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*ARTICLE XI. NOTES ON SPECIES OF NORTH AMERICAN OLIGOCHÆTA. IV. ON A NEW LUMBRICULID GENUS FROM FLORIDA, WITH ADDITIONAL NOTES ON THE NEPHRIDIAL AND CIRCULATORY SYSTEMS OF MESOPORODRILUS ASYMMETRICUS SMITH.*

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BY FRANK SMITH, A. M.

Assistant Professor of Zoölogy, University of Illinois.

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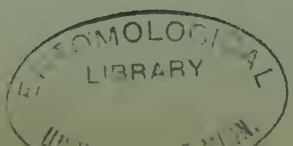

## ERRATA.

Page 136, line 2, and page 182, line 17 from bottom, for '*95a* read '*95*.

Page 226, line 2, page 263, line 17 from bottom, and page 267, lines 2 and 15, for '*98*, read '*96*.

Page 233, line 15 from bottom, for '*82* read '*82a*.

Page 355, line 2 from bottom, for C. *F.* Hudson read C. *T.* Hudson.

Page 389, foot-note, for Vol. *V.* read Vol. *IV.*

Page 457, line 5, for *Genera* read *Genus*.

ARTICLE XI.—*Notes on Species of North American Oligochæta. IV. On a New Lumbriculid Genus from Florida, with Additional Notes on the Nephridial and Circulatory Systems of Mesoporodrilus asymmetricus Smith.* By FRANK SMITH.

*Premnodrilus palustris* n. g. et n. sp.

The worms here described were found by Mr. Adolph Hempel in a decayed stump in a marsh in Polk county, Florida, in March, 1897. The collection consists of eight sexually mature individuals and a few others that are imperfect or immature. The worms were killed in corrosive sublimate and preserved in alcohol, and are in excellent condition for study. All of the facts pertaining to this species which are presented in this paper have necessarily been obtained from an examination of this preserved material.

Sexually mature specimens, well extended, average about 50 mm. in length and 1 mm. in diameter at the tenth somite, where the diameter is greatest. The body gradually decreases in diameter toward the posterior end, where the somites are relatively smaller and less distinct. The anterior end terminates in a proboscis about .15 mm. in length, its diameter being .07 mm. at the base and .035 mm. at the middle. In these preserved specimens it is bent upwards. In five apparently complete individuals the number of somites varies from 155 to 177, the average number being 167.

The clitellum extends from the anterior part of VIII to the middle of XII, and is developed on the ventral surface. The spermiducal pores are on the ventral side of IX (Pl. XLI., Fig. 1); the oviducal pores are in the groove between somites X and XI and in line with the ventral setæ; and the spermathecal pores are on the ventral side of VIII, a short distance posterior to the ventral setæ of that somite. It will be noted that the external openings of the reproductive organs are further forward by one somite than is usual in the *Lumbriculidæ*. The three sectioned specimens which form the

basis of this description show uniformity throughout in the position of the various reproductive organs.

There are four pairs of setæ in each of the setigerous somites, the interval between the dorsal and ventral bundles of one side of a somite being five sevenths as great as that between the two ventral bundles and one half as great as that between the two dorsal bundles of the same somite. The setæ are of the ordinary sigmoid form, without a cleft at the outer extremity, and are somewhat variable in length, but average about .2 mm. There are no genital setæ.

The brain consists of two lateral masses, each with its longest axis dorso-ventral, the two being connected by a stout fibrous commissure. The surface layer of each mass, except in the ventral region, consists of a thick layer of nerve cells. The commissures extending to the ventral cord and the large nerve trunks leading to the prostomium are given off from the ventral side of the lateral masses.

No marked peculiarities have been noticed in the alimentary tract. There is a gradual transition from pharynx to intestine without any well-marked intermediate œsophagus. The anterior part of the pharynx is capacious, with a dorso-ventral diameter considerably greater than the lateral one. The ventral wall of the pharynx is quite thin, while a thick glandular wall extends over the dorsal, and somewhat more than half over the lateral, region. Toward the posterior part of the pharynx the dorso-ventral diameter decreases, as does also the extent of the thin ventral wall, and in the anterior part of IV the walls are uniform in thickness and circular in outline. The thickened part of the pharyngeal wall is ciliated. Chloragogue cells first appear in the sixth somite. There are no pharyngeal glands, but there are a few deeply staining cells on some of the muscular strands in a few anterior somites. On the anterior face of septum VI/VII and on both faces of septum VII/VIII are borne rather small masses of cells which do not stain very deeply. They may correspond to the septal glands of some *Oligochæta*. In that part of the body containing the reproductive organs the lateral diameter of the intestine is greatly reduced (Pl.

