PELAGIC NEMERTEANS

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WITH 2 PLATES

Introduction.

It is now forty years since the first pelagic nemerteans were brought to light during the voyage of the "Challenger", and although new finds have subsequently been made by various other expeditions, notably that of the "Valdivia", the material has throughout been but scanty in amount, and only partly available for thorough investigation. With regard to this peculiar animal group therefore, interesting as it is from the point of view of general zoology on account of the remarkable transformations occasioned by the need of adaptation to pelagic life, our knowledge is still irregular and incomplete in the extreme. It has even, in several cases, been found quite impossible to identify species previously described, owing to the superficial character of the original descriptions.

The "Michael Sars" expedition brought home a very rich amount of material of this group, for the most part in a good state of preservation; this materiel has since been placed at my disposal by the Norwegian Director of Fisheries, Dr. Johan Hjort, who was in command of the expedition, conjointly with Sir John Murray.

I had then already, some ten years before, commenced the study of the pelagic nemerteans, specimens of which I had received from several Danish expeditions, and in course of the work other collections came to hand. It was the material from the "Michael Sars" however, which rendered it possible to make a thorough investigation into the taxonomy, distribution and anatomical structure of this group.

Any work dealing with nemerteans must necessarily be based upon highly detailed treatment of the subject by means of serial sections, and should, moreover, if it is to prove of real value to subsequent investigators, include exhaustive descriptions, supplemented, as regards anatomy, by a great amount of illustrative matter. Such a method of proceeding would however, in the present instance, involve a demand for space altogether transcending the limits assigned to this chapter in the report of the expedition, and disproportionate to the small number of species treated; the scope of the work has here therefore been very essentially curtailed. The plan now adopted, after consultation with the Editor, Dr. Hjort, is to give a fairly detailed diagnosis of all new or little-known species, with a statement of their respective geographical distribution as indicated by the material. The entire subject will thereafter be treated at length, with the requisite illustrations, in a separate monograph on the pelagic nemerteans shortly to be issued among the publications of the Bergen Museum. In this latter work will be found the full explanation of the classification also employed in the present report, a system based upon a number of species over and above those here concerned, and, in the case of several species, upon a considerably greater number of specimens than furnished by the expedition.

With regard to the terminology employed, it will suffice to mention that this is in all essentials identical with that formulated by Bürger (3) in his monograph on the nemerteans.

Bergen, June 1915.

Aug. Brinkmann.

HOPLONEMERTINI

Hubrecht 1879.

Surface epithelium in single layer. Two layers of musculature in the body wall. Mouth opening in front of or below the brain. Intestine straight. Intestinal cæcum and diverticula developed. Nerve system in the parenchyma. Cerebral organs — if present — separate from the brain. Proboscis with a highly developed armature. Blood lacunæ lacking.

MONOSTILIFERA nov. subordo.

Hoplonemerteans with one stylet on the stylet basis.

POLYSTILIFERA nov. subordo.

Hoplonemerteans with several stylets on the stylet basis.

Reptantia nov. tribus.

Polystilifera living on the bottom. Cerebral and nephridial organs and diverticula on the proboscis sheath developed.

Pelagica nov. tribus.

Pelagic polystilifera. Cerebral and nephridial organs, diverticula on the proboscis sheath and metameral transverse vessels lacking. ♂ sexual glands confined to the head region.

Bathynemertidæ nov. fam.

Medium sized pelagic nemerteans. Body not particularly broad and only slightly flattened. Hinder end without caudal fin. Stomach and intestinal cæcum large. The intestinal diverticula with ventral branch; between this and the dorsal are placed the lateral nerve and blood vessel. The muscular system of the body wall much reduced. The muscular wall of the proboscis sheath consists of interwoven circular and longitudinal muscle fibres.

Bathynemertes nov. gen.

Body tapered at both ends. Mouth and proboscis pore united. The proboscis sheath extends throughout the whole length of the body. Many eggs are developed in the ovaries.

Bathynemertes Hubrechti nov. sp.

(Plate I, Fig. 5.)

