glands in somite vii and viii or in fact the comparatively small size of the three posterier glands compared to the anterior gland in somite v, this gland being

of about the same size as in other species. As regards the lobing of the glands, it resembles that of *O. Rosæ*, that is the glands are almost entire, but the relative size of the gland is very different from what is the case in that species. In *O. Rosæ* the gland in somite vii is much larger than the one in somite viii while it is of nearly the same size as the one in somite vi. From *Ocnerodrilus guatemalæ* which this species resembles perhaps more than any other, it is distinguished by more entire septal glands, by a smaller spermatheca, etc.

The *sepermatheca* is very small, about as long as the diverticulum of the œsophagus is wide. It is contracted on two places and greatly resembles the same organ in *O. limicola*.

The *sperm-sacs* occur in ix, x, xi, xii. The one in somite ix, as usual, situated principally above the diverticulum, is very large, filling the whole of the upper part of the somite. It is entire, not lobed. The sperm-sacs in x are smaller, or even absent, but the one in vi is again very large, occupying a large part of the respective segment. The one in xii is situated as in the other species, and is deeply lobed, but as regards size is much smaller than the one in somite xi. In *O. sonoræ* the sperm-sac in somite xii is very large.

The *prostate gland* is short, running through about two somites. The muscular part is very small and the lower part of the sperm duct is not enlarged. The specimen being much macerated, I am not able to give a very accurate description of these organs. There is a very small zone around the male pore, partly extending ventrally. The inner couple of setæ in somite xvii is wanting (fig. 72).

As regards the size of the prostate, *O. Hendriei* and *guatemalæ* resemble each other more than they do other

species. *O. Hendriei* has the largest prostate of the two, about as large again as the one in *O. guatemalæ* (fig. 65, 66 and 83).

The *vascular system* resembles that of *Ocnerodrilus limicola*, and there is a large connecting vessel, evidently a pulsating one, in somite ix, just behind the diverticulum of the œsophagus. But this vessel is larger than in *O. limicola*, and partakes in shape and size of the nature of a heart, much resembling the one in the somite posterior to it.

Habitat. Santo Tomas, Guatemala, Central America, between Salama and Coban, on the road after a rain.

Ocnerodrilus limicola, *n. sp.* Fig. 31, 35, 47, 53, 78.

The *Clitellum* comprises at least five somites, extending from xiv to xviii, and encroaching on somites xiii and xix.

Spermathecal pore in somite ix, as usual, in the groove between that and somite viii.

Ovipore in somite xiv.

Male or *spermiducal papillæ* one pair in somite xvii, and a pair of prostate papillæ in somite xviii. The zone surrounding the papillæ is small, and does not extend across the ventral region, as in *O. agricola*.

The *septal glands* are in somites v to viii, as usual. The anterior three glands are the largest, of nearly equal size, but the one in somite v is slightly longer. All the glands are characterized by being much more deeply lobed than in any other species, even more so than in *O. Beddardi* and *guatemalæ*. The posterior gland in somite viii is, as generally, the smallest.

Spermathecæ (fig. 31-35, *s. spth.*) one pair in somite ix. This organ is smaller in this species than in any of the other which possess spermathecæ, except *O. guate-*

malæ. The form is irregular, cylindrical, contracted in several places, and with a few only slightly elevated or wart-like diverticula, hardly differentiated from the main pouch. In general appearance it comes nearest to that of *O. Beddardi*, but it is smaller, and the diverticula are less prominent.

The *testes* are in somites x and xi, and offer no peculiarities. The *sperm-sacs* are very large, and always fill the somites ix to xii. The sperm-sac in somite ix is situated as in *O. Beddardi* and *O. agricola*. It is deeply lobed as in these species. The sperm-sacs in somite xii are similarly situated and lobed as in the species just referred to. *Ovary* and *oviduct*, as usual, respectively in somites xiii and xiv.

The *clitellum* does not show the peculiar zone around the male pore as in *O. agricola*, and the male papilla is very small and not prominent.

The inner pair of setæ in somite xvii is wanting, similarly as in *O. agricola*, *Hendrici*, etc.

While all other species contain only one pair of prostate glands, *O. limicola* possesses two pair, one in somite xvii and one in xviii. The one in somite xvii opens in the male pore, together with the sperm duct. In *Gordiodrilus robustus*, as lately described by Beddard, there are two prostates on each side opening in two consecutive somites, but only one pair of sperm ducts, both sperm ducts opening in one pore. The prostate itself is unusually narrow at the distant end, thicker at the middle, and then again gradually tapering towards the muscular part. This muscular part is narrowest close to the glandular part, from which it gradually increases in size towards the male pore (fig. 53).

The sperm ducts are not enlarged close to the pore, as in at least three other species, *O. agricola*, *Rosæ* and *contractus*.

The inner couple of the setæ in somite xvii, close to the male pore, is generally full, though in some specimens there was only one seta. The pair in xviii is also present.

A most important characteristic of the species is a connecting secondary vessel in somite ix. In other species, except *O. Hendriei*, so far known, the two pair of hearts in somites x and xi are the only four secondary vessels which connect the dorsal and ventral vessels. But in *O. limicola* we find one pair of large vessels in the posterior part of somite ix, just behind the diverticulum, which connects the two main vessels. This connecting pair is cylindrical of almost even width, and evidently does not pulsate, or pulsates only weakly, judging from its appearance in preserved specimens (fig. 31, *c. v*).

In size *Ocnerodrilus limicola* stands between *O. Beddardi* and *O. agricola*. It is decidedly smaller than *agricola*, especially as regards the part anterior to the clitellum. Too much importance must not be placed on the size of any of the species, as they vary considerably, and the smaller individuals are equally sexually developed as the larger specimens.

Habitat. This worm I found in a clear running millrace and pond at El Portal, a hacienda close to Antigua Guatemala, in Guatemala, Central America. It appears to be strictly a water species as I did not find it in the drier soil outside of the pond. All the other species hitherto known either live both in water and in drier soil, or in soil only, and must be considered as semi-aquatic or terrestrial.

Ocnerodrilus Eiseni Beddard.

This worm lately described by Beddard differs, according to that author, from the other species as regards the following points: *Clitellum* extends from somites xiii to

xviii, and does not encroach on the adjoining somites. Such distinct clitellum is not possessed by the other species, in all of which the clitellum encroaches on the adjoining somites. The inner pair of *setæ* in somite xvii is wanting entirely. In this respect this species differs from many other species, except *O. agricola*, *Hendriei* and *contractus*, which all possess this characteristic.

Spermathecal pore between somites vii and viii, and the *spermathecæ* in somite viii, are smaller than the spermathecæ in *O. agricola*. All other species possessing spermathecæ have this organ (one pair) situated in somite ix. No spermathecal diverticula. *Ovipore* in xiv and *oviduct* in the same somite, opening with the funnel in xiii behind the ovary. No enlargement of the sperm duct close to the male pore. Prostate with a long, narrow, muscular tube.

Buccal cavity extends through three somites and the pharynx to the fifth, as in other species. The buccal cavity of all species examined by me appears shorter, though the want of septa makes the limits uncertain.

The *œsophagus* is widened at the junction of the diverticula, which is not the case in the other species, at least not to the same extent. The ciliated tubular intestine is narrower than the œsophagus, and differs in this from other species, all of which have the œsophagus and tubular intestine of more or less the same width.

Nephridia degenerate in somites x and xi, as is the case to a greater or lesser degree in other species, and the posterior nephridia are enveloped in large peritoneal cells.

Testes in somites x and xi.

Habitat in soil, not in water.

As will be seen from the above characteristics this species differs from all others in having the spermathecæ in somite viii. It undoubtedly comes nearest to *O. agri-*

cola, the spermathecæ of the two species being of the same general form, but much larger in *O. agricola*. The clitellum in the latter species is also the smallest.

Ocnerodrilus Rosæ, *n. sp.* Figs. 23, 24, 25, 26, 36, 48, 79.

This is a small species, in size a little longer but not any wider than *Ocnerodrilus occidentalis* or about 1 inch by ¾ line. The body-wall is peculiarly thin, especially in somite xii, and more transparent and less tough than in *O. occidentalis*. *Clitellum* commences at the anterior ⅓ or ¼ of somite xiii and extends to xviii. There is no ventral zone surrounding the male pore as in *O. agricola* which this species otherwise comes near.

The *setæ* are as usual, and the inner couple in somite xvii is wanting.

Spermathecal pore in xix.

Ovipore as usual in xiv and *Spermiducal* or *male papillæ* (one pair) in xvii.

This species appears to form a group with *O. contractus* and *agricola*.

The upper part of the peristomium is longer than the second somite, but the prostomium appears smaller than in other species. The *buccal region* extends to the posterior part of somite ii when the worm is contracted.

Pharynx occupies somites iii, iv and v and is as usual very muscular and glandular, but the salivary glands on the upper side are much larger than in any other species, projecting backwards and encroaching on somite v in such a way that the septal gland in this somite is pushed backwards into somite vi.

The four septal glands in somites v–viii are smaller than in other species and crowded together in the space below three segments. In other words, the salivary

glands are larger and the septal glands are smaller than in other species. In reality they are confined to the same somites as other species of the genus.

The anterior septal gland in somite v is hardly any larger than the one in somite vi. The one in vii is hardly lower than the one in vi, while the septal gland in somite viii is much higher than in other species except *O. occidentalis*, but with a much smaller base. The anterior septal gland has the broadest base, those following have shorter bases, and the last one in somite viii has the shortest base of all; this is the opposite of what is the case in the other species. But this peculiarity is not the only one as regards these glands. They are all of them less lobed than in any other species except perhaps *O. occidentalis* and *Hendriei*, the anterior gland in somite v being especially entire and continuous in outline.

The *œsophagus* which in most other species is tubular and hardly contracted is in this species very much nipped by the septa. Its walls are also thicker except in somite xii where they are remarkably thin and transparent. In this somite also, the tubular intestine (or posterior part of the œsophagus) is narrower, the sacculated intestine commencing first in somite xiii, where, as usual, is also found the ovary. The inflation of the sacculated intestine is not any greater in somite xiii than in any of the other clitellial somites.

Testes in x and xi as usual.

The *sperm-sacs* are small, of undecided form situated in the upper part of somites ix, x, xi and xii. The anterior and posterior sperm-sacs are not deeply lobed. In this respect the species differs from all the others.

The *spermatheca* (fig. 23–36) is long, cylindrical, of even outline, thick and opaque, without any trace of diverticula. It resembles that of *O. agricola* in this respect,

but in shape it is entirely and characteristically different from the one in that species. It is about one-third as thick and three-fourths as long as the diverticulum of the œsophagus. The spermatheca of *O. agricola* is about one and one-half times thicker than the diverticulum, and almost globular in outline.

The *ciliated rosettes* are in this species smaller, as compared to those of other species.

The *prostate glands* are very slender and twist considerably, extending behind the clitellum, or as far as the end of somite xx. In width they are about the size of the widest part of the ventral ganglion. The *prostate* consists of two distinct parts; the more distant one, which is glandular, and the one nearest the male pore, which is muscular. The glandular part is by far the longest, as well as the widest. In form it is cylindrical, of the same width throughout its length, and not tapering as in some other species. This glandular part consists of a single layer of epithelial cells, just as in all other species.

The muscular part is in this species very long, occupying about the length of one and two-thirds somite, and about one-third or one-half longer than the enlarged part of the sperm duct. In width the muscular part of the prostate is slightly narrower than the glandular part. It is also more transparent. The transverse muscles are very conspicuous (fig. 24), enclosing a large, regular and well defined lumen. The prostate and the sperm duct are entirely independent of each other until they reach the male pore, in which they both open apparently separately.

The muscular part of the prostate is a little less than one-half as long as the glandular part, and somewhat narrower. It is narrowest close to the glandular part, and then becomes wider towards the male pore. The greater part, however, is of even thickness. In the

vicinity of the male pore it narrows considerably, but widens again nearer the pore. The interior lumen of the muscular part is much wider close to the glandular part of the prostate. The walls of the muscular part consist of spirally wound muscles, which enclose a row of glandular bodies arranged at intervals in globular masses around the lumen (fig. 25).