XLI., Fig. 3), so that the lumen is a mere slit and the lateral walls are almost in contact.

The study of the circulatory system in this species, necessarily confined to sections of preserved material, has been incomplete and somewhat difficult. The dorsal vessel contains an extensive "Herzkörper" of nearly uniform diameter, and similar structures are present in the lateral vessels of X and of a few preceding somites. The ventral vessel forks near the septum III/IV. In each of somites II–IX a single pair of lateral vessels connects the dorsal vessel with the ventral vessel or with its anterior branches. These vessels have a somewhat tortuous course and are without chloragogue cells. The lateral vessels of VIII follow the spermathecæ into IX and sometimes farther, while those of IX extend inside the sperm-sacs through a considerable number of the succeeding somites. In somite X there are two pairs of lateral vessels, the anterior pair connecting the dorsal vessel with the ventral part of an extensive plexus of vessels in the intestinal wall, and each vessel of the posterior pair extending posteriorly, through several somites, between the corresponding sperm-sac and its inclosing membrane, and connecting the dorsal and ventral vessels. In somite XI and in each succeeding one there are two similar pairs of lateral vessels, which pass from the dorsal vessel outward and downward near the body wall, and enter the intestinal plexus on the ventral side of the intestine. A short blood-vessel connects the ventral vessel with that part of the intestinal plexus into which the lateral vessels of the anterior pair open, and a similar vessel connects the ventral vessel with the corresponding region of the plexus into which open the vessels of the posterior pair. The lateral vessels of XI and of succeeding somites have cœcal diverticula, and those of somites posterior to XI are invested with a layer of chloragogue cells. In each of a few somites at the posterior end there is but one pair of lateral vessels.

The nephridia are quite similar in structure to those of other members of this group, the funnel being situated in the posterior part of one somite, and the remainder of the

nephridium in the somite next following, with the nephridiopore a little anterior to the ventral setæ. On the duct, a short distance posterior to the funnel, is a compact glandular mass through which ramify minute ductules that seem to be branches of the main duct. A considerable part of the coiled region of the nephridium is in close relation to the dorsal part of the ventral vessel.

The arrangement of the nephridia is an unusual one, or, at least, different from that ordinarily assumed to exist in the *Lumbriculidæ*. In one of the sectioned specimens there are no nephridia anterior to XIV, while in the other two there are nephridia in VI–VIII but none in the following somites anterior to XII, the first nephridiopores posterior to the reproductive organs being in XII. In each of the two individuals having nephridia anterior to the reproductive organs there is but one pair so situated, and the funnels of these nephridia are in V, the nephridiopores in VI, and the main masses of the organs extend along the dorsal side of the ventral vessel into VII and VIII. Posterior to the clitellum there is ordinarily but one nephridium in each somite,—an examination of over a hundred somites affording but two exceptions to this rule,—and the more common arrangement is one in which there is on each side of the body, alternately, a single nephridium in each of several successive somites.

In the three specimens studied there is but one pair of testes in each, and these are borne on the posterior face of septum VIII/IX; but since there is a pair of spermiducal funnels in VIII as well as in IX, it seems probable that there has also been at some time a pair of testes in VIII.

The spermiducal apparatus is quite complex and somewhat similar to that of *Eclipidrilus* and *Mesoporodrilus* (Eisen, '95, pp. 87–89; Smith '96, pp. 404, 405). It will perhaps be advantageous to mention briefly the principal structures composing it before giving a detailed description. As already stated, there are two pairs of spermiducal funnels, one on the posterior septum of VIII and the other similarly situated in IX (Pl. XLI., Fig. 1). The two sperm-ducts of either side extend backward to the posterior part of X or to the anterior

part of XI, where they enter the wall of the anterior end of a long sperm-reservoir which extends backward through six to eight somites. After passing through the muscular layer of this wall the ducts pass between it and the inner epithelium to the posterior end of the reservoir, where they open into its cavity. The anterior part of the reservoir is continued as a much narrowed and often considerably contorted duct, which is continuous with the inner end of a large muscular penial apparatus, the spermiducal pores being situated on the posterior part of the ventral side of IX.