As shown in the figure, the shape of the body in this species is only slighthly affected by the pelagic conditions, there being still considerable resemblance to the *Drepanophorus* species of the bottom, from which all known pelagic nemerteans are derived.

Length 56 mm. greatest breadth 10 mm. greatest thickness 5.5 mm. The surface epithelium slightly, the basement layer very strongly developed.

The tip of the snout forms a funnel-shaped depression at the bottom of which lies the proboscis pore, the mouth opening being a broad transverse fissure in the ventral wall of the funnel. An œsophagus being absent, the mouth opening leads directly into the stomach which is developed to an unusual degree with highly folded walls, permitting a considerable expansion; its length is about 3 mm. Behind the brain it leads gradually into the pyloric tube which is no less than 8 mm. long.

The intestine is narrow, and furnished with about 40 pairs of large lateral pouches or diverticula which are highly ramified, the ramification proceeding from a dorsal and a ventral main branch. The intestinal cæcum is well developed: it has a length of 8 mm. and is furnished with five pairs of diverticula, likewise highly ramified.

The proboscis is surprisingly strong, but relatively short, its length not exceeding that of the body. Its wall contains 29 proboscidial nerves. Structure of the stylet apparatus as in *Drepanophorus*. The rhynchodæum is very short; the proboscis sheath however, may be found extending right out into the point of the tail. The musculature in the wall consists of a network of interwoven circular and longitudinal fibres, exactly as in *Drepanophorus*.

The specimen in question is a young ♀ with ovaries not yet fully developed; they lie between the pouches of

the intestine in a single row on either side of the proboscis sheath, commencing in the cæcal region. The ovaries open to the exterior on the outer side of the lateral nerve. A considerable number of eggs are developed in each of the ovaries.

Habitat; St. 92 (Lat. 48° 29′ N; long 13° 55′ W.) $^{23}/_{7}$—$^{24}/_{7}$, 2000 metres depth (3000 metres of wire).[1])

Plotonemertes nov. gen.

Forepart of the body thickened to a club-shape. Mouth and proboscis pore separate. Muscles following the lateral nerve lacking. The male has a large double integumental glandular organ on the under side of the tail.

Plotonemertes adhærens nov. sp.
(Plate I, Figs. 9—10.)

This species is likewise based upon a single specimen. As will be seen from Fig. 9, the shape of the body differs from that in *Bathynemertes* by the club-shaped thickening of the forepart; the proboscis is unusually thick, owing to the presence of a highly developed exterior basement layer, a character which renders the species easily distinguishable. The male is further easily recognised by the large double integumental glandular organ on the under side of the tail, some idea of which may be obtained from Fig. 10. Judging from the structure of the organ it can be pushed out, and the enormous glandular apparatus would appear to indicate that it is an adhesive organ, probably used to grip the female during fecundation.

The species is somewhat smaller than *Bathynemertes*, length 30 mm., greatest breadth 9 mm., greatest thickness 4 mm.

The muscle layers of the body wall are highly reduced, this being especially the case with the circular layers, but the longitudinal musculature is also very thin laterally.

The mouth opening lies very close to the terminal proboscis pore, being however distinctly separated from it. Oesophagus lacking. Stomach well developed, its length together with that of the pyloric tube making in all 4.75 mm. The intestine narrow but furnished with over 50 pairs of large and highly ramificated diverticula. The well-developed intestinal cæcum has 6 pairs of diverticula.

The proboscis is more than twice as long as the animal itself; its maximal thickness is about 2 mm. In its wall are 27 proboscideal nerves; the stylet apparatus developed as in *Bathynemertes*. The proboscis sheath is likewise similar in structure to that of the species mentioned, but does not extend to the hindmost quarter of the body.

Save for the lack of metamerical commissures between the lateral and the dorso-median vessel, the vascular system exhibits but one peculiartty, a short, median vessel extending from the dorsal anastomose of the lateral vessels in the tail, into which the dorso-median vessel opens, out to the extreme point of the tail.

The lateral nerves are connected by numerous ventral transverse anastomoses.