Sperm ducts. The most important character of *Ocnerodrilus Rosæ* is connected with the sperm ducts. In all the others, except *O. contractus* and *agricola*, the two ducts on either side unite in somite xii into one continuous duct, of equal size and thickness throughout its course, and even in the somite of the male pore (xvii) is in no prominent way differentiated. But in *Ocnerodrilus Rosæ* the sperm-tube is prominently modified in xvi and xvii. It is there enlarged to about five or six times its original or usual size, forming a kind of long, cylindrical, shuttle-like at both ends, tapering enlargement, the lumen of which is somewhat wavy and as wide as the sperm duct before it enters the enlargement. The transition between the narrow and the wide part of the duct is short, but gradual. Compared to the prostate gland, this enlargement of the sperm duct is about one-fourth wider than that organ at its widest point. It is flat or compressed, and when in its natural state lies closely pressed to the parietes of somites xvi and xvii, parallel to the ventral ganglion. In length this enlargement reaches from the middle of somite xvii to the anterior end of somite xvi, thus occupying a length of almost, but not entirely, one and one-half somite. The enlargement is about one-third wider than the widest part of the ventral ganglion in the same somite.

The enlargement consists of a heavy longitudinal layer of muscles, composed of small, shuttle-like cells, arranged

longitudinally. These directly enclose the original duct. A transverse layer of muscles surrounds the whole enlargement.

Habitat, under damp moss at springs at San Antonio, near the city of Guatemala, Central America.

Ocnerodrilus contractus, *n. sp.* Fig. 42, 43, 45, 50, 51, 52, 67, 80.

Clitellum occupies xiii–xviii. The inner pair of setæ in somite xvii is wanting. One very elevated papilla and a narrow half-moon like groove around the male pore, but no ventral zone.

The *septal glands* resemble those of *O. occidentalis* and *O. Rosæ*. The gland in somite v is not larger than the one in vi, but somewhat smaller. The gland in somite vi is the largest of the four glands. The gland in somite vii is of nearly the same size as the one in somite v, or slightly smaller. The gland in somite viii is, as usual, very small as to height, but not as narrow of base as the corresponding gland in *O. Hendriei*. All the glands are only slightly lobed, almost entire in their margins. The relative size of the septal glands distinguishes this species from *O. Hendriei*.

The *salivary glands* of the pharynx are rather deeply lobed, the lower glands being the largest ones.

The septa supporting the septal glands vary in size, and are all much thinner than for instance in *O. Hendrici*. The one between viii and ix is the thickest. The one between viii and vii is much thinner, and those between v and vi and vi and vii are the thinnest, both being of nearly equal size.

The *spermatheca* is cylindrical, rather even in outline. It is larger than the same organ in *O. Hendriei*, but not as large as in *O. Rosæ*, though of about the same form

as in that species. The length of the spermatheca is not quite equal to that of the œsophageal diverticulum, while in *O. Rosæ* it is longer than the said diverticulum. These measurements refer to sexually mature species. The lower part of the spermatheca is narrower and muscular, the muscles being arranged in two directions. The outer circular layer is the thickest, and reaches only to the pouch part of the spermatheca. It contains large round nuclei. The longitudinal layer extends all around the spermatheca, and is narrower than the inner epithelium of the pouch. The cells of the epithelium are narrower and less regular than in *O. Beddardi*.

The œsophagus is contracted at the septa similarly as in *O. Hendriei* and *Rosæ*. The sacculated intestine begins in somite xii, and differs in this respect from *O. Rosæ*, in which species it commences in somite xiii.

The *sperm-sacs* are large, and in mature specimens constant in size and are characteristic of the species. The one in somite ix consists of an enormous sac, not lobed, which fills the whole somite. The sperm-sac in somites x and xi are narrow, but long, reaching from the dorsal to the ventral parietes. The sperm-sac in xii is lobed, and attached in the usual way to the anterior septum. In *O. Rosæ* the sperm-sac in somite x is generally wanting, and always, when present, is of very small size.

The *vascular system* resembles that of other species, but there is no connecting vessel in somite ix, as in *O. Hendriei* and *limicola*, which former species the present form otherwise much resembles. From *O. limicola*, which possesses this connecting vessel, the present species is distinguished among other things by its almost entire septal glands, by one pair of prostates, etc.

The lower part of the *sperm duct* is muscular, enlarged and shuttle-like, in very much the same way as in *O.*

Rosæ and *agricola*. But the relative length is not the same. In *O. contractus* this muscular swelling of the sperm duct is as long as the muscular part of the prostate, while in *O. Rosæ* this part is about one-fourth to one-third smaller than the muscular part of the prostate.

The lumen also is wider in this species than in *O. Rosæ*. In *O. contractus* the lumen is considerably wider than the narrow part of the sperm duct, while in *O. Rosæ* the lumen is narrower than the sperm duct proper. In *O. contractus* the lumen occupies about one-third of the enlargement, while in *O. Rosæ* it occupies only about one-sixth or one-seventh. The enlargement consists of two additional layers, one exterior of transverse muscles, which part is very thin, and one interior of longitudinal rhomboid cells, arranged obliquely.

The *prostate* is long, cylindrical, not tapering, with a long muscular lower duct, of similar form and construction as in *O. Rosæ*. This muscular part of the prostate is of the same length or slightly shorter than the muscular part of the sperm duct. The glandular part of the prostate is shorter than in *O. Rosæ*, or about one and one-half times larger than the muscular part. In *O. Rosæ* it is over twice as large as the muscular part.

The *ovary* is in xiii and the oviduct in somite xiv, as usual. The ovary, affixed to the anterior septum, contains very large globular or circular ovæ. The oviduct is almost straight, gradually increasing in size towards the funnel, which is not distinctly set, widened or reflected.

The *cephalic ganglion* is in somite iii, and the infrapharyngeal ganglion, which is very large, is between somites iii and iv, as usual.

Habitat, in pools close to the road, near Llano Grande, in Guatemala, Central America.

Ocnerodrilus agricola, *n. sp.* Figs. 34, 41, 44, 46, 54, 81.

Clitellum is very small, occupying only four somites, from xiv to xvii, inclusive, sometimes transgressing on the adjoining somites xiii and xviii. But the shortness of the clitellum is not its only characteristic. It does not extend to the region nearest the ventral ganglion, as in the other species, but immediately around the male pore in somite xvii it shows a half-moon like margin, leaving a round disk-like zone surrounding the male pore. But this zone is much thickened, of a somewhat different structure from the clitellum. The specimens having become much macerated, I could not fully make out this structure, but it occupies the whole width of somite xvii and part of xvi, on which latter it curves with a concave sweep towards the anterior part of that somite.

Spermathecal pore in somite ix, close to the septum and in the inter-segmental groove.

Spermiducal papillæ, one pair in somite xvii.

Ovipore in somite xiv.

The anterior *septal gland* in somite v is longer and broader than the one in somite vi. The septal gland in somite viii is very low, and is the smallest one of the four glands. The anterior gland is less lobed than in *O. Beddardi*, or in *O. guatemalæ*.

The *septa* in the gland bearing somites are, as usual, thicker than the other septa.

Spermathecæ, one pair, are found in somite ix. In shape the spermatheca differs from those of the other species, in being almost globular without any diverticula, and of a size at least twice as large as the spermatheca of *Ocnerodrilus Beddardi*. In general shape it agrees with the same organ in *O. Eiseni*, as described and figured by Beddard, but it is larger and more globular, apparently but

little varying in shape or size in sexually mature worms. The lower part of the spermatheca is muscular, but there are no glands at the base. The spermatheca fills the whole width of the somite.

Testes are found in two pairs, one in somite x and one in xi, of the same shape and size as those in *O. Beddardi* and other species.

Sperm-sacs are found in somites ix, x, xi and xii, of the same general form as those of *O. Beddardi*. The sperm-sacs in somite ix are globular and lobed, but not as much so as those in somite xii, which are deeply lobed, and closely cover the anterior end of the sacculated intestine like a collar. The sperm-sacs in *O. Beddardi*, *agricola* and *guatemalæ* are all very similar. They do not enclose nor even cover the testes, and the anterior and posterior sperm-sacs are not connected with the middle ones. These latter are unusually large in this species, occupying the whole space in somites x and xi between the body-wall and the other organs. They are larger than in any other species of Ocnerodrilus.

The *ciliated rosettes* and *sperm ducts* resemble those of *O. Rosæ* and *contractus*, but the prostate glands are much longer, extending from somite xvii to xxviii, as in *O. occidentalis*, to which species, however, the present worm shows no other affinity. The sperm duct is enlarged, or rather is surrounded by a muscular swelling close to the male pore. The enlargement is about one-third as long as the muscular part of the prostate.

The muscular part of the prostate is very long, covering approximately two somites or more, while the glandular part of the prostate extends through nine somites. In the other species with similar structure of the male organs, the prostate is much shorter. Thus in *O. Hendriei* and *contractus*, the glandular part of the prostate

does not exceed two and one-half times the muscular part, while in the present form the glandular part of the prostate is about four times as long as the muscular part.

The *ovary* and *oviduct* are, as elsewhere, situated in somites xiii and xiv, and offer no peculiar characteristics.

The inner couple of the *setæ* in somite xvii is wanting. The species is easily and best characterized by the large globular spermatheca in somite ix, which is so large that it obstructs the view of the œsophageal diverticulum.

The body-wall of *Ocnerodrilus agricola* is very thin, much more so than in other species; it is also quite transparent and white. As to size, this species is thicker than any other. Epecially the anterior part is thicker than the corresponding part of *O. Beddardi*.

Habitat. Guatemala City, in Guatemala, Central America, in garden soil. This species was never found in running water, but always in moderately dry places.

Ocnerodrilus occidentalis, *Eisen*. Figs. 15, 16, 21, 22, 68, 69, 70, 82.

Clitellum occupies six to seven somites, from xiv to xix, sometimes encroaching on somites xiii and xx. It is not always present, even in sexually mature specimens.

No *spermathecal pores* or *spermatheca*. *Spermiducal* or *male papillæ*, one pair in somite xvii. The inner couple of setæ in somite xvii present; *ovipore* in somite xiv—one pair; *septal glands* in somites v, vi, vii and viii. The glands respectively in somites v, vi and vii are of about the same size, while the one in somite viii, which is generally in other species much lower, is in this species of about the same size as the anterior glands. The gland in somite v is not longer than those in vi and vii, and all the glands are less lobed than in other species.

The testes and sperm-sacs are differently arranged in

Ocnerodrilus occidentalis than in any other species so far known. Instead of two pairs of testes there is only one pair. This one situated in somite x, attached to the anterior septum. It is of the same general structure as the posterior testes in *O. Beddardi*, small, thin and heart shaped. Instead of a pair of testes in somite xi, as might be expected from analogy with other species, we find in this somite a pair of small sperm-sacs, which might be mistaken for testes, and were so at first considered by myself. They are attached to the anterior septum, varying in size, but always only slightly larger than the testes, and never attaining to the size of the sperm-sacs of the other species. This sperm-sac, which is situated in line with the testes in the somite in front, is rounded, almost globular, with a more or less irregular surface, like a more or less inflated or collapsing balloon. It is furnished with a lower duct, which consists of a muscular and glandular layer of cells which in the duct are strongly ciliated. This duct reaches only to the septum in somite xi, and then connects from there with the anterior testes. I suspected first that this muscular duct connected with the exterior through the body-wall, in which case the sperm-sac would have served also as a spermatheca, this organ being absent in this species, but I could not find any connection between it and the body-wall.

The lobed sperm-sacs which in other species are found in somites ix and xii, are not found in this species, nor is there a pair of sperm-sacs in x, as in all other species.

The *prostate* gland is very long, several times bent on itself, and extending from somite xvii to xxvi, when fully developed. The ciliated rosettes are in somites x and xi, behind the testes and sperm-sacs. The sperm ducts pass posteriorly and open with the prostate in somite vii.

The seta of the inner couple in this somite are both present (fig. 68). There are no spermatheca.

Ovary in xiii and *oviduct* in somite xiv. The inner opening of the oviduct is found in somite xiii, close to the ovary. It is of less rounded form than in *Ocnerodrilus Beddardi*.

The *nephridia* are much smaller than in any other species, and occupy only about one-fifth of the whole width of the somite, while the nephridia in most other species are very large, occupying the larger part of the somite, the upper part of the nephridium of *O. Beddardi* covering the whole width of the somite from septum to septum. Those in front of and in the clitellum, except the one in somite ix, are not surrounded by any peritoneal cells. Those posterior to the clitellum are furnished with a few such cells along the upper part of the nephridium, the long, slender lower part being entirely free. The quantity of such cells varies greatly with maturity of the individual. In many specimens they are hardly traceable, in others they are more prominent, but never to such an extent as is the case in any of the other species, where this glandular covering is most copious. As a rule, in the sexually mature worms the peritoneal cells are more numerous. In younger worms of *O. occidentalis* I could find no trace of them. The nephridium in somite ix is always at sexual maturity furnished with peritoneal cells, but only along its upper part. This is in analogy with the development of the nephridia in *Ocnerodrilus Beddardi*, where the nephridia in somite ix are larger than any others anterior to the clitellum.

The *alimentary canal* offers the same characteristics as in the other species, but the anterior portion is much more contracted and shortened. Thus the pharynx is more globular, and the œsophagus and the tubular intestine

are thicker than in *O. Beddardi.* The tubular intestine is considerably nipped by the septa. The sacculated intestine commences in somite xii, and the inflation is widest in the anterior somites, as in the other species. The body-wall is much tougher than in any other species.

Size of worm, about three-fourth inch long by three-fourth line wide.

From the above it will be seen that *O. occidentalis* differs in many important points from all other species known. The septal glands in viii are very large, in all other species they are very small, compared to the anterior glands. Spermathecæ are absent. Sperm-sacs in ix, x and xii are absent. The one in xi is differently situated and of a different structure from those in any other species. The nephridia are smaller than in other species. The number of bloodvessels in the œsophageal pouch are less in number than in other species. The pouch itself at its attachment to the œsophagus is not, or only a trifle, narrower than at its greatest width, while in all other species the pouch is much narrower at the attachment than elsewhere (fig. 84).

With an increasing number of species known, it may be necessary to arrange them in sub-genera, though at present any subdivision of the genus would be superfluous.

Habitat. California, San Joaquin valley, at Fresno, in garden soil. It comes to the surface when irrigation is practiced. So far only found in the garden of the Eisen Vineyard, six miles east of Fresno. As I have in vain looked for it elsewhere, it is possible that this worm has been introduced there from some other locality with plants, though I believe that the native habitat of the worm is in California, as at the time of the first find no foreign plants had been introduced.

SETÆ.

But little mention has been made of the setæ of the different species. As species characters they are of limited value, principally on account of the difficulty experienced in describing them properly, but also on account of the small variation between the different species. In all the species the setæ are sigmoid of the lumbricid pattern, and in their general form there is but little or any difference between those of various species. But in size the difference is greater, as may be seen from figures 74 to 82, where are represented the setæ of all the varieties described by me. All the figures have been drawn to the same scale (about 750 diameters) by means of a camera, and are as exact as it was possible to make them. The margins in all the forms are more or less wavy, in some there is only a suggestion of undulation, in others again the outlines are distinctly wavy. A comparison of the figures will give a better idea than any lengthy description. It will suffice to say that the anterior or free ends of the setæ are more wavy than the posterior parts. The setæ of *Ocnerodrilus Hendriei* are more wavy than those of any other species (fig. 77), and are besides very characteristic in form. It is interesting to note that the setæ of this species differ, both in size, form and waviness, from the setæ of *O. guatemalæ*, its most allied species. The setæ of *O. limicola* are perhaps the most characteristic of any, the general central swelling here having given place to two rounded swellings (fig. 78).

With our knowledge, extended through the discovery of new species, the following must be the diagnosis of the genus:

Ocnerodrilus Eisen.

Small oligochetes inhabiting soil, water, or both. Clitellum comprises the oviduct and the male pore.

Spermathecæ, with or without diverticula, present or wanting; in somite ix or viii, generally in ix. Spermathecal pores in front of inner couple of setæ.

No differentiated penial setæ; the inner pair in somite xvii either wanting entirely or wanting in one seta, or present. Nephridia paired, after the first few surrounded by a smaller or greater quantity of peritoneal cells.

Alimentary canal without gizzard and typhlosole, but with one pair of diverticula in somite ix. These diverticula connect with the œsophagus in the posterior part of the somite near the posterior septum. No subnervian vessel. One pair of hearts in somite x and one pair in xi. Sometimes a stout connecting vessel in somite ix. The ventral and dorsal vessels are, except in the somites, generally only connected in somites x and xi, and sometimes also in ix. One pair of lateral longitudinal vessels from the diverticula of the œsophagus. Testes in x and xi. One or two pairs of prostate glands (atria) in somites xvii and xviii opening in the same papilla as the sperm ducts. The epithelial lining of the prostate only one cell thick.

SYNOPTIC ARRANGEMENT OF THE SPECIES.

I. Spermatheca present in somite ix. Lower part of sperm duct not enlarged.

1. In the inner couple of setæ in somite xvii one seta is wanting. The lower part of the prostate not greatly differentiated.

a. The spermatheca large, club-like, with several distinct but rudimentary diverticula. The anterior septal gland is much larger than the one behind in somite vi. The prostate not exceedingly small. O. BEDDARDI.

b. The spermatheca is small, slightly indented, but otherwise with no distict diverticula. The anterior septal gland twice as long as the gland in somite vi. Prostate gland is unusually small. O. GUATEMALÆ.

c. Spermatheca very minute, without constrictions or trace of diverticula. The anterior septal gland only slightly larger than the one in somite vi. The prostate not unsually small.
O. SONORÆ.

2. The inner couple of setæ in somite xvii is wanting.

d. Spermatheca cylindrical, contracted, but with no diverticula. The septal gland in somite vii almost equal in size to the one in somite viii. One connecting vessel in somite ix. The prostate very small. O. HENDRIEI.

3. The inner couple of setæ in somite xvii is present. The lower part of the prostate is muscular and much differentiated from the upper glandular part.

e. One connecting vessel in somite ix. Spermatheca with a few wartlike and rudimentary diverticula. The septal gland in somite vii much larger than the one in somite viii.
O. LIMICOLA.

II. Spermatheca present in somite xi, with no diverticula. Lower part of the sperm duct with a large shuttle-like enlargement close to the male pore.

f. Spermatheça very large, globular, much wider than the œsophageal diverticulum. Sperm-sac in somite ix very large, lobed.
O. AGRICOLA.

g. Spermatheca long, cylindrical, not as wide as the width of the œsophageal diverticulum. Sperm-sac in somite ix very small, deeply lobed. O. ROSÆ.

h. Spermatheca medium, cylindrical, narrower than the width of the diverticulum of œsophagus. The sperm-sac in somite ix very large, not lobed. O. CONTRACTUS.

III. Spermatheca present in somite viii, with no diverticula. No enlargement of the lower part of the sperm duct.

i. Spermatheca sac like, with no diverticula. Sperm-sacs in ix and xii not lobed. O. EISENI.

IV. No spermatheca; no enlargement of the lower end of the sperm duct.

j. The septal glands in somites v, vi, vii and viii of nearly equal size. No sperm-sacs in ix, x, and xii, and those in xi very small. The inner couple of setæ in somite xvii present.
O. OCCIDENTALIS.

DIOGNOSES OF THE SPECIES.

Ocnerodrilus Beddardi, n. sp.

Clitellum xiii to xix. No ventral zone in xvii. One seta wanting in the inner pair in xvii. Spermathecæ, one pair in ix, club-like, medium size, small diverticula. Prostate

short. The muscular part of the prostate is very short. The sperm ducts not enlarged before reaching the male pore. Large lobed sperm-sacs in ix and xii. No connecting vessel in somite ix. The septal gland in v largest. Sacculated intestine begins in xii.

Ocnerodrilus guatemalæ, n. sp.

Clitellum very short, xiv to xviii inclusive. No ventral zone. Spermatheca very short, sac or club-like, with a distinct lower muscular duct, with only a trace of diverticular swelling. The septal gland in somite v twice as large as the one in vi. Sacculated intestine begins in somite xii. No connecting vessel in somite ix.

Ocnerodrilus sonoræ, n. sp.

Clitellum very short in xiv to xvii. In the inner couple of setæ in somite xvii, the outer seta is missing. Spermatheca small, bag-like, no diverticula. Septal glands in v of almost the same same size as the one in vi, slightly larger. The lower part of the sperm duct is not enlarged. One pair of prostates in xvii; the lower or muscular part of each duct is not narrower than the glandular part. The large lobed sperm-sac in xii is the largest. Sacculated intestine begins in xii.

Ocnerodrilus Hendriei, n. sp.

Clitellum from xiv to xix, encroaching on xiii and xviii. The inner couple of setæ in xvii is wanting. Spermatheca small, cylindrical, no diverticula, about as long as the width of the diverticulum. Prostate short in two somites. Sperm-sacs in ix, xi, xii. The one in ix not much lobed. The one in xi very large, not lobed, and the one in xii much lobed. Sperm ducts without swelling. One pair of connecting vessels in somite ix. The septal gland in v much larger than the one in vi. The glands in vii and viii are very small. Sacculated intestine begins in xii.

Ocnerodrilus limicola, n. sp.

Clitellum, xiii to xix. No zone in xvii. The inner pair of setæ in somite xvii are wanting. Spermathecæ, small, cylindrical, with few, small, wart-like diverticula in somite ix. Prostate short. The sperm ducts not enlarged before reaching the male pore. Large lobed sperm-sacs present in ix and xii. One pair of connecting vessels between the dorsal and ventral vessels in somite ix. The septal gland in somite v is the longest. Sacculated intestine begins in xii.

Ocnerodrilus Eiseni, Beddard.

Clitellum in xiii to xix. The inner pair of setæ in xvii is wanting. Spermathecæ in viii, sack-like, medium, with no diverticula. Prostate long. Sperm ducts not enlared before reaching the male pore. Large lobed sperm-sacs in ix and xii. No connecting vessel in ix.

Ocnerodrilus Rosæ, n. sp.

Clitellum, xiii to xviii. The inner pair of the setæ in xvii is wanting. Spermathecæ, one pair in ix. Form long, cylindrical; no diverticula. Prostate very slender and long, with a long muscular part. Sperm ducts greatly enlarged close to the male pore. Sperm-sacs in ix, x, xi, xii. The one in ix is smaller than in other species, the one in xii not deeply lobed. No connecting vessel in ix. Septal glands not deeply lobed, almost entire. The one in v not, or hardly, larger than the one in somite vi. Sacculated intestine begins in somite xiii.

Ocnerodrilus contractus, n. sp.

Clitellum in xiii to xviii. The inner pair of the setæ in xvii is wanting. Spermatheca, as long as the diverticulum of the œsophagus is cylindrical, even in outline, with no diverticula. Sperm duct with a shuttle-like en-

largement near the male pore, occupying about one and and one-half somite; its lumen about one-fourth or one-third as wide as the enlargement. Prostate with muscular duct. Septal gland in somite v not larger than the one in vi. Sperm-sac in somite ix very large, and longer than those in x, xi and xii. No connecting vessel in ix. Sacculated intestine begins in somite xii.

Ocnerodrilus agricola, n. sp.

Clitellum in xiv to xvii. A large ventral zone in somite xvii surrounding the male papilla. The inner pair of setæ in somite xvii wanting. Spermathecæ, one pair in ix, sack-like, globular, very large, with no diverticula. Prostate long. Sperm ducts enlarged before reaching the male pore. Large lobed sperm-sacs in ix and xii. No connecting vessel in ix. The septal gland in v is the largest. Sacculated intestine begins in xii.

Ocnerodrilus occidentalis, Eisen.

Clitellum, xiii to xix. No zone in xvii. One seta is wanting in the inner pair in somite xvii. No spermathecæ. Prostate very long. Sperm ducts not enlarged before reaching the male pore. No connecting vessel in ix. One pair of testes in x. No large lobed sperm-sacs in ix, x and xii. One pair sperm-sacs in xi, with muscular duct. The septal gland in v not longer than the one in vi, and the one in viii not smaller than the others. Sacculated intestine begins in xii.

The affinities of Ocnerodrilus have already been commented upon by Beddard, and he has pointed out the relationship of our worm with Pontodrilus, Photodrilus, Microscolex and Gordiodrilus. The latter genus he places in the same family as Ocnerodrilus, and retains the name of Ocnerodrilidæ.

In this I cannot exactly agree. It is, however, entirely

too early to successfully generalize as regards the relationship of these worms, as it is evident that a whole class of worms must exist which forms connecting links between the land and water Oligochætæ, and of which class so far only very few genera are known. They have escaped the casual collectors by their minuteness, while the students of this class of worms have had only little opportunity to collect in tropical countries. When these minute Oligochætæ have become better known we will be able to generalize without running the risk that the next investigator will, with equal propriety, upset all our views. While Gordiodrilus in many respects greatly resembles Ocnerodrilus, it appears to me that it differs too much and in too many important points to be placed in the same family. As Benham remarks, the affinities of both genera are greatest with many genera of the large family of Cryptodrilidæ, least of all perhaps with Cryptodrilus.

From Gordiodrilus our genus differs principally in having salivary pharyngeal glands. Gordiodrilus has none. Also in having a pair of œsophageal pouches, while Gordiodrilus has only one. This latter is very differently constructed from the pouches in Ocnerodrilus. In Gordiodrilus the prostate and the sperm duct open in different pores, similarly as in Acanthodrilidæ, while in Ocnerodrilus the prostate and sperm duct open in the same pore. In Ocnerodrilus the male pore is invariably found in somite xvii, while in Gordiodrilus it opens in somite xviii. The prostates in this genus vary considerably, in one species opening in somites xvii and xviii (*G. robustus*), in another in xviii and xix (*G. elegans*), and in another in xx and xxi (*G. tenuis*).

The following comparative table will show the differences and similarities of the two genera:

	Ocnerodrilus.	*Gordiodrilus.*
Setæ.	Paired, of usual lumbricid pattern.	Same.
Clitellum.	Variable, always including the male papillæ.	Same.
Nephridia.	Paired, after the first few surrounded by a smaller or greater mass of peritoneal cells.	Same.
Alimentary.	No gizzard.	Gizzard generally, but not always absent.
	No typhlosole.	Same.
	One pair of diverticula of the œsophagus in somite ix.	One single diverticulum of the œsophagus.
	Only longitudinal parallel bloodvessels in the diverticulum.	Longitudinal and transverse bloodvessels in the diverticulum.
Testes.	In x and xi, or only in x.	Same.
Vessels.	No subnervian vessel.	Same.
	Two pair of large hearts in x and xi.	Same.
	One or two pair of prostate glands opening in xvii (and xviii).	One or two pair of prostate glands opening in two consecutive somites, in xvii, xviii, xix, xx or xxi.
	Sperm ducts open in the same pore as the prostate.	Sperm ducts open independently of the prostate, and in the same somite as one of the prostates, but not in the same pore.
Ovaries.	In xiii.	Same.
Spermathecæ.	One pair, or none, in viii or ix, generally in ix. Diverticula rudimentary or absent.	Two pair or one pair, in vii, viii. Diverticula rudimentary or absent.
Spermiducal pore. (Vas deferens)	Always in xvii.	In xviii.

Considering these differences, I propose to place Gordiodrilus in a family of its own, *Gordiodrilidæ*, which might be characterized as follows (the description being after Beddard):

GORDIODRILIDÆ.

Small slender terrestrial oligochætæ, with paired setæ of the usual lumbricid pattern. Clitellum includes the male pore. Nephridia paired, after the first few surrounded by peritoneal cells. No pharyngeal or salivary glands. Large septal glands investing the œsophagus in somites v to vii. No typhlosole. *Œsophagus with a single median ventral diverticulum.* No subnervian vessel. Two pairs of hearts in x and xi. Testes in x (and xi). *Prostates opening independently of the sperm ducts. Spermiducal pore in xviii.* Ovaries in xiii. Ovi ducal pore in xiv. Spermathecæ variable, in vii or viii, or absent, with no or rudimentary diverticula. No penial setæ, no subnervian vessel, and no blood vessels on the nephridia.

OCNERODRILIDÆ.

Small slender terrestrial oligochætæ, with paired setæ of the usual lumbricid pattern. Clitellum includes the male pore. Nephridia paired, the first row with no peritoneal cells, the posterior nephridia with more or less peritoneal cells. Large pharyngeal or salivary glands. Large septal glands investing the œsophagus in v to viii. No typhlosole. *Œsophagus with one pair of lateral pouches or diverticula* in somite ix, through which pass a pair of large lateral vascular trunks. No subnervian vessel. Two pair of hearts in x and xi (and sometimes a third, smaller, in xi). Testes in x and xi. *Sperm ducts always opening in the same pore as a large prostate in xvii.* Sometimes an additional prostate opening independently

in xviii. Ovaries in xiii. Oviducal pore in xiv. Spermathecæ, one pair or none in viii or ix, with no or rudimentary diverticula. No penial setæ and no subnervian vessel. No blood vessels on the nephridia.

Among other genera which Ocnerodrilus resembles, Pygmæodrilus appears rather prominently. I will here only call the attention to the long prostates which are differentiated into a muscular and a glandular part, and which extend through many somites, just as in Ocnerodrilus and Gordiodrilus. The swelling or muscular enlargement possessed by some species of Ocnerodrilus resembles greatly that of Pygmæodrilus. The greatest difference between that and our genus is the arrangement of the ciliated rosettes which in Pygmæodrilus are invested by the sperm-sacs, while in both Ocnerodrilus and Gordiodrilus they open independently. The paired diverticulum of the œsophagus is also found in Pygmæodrilus.

Of all the various characters in which Ocnerodrilus and Gordiodrilus resemble each other and in which they also differ from the genera of Beddard's Cryptodrilidæ, the absence of bloodvessels on the nephridia and the single cell structure of the glandular part of the atrium are the two most important ones. The character derived from the presence or absence of diverticula on the spermatheca is weaked by the fact that the diverticula of this organ vary greatly in size, or are entirely absent in some species of the same genus. The absence of a gizzard is of late consigned to a mere species character (by Beddard), and the form and arrangement of the setæ can in no way be considered of equal value to the arrangement of the inner organs. The presence of septal glands in our two genera is also of great importance, as connecting them with lower forms. The safest we can

say at present is, that Ocnerodrilus and Gordiodrilus are connecting links which, through their relationship with Pontodrilus, Photodrilus, Microscolex and Pygmæodrilus, connect the limicolid oligochætæ with the higher terrestrial forms.

I append some diagrams to show the arrangement of the several organs, etc., in the genera, which may be best compared with Ocnerodrilus. Some of these diagrams are borrowed from Benham's admirable paper (An Attempt to Classify Earth Worms). The diagram of Gordiodrilus has been compiled from Beddard's paper on this genus.

PAPERS REFERRED TO.

FRANK E. BEDDARD. On the Anatomy of Ocnerodrilus. Proceedings Royal Society of Edinburgh. Vol. 36, pages 563 to 583.

FRANK E. BEDDARD. On a New Genus of Oligochætæ, Comprising Five New Species Belonging to the Family Ocnerodrilidæ. Annals and Magazine of Natural History, No. 55, July, 1892, page 74, plates vi and vii.

FRANK E. BEDDARD. Abstract of some Investigations into the Structure of the Oligochæta. Annals and Magazine of Natural History, Jan., 1891, p. 88.

DANIELE ROSA. Sui genere Pontodrilus, Microscolex and Photodrilus. Bollettino dei Musei di Zoologia, Universita di Torino, vol. iii, No. 39, Marzo, 1888.

W. B. BENHAM. An Attempt to Classify Earth-worms, Quatr. Journal of Microscopical Science, vol. xxxi, part ii, p. 201.

TABLE OF SPECIES OF OCNERODRILUS.

Ocnerodrilus	*Beddardi* n. sp.	*guatemalæ* n. sp.	*sonoræ* n. sp.	*Hendriei* n. sp.	*limicola* n. sp.	*Eiseni* Beddard.	*Rosæ* n. sp.	*contractus* n. sp.	*agricola* n. sp.	*occidentalis* Eisen.
Clitellum in somites	xiii to xix. No ventral zone	xiv to xviii. No zone.	xiv to xvii. No zone.	½xiii to ½xviii, or xiv to xvii. No ventral zone.	xiii to xix. No ventral zone.	xiii to xix. No ventral zone.	xiii to xviii. No ventral zone in xvii, one in xviii.	xiii to xviii. No ventral zone.	xiv to xvii. Ventral zone around male papilla in xvii.	xiii to xix. No ventral zone.
Inner couple of *setæ* in somite xvii:	The inner seta is wanting.	The outer seta is wanting.	The outer seta is wanting.	Both setæ wanting.	Both setæ present.	Both setæ wanting.	Both setæ wanting.	Both setæ wanting.	Both setæ wanting.	Both setæ present.
Spermatheca:	Medium size, club-like, with rudimentary diverticula. In somite ix.	Very small, no diverticula. In somite ix.	Very small, bag-like; no diverticula. In somite ix.	Small, cylindrical. No diverticula. In somite ix.	Small, cylindrical, a few wart-like diverticula. In somite ix.	Medium, sac-like; no diverticula. In somite viii.	Long, cylindrical; no diverticula. In somite ix.	Medium, cylindrical; no diverticula. In somite ix.	Very large, globular; no diverticula. In somite ix.	No spermatheca.
Septal glands: The one in somite v is:	Larger than the one in vi.	Very much larger than the one in somite vi; all deeply lobed.	Of almost the same size as the onein somitevi, slightly larger.	Much larger than the one in vi.	Larger than the one in vi.		Not larger than the one in vi.	Not larger, but smaller than the one in vi.	Larger than the one in vi.	Not larger than the one in vi.
Lower part of *sperm duct* in somites xvi and xvii:	Not enlarged.	Not enlarged.	Not enlarged.	Not enlarged.	Not enlarged.	Not enlarged.	Much enlarged; lumen narrow.	Much enlarged; lumen wide.	Much enlarged.	Not enlarged.
Prostate:	One pair in somite xvii.	One pair; very minute and slender; confined to one somite, xvii.	One pair in somite xvii.	One pair in somite xvii, very minute.	Two pair, in somites xvii and xviii.	One pair in somite xvii.	One pair in somite xvii.	One pair in somite xvii.	One pair in somite xvii.	One pair in somite xvii.
Large lobed sperm-sacs in ix and xii	Present.	Present, the one in somite xii not larger than the one in somite ix.	Present. The one in somite xii very much larger than the other.	Present; in ix slightly lobed in xii much lobed.	Present, both deeply lobed.	Present, but not lobed.	Present, but not as deeply lobed as in *limicola*.	The one in ix not lobed, the one in xii much lobed.	Present, both deeply lobed.	None.
Sacculated intestine commences in	xii.	xii.	xii.	xii.	xii.	xii.	xiii.	xii.	xii.	xii.
Connecting vessel in somite ix between v. v. and d. v.	None.	None.	None.	One pair.	One pair.	None.	None.	None.	None.	None.

EXPLANATION OF THE FIGURES.

Plate V.

Ocnerodrilus Beddardi, fig. 1 to 15.

Fig. 1. Collective view of the various organs in the anterior part of the body, showing their general form and location. This view is semi-schematic.

pr. st. prostomium.
phx. pharynx.
s. ph. gl. supra-pharyngeal ganglion.
s. gl. septal glands in somites v, vi, vii, viii.
t. testes in x and xi.
s. s. sperm-sacs.
ss. l. lobed sperm-sacs.
spth. spermatheca.
c. r. ciliated rosettes in somites x, xi.
clt. clitellum.
ov. ovary.
od. oviduct.
op. ovipore.
♂ . male papilla.
pr. prostate gland or atrium.
s. i. sacculated intestine.
sp. d. Sperm ducts.
v. v. ventral longitudinal vessel.
d. v. main longitudinal dorsal vessel.
s. d. v. secondary dorsal vessel.
s. v. v. secondary ventral vessel.
l. v. lateral vessel from the diverticulum.
œs. œsophagus.
dvt. diverticulum between œsophagus and tubular intestine.
h. hearts.
clt. clitellum.
ms. muscles connecting the glands with the parietes of the somites.
nph. nephridia. In this figure the nephridia have been left out in order not to crowd the lines.
sp. septa.
sl. gl. salivary glands.
i to xx. the roman numerals indicate the number of the somites, counting the prostomium and the peristomium as the first somite (i).

Fig. 2. Section of the seven anterior somites, showing the pharynx and pharyngeal glands. The letters indicate the same as in the previous figure.

Fig. 3. One of the testes in somite xi.

Fig. 4. One of the testes in somite x.

Fig. 5. A body of peritoneal cells of one of the posterior nephridia.

Fig. 6. Part of a septal gland.

Fig. 7. Part of a salivary pharyngeal gland.

Fig. 8. Transverse section of the clitellum.

Fig. 9. Perigastric cells, massed and single.

Fig. 10. Lower part of one of the posterior nephridia.

i. s. g. inter-segmental groove.

nph. pr. nephridio pore.

pr. c. peritoneal cells.

Fig. 11. Anterior part of the œsophageal diverticulum, showing the beginning of the lateral collective vessel. Exterior view.

dvt. exterior of diverticulum.

cl. v. collective vessel.

Fig. 12. Longitudinal section of the anterior part of the diverticulum, showing the lacunary system.

ep. l. inner epithelial lining.

i. l. interior lacunary system.

tb. tube supposed to be joined to *i. l.*

cl. v. collective vessel.

Fig. 13. A more highly magnified part of the former.

ep. l. epithelial lining.

v. bloodvessels.

Plate VI.

Fig. 14. Nephridium of one of the posterior somites. The peritoneal cells in the upper part of the nephridium are not indicated, the general outline only being shown.

Fig. 15. *O. occidentalis.* Testis from somite x.

Fig. 16. *O. occidentalis.* Sperm-sac with duct from somite xi.

s. septum.

Fig. 17. *O. Beddardi.* Oviduct.

Fig. 18. *O. Beddardi.* Sperm duct.

c. r. ciliated rosette.

t. testis.

h. heart; all from somite x.

Fig. 19. *O. Beddardi.* A celloidine section of the diverticulum of the œsophagus in somite ix. The central streamers at *a* and *c* are parts of the diverticulum wall and not any interior partitions,

these walls being raised in such a way as to be cut through in an eccentric section.

v. vessels of the pouch, collecting in the longitudinal vessel, *c. l.*

i. l. interior lacunary system.

œs. œsophagus and tubular intestine.

Fig. 20. *O. Beddardi.* The semi-parallel vessels of the œsophageal diverticulum.

œs. v. œsophageal vessel.

cl. v. collecting vessel.

Fig. 21. *O. occidentalis.* Ovary and oviduct in somites xiii and xiv.

ov. ovary.

od. oviduct.

s. septa.

Fig. 22. *O. occidentalis.* Septal gland of somite vi.

œs. œsophagus.

ms. muscular bands.

Fig. 23. *O. Rosæ.* A collective and semi-schematic view of the anterior part of the body in longitudinal section.

s. ph. gl. supra-pharyngeal ganglion,

sl. gl. salivary glands of the pharynx.

s. gl. septal glands in somites v, vi, vii and viii.

s. septa.

spth. spermatheca.

ss. l. lobed sperm-sacs in somites ix and xii.

s. s. sperm-sacs in somites x and xi.

s. i. sacculated intestine, beginning in somite xiii.

cl. clitellum.

d. v. dorsal vessel.

v. v. ventral vessel.

dvt. diverticulum of the œsophagus in somite ix.

t. testes.

c. r. ciliated rosettes.

ov. ovary.

od. oviduct.

sp. d. the widened or muscular part of the sperm duct.

♂. male papilla.

m. pr. muscular part of the prostate gland.

gl. pr. glandular part of the prostate gland.

Fig. 24. *O. Rosæ.* Male papilla with sperm duct and prostate gland in somite xvii.

m. pr. muscular part of the prostate gland.

gl. pr. glandular part of the prostate gland.

m. sp. d. muscular part of the sperm duct.

sp. sperm duct.

Fig. 25. *O. Rosæ.* A part of the muscular portion of the prostate gland showing glandular cells imbedded in and between the spiral muscles.

gl. glands.

l. inner lumen of the duct, the focus being set on the surface of the duct.

ms. spiral muscles.

Fig. 26. *O. Rosæ* A portion of the upper surface of the glandular part of the prostate gland, showing the ends of the tubular cells.

Plate VII.

Fig. 27. *O. Beddardi.* A spermatheca from somite ix.

d. rudimentary diverticula; a portion of the tubular cells are shown. They are more regular and prominent than in any other species.

b. w. body wall.

Fig. 28. *O. Beddardi.* The other side of the same spermatheca.

d. rudimentary diverticula.

ms. muscular lower part of the organ.

Fig. 29. *O. Beddardi.* Section of the wall of one of the spermathecal diverticula shown in the last figure.

spz. spermatozoa.

Fig. 30. *O. Beddardi,* a semi-schematic view of the lateral vessels in one of the posterior somites.

d. v. dorsal longitudinal pulsating vessel.

v. v. ventral longitudinal non-pulsating vessel.

l. d. v. lateral dorsal vessel, two of which are found in each somite.

l. v. v. lateral ventral vessel, two of which are found in each somite. Both of these two vessels cling principally to the parietes of the somite.

g. v. gastric vessel, one pair of which are found in each somite, they spread on the sacculated intestine, feeding the gastric system.

v. gl. ventral nerve ganglion.

s. septa.

s. i. sacculated intestine. The upper and lower line indicate the parietes of the body somites.

Fig. 31. *O. limicola.* A semi-schematic view of the pharynx, œsophagus, septal glands, dorsal vessel and hearts, showing the relative size of the septal glands and their lobes. Also the connecting vessel in somite ix.

phx. pharynx.

sl. gl. salivary glands.

s. septa.
s. gl. septal glands.
dvt. diverticulum of the œsophagus.
c. v. connecting vessel in somite ix between the dorsal and ventral vessel.
h. hearts in somites x and xi.
s. i. sacculated intestine.

Fig. 32. *O. Beddardi.* Sperm-sac in somite xii.

Fig. 33. *O. Beddardi.* Part of a lobe showing spermatozoa.

Fig. 34. *O. agricola.* The anterior part of the intestine shown in outline.

Fig. 35. *O. limicola.* The spermatheca.

Fig. 36. *O. Rosæ.* The spermatheca.

Fig. 37. *O. Beddardi.* The upper lobe of the septal gland in somite v, and the muscular band around which it is arranged.

Fig. 38. *O. Hendriei.* The anterior somites, longitudinal or side view, showing the relative proportions of the septal glands, sperm-sacs, etc.
sl. gl. salivary glands of the pharynx.
s. septa.
l. v. lateral longitudinal vessel.
spth. spermatheca and spermathecal pore.
dvt. diverticulum of the œsophagus.
s. s. sperm-sacs.
ss. l. lobed sperm-sac in somite xii.
h. hearts in somites x and xi.
c. v. connecting vessel in somite ix.
s. i. sacculated intestine.
d. v. dorsal vessel.
v. v. ventral vessel.

Fig. 39. *O. Hendriei.* Spermatheca.

Fig. 40. *O. Beddardi.* Supra-pharyngeal ganglion, the commissures and the ventral nerve trunk and their branches.

Fig. 41. *O. agricola.* The globular spermatheca.

Fig. 42. *O. contractus.* Side view of the anterior somites, showing the relative proportions of the septal glands, spermatheca, sperm-sacs, etc.
sl. gl. salivary gland of the pharynx.
s. septa.
dvt. diverticulum of œsophagus.
spth. spermatheca.
s. s. sperm-sac in somite ix, x and xi.
ss. l. lobed sperm-sac in somite xii.

Fig. 43. *O. contractus.* Spermatheca from the right hand side of somite ix.

Fig. 43*b*. *O. contractus.* Spermatheca from the left side of somite ix; same individual as last, showing the slight variation in size and form.
Fig. 44. *O. agricola.* Ventral view of the clitellum and male pores.
Fig. 45. *O. contractus.* Distal end of spermatheca more magnified.

Plate VIII.

Fig. 46. *O. agricola.* The prostate gland and the enlargement of the sperm duct. Only a part of the prostate is shown; the beginning of the glandular part is in somite xviii and the end in somite xxvi.
Fig. 47. *O. limicola.* The two prostates in somites xvii and xviii.
Fig. 48. *O. Rosæ.* The prostate and the enlarged sperm duct in somite xvii.
Fig. 49. *O. Beddardi.* The prostate and the sperm duct somite xvii.
Fig. 50. *O. contractus.* The prostate and sperm ducts in somite xvii.

pr. prostate.
sp. d. sperm duct.
v. g. ventral ganglion.
ms. muscular band confining the lower parts of the sperm ducts and the prostates to the parietes of the somites.

Fig. 51. *O. contractus.* The lower part of the prostate and the enlarged sperm duct, showing the relative size of the lumen in the latter.
Fig. 52. *O. contractus.* The ovary and oviduct in somites xiii and xiv.
Fig. 53. *O. limicola.* One of the prostates and part of the sperm duct in somite xvii.
Fig. 54. *O. agricola.* Side view of somites iv to xii.

s. s. sperm-sacs.
ss. l. lobed sperm-sacs.
h. hearts.
s. septa.
sl. g. salivary glands.
sp. gl. septal glands in v, vi, vii and viii.
spth. spermatheca.
dvt. diverticulum of the œsophagus.
t. testes.
œ. œsophagus.
s. i. sacculated intestine in xii.

Fig. 55. *O. Beddardi.* The prostate and part of sperm duct.

st. inner seta in somite xvii.
c. p. copulatory papilla.
b. w. body wall.
sp. d. sperm duct.
pr. prostate.

Fig, 56. *O Beddardi.* The lower part of the prostate showing the muscular part.
Fig. 57. *O. sonoræ.* Part of the sperm duct close to the male pore.

Fig. 58. *O. sonoræ.* Part of the muscular part of the prostate.
Fig. 59. *O. sonoræ.* The prostate and part of sperm duct.
Fig. 60. *O. sonoræ.* Spermatheca.

PLATE IX.

Fig. 61. *O. guatemalæ.* Side view of the anterior somites. The parts of the septal glands covering the œsophagus are not represented.

sl. gl. salivary glands of the pharynx.
s. gl. septal glands.
s. septa.
s. s. sperm-sacs.
dvt. diverticulum of the œsophagus.
œs. œsophagus.
s. i. sacculated intestine.
ov. ovary.
ovd. oviduct.
spth. spermatheca.
d. v. dorsal vessel.
v. v. ventral vessel.
h. hearts.
t. testes.

Fig. 62. *O. guatemalæ.* Spermatheca.
Fig. 63. *O. guatemalæ.* Spermatheca, a smaller form.
Fig. 64. *O. guatemalæ.* Free end of spermatheca more enlarged.
Fig. 65. *O. guatemalæ.* Somite xvii, showing the prostates.
Fig. 66. *O. guatemalæ.* One of the prostates more enlarged.
Fig. 67. *O. contractus.* One of the male papillæ in somite xvii.
Fig. 68. *O. occidentalis.* The male papilla and the inner couple of setæ in somite xvii.
Fig. 69. *O. occidentalis.* The prostates and part of the sperm ducts.

sp. d. sperm ducts.
m. pr. muscular part of the prostate.
gl. pr. glandular part of prostate.
v. gl. ventral ganglion.

Fig. 70. *O. occidentalis.* The anterior somite, side view. In this, as in nearly all the side view figures where the septal glands are shown, only a part of the glands are represented in order to show the œsophagus. In all the species the septal glands surround the œsophagus completely and hide it from view.

sl. gl. salivary glands of the pharynx.
s. gl. septal glands of somites v to viii.
dvt. diverticulum of the œsophagus.
s. s. sperm-sacs.
o. ovary.
ovd. oviduct.

t. testes.
c. r. ciliated rosettes.
h. hearts.
s. i. sacculated intestine.
æs. œsophagus.
s. septa.
d. v. dorsal vessel.
v. v. ventral vessel.

Fig. 71. *O. sonoræ.* The anterior somites, side view. Letters indicate the same as preceding figure.

Fig. 72. *O. Hendriei.* The male pore.

Fig. 73. *O. sonoræ.* The male pore.
a. side view.
b. front view.

Figs. 74 to 82. Setæ of the various species of Ocnerodrilus described in this paper. The figures have all been drawn to the same scale, with camera, and represent the relative size of the seta in the various species. The drawing was made of one of the inner couples immediately behind the clitellum.

Fig. 74. Seta of *O. Beddardi.*
Fig. 75. Seta of *O. sonoræ.*
Fig. 76. Seta of *O. guatemalæ.*
Fig. 77. Seta of *O. Hendriei.*
Fig. 78. Seta of *O. limicola.*
Fig. 79. Seta of *O. Rosæ.*
Fig. 80. Seta of *O. contractus.*
Fig. 81. Seta of *O. agricola.*
Fig. 82. Seta of *O. occidentalis.*

Fig. 83. *O. Hendriei.* The prostate.
pr. prostate.
sp. d. sperm duct.
v. gl. ventral ganglion.

Fig. 84. The œsophageal diverticulum of *O. occidentalis.*

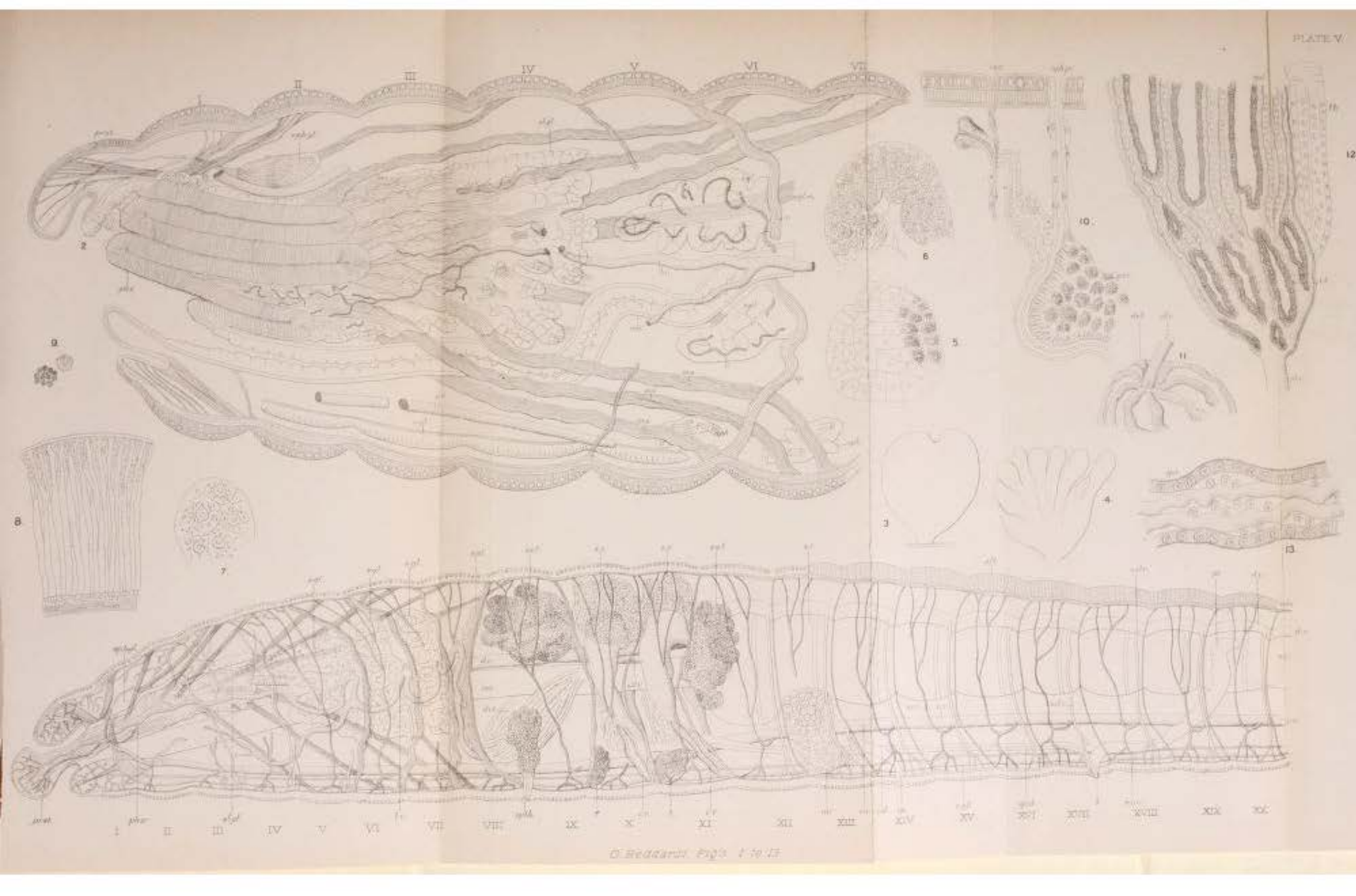
Fig. 85. The œsophageal diverticulum of *O. sonoræ.*

Plate X.

Figs. 86 to 91. Diagram of the organs of various genera showing relationship with Ocnerodrilus.

Fig. 86. *Ocnerodrilus.*
Fig. 87. *Gordiodrilus.*
Fig. 88. *Pontodrilus.*
Fig. 89. *Photodrilus* (after Benham).
Fig. 90. *Microscolex* (after Benham).
Fig. 91. *Pygmæodrilus* (after Benham).

PLATE V.



G. Beddard. Figs. 1 to 13.

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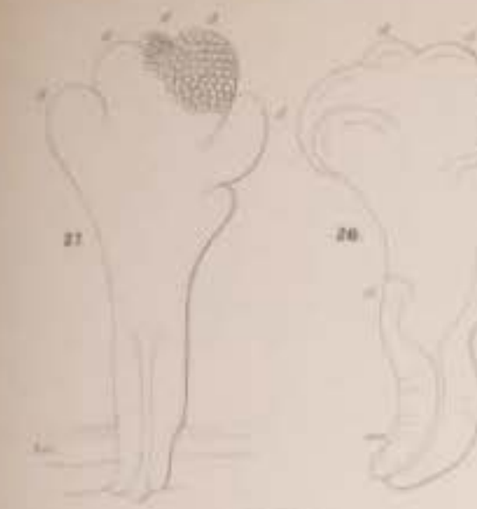
O. Baddeana: Figs. 14, 15, 16, 17, 23, 24, 25, 26. *O. occidentalis*: Figs. 18, 19, 20, 21. *O. Rossi*: Figs. 22, 23, 24, 25, 26.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XI


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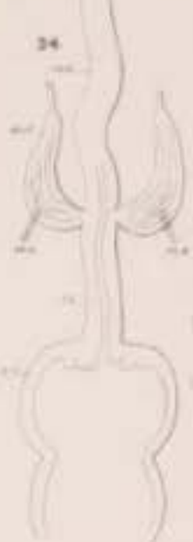
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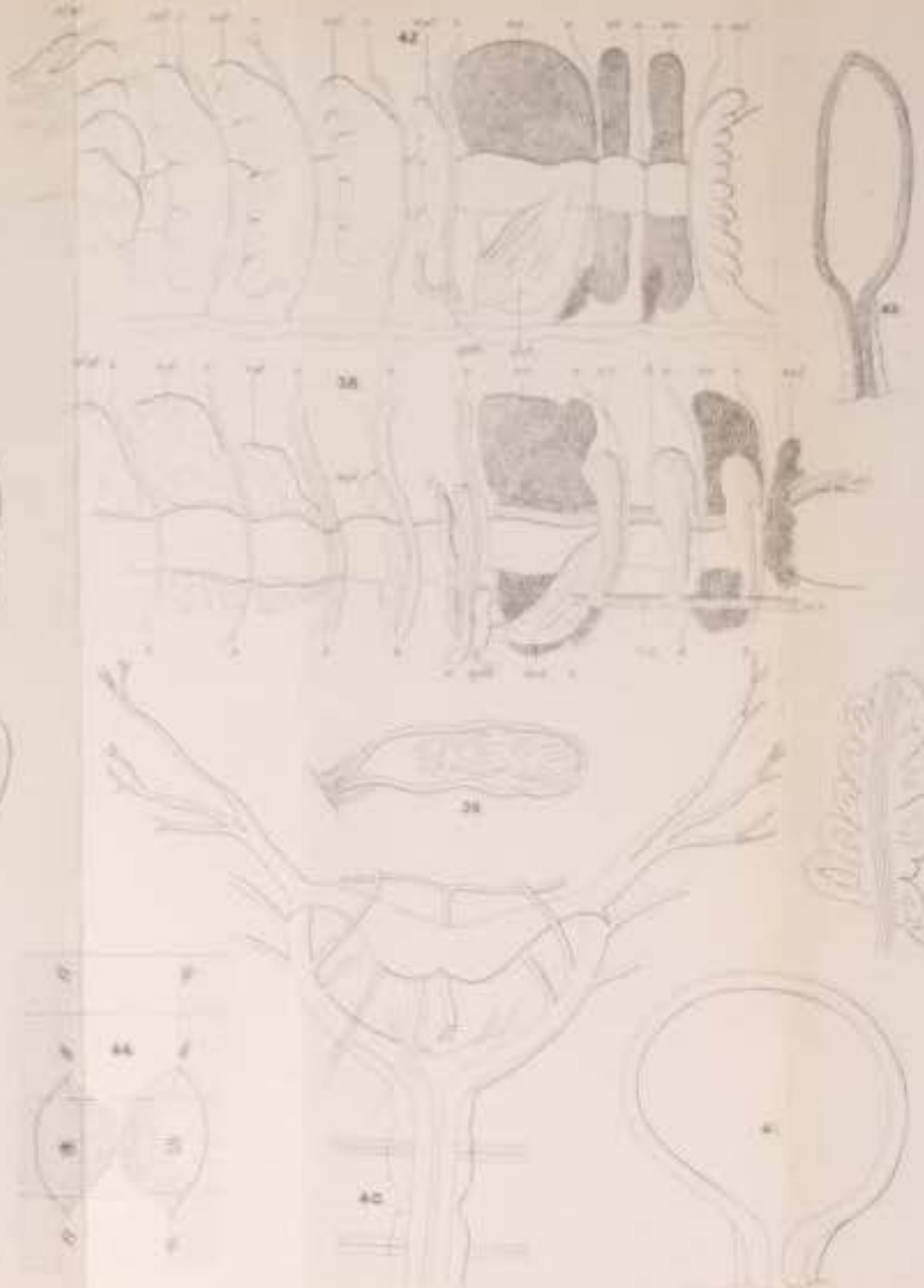
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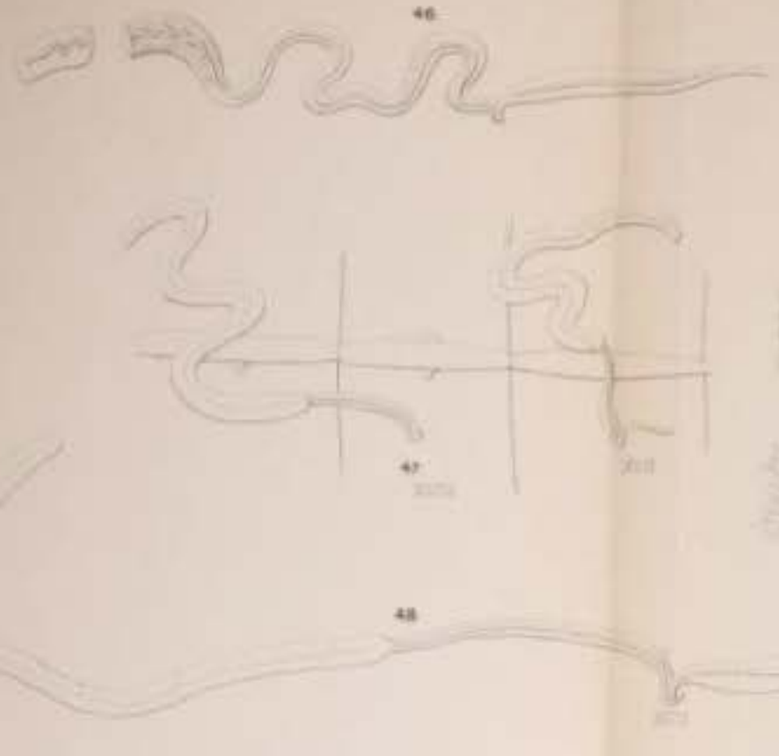
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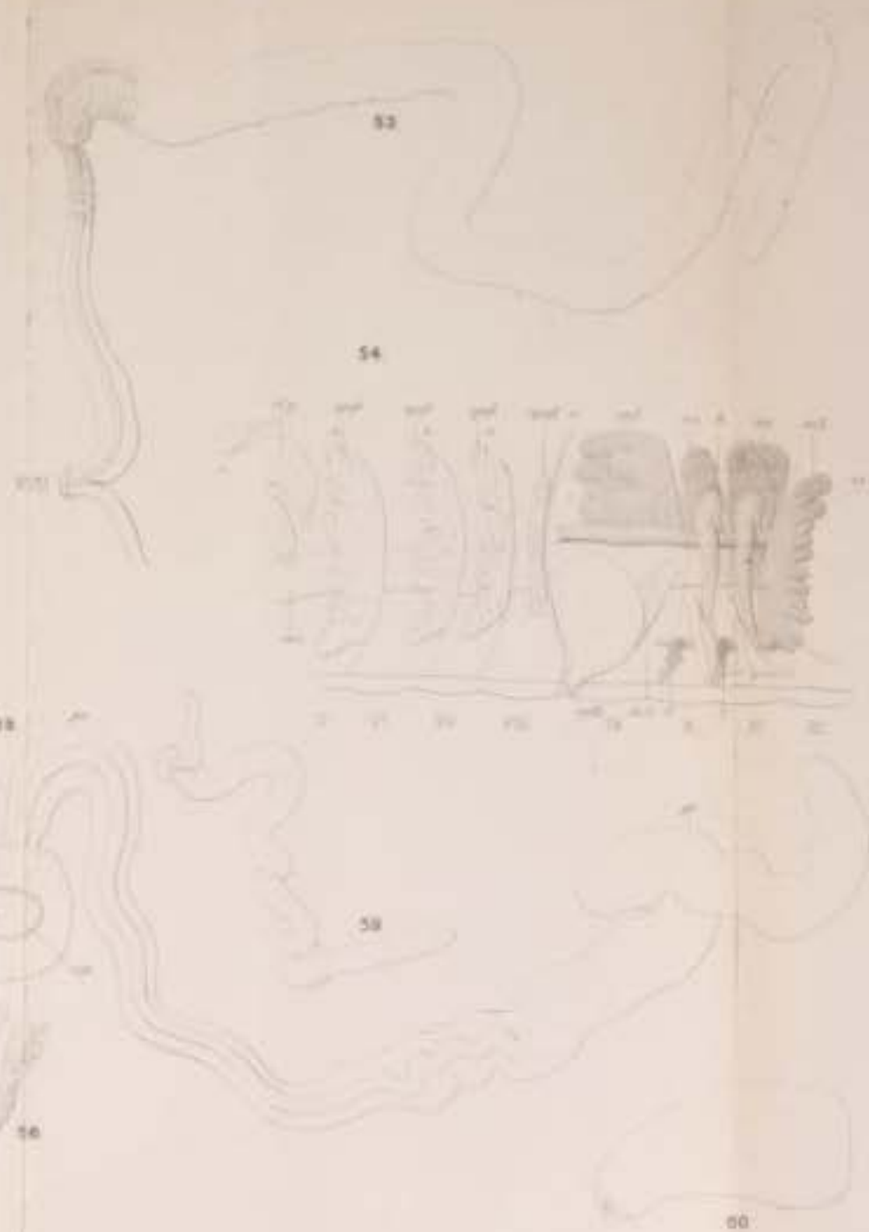
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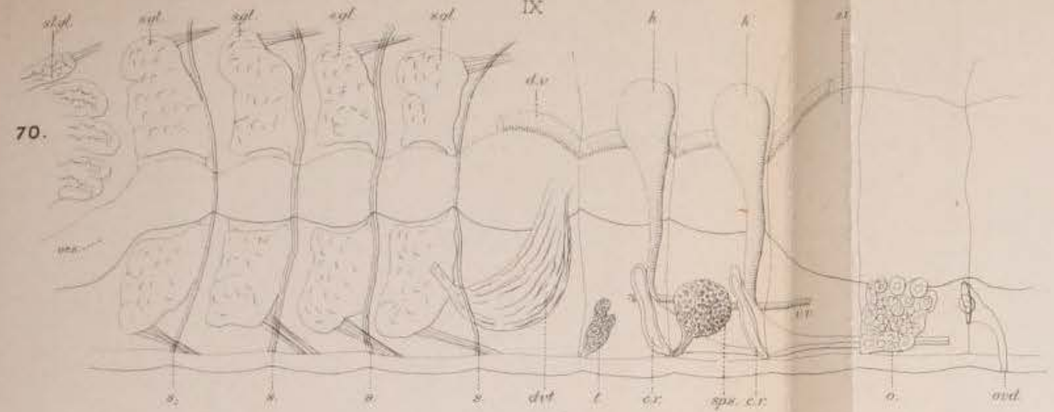
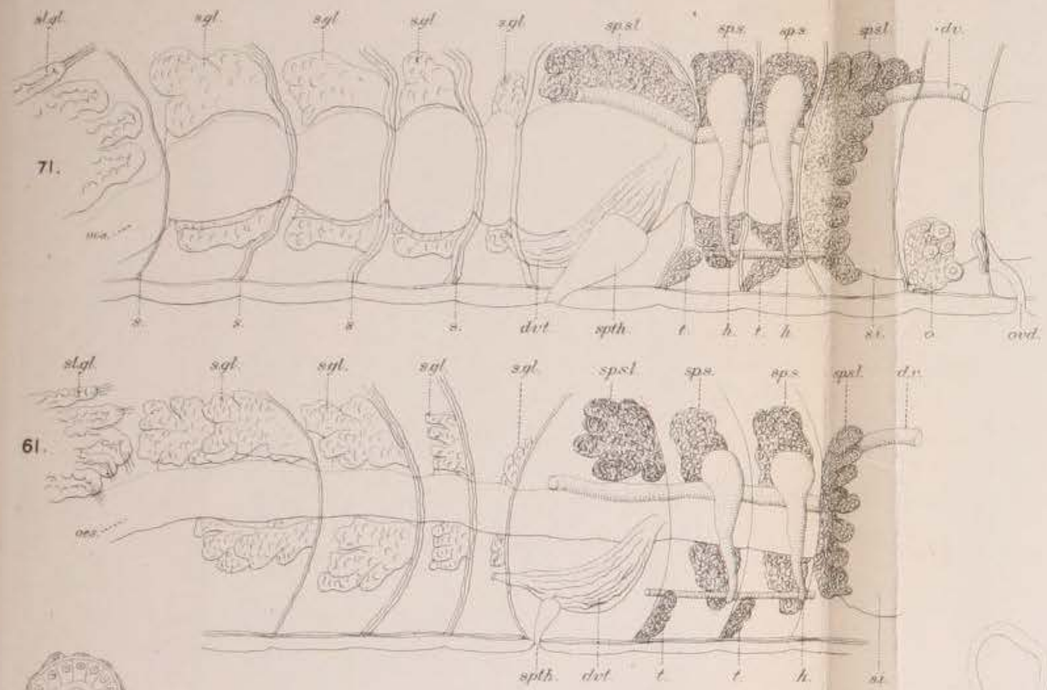
PLATE IX.



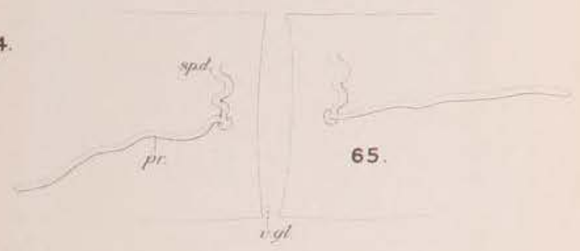
70.



71.

61.

64.



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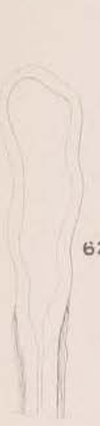
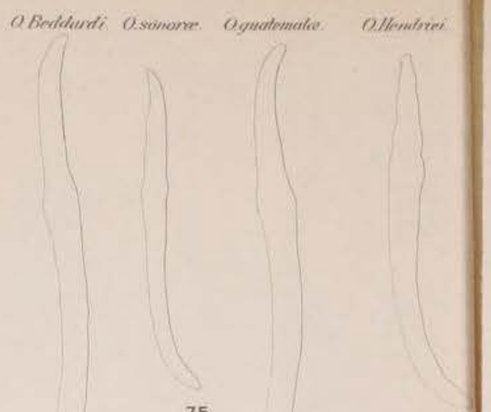
63.



62.

83.



74.

75

76.

77.

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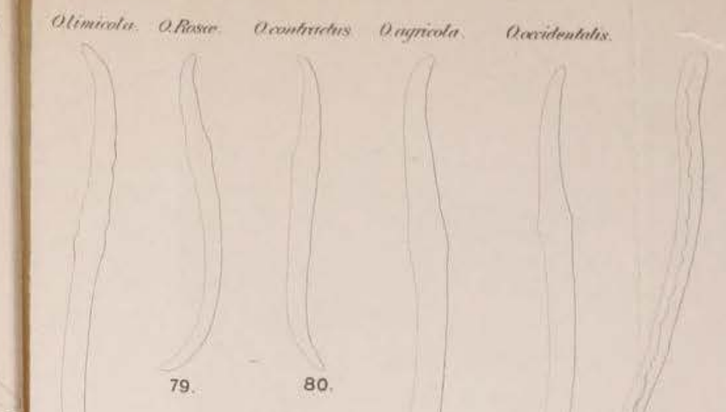
84.

85.



78.

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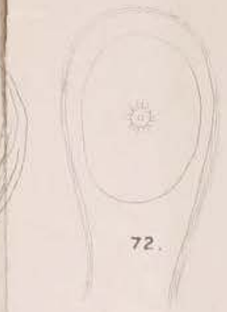
82.

66

73B.

73



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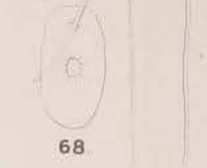
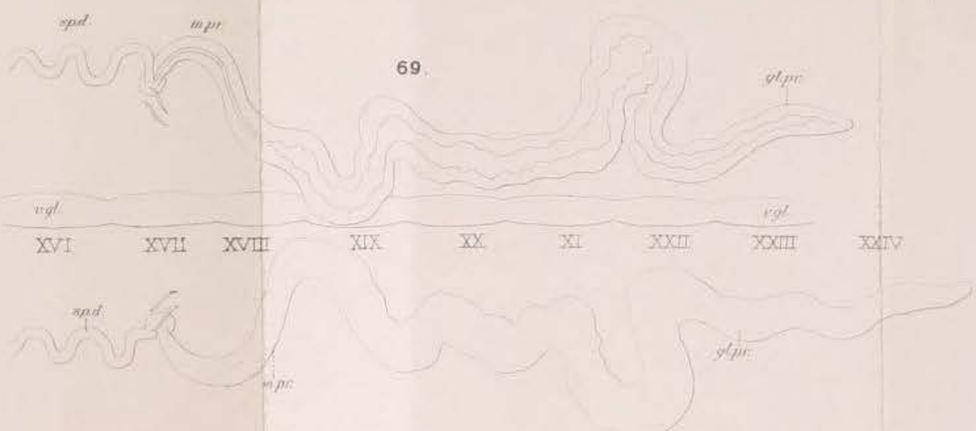


68

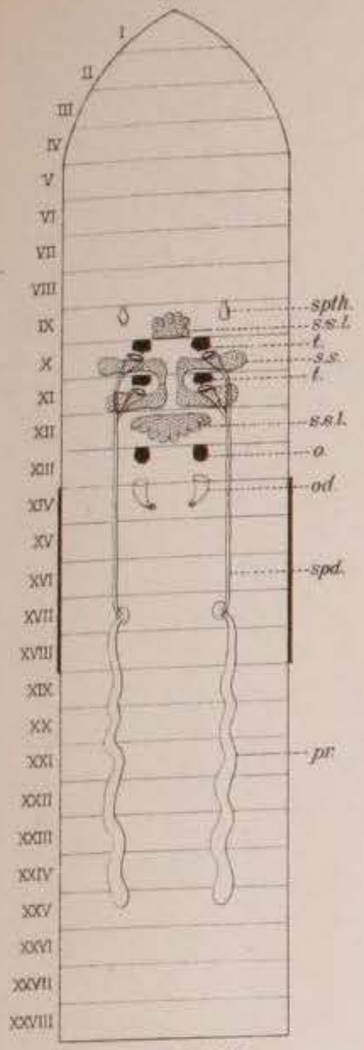


69.

O. guatemalæ Fig's. 61. 62. 63. 64. 65. 66. 76. O. contractus Fig's. 67. 80. O. occidentalis Fig's. 68. 69. 70. 82. 84. O. sonoræ Fig's. 71. 73. 75. 85. O. limicola Fig's. 78. O. Hendriei Fig's. 72. 77. 83.

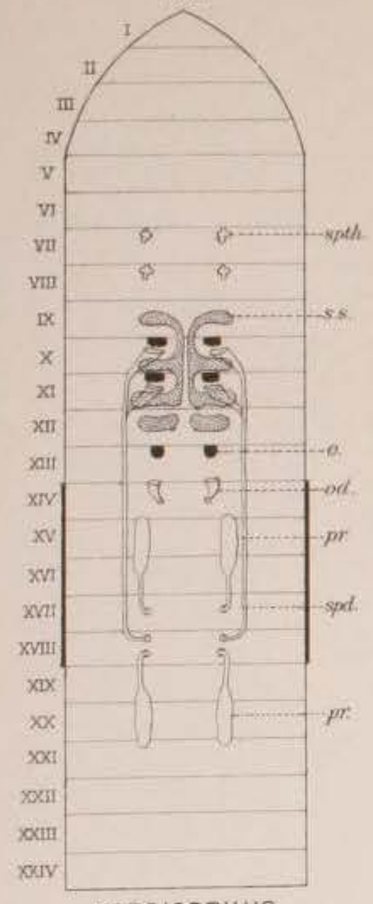
O. Beddardi Fig's. 74. O. Rosæ Fig's. 79. O. agricola Fig's. 81.

86.



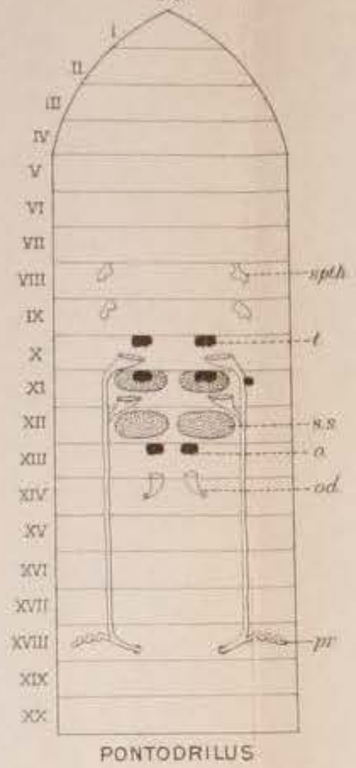
OCNERODRILUS

87.



GORDIODRILUS

88.



PONTODRILUS

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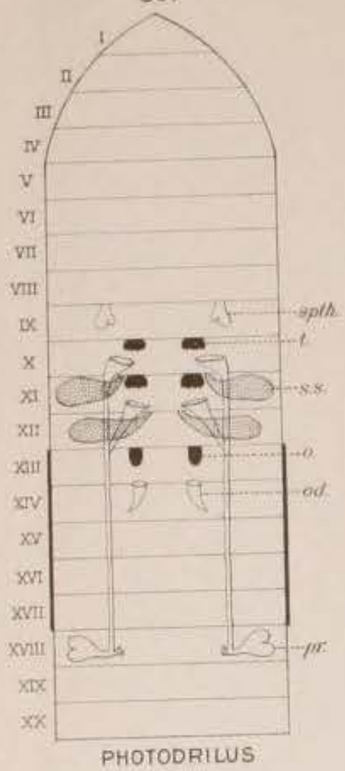
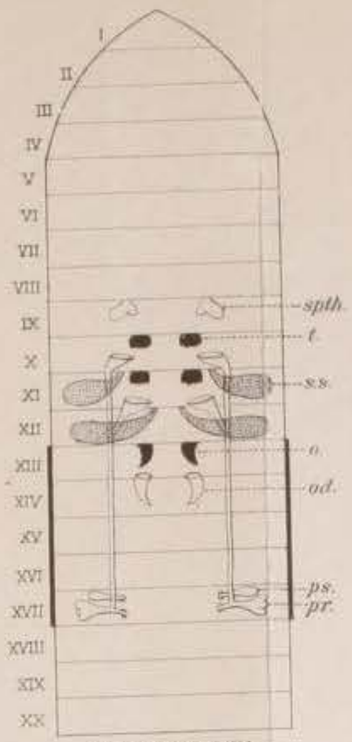


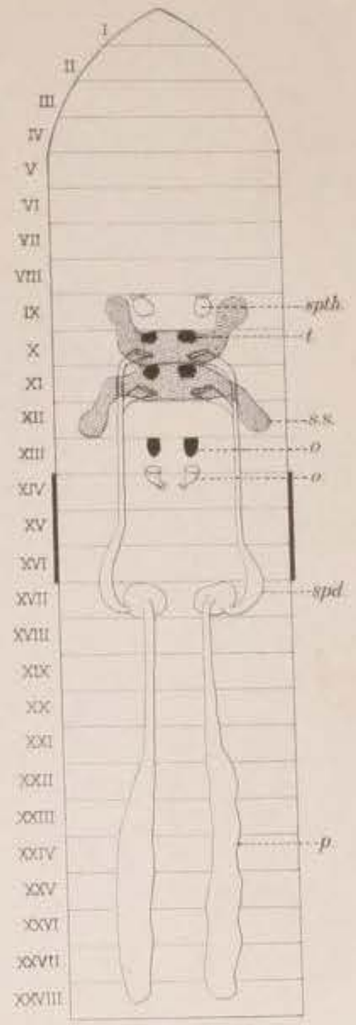
PHOTODRILUS

90.

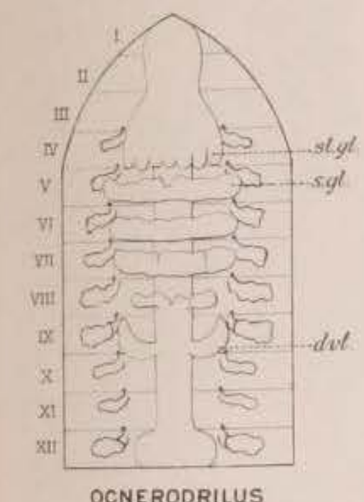


MICROSCOLEX

91.



PYGMÆODRILUS



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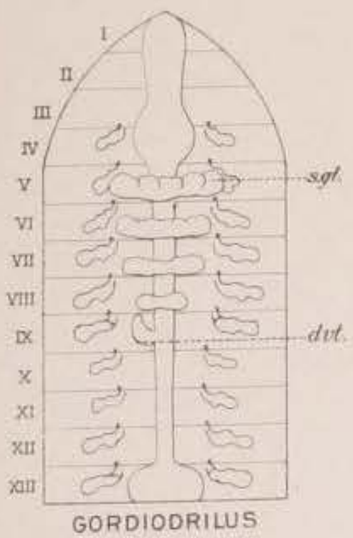

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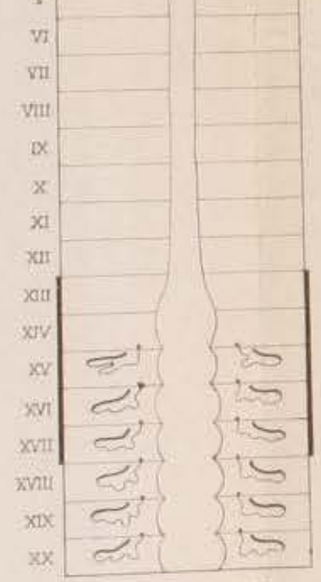

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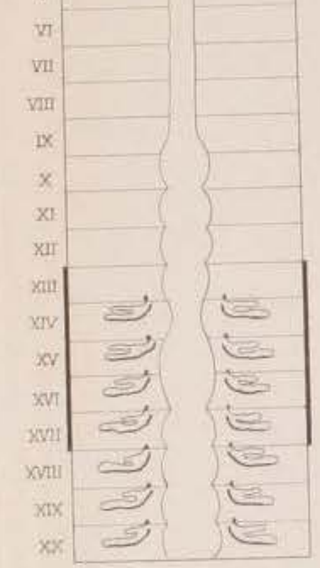

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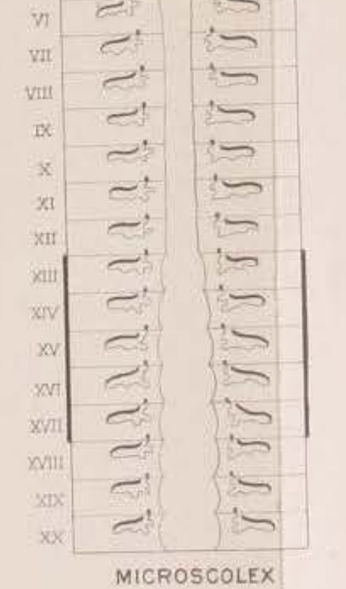

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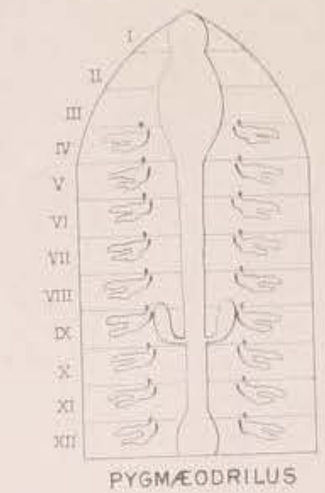

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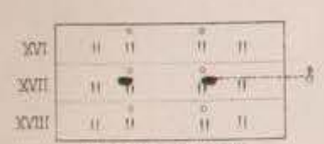

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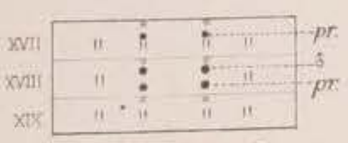

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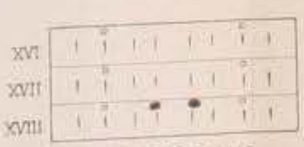

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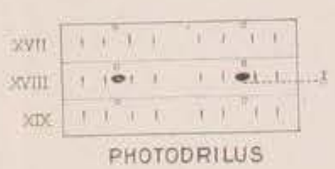

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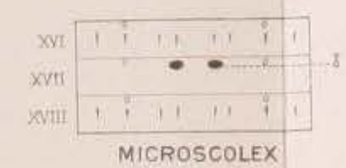

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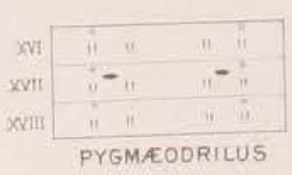

PYGMÆODRILUS

Hernia McDonaldi. Figs. 1 to 8. 8 to 10 12. Hernia zonalis. Figs. 7 11

Kerria McDonaldi Figs. 10 to 19, 22 to 27.

Kerria zonalis Figs. 20, 21.

Conchaphis Bealeana Fig. 28.