We can now go a little more into detail in describing the spermiducal structures. As already stated, there are no testes in VIII, although that somite contains a pair of spermiducal funnels. The presence of an abundance of spermatozoa in the sperm-reservoir and spermathecæ and of well-developed ova bears evidence that the animals had at least reached a state of sexual activity, and yet the most careful examination revealed not the slightest trace of testes in VIII. A similar condition of affairs is described by Beddard ('92, p. 196) as existing in *Sutroa alpestris*, in which species he found spermiducal funnels in IX and X but no trace of testes in the former somite. The smaller and more variable size of the funnels in VIII and the smaller diameter of their ducts—which is only a third of that of the posterior ones—may reasonably be regarded as indicating a degenerate condition, and that the complete disappearance of the testes has preceded that of the funnels and ducts.

Each of the sperm-ducts leading from the anterior funnels bends abruptly down, passing through the testis close to its attachment to the septum. It then turns posteriorly and passes into the extensive mass of muscular tissue surrounding the ventral part of the penial structure. After emerging from this mass it extends upward for a short distance alongside the muscular investment of the penis, passing along its ental surface, and then extends across to the muscular duct between the penial organ and the sperm-reservoir, which it follows to the latter organ, and, as before stated, passes between its muscular layer and inner epithelial lining, along

the ventral side of its cavity. Each of the sperm-ducts connected with the posterior funnels extends at first directly downward, and then, bending posteriorly, takes a quite direct course to the muscular duct, which it follows to the sperm-reservoir. Passing then through the muscular coat of that organ it extends posteriorly, having the same relation to the muscle layer and lining epithelium as has the duct from the anterior funnel, except that it lies on the dorsal instead of the ventral side of the cavity and opens into the chamber at a point nearly opposite the opening of the anterior duct.

Each sperm-reservoir lies in the sperm-sac of its own side, and extends from the posterior part of X or the anterior part of XI for a distance of six to eight somites. This organ has powerful muscular walls, which are not constricted by the septa, and which consist of a thin inner epithelial layer, a thin layer of circular muscle fibers, and an outer and much thicker layer of muscle fibers which are nearly longitudinal but have a somewhat spiral course. Numerous large cells, apparently glandular in nature, lie outside the reservoir, and are connected with its wall by elongated narrowed extensions which presumably function as ducts, but have not been followed beyond the superficial portion of the muscular wall. The cells are altogether similar to those figured and described by Eisen ('95, p. 88) as being numerous about the anterior end of the "storage chamber" of *Eclipidrilus frigidus*. In *Premnodrilus palustris*, however, they are more abundant near the posterior end of the chamber, and much less frequent at the anterior end. Besides these large prostate glands, following Eisen's nomenclature, there is a more or less interrupted layer of smaller cells much like those called by Eisen small prostate glands. The inner epithelium is everywhere thin and the cell walls are indistinguishable.

Throughout the greater part of its length the sperm-reservoir, exclusive of the layer of prostate cells, has a diameter of about .25 mm., that of its lumen being about .08 to .09 mm. The diameter of the reservoir diminishes more gradually toward the anterior end than toward the posterior, and the chamber tapers off into a muscular duct

about 1 mm. in length, of which the diameter is .015 to .025 mm., while that of its lumen is .005 to .010 mm. The walls of this duct include an inner epithelium, layers of circular and longitudinal muscles, and an outer layer of small, more or less isolated cells, like that already described for the sperm-reservoir. This duct is usually contorted in its course, and passes through the muscular wall of the inner end of the penial apparatus and opens into the inner end of the greatly elongated penis. There is no "prostate" nor "atrium" as in *Eclipidrilus frigidus*, and the muscular duct, which is perhaps comparable to the "bridge" of *E. frigidus*, connects the sperm-reservoir directly with the penis.

The proportions and relations of the penis in *Premnodrilus palustris* can best be understood by reference to Fig. 1, Pl. XLI. The penial apparatus includes an elongated sac lined with epithelium, continuous with the outer epithelial layer of the penis proper, and, adjacent to this, a thick layer of longitudinal muscle, outside of which is a delicate epithelium. No layer of circular fibers is developed. In a specimen in which the penis is not much protruded the penial sac extends upward and backward into the anterior part of XII, the posterior septa of IX, X, and XI being forced back with it. Strong muscular bands connect the free end of the sac with the dorsal body wall of XII–XV, the strongest band being in the posterior part of XIV. The long slender penis is inclosed by the walls of the muscular sac, but is nowhere connected with it except at its inner end. Its entire length is 1.25 mm., of which .4 mm. is protruded from the body in one of the specimens studied. Its diameter varies from .015 mm., near the tip, to .08 mm., near the point of attachment, and at the middle is about .04 mm. Its unusual length is doubtless correlated with the correspondingly long spermathecal duct, to be described later.

The lumen of that portion of the sperm-duct which forms the penis has a nearly straight course and is of small diameter, being but .005 mm. at a point midway of its length. The penis is covered superficially by an epithelial layer continuous

with that of the muscular sac inclosing it, while the lumen of the sperm-duct which passes through it is surrounded by an epithelial layer continuous at the inner end with that of the muscular duct, and at the tip with the epithelium covering the outer surface. Between these two epithelial layers is a tissue composed of elongated cells, slightly inclined to the long axis, which connect the inner and outer epithelial layers. The cells are not as closely packed as are those of muscle layers, and the tissue which they compose probably corresponds to the "fibrous tissue" which is present in the atrium of *E. frigidus.*

A pair of large elongated sperm-sacs extends backward from the posterior septum of IX through twelve to eighteen somites. A sperm-reservoir and its connecting ducts are situated in the anterior part of each, and in one specimen the spermathecæ also were included in the anterior part of the sperm-sacs (Pl. XLI., Fig. 3). The posterior part of each sperm-sac is constricted by the septa, and in the specimens studied the cavities were filled with spermatozoa.

One pair of ovaries is present in the anterior part of X, and a pair of oviducal funnels is borne on the posterior septum of that somite, opening to the exterior in the groove between X and XI. Large ova were present in but one specimen and were contained in X. From the posterior part of that somite a thin sheath of cells extends backward, enveloping the sperm-sac, and including in the cavity between them the posterior pair of lateral vessels of X. The posterior limits of this sheath have been difficult to determine, and there is certainly no appreciable space between it and the posterior end of the sperm-sac, neither have any signs of ova been found within it. It may be, however, that it represents an ovisac into which ova might pass at a later stage of development.

There is one pair of spermathecæ, opening on the posterior part of the ventral surface of somite VIII. These organs are unusually long and much differentiated in their structure. In two specimens they push the septum VIII/IX backwards into IX, forming contorted masses, while in the other specimen each spermatheca extends posteriorly into the corre-

sponding sperm-sac, and lies dorsad of the sperm-reservoir and parallel with it (Fig. 3), one extending into XII and the other as far as XVII. In two specimens, in which careful measurements were made, the entire length of each spermatheca was a little over 3 mm., the greatest diameter being .25 mm. The general form and proportions of these organs can be readily seen in Fig. 2.

Each spermatheca includes three distinct regions, which may be designated respectively as duct, storage region, and glandular region. The duct is about 1 mm. in length, and has comparatively thick walls, which consist chiefly of longitudinal muscle fibers. The muscular layer is thickest in the middle of the duct and gradually thins out near the beginning of the storage region. The diameter of both duct and lumen is subject to considerable variation as shown by the following measurements, which are very nearly the same for the two spermathecæ most carefully studied. At a distance of .25 mm. from the pore the diameter of the duct is .1 mm. and that of the lumen .05 mm., and in this region the lining epithelium is thrown into numerous high transverse folds, which nearly fill the cavity. The diameter of the duct .4 mm. from the pore is .1 mm., while that of its lumen is reduced to .02 mm. From this point to the beginning of the storage region the diameter of the duct gradually decreases to .045 mm., while the lumen at first increases to .045 mm., next decreases to .02 mm., and then enlarges into the cavity of the storage region. The storage region is about .5 mm. in length and has a diameter of .15 mm. for the first half, then widens out to .22 mm., and is next constricted to .14 mm. where the division between the second and the third region occurs. Its walls are quite thin in the part nearest the duct, but gradually become thicker and more glandular and like those of the third region. This third, or glandular, region is about 1.85 mm. in length, and its diameter is pretty nearly uniform, varying only from .2 mm. to .25 mm., while that of its lumen varies from .12 to .18 mm. The storage region and the glandular region are not sharply differentiated, but the former is filled with spermatozoa while the latter con-

tains but few or none, and the walls of the two regions are decidedly different in structure except in the parts adjacent.

The spermathecal wall consists of outer and inner epithelial layers, in addition to which layers of muscle tissue are present in the duct. The outer epithelium is everywhere thin, and composed of flattened cells except near the middle of the duct, where this layer is considerably thickened and the cells are columnar in character. The inner epithelial layer is of moderate thickness in the duct and in the greater part of the storage region, and its cells stain quite deeply in hæmatoxylin. In the remainder of the storage region and in the glandular part this layer becomes quite thick, and is composed of columnar cells having their nuclei in the basal portion and staining only slightly in Ehrlich's hæmatoxylin. A layer of circular muscle fibers, which lies next to the inner epithelial layer and is comparatively thin, is present throughout the whole length of the duct. Between this layer and the outer epithelium there is a layer of longitudinal muscle fibers which is quite thick in the greater part of the duct, but thins out, and finally disappears in the part nearest the storage region.

From the foregoing description it is evident that *Premnodrilus palustris* belongs to that branch of the *Lumbriculidæ* which includes the peculiar genera *Eclipidrilus* and *Mesoporodrilus*. For the purpose of studying the relationships of these different forms, a more extended examination of the nephridial and circulatory systems of *Mesoporodrilus asymmetricus* has been made, the results of which are next recorded.

### *Nephridial and Circulatory Systems of Mesoporodrilus asymmetricus Smith.*

In the original description of this species the only reference to the nephridia is to the effect that the first pair is in VII, and that the nephridiopores are in front of the ventral setæ (Smith '96, p. 404). A re-examination of the material studied, however, with more careful attention to the nephridia, shows that the main masses of the pair belonging to VII extend

alongside the ventral vessel into IX; that there are no other nephridia until we reach XII; and that in this somite and in each of the following ones there is but one nephridium, the order of occurrence being that common in *Premnodrilus palustris*, in which, as before stated, there is on each side of the body, alternately, a single nephridium in each of several successive somites. The asymmetry found to exist in these two species suggests that possibly the views ordinarily held as to the universality of the paired arrangement of the nephridia in the *Lumbriculidæ* may be due to the lack of a careful examination of their distribution. On the other hand, in *Thinodrilus inconstans*, in a species of *Sutroa* from Yellowstone Park, and in *Eclipidrilus frigidus*,—the only other species of *Lumbriculidæ* which have been accessible to the author for study,—the nephridia are paired.

Our knowledge of the circulatory system is necessarily incomplete, since the material for the study of this species is limited to serial sections of parts of two specimens; but it has been possible to ascertain several facts concerning it.

As in many other aquatic *Oligochæta*, branches of the vascular system are freely distributed to the wall of the intestine, taking either the form of extensive plexuses or of sinuses of considerable extent. The ventral vessel is forked near the septum V/VI, and in each of somites II–V its branches are connected with the dorsal vessel by one pair of perigastric vessels.[1] In the anterior part of each of somites VI–IX a pair of lateral vessels invested by gland cells connects the ventral vessel with the dorsal part of the intestinal plexus, while in the posterior part of each, a pair of slender lateral vessels without investing gland cells and having a somewhat tortuous course connects the dorsal and ventral vessels. The relations of the lateral vessels in X are similar to those existing in VI–IX, except that the posterior vessels extend backward through several somites.

Before describing further the course of these vessels, it

[1] The terms perigastric and gastric are applied as by Eisen, who calls lateral vessels lying in the cœlomic cavity perigastric, and those closely associated with the wall of the alimentary tract gastric.

becomes necessary to correct the statement made in the original description that there is but one sperm-sac (Smith '96, p. 405), for while it is true concerning the specimen of which transverse sections were made and in which the reproductive organs were somewhat degenerate, in the other specimen there are two sperm-sacs, one containing the sperm-reservoir and the greater part of the spermiducal apparatus, and the other, a considerably smaller one, belonging to the other side of the worm, containing no trace of a sperm-duct. Each of the posterior pair of lateral vessels of X extends backward into the sperm-sac of its own side, forming long loops in its course. In the specimen of which transverse sections were made and in which there is but one sperm-sac the posterior lateral vessel of X which is in the side containing the sperm-sac extends posteriorly into that organ for a distance of several somites, while the corresponding vessel of the other side extends posteriorly for a similar distance, and is closely invested by a layer of tissue which doubtless represents a degenerate sperm-sac.

In the individual most carefully studied somites XI–XVII have no perigastric vessels, but there seem to be two pairs of gastric vessels in each (Pl. XLI., Fig. 4). There is an anterior pair of lateral vessels without cœca in each of somites XVIII–XXIII, which leave the dorsal vessel as perigastric vessels but unite with the intestinal plexus instead of the ventral vessel. There is considerable variability in the positions at which these vessels enter the intestinal wall. It may be anywhere from the ventral part of the intestine to a position two thirds of the way from the ventral to the dorsal region (Fig. 5). The posterior pair of lateral vessels in each of these somites are gastric vessels. In each somite the ventral vessel is connected with the ventral part of the intestinal plexus in the two regions that are most closely related to the two pairs of lateral vessels. A considerable number of somites posterior to XXIII have not been sectioned, but of some of the posterior ones sections have been made, the most anterior of which has two pairs of perigastric vessels with cœcal diverticula: an anterior pair, connecting the dorsal vessel with the ventral

part of the intestinal plexus; and a posterior pair, connecting the dorsal and ventral vessels. In several somites nearest to the posterior end, both pairs of perigastric vessels have cæca and connect the dorsal vessel with the ventral part of the intestinal plexus.

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Thus far, our knowledge of the *Lumbriculidæ* of North America has been limited to species collected in very restricted and widely separated regions. Two species of *Sutroa* and one of *Eclipidrilus* from California have been described by Eisen ('81, '88, '92, and '95); one species each of *Mesoporodrilus* and *Thinodrilus* from Illinois, by the writer ('95 and '96); and this paper contains the description of a species from Florida, for which still another genus name is proposed, namely, *Premnodrilus*.[1] Of these, *Thinodrilus* is much more nearly allied to *Lumbriculus* and certain other European forms than to its North American associates that have thus far become known, while *Sutroa* seems in certain particulars intermediate between the European genus *Rhynchelmis* (Vejdovský, '76) and the peculiar group of North American *Lumbriculidæ* which includes *Eclipidrilus*, *Mesoporodrilus*, and *Premnodrilus*. The species included in these three genera are much more nearly related to each other, so far as the structure of their reproductive organs is concerned, than is any one of them to species of other genera of the family, and yet the differences beeween them seem to the writer too great to be considered as merely specific. Thus, at present, six species of North American *Lumbriculidæ* are known, and they have been placed in five different genera.

Such a condition of things, in which we have in a comparatively small group of animals a number of genera nearly or quite as great as the number of species, may be due to one or more of several causes, and in this case it may be owing to the fact that at present our knowledge of the *Lumbriculidæ* is insufficient to make it possible to determine which

[1] Leidy's descriptions of species presumably belonging to the *Lumbriculidæ* are inadequate and must be disregarded.

characters should be regarded as generic and which as of specific value merely. It is possible that an unusual variability in the reproductive organs exists in worms of this group, and that in a similar length of time and under similar differences of conditions there might be a greater amount of divergence in the character of these organs than there would be in worms of other groups, as, for example, the earthworms, and hence that differences which among the latter would be generic ought perhaps to be considered as only specific when found among the *Lumbriculidæ*. On the other hand, it may be that species which now form the only members of the genera to which they belong, will after a time, by the discovery of other species, become types of genera which will each contain two or more species more closely related to each other than are the species now known, and thus the establishing of so many genera may be justified. In the case of the three genera last referred to, when we consider that a distance of a thousand miles intervenes between Florida and Illinois and two thousand miles between Illinois and California, and that nothing whatever is known of the *Lumbriculidæ* of the intermediate regions, it seems reasonable to suppose that subsequent collections from the intervening territory may bring to light other species more nearly related to one or more of them than they are to each other. Until future collections and study shall disclose the facts, it seems best to the writer not to include in one genus species which differ so widely as do *Eclipidrilus frigidus*, *Mesoporodrilus asymmetricus*, and *Premnodrilus palustris*.

A comparison of these three species will be facilitated by the use of the following table, which includes characters that are of more or less importance from the systematic standpoint.

| | *E. frigidus.* | *M. asymmetricus.* | *P. palustris.* |
|---|---|---|---|
| Setæ. | Not cleft at outer extremity. | The same. | The same. |
| Sperm-reservoirs ("storage-chambers"). | One pair, extending through several somites and having thick muscular walls. | A single one, etc. | One pair, etc. |
| Eversible penes. | One pair in X. | A single one in X. | One pair, very long, in IX. |
| Clitellum. | Posterior part of IX to the middle of XIV. | Middle of IX to the middle of XIII. | Anterior part of VIII to middle of XII. |
| Prostomium. | Without proboscis. | With proboscis. | With proboscis. |
| Anterior nephridia. | One pair in each of somites IV–VIII. | One pair in VII, extending into VIII and IX; pores in VII. | Absent, or one pair in VI, extending into VII and VIII; pores in VI. |
| Posterior nephridia. | Paired, beginning in XIII. | Single, beginning in XII. | Single, beginning in XII or XIV. |
| Testes. | Two pairs—in IX and X. | One pair—in X. | One pair—in IX. |
| Spermiducal funnels. | Two pairs—in IX and X. | A single one—in X. | Two pairs—in VIII and IX. |
| Prostate and atrium. | Differentiated parts of sperm-duct connected with sperm-reservoir by narrowed part of sperm-duct ("bridge") having muscular walls. | The same. | Absent. |
| Spermiducal pores. | A pair; posterior part of X. | One; on median line in posterior part of X. | A pair; posterior part of IX. |
| Sperm-sacs. | One pair, extending back from IX thro' several somites; not inclosing sperm-reservoirs. | One pair, extending back from X thro' several somites; small one with no corresponding sperm-duct, and larger one inclosing sperm-reservoir. | One pair, extending back from IX thro' several somites; inclosing sperm-reservoirs. |
| Ovaries. | One pair—in XI. | One pair—in XI. | One pair—in X. |
| Oviducal pores. | Anterior part of XII. | XI / XII. | X / XI. |
| Spermathecæ. | One pair; in IX. | Two; in IX, on same side of somite, one posterior to the other. | One pair; in VIII; of unusual length |
| Spermathecal pores. | Posterior to ventral setæ of IX. | On mid-ventral line of IX, one behind the other. | Posterior to ventral setæ of VIII. |

The principal features of the circulatory system of *M. asymmetricus* and of that of *P. palustris* having already been described at length in this paper, it has seemed unnecessary to tabulate the characters of this system for all three genera, and, instead, a summary from Eisen's description of *E. frigidus* ('81, p. 3) is subjoined.

There is in *E. frigidus* but one pair of lateral vessels in each of somites I–IX, and they are perigastric, connecting the dorsal and ventral vessels, those of IX and X extending posteriorly through several somites in connection with the spermiducal organs. A considerable number of somites following X contain only gastric vessels, of which there is but one pair in each somite. Each of about thirty posterior somites contains two pairs of perigastric vessels, which are connected with the dorsal vessel and end blindly in the cœlomic cavity, all being short, and all more or less imperfectly forked or branched. There are no gastric vessels in these somites.

An examination of the foregoing table shows that sperm-reservoirs ("storage chambers") are present in all three genera. These are specially modified regions of the sperm-ducts, which are found in no other members of the family. Other characters common to the three genera, but not so distinctive, are the simple setæ, the eversible penes, and the great extent of the sperm-sacs. These four characters taken together may be regarded as distinguishing the subfamily *Eclipidrilinæ* from other *Lumbriculidæ*. As the three included genera contain but one species each, the definition of genera and species is not attempted.

*E. frigidus* is distinguished from the other two members of the subfamily by the absence of a prostomium and by the presence of (1) several pairs of nephridia anterior to the reproductive organs, (2) paired nephridia posterior to XII, (3) but one pair of lateral vessels in each somite—excepting thirty or more posterior ones in which are two pairs of perigastrics ending blindly in the cœlomic cavity, (4) two pairs of testes, (5) paired spermiducal pores on X, (6) paired spermathecæ and spermathecal pores in IX, and (7) paired

oviducal pores in the anterior part of XII. These differences seem sufficient to warrant the recognition of the species as generically distinct from the other two.

*M. asymmetricus* and *P. palustris* are more closely related to each other than is either of them to *E. frigidus*. They, alike, have (1) a prostomium, (2) but one pair of nephridia anterior to the reproductive organs, (3) unpaired nephridia posterior to XII, (4) one pair of testes, (5) two pairs of lateral vessels in each of the somites posterior to X, and (6) no perigastrics ending blindly in the cœlom. They differ from each other in several important respects, as follows: (1) in the position of the anterior nephridia, (2) in the position of all the reproductive organs, (3) in the number of sperm-ducts and spermiducal funnels, (4) in that the prostate and atrium of *M. asymmetricus* seem to be replaced in *P. palustris* by a greatly developed penial apparatus, (5) in the position of the spermiducal pores, (6) in the symmetry or asymmetry of the sperm-sacs, (7) in the structure and proportions of the spermathecæ, (8) in the position of the spermathecal pores, and (9), in a marked manner, in the relations of the lateral vessels. As already intimated, only future collections and study can make it possible to determine whether these differences ought to be regarded as generic or as merely specific; but, all things considered, it seems the wiser plan at present to regard the two species as generically distinct.

The writer takes this opportunity to acknowledge his obligations to Mr. Hempel for his kindness in obtaining the specimens of the new species described; to Dr. Gustav Eisen for several specimens of *Eclipidrilus;* and to Prof. S. A. Forbes for the opportunity to study a species of *Sutroa* collected by him in Yellowstone Park. The drawings for the figures were made by Miss Lydia M. Hart, Artist of the Illinois State Laboratory of Natural History.

University of Illinois, May 19, 1900.

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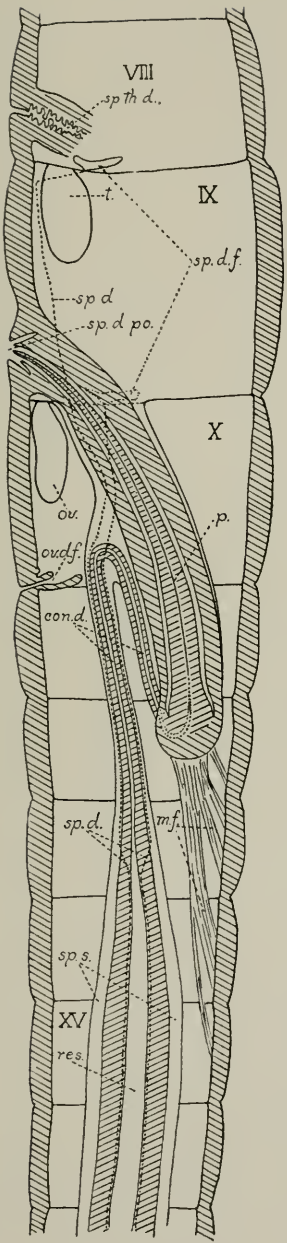
# Plate XLI.

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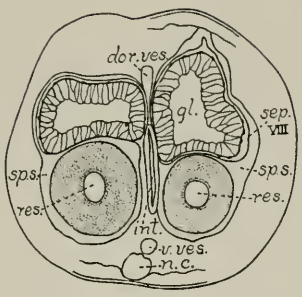


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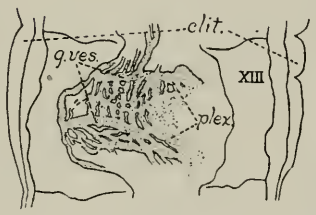


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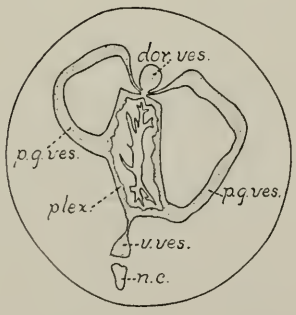


5

## EXPLANATION OF PLATES.

ABBREVIATIONS.

*con. d.*, duct connecting reservoir and terminal portion of penial apparatus.
*clit.*, clitellum.
*dor. ves.*, dorsal vessel.
*gl.*, glandular region of spermatheca.
*g. ves.*, gastric vessel.
*int.*, intestine.
*m. f.*, muscular fibers.
*m. l.*, muscular layer of spermathecal duct.
*n. c.*, nerve cord.
*ov.*, ovary.
*ov. d. f.*, oviducal funnel.
*p.*, penis.
*plex.*, intestinal plexus.
*p. g. ves.*, perigastric vessel.
*res.*, sperm-reservoir.
*sep. VIII.*, septum of VIII.
*sp. d.*, sperm-duct.
*sp. d. f.*, spermiducal funnel.
*sp. d. po.*, spermiducal pore.
*sp. s.*, sperm-sac.
*sp. th. d.*, spermathecal duct.
*sp. th. po.*, spermathecal pore.
*st.*, storage region of spermatheca.
*t.*, testis.
*v. ves.*, ventral vessel.

## Plate XLI.

### *Premnodrilus palustris.*

Fig. 1. A diagrammatic representation of a part of the reproductive organs. × 35.

Fig. 2. A diagrammatic longitudinal section of a spermatheca, reconstructed from a series of sections. × 50.

Fig. 3. A transverse section of XI, from a specimen in which the posterior parts of the spermathecæ were included within the sperm-sacs. × 45.

*Mesoporodrilus asymmetricus.*

FIG. 4. From a longitudinal section through XIII, showing a part of the circulatory system. × 85.

FIG. 5. A part of the circulatory system in XXI, composed from several transverse sections. × 75.