The specimen in question is a young male. The testicles form an almost regular row in the head on either side of the proboscis sheath; the one row contained 8, the other 11, opening ventrally.

Habitat; St. 80 (Lat. 47° 34′ N; long. 43° 11′ W.) $^{11}/_{7}$, 2000 metres depth (3000 metres of wire).

Pendonemertes nov. gen.

Body thickening to a club-shape at the fore end, the hinder end somewhat applanated. Mouth and proboscis pore separate. Muscles following the lateral nerve well developed[1]). The proboscis sheath does not extend to the rear half of the body. Only few eggs are developed in the ovaries.

Pendonemertes Levinseni nov. sp.
(Plate I, Fig. 4).

The "Michael Sars" expedition brought home two specimens of this form, which is of especial interest, since the species — or at any rate the genus to which it belongs — must be regarded as the original form of a closely related series, the families of *Pelagonemertidæ* and *Armaueriidæ*.

The shape of the body is still but very slightly different from the *Drepanophorus* species of the bottom; the fore part is almost circular in section, the hinder end somewhat flattened, though not forming any caudal fin.

The dimensions of the two specimens were as follows:

	Length.	Greatest breadth.	Greatest thickness.	Length of prob. sheath.
I	26 mm.	6	4	13
II	20 „	5	3.5	11

The musculature of the body wall is here also highly reduced, even the longitudinal muscle layer being laterally almost entirely lacking.

The stomach is well developed, leading close behind the brain into the pyloric tube, the two sections together making up a length of 3.6 mm.

The intestine has between 30 and 40 pairs of diverticula; here again they are, with the exception of the

[1]) The question of depth as estimated from length of wire is further discussed on p. 10.

[1]) These muscles were first designed by Bürger (6) under the name of "Seitenstammuskel" as found by him in *Balaenanemertes* churi.

caudal region, ramifying out from a dorsal and a ventral main branch. The intestinal cæcum has three pairs of diverticula.

The proboscis resembles in structure that of the *Plotonemertes* but is considerably thinner; 16 proboscideal nerves are developed. The stylet apparatus is developed as in the remaining members of the family.

The proboscis sheath terminates at the limit between the fore and hinder portion of the body, its muscular layers are interwoven as in the forms previously described. From this musculature a strong muscle extends on either side, commencing in the cerebral region close behind the ventral commissure of the brain and running close to the lateral nerve of the respective side, following it to the tail.

The vascular system in this species exhibits the same peculiarity as in the case of *Plotonemertes*, with a similar blind vessel terminating in the extreme end of the tail and running from the posterior surface of the caudal commissure.

The lateral nerve stems are situate far up in the parenchyma.

Both the specimens were female, with from 20—24 pairs of ovaries situate between the diverticula of the intestine and opening ventrally just outside the lateral nerves. In each ovary, only two, or in exceptional cases three, eggs are developed; these reach, however, a considerable size.

Habitat; St. 25 (Lat. 35° 46′ N; long 8° 16′ W.) $^{5}/_{8}$, 1000 metres depth (1500 metres of wire).

St. 94 (Lat. 50° 13′ N; long. 11° 23′ W.) $^{20}/_{7}$, 1000 metres depth (1500 metres of wire).

Planktonemertidæ nov. fam.

Medium-sized pelagic nemerteans. Body very broad and more or less flattened. The diverticula of the intestine and intestinal cæcum commonly with ventral branch, in any case always highly ramified. Circular and longitudinal musculature in the proboscis sheath interwoven. Musculature of the body wall highly reduced.

The typical genus of the family is *Planktonemertes* Woodworth (21); is is not represented in the material.

Crassonemertes nov. gen.

Body very broad and thick. Tail short, somewhat flattened and sharphy distinct from the body. Mouth and proboscis pore separate but situate very close together. Vascular and nerve commissure immediately in front of anus. The proboscis sheath extends into the tail.

Crassonemertes robusta nov. sp.
(Plate I, Fig. 8.)

This species, with its remarkably heavy form, is represented by a single female specimen.

The animal in question, which had been preserved in formalin, was yellowish white and entirely opaque.

Length 25 mm. greatest breadth 10 mm. greatest thickness 4.5 mm.

Musculature of the body wall so reduced as to be of probably but little importance for swimming. The species should in all likelihood be considered as principally a floating organism.

Stomach highly developed — it had been forced somewhat out of the mouth opening by process of fixation; *vide* Fig. 8, Pl. I. — passing over behind the brain into the pyloric tube, the latter 6 mm. long.

The intestine fairly broad at the fore end, but quite narrow at the rear; it forms some 40 pairs of diverticula which are ramified to a quite unusual degree and so closely adjacent one to another that the ramifications appear interwoven. The intestinal cæcum is furnished with at least five pairs of diverticula, likevise highly ramified, the ramification throughout emanating from a dorsal and a ventral main branch.

Proboscis of about the same length as the body. The stylet basis is bent almost to a right angle and furnished with at least 10 stylets. Some 20—21 proboscideal nerves are developed.

The proboscis sheath terminates 2 mm. in front of the anus; the musculature in its wall consists of interwoven bundles of circular and longitudinal fibres.

The rhynchodæum is short, opening at the base of a depression in the epithelium, this depression, however, is not so large as to include the mouth, as is the case with *Bathynemertes* and *Planktonemertes*. The vascular system here exhibits the same original features as in *Bathynemertes*, the caudal commissure being situate far out at the tip of the tail.

Ovaries to the number of 35 pairs are developed, being still quite young and forming elongated sacs on the outer side of the lateral nerves with the dorsal portion curving in over the latter. Numerous young egg cells were found in the ovaries, and a considerable number of eggs are doubtless developed in each ovary.

Habitat: St. 101 (Lat. 57° 41′ N; long. 11° 48′ W) ^{6}—$^{7}/_{8}$, abt. 1666 metres depth (2500 metres of wire).

Bürgeriellidæ nov. fam.

Body broad but relatively slightly flattened. The intestinal diverticula highly reduced in number, projecting from the intestine at considerable

ntervals. Ramification of the diverticula altog-ther extreme. The muscle layers of the proboscis heath are arranged in an inner layer of circular, nd an outer one of longitudinal fibres.

Bürgeriella nov. gen.

Characters of family.

Burgeriella notabilis n. sp.
(Plate I, Figs. 6—7.)

It has been found necessary to institute a new family or this highly peculiar form, of which unfortunately only single specimen (male) is known; it is doubtless derived rom forms such as the *Planktonemertidæ,* but cannot be ncluded in this group, differing therefrom in particular as egards the structure of the intestine and of the proboscis heath.

Unfortunately, nothing is known as to the appearance f the animal in a living state: judging from that of the pecimen preserved in formalin, however (Plate I, Fig. 6) would seem likely that it is then quite transparent, which ould render the intestine even more conspicous. From he habitus figure it will be seen that the extreme and emarkable ramification of the intestine renders this form nmediately distinguishable from all other nemerteans.

Bürgeriella is a very imposing form among pelagic emerteans, and is in point of size only surpassed by pecies of the genus *Dinonemertes.*

Length 52 mm. greatest breadth 15 mm. greatest hickness 4 mm.

The muscular layers of the body wall are thin, the arenchyma however, being highly developed.

The mouth and proboscis pore are distinctly separate. Esophagus lacking. The stomach remarkably short, narrow nd capable of only slight expansion; at a distance of nly 1 mm. behind the mouth-opening it leads into a arrow pyloric tube about 6 mm. long.

The intestine is narrow, and furnished at intervals ith slender but highly ramified diverticula; here also ie ramification proceeds from a dorsal and a ventral ain branch; these secondary ramifications however, dif-er from those observed in other nemerteans in being ong, slender, and frequently branching off again. The iverticula being placed at relatively considerable distance ne from another, they are further developed to a high egree of ramification on their anterior and posterior urfaces, so that each diverticulum forms a large arboriform ppendix to the intestine, not, however, extending so far s to occasion any interweaving of the branches with ose from the adjacent stems.

The intestinal cæcum