The Natural History of the Genus *Dero*.

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(PLATES III.–V.)

AT the meeting of the British Association in 1885, at the request of Prof. McIntosh, I presented a summary of the results of my study of the Annelids of the genus *Dero*, with descriptions of some new species which had come under my notice, and remarks as to the identification of others. From the necessary limits of such a communication, I was compelled to omit much detail; and lack of time and material led to a certain want of accuracy in my collation of the work of other writers, and the comparison of the examples which came under my own notice with their descriptions.

Enlarged facilities of reference having now enabled me to acquire a tolerably complete knowledge of all that has hitherto been written on this genus, and a considerable supply of material from various sources having given opportunities for extended observation and closer comparison, I venture to offer the following as the most complete account of the genus allowed by the present state of knowledge. Four new species having been met with in the course of the eighteen months or more during which I have been working at these Annelids, it would appear probable that others still remain to be discovered; and it is to be hoped that the publication of a summary of what has at present been accomplished may facilitate future observation.

History and Bibliography.

The Annelids with which this paper deals, though their bibliography covers a period of a century and a quarter, have hitherto been the subject of very little original work, owing probably to their habits of life, which prevent their presence in a state of nature from being easily discovered. In view of the great advances which have been made in methods of research, and especially in optical appliances, the very evident way in which the observations of earlier writers, and their interpretations (not unfrequently erroneous), have been copied by later authors, in many cases almost *verbatim et literatim*, is not a little surprising.

The first description of any species of *Dero* is to be found in the 'Insecten-Belustigung,' iii. Theil, of Rösel von Rosenhof (24*), published in 1755. Several figures and a lengthy description are there given of a species identical with *Dero furcata*, under the name of "das geschmeidige Wasserschlänglein mit zwey Gabelspizen." The remarkable feature of Rösel's account is the moniliform arrangement of the two long palpi by which this species is distinguished, which he described. This character has not been noticed by Grebincky, Semper, or myself; but the explanation is not far to seek. One of the first signs of approaching dissolution in the Naid family is the separation of the cuticle from the cells of the epidermis, with formation of *bullæ*; and under these circumstances something of the kind has been observed by the writer. It is somewhat curious that up to 1877, when the last description of this species was written, every observer who described the form gave it a fresh name; so that it has received trivial names from its discoverer and from Müller, and scientific ones from Oken, Grebincky, Leidy, and Semper. Rösel observed the process of transverse fission in an advanced stage, and described it as a "curious method of copulation." He also described the result of transverse sections of the worm.

Following Rösel, the distinguished naturalist O. F. Müller (18), in 1771, gave a remarkably excellent account of one or two species; all the main features having been grasped, and the branchial processes (the characteristic feature of the genus) having had their proper function assigned to them. In specific characters, however, Müller was less fortunate; and to him must be given the blame of the confusion in the nomenclature of the genus which so long existed. In consequence of the small scale on which his figures are drawn, there is great difficulty in identifying the species represented; but two, if not three, distinct ones are certainly shown, all being included under the general name of *Nais digitata*. Rösel's species is recognized as distinct, and named "the eyeless Naid with pronged tail," the other being called "the blind Naid with fingered tail." The distinction thus formulated is too slender to enable me to decide as to the specific differences; and in view of the impossibility of ascertaining the particular species to which Müller intended to apply the name *digitata*, there seems to be no

* The numbers in brackets refer to the Bibliography, p. 106.

better course open than to entirely reject it. Up to the present time the name is occasionally used on the Continent; but as the worm designated may be any one of three species at least, and as no clear definite description has yet been given of any of these in particular under the name in question, this cannot be used as an argument against the course proposed.

In acknowledgment of Müller's work, I have attached his own name to the last new species discovered.

The name by which the genus is now known was bestowed upon it by Oken (20) in 1815, and the species described by Rösel distinguished as *Dero furcata*, Müller's appellation being retained for the other species. This was apparently the extent of Oken's knowledge of the genus, as his figure was taken from Müller, and his diagnosis is as scanty as possible.

Dutrochet (9) rediscovered the genus, and being ignorant of the work of earlier writers, renamed it *Xantho*, remarking that it appeared either not to have been observed before or to have been confounded with *Nais*. He also described the branchial funnel as an organ of progression and retrogression and of prehension; the branchial processes being spoken of as veritable non-articulated limbs, resembling the feet of cephalopodous Mollusca and the arms of the polyps! The number of branchial processes is given as ten in one species and six in another, to which the names *Xantho decapoda* and *X. hexapoda* are respectively given. As the figures which accompanied the original paper appear to have been lost, any attempt to identify Dutrochet's species must be mere guesswork.

Blainville (1) gave a somewhat unintelligible account of two species, named *Nais digitata* and *N. decapoda*. The former is credited with the possession of six *pairs* of fleshy lobes, the latter with five, reference being also made to a drawing in the 'Encyclopédie Méthodique' of a species with no less than eight pairs. Having had an opportunity of examining the latter work, I found that the plate in question is merely a *replica* of Müller's (18); while the peculiarly unmethodical character of the arrangement of the text renders any search for the article referring to the figures hopeless. However, as none of Müller's figures show more than four pairs of lobes, Blainville has evidently interpreted them wrongly.

Blainville (2) in a second article in the 'Dictionnaire des Sciences naturelles' and a writer in 'Rees's Cyclopædia' (23) quoted from

Fabricius the description of a worm which he described as *Nais quadricuspida*, which appears to have some affinity with the genus *Dero*. Apparently this species has not since been observed, though from the description given by Fabricius (10) it seems sufficiently well marked *.

Gervais (11) reclassified the Naïdidæ, and renamed the genus *Dero*; *Uronaïs* being the designation applied to it, apparently from the peculiarity of the tail. He appears to have been the first to remark that Müller's figures evidently represented two distinct species. In common with some other writers, he included the *Nais barbata* of Müller, in spite of the fact that the latter is described as having a simple truncated tail.

Œrsted (19) gave only a very short account of the genus, calling it *Proto* (Oken).

Grube (12), whilst contributing little or nothing to our knowledge of the genus, made some interesting remarks on its systematic position, and referred to two marine forms, described by Dujardin (8) and Dugès (7) respectively, which he regarded as allied to *Dero*. Having carefully compared the papers referred to by Grube, I am unable to agree with his conclusion. Grube also remarked on the confusion in the nomenclature, professing himself unable to decide the question of the origin of the name *Proto*†. It should be remarked that Grube does not mention having seen *Dero*.

Bosc (4) mentioned, under the name of *Nais auricularis*, a worm found in Carolina with a tail formed by a large tubercle, in the middle of which is the anus,—a description which would well apply to a *Dero* in a contracted state.

Pennant (21), Shaw (27), Stewart (28), and Turton (30) gave descriptions of *Nais digitata* which afford no assistance in identifying the form; and the same may be said of a long paper by Houghton (13), who, having found the genus in England, instead

* "Nais verrucis lateralibus bifidis setosis cirris abdominalibus et caudâ quadrifidâ."

† The origin of this name remains unknown. Œrsted attributed it to Oken, in whose work no trace of it is to be found; nor is it likely that he would have given to one genus two different names. Another writer, in spite of Grube's remark, attributed the name to him. The only feasible explanation appears to be that some unknown writer, between the time of Gervais and Œrsted (*i. e.* 1838 and 1843), originated it in a paper which has been lost. The 'Nomenclator Zoologicus' of Agassiz gives both names, and attributes both to Oken, but evidently wrongly. The etymology is there given as δέρω, *cutem exuo*.

of observing it for himself, did little more than copy Müller's description. Johnston (14) merely mentions the genus to throw doubt on its right to a position in the British fauna at all.

In 1855, for the first time since Müller noticed the genus under consideration, we meet with an attempt to give something like an exact account of a new species. In that year a paper appeared from the pen of D'Udekem (6), which must be regarded as the starting-point of all modern work on the subject. Up to that time *Dero digitata* and *D. furcata* (the latter of which had almost been lost sight of) had held the field alone; but D'Udekem's contribution contained a description of a new species, *Dero obtusa*, clearly expressed, and accompanied by a figure which rendered it easily recognizable.

In 1872 Perrier (22) published a very interesting and exhaustive account of a species which he identified with that described by D'Udekem; and the fact that he was wrong on this point in no way detracts from the value of his observations, whilst his figures are almost all that could be desired. In acknowledgment of Perrier's work, I have named the species which he studied *Dero Perrieri*, it being new.

Prof. Leidy (15), in a paper of which he has kindly sent me a reprint, describes two worms, one of which he calls *Dero limosa* and the other *Aulophorus vagus*. The former appears to be identical with a species found abundantly round London; the latter is considered by Prof. Leidy to be identical with that described by Rösel (*loc. cit.*), the *Dero furcata* of Oken; and apparently Prof. Leidy's distinction is based upon the fact that he found the latter free.

Semper (26) has described two species under new names, his *Dero philippinensis* being apparently the same as *Dero limosa* just referred to, whilst *Dero Rodriguezii* is undoubtedly the same as the *Aulophorus vagus* of Leidy, *Dero furcata* of Oken, and *Dero palpigera* of Grebincky.

Tauber's work (29) contributes nothing to our knowledge of the genus, being merely a catalogue of Danish Annulata. He remarked that the genus is rare in Denmark.

The magnificent work of the Bohemian Professor Vejdovsky (31) contains a full list of names and synonyms of the species of *Dero* known up to the date of his publication. Unfortunately he observed only a very few examples of the genus, the species

being one which he identifies with *Dero digitata*. As there is, however, an absence of anything like a diagnostic description of the species in question, the identity of *Dero digitata* is still, and probably will remain, unsettled.

The last contribution to the literature of the subject is the abstract of a paper read by me at the Aberdeen Meeting of the British Association (5). The conclusions therein arrived at hold good only in so far as they are corroborated by the present communication.

Habits, and Methods of Observation.

The species of the genus *Dero*, with the doubtful exception of the form described by Fabricius in 1778, are all freshwater dwellers. They pass their lives entirely below the water-level in tubes which they secrete, and into the composition of which foreign matter does not enter. The tubes are as a rule either constructed in the mud, or along the stems of aquatic plants, or even within decayed stalks.

To this method of life is probably owing the small amount of attention which the genus has attracted. If, however, these worms be present in any locality, they may be easily detected as follows:—

A portion of the mud, within an inch of its surface, is placed in a bottle to about the depth of half an inch and water added. After the mud has subsided the bottle is allowed to stand for about 12 hours, when, if any samples of *Dero* be present, they will have constructed their tubes in contact with the glass, either in the mud or on the sides of the bottle, and may be removed for examination by pressing on the end *from which the head protrudes* (as the tail is very easily injured) with a camel-hair pencil. Under this treatment the worm backs rapidly out of the tube, and may be readily secured with a pipette. The species of the genus *Dero* are sociable in their habits, as many as half a dozen tubes being often placed side by side, and it is quite the exception to find single ones.

Having secured the worm, the question arises how best to examine it. It is almost impossible to determine the species of any given example when ordinary methods, such as the compressorium or the live-trough, are alone employed. In the first case the pressure, even if slight, prevents that full expansion of the branchial area which is absolutely necessary for exact observation; whilst in the second case the restlessness of the worm is

so great that it can only be kept in the field of a power too low for needful details to be made out.

For general observation the method which I have found most suitable is to transfer the worms to a live-trough, with a sufficient depth of mud for them to form their tubes (about $\frac{1}{4}$ inch), when they may be observed under perfectly natural conditions; the hinder end of the worm, carrying the respiratory apparatus, being kept protruded upward, whilst the head is occupied below in ingesting the mud which forms the food of these creatures. If the tubes have been formed amid vegetable *débris*, the best plan is to secure a portion in the compressorium under slight pressure, or in a small zoophyte-trough, when powers as high as Zeiss's B B or an English $\frac{2}{3}$-in. may easily be employed. To make out the histological details, nothing is better than the cotton-wool trap used for wandering Rotifera; with this and a judiciously regulated pressure, a $\frac{1}{10}$-in. objective may be safely used. The form of compressorium adopted by me is that known as Beck's parallel compressorium, and I have found nothing to equal it for the facilities it offers of increasing or diminishing pressure without removal, and of viewing an object on both sides.

General Characters.

In general outline the species of *Dero* closely resemble their relatives of the genus *Nais*. The following marked differences, however, obtain :—

1. They are destitute of eyes.
2. They are furnished with decidedly red blood.
3. The perivisceral fluid is devoid of corpuscles.
4. They inhabit fixed tubes.
5. They possess a highly specialized respiratory organ on the last segment of the body.

The general form of the body is more or less cylindrical, the head being obtusely pointed. The thickness gradually increases from the head for about two fifths of the length of the worm, after which it diminishes gradually again, being narrowest in the last segment but one.

As in *Nais*, the mouth-segment is destitute of organs of motion, whilst the four following have them only on the ventral surface *.

* Except *Dero furcata*, of which see description.

These organs are known as setæ, their form being more or less that shown in Pl. IV. fig. 10 and Pl. V. fig. 16, curved like a long *f*, with a central shoulder and bifurcate outer end. Each of the bristle-bundles in the first four ventral pairs contains from four to six such setæ, in length considerably exceeding those of the body generally, though there is but little difference in the general form.

In the dorsal bristle-bundles, the first pair of which is found in the sixth segment, bristles of two forms are found. The first and most evident are tapering, projecting through the epidermis to a distance about equal to the diameter of the worm, and of these one is found in each bundle. The second are short, stout, notched at the outer extremity, and barely penetrate the skin. Notwithstanding their inferior length they are always the first developed, and if there should by chance be two tapering bristles in a bundle, each of them is accompanined by its own shorter one.

The developmental relation between these two forms was pointed out by Perrier, and is additionally proved by the fact that in the posterior segments the tapering bristles are altogether wanting, the short ones alone remaining; these at length are reduced to mere points in the last few segments, and finally disappear.

Illustrations of the various forms of setæ will be found in the figures already referred to.

The integument of the worm is smooth, and shows but few palpocils, except at the head and tail, and even there not many; they are connected with pyriform cells in the epidermis in the manner described by me in a previous paper*.

The digestive canal conforms closely to the Naid type in its exsertile proboscis, its pharynx beset with mucous glands, and its long pharynx dilated at one point to form a gastric enlargement, passing on into an intestine, capacious, closely beset with the so-called hepatic cells, and having a very strong inward ciliary current for a great part of its length. The segmental organs, which begin in the sixth segment, are essentially simple convoluted tubes with very narrow *lumen*, the dilated inner extremity being thickly clothed with fine short cilia. The external condition of these organs varies greatly. Frequently they are as described above, without any appendages. In other instances in the same species, at the same period of the year,

* "On *Slavina* and *Ophidonais*," Journ. Linn. Soc., Zool. vol. xix. p. 265, 1886.

they are embedded, except for a short distance at each end, in a mass of large, clear, spheroidal cells. When these masses are not found on the segmental organs, they may occur on the septa between the segments, or they may be absent altogether. I have, however, been unable to discover the conditions which govern their appearance.

It has been stated that the internal end of the segmental organs is a ciliated funnel; they end externally in a somewhat dilated portion, which communicates freely with the surrounding element. Their function appears to be purely mechanical—that of preventing undue distention of the body by the fluid which passes through the wall of the intestine, and is doubtless charged with effete material from the blood-vessels which run in contact with it. Accordingly I find that, contrary to the general accepted opinion, the lumen of the tube of the segmental organ is not ciliated, but that along one side of it is attached a membrane whose undulations have the effect of driving the contained fluid in an outward direction. During full activity it is not easy to see the edge of the membrane, though the character of the movement even then is such as to suggest some action quite different from that of cilia, and much more nearly resembling that seen in the vibratile tags of the rotifers.

When vitality is at a low ebb, it is by no means difficult, with a power of about 800 diameters and suitable illumination, to see the edge of the membrane. The same conditions exist in the case of other Oligochæta, and indeed it is not easy to see how cilia could act to advantage in a tube of such extremely small calibre, nor am I aware of any instance in other forms of animal life where such is the case *.

The nervous system of *Dero* is excessively difficult to make out, but appears to closely resemble that of *Nais* in its arrangement. Perrier's account of the species which he observed stops short at this point, his description being very meagre, and in the few details given there is nothing to indicate any special arrangement.

* The observations which led to the above conclusions were made on *Tubifex*, *Dero*, *Nais*, *Stylaria*, *Chætogaster*, and *Æolosoma*. In the case of *Chætogaster* only was there any difference. In the latter genus I have never seen any movement whatever in the tubular portion of the segmental organs, but on one occasion observed in connection therewith an organ exactly resembling the vibratile tags already referred to.

Branchial Area and Circulatory System.

The branchial apparatus is by far the most important character of *Dero*. Though it is found in a modified form in the *Aulophorus* of Schmarda (25), yet in its full development it is present only in the genus under notice. In all the Oligochæta a strong inward current is visible in the hinder part of the intestine, which no doubt subserves a respiratory purpose, as it commences at the point where the arterial system receives the blood from the venous; and at this point, if nowhere else, both vessels run in close contact with, or are embedded in, the intestinal wall, so that the most favourable conditions for interchange are combined. In those forms which live and move free in the water, this is doubtless sufficient provision for their needs; but in the case of *Dero*, which, though not fixed, is yet stationary, a special provision seems required, such as is found in the branchial area.

This is essentially, and in its simplest aspect, an opening-out of the hinder part of the intestine, supported by a layer of epidermis, the space between the two being occupied by muscular elements and blood-vessels. Figs. 4 and 5 in Pl. IV. (the former taken from Perrier's monograph, the latter from life) will show the general arrangement. In fig. 5, which gives the area in section, the relative proportions between its two constituents are shown by the shading, the dark portion being integumental, whilst the light shading indicates the continuation of the mucous membrane of the intestine, which supplies the respiratory element. The form of the area differs in different species; but in all cases a number of branchial processes arise from the floor of it, their number being four and *no more*. This may seem a surprising statement, in view of the considerably greater number, *eight pairs* according to one writer already referred to, which have previously been described. Reference has already been made to the difficulty of determining the species of any given example of the genus, and similar difficulties, not overcome, have been the cause of the remarkable divergencies and discrepancies to be found in the descriptions heretofore given. These have obtained down to the latest period: thus both Semper and Leidy have described appearances which can easily be reproduced, but which are not by any means normal. If an apology be needed for such an assertion, I hope it will be found in the fact that I have devoted myself almost exclusively to the study

of this genus for nearly two years, have examined hundreds of examples of its various species, and have done my utmost to make sure of every fact which I advance. It is true that in three species supplementary branchiæ are present, but these are much smaller than the primary ones, and are always placed at the angles of the dorsal lip of the area. Where more than three pairs are attributed to any species, the incurved margins of the area, which are ciliated on both surfaces, have been mistaken for additional branchiæ.

The integumental and mucous layers of the area are not equally extensive; the mucous layer is wanting (Pl. IV. fig. 5) at the tip, and encroaches on the margin of the integumental layer at every other part. The branchiæ are simple elevations of the mucous layer, containing loops of blood-vessels one in each, and are lined by a layer of stellate muscle-cells continuous with the layer which underlies the mucous membrane of all the other portions of the area. This muscular network is capable of great expansion and contraction, and in the latter condition fully realizes Bosc's description of *Nais auricularis*. The area is extremely sensitive, the slightest jar causing contraction, and, what is somewhat remarkable, it appears to be endowed with sensibility to actinic light *.

In some species, in addition to the muscular network of stellate cells already spoken of, an arrangement of radiating cells, spindle-shaped, with forked extremities and a central nucleus, is found connecting the dorsal lip of the branchial area with the intestine beneath it.

In most cases the branchial area is concave in full dilatation; but in *Dero Mülleri* it is capable of such expansion as to become altogether convex, and to stand at right angles to the axis of the body. The same is the case to a less extent in *D. latissima*.

The chief blood-vessels are, as usual, two in number, a dorsal (arterial) and a ventral (venous). The dorsal vessel in *Dero* can

* I have several times tried to photograph the tail of *Dero*, but hitherto with small success, the ignition of the magnesium-ribbon employed as the source of light causing contraction in nearly every case. The same phenomenon occurs in *Hydra*. In order to overcome this difficulty a drop-shutter was placed between the source of the light and the object, but the result was the same; and the marvellous rapidity of the contraction was shown by the fact that, although fully expanded up to the instant of exposure, the photograph in every case showed the polyp in a contracted condition.

only be so called for convenience; since for the greater part of its length it runs along the side or lower part of the intestine embedded in its wall, only becoming free when it reaches the junction of the latter with the stomach. From this point it is connected by a varying number of contractile loops with the ventral vessel, and terminates exactly as in *Nais*. In the branchial area the circulation between the dorsal and ventral vessels is carried on as follows:—The abdominal vessel, running backward undivided to the boundary of the mucous layer of the area, divides into two branches which run right and left round its margin. Each of these main branches gives off at least three secondary ones, one to each of the branchia of its own side, which runs to its summit and down again without breaking up into a capillary network; whilst the third, also undivided, runs obliquely across the area, the continuation of the main branch running on round the margin. All these branches again unite to form a common trunk, which joins with a similar one from the opposite side to form the commencement of the dorsal vessel.

The specialization of the termination of the hinder portion of the intestine does not appear to have any effect in abrogating the general respiratory function of that tube; doubtless an advantage to these worms, which spend so large a portion of their lives in crawling in the mud in search of food. It should be remarked that the tube is much too narrow to admit of the branchial area being drawn into it when expanded; nor is the tube wide enough to give room for the bristles, the latter being always much curved when within it; and though the worm is able, as a rule, to turn round with facility, yet it sometimes happens that it becomes fixed in the tube in so doing, and is quite unable to extricate itself.

Distribution of Species.

With the exception of *Dero Mülleri*, received from Mr. Bolton, of Birmingham, I have found all the known forms within a short distance of London. The richest hunting-grounds are without doubt the tanks at Kew and at the Royal Botanic Society's Gardens, Regent's Park. The latter locality has furnished a species, the only one whose indigenous character is doubtful, viz. the beautiful *D. furcata*, the finding of which and the difficulty of obtaining any reliable information about it, first led the writer to undertake the study of this genus. Here also he first found

D. latissima, as also in a pond between Sutton and Redhill on the high road, and later *D. limosa*. The latter is especially abundant in the Lily-tank at Kew. *D. obtusa* and *D. Perrieri* are to be found in the large pond on Wandsworth Common; and both species, as well as *D. latissima* and the rare *D. acuta*, have been found in the pond at Greenwich Park. The last-named species was also found for the first time by my wife in the Crystal-Palace basin.

Abroad the only species known to have been found are *D. furcata*, *D. limosa*, *D. obtusa* (Belgium only), and the doubtful *D. digitata*. Of these, the first two are widely distributed, ranging from the United States to South Russia and the Philippine Islands. It will be seen, therefore, that at present the British Isles are apparently by far the richest in species of any known locality. Others doubtless remain to be discovered; and to this end I am anxious to obtain samples of mud in a moist state from various localities abroad*; and South America especially should prove fertile in this direction. Much remains to be done before our knowledge of the minute Oligochæta can be considered even fairly complete; and it is quite possible that systematic observations in tropical and subtropical regions would reveal forms still more interesting and remarkable than those included in the genus *Dero*.

My thanks are due to Mr. T. Bolton, whose kindness in supplying me with specimens has resulted in the discovery of one new species which has not yet been found elsewhere.

The following is a systematic account of the various species at present known.

Family NAIDOMORPHA, *Vejdovsky*.

Genus DERO, *Oken*.

Proto.—Xantho, *Dutrochet*.—Nais digitata, *Müller*.

Char. Minute Annelids of from 40 to 100 segments, red-blooded, eye-less, inhabiting tubes secreted from the body, without aggregation of foreign material. The last segment bears an expansion from which arise four processes. Perivisceral fluid free from

* I shall be much obliged for samples from any freshwater lake, pond, or tank, or even slow stream abroad. The best time for collecting would probably be before the rainy season in such localities as have one; in those which have not, probably the end of summer would be best. The samples may be sent to me, care of the Linnean Society.

corpuscles. First five segments destitute of dorsal setæ; the sixth and following having both dorsal and ventral setæ, the latter hooked, the former straight, and one forked bristle in each bundle. Contractile loops in the sixth and some following segments, one in each.

α. Without secondary branchiæ.

1. DERO LATISSIMA, *Bousfield* (5). Pl. IV. fig. 8.

Segments 30–40. Contractile loops 4. The branchial area with entire margin, well developed, width in full expansion exceeding length, capable of complete eversion, then becoming convex. Branchiæ long, well developed, plano-cylindrical.

2. DERO PERRIERI, *Bousfield*. Pl. IV. figs. 4–7.

Dero obtusa, *Perrier* (22).

Segments 25–35. Contractile loops 3–5. Branchial area with entire margin, trefoil-shaped in full expansion. Branchial processes well developed, cylindrical, the posterior pair longer than the anterior.

3. DERO OBTUSA, *D'Udekem* (6). Pl. III. figs. 1–3.

Segments 45–50. Contractile loops usually 4 (4–6). The branchial area somewhat irregular, and apt to be unsymmetrical. Branchiæ rather short, foliate; the posterior margin nearly straight, the anterior curving outward at the middle. A distinct dorsal lip, divided from the alar portions of the area by a deep groove on each side.

This species shows the first trace of the modification which leads to the formation of supplementary branchial processes in the distinct demarcation of the dorsal lip, at the angles of which they are borne by those species which possess them.

4. DERO MÜLLERI, sp. nov. Pl. IV. figs. 9, 10.

Segments 70–95. Contractile loops usually 7 (6–8). The branchial area with separate dorsal lip. Branchial processes oblong, quadrangular, the attached border the longest, superior angles rounded.

The largest of all known species. Furnished to the writer by Mr. Bolton. Chains of two zooids frequently consist of 130–140 segments, and measure nearly an inch in length. Branchial area disproportionately small.

β. With secondary branchiæ.

5. Dero limosa, *Leidy* (15). Pl. V. figs. 11–16.

Dero philippinensis, *Semper* (26).

Segments 55–60. Contractile loops 5, the last much the smallest. The branchial area with dorsal lip, each angle bearing a secondary branchia, short, cylindrical, and containing a loop of blood-vessels. Branchial processes as in *D. obtusa*, but longer and narrower.

The foregoing species appears to me, for reasons already stated, to be identical with Prof. Leidy's; and there is no difference which cannot be explained on the grounds laid down (p. 100). Should the species under notice hereafter prove to be distinct from Prof. Leidy's, it will stand as new, unless indeed it be the same as Prof. Semper's *D. philippinensis*, as on the same considerations seems probable; though the latter may possibly be identical with the species next to be described, a point which cannot be settled in the absence of a figure of Prof. Semper's worm.

6. Dero acuta, *Bousfield* (5).

Characters nearly as in *D. limosa*; but the branchiæ much longer, obovate in form, with pointed apices; length about 4 or 5 times the greatest breadth.

Only two examples of this species have come under my notice from the localities already mentioned (p. 103). A careful search during the present season has been unsuccessful; so that no figure can be given; but there will be no difficulty in recognizing the worm from the description above.

γ. With secondary branchiæ and palpi.

7. Dero furcata, *Oken* (20). Pl. V. figs. 17, 18.

Das geschmeidige Wasserschlänglein mit zwey Gabelspizen, *Rösel* (24).—Dero palpigera, *Grebincky*.—Dero Rodriguezii, *Semper* (26).

Segments 35. The branchial area more funnel-shaped than in the other forms; the dorsal lip not divided off, but bearing supplementary branchiæ at its junction with the alæ. The integumental layer at the tip of the branchial area prolonged into two palpi of varying length, non-ciliated, extra-vascular. Branchiæ nearly cylindrical; contractile loops five. The first dorsal bristle-bundles in the fifth segment.

The most beautiful of all the species of *Dero*; but somewhat anomalous in the position of the first dorsal bristles and in the possession of palpi. Only found among the fibrous bundles of the dead stems of *Cyperus* (in the Royal Botanic Gardens), which must be pulled apart to obtain the worms.

Note.—The above descriptions all apply to the asexual forms only. A description of the sexual forms is reserved.

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DESCRIPTION OF THE PLATES.

Plate III.

Fig. 1. *Dero obtusa.* The whole worm, enlarged from a photograph of the living object.

2. A dorsal view of the branchial area and processes of *D. obtusa*, drawn from life. × 75.

3. The same. A copy of D'Udekem's original figure.

Plate IV.

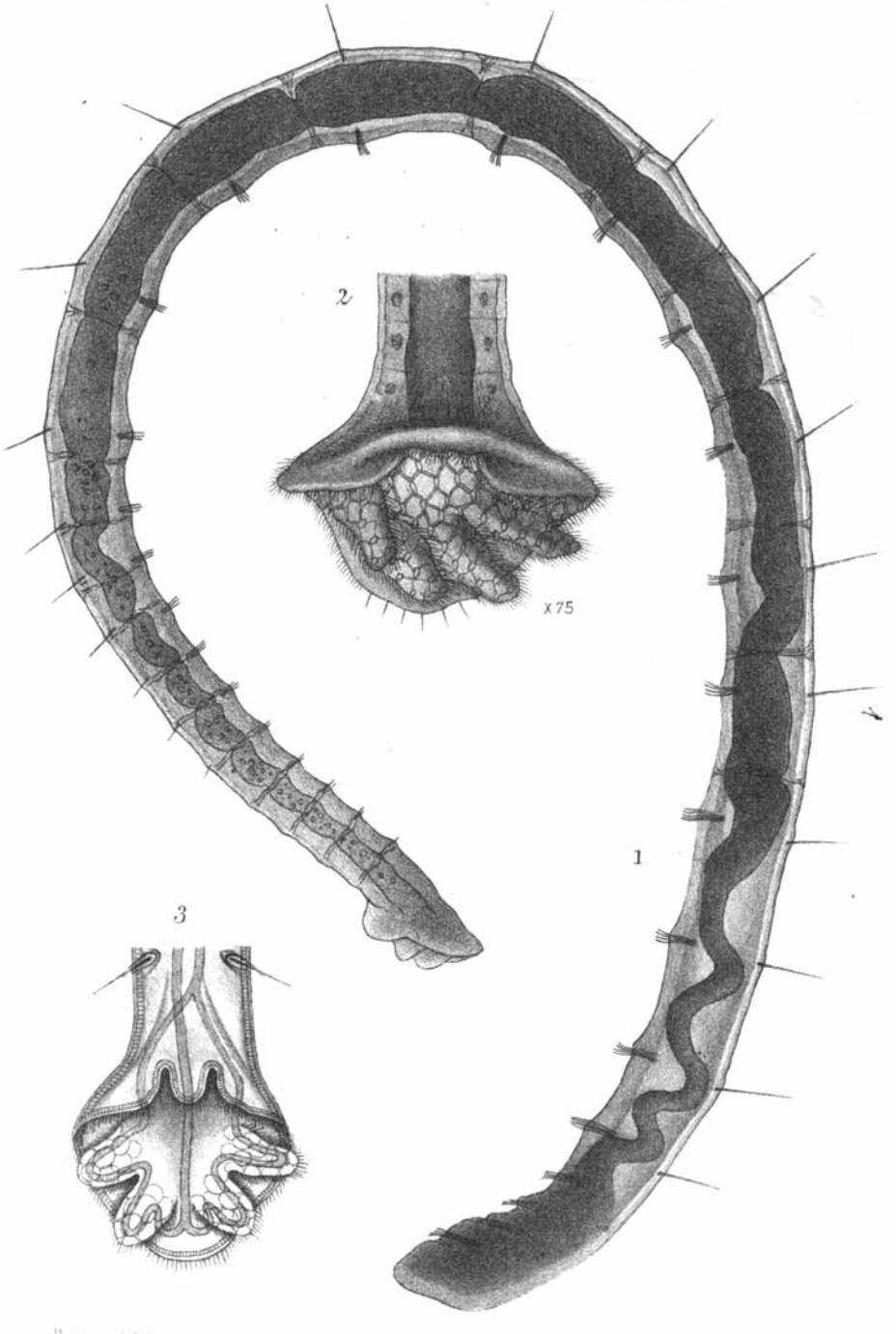
Fig. 4. *Dero Perrieri*, as a transparent object, showing arrangement of blood-vessels &c. After Perrier.

5. The same, in optical longitudinal section: *a*, integumental layer; *b*, ciliated layer; *c*, blood-vessels. From life.
6. The same. Dorsal view of branchial area. From life.
7. The same. Lateral view of branchial area. From life. × 30.
8. *Dero latissima*. Dorsal aspect of branchial area. From life. × 80.
9. *Dero Müllerí*. A similar view. From life. × 125.
10. Setæ of ditto: *a*, ventral seta of second to fifth segments; *b*, hooked dorsal seta of the same segments.

Plate V.

Fig. 11. *Dero limosa*. Dorsal view of expanded area. From life. × 50.

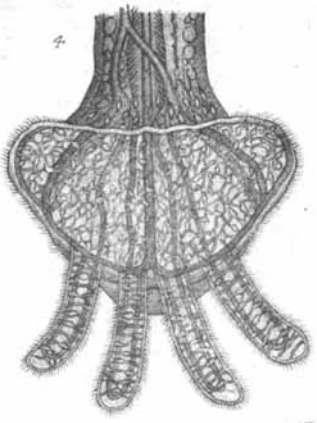
12. The same. Lateral view of expanded area. From life. × 50.
13. The same. Dorsal view in outline. After Leidy.
14. The same. Ventral view of contracted area. Photographed from life.
15. The same. Ventro-lateral view. Photographed from life.
16. Setæ of *D. limosa*: *a*, ventral seta of second to fifth segments; *b*, ventral seta of sixth and following segments; *c*, hooked dorsal setæ.
17. *Dero furcata*. Dorsal view of branchial area. From life. × 80.
18. The same. Lateral view. From life. × 60.

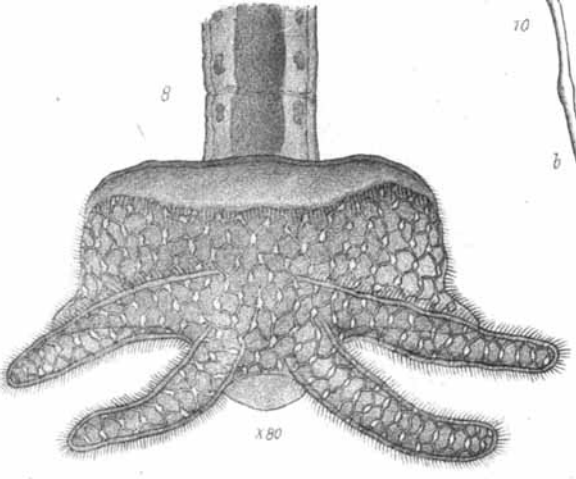


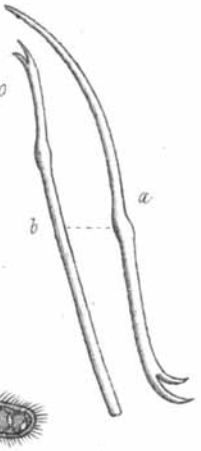
Hammond lith.

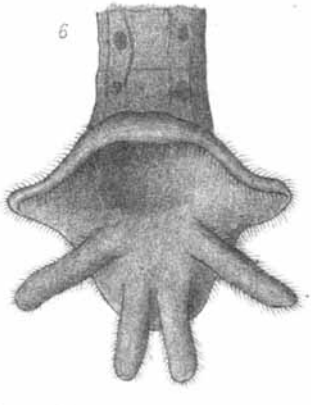
Hanhart imp.

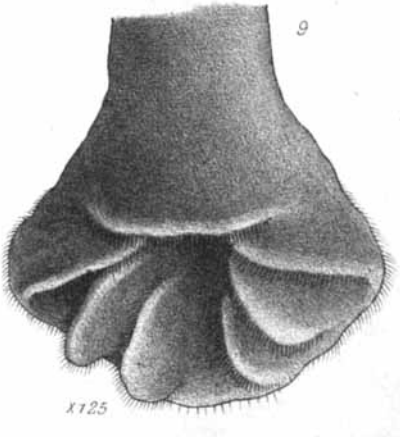
DERO OBTUSA.





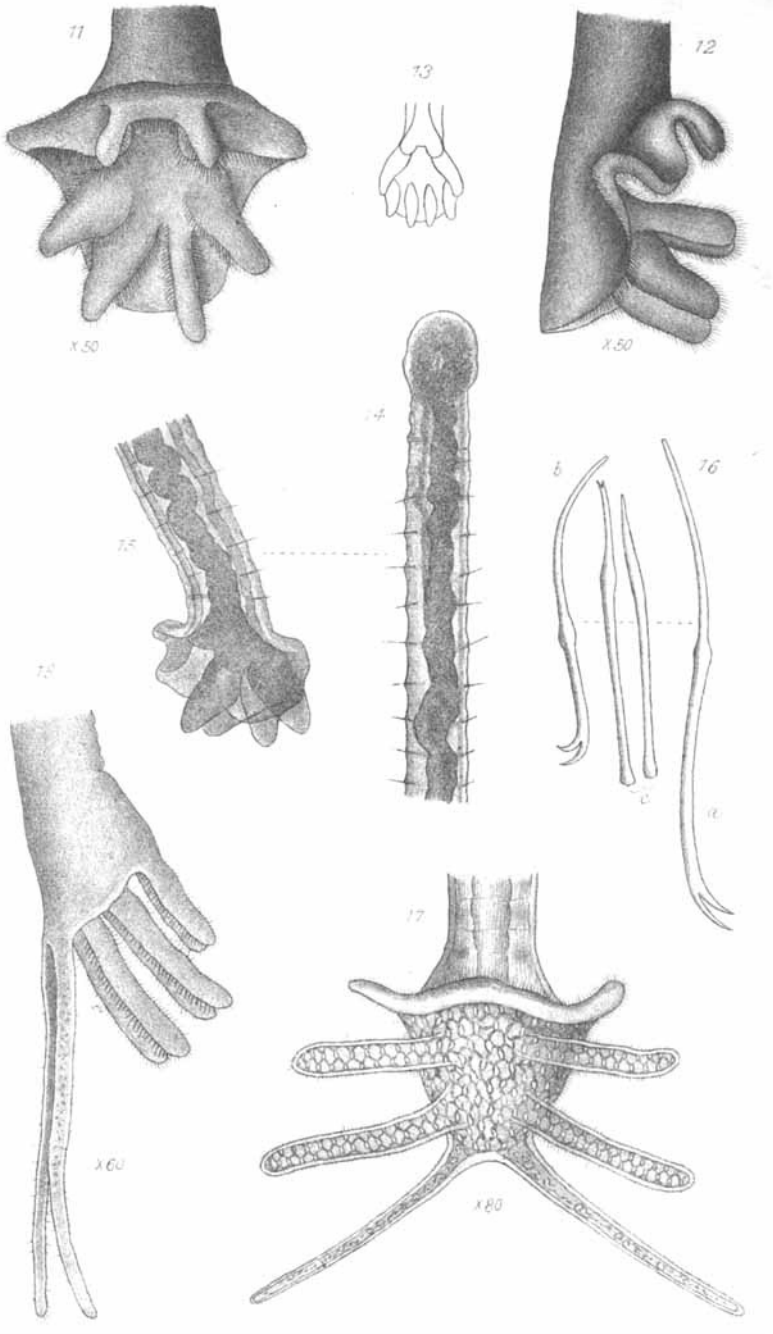






Hammond lith. Hanhart imp.

4-7 D. PERRIERI. 8 D. LATISSIMA. 9,10 D. MÜLLERI.



Hammond lith.

11-16 DERO LIMOSA. 17,18 D. FURCATA

Hanhart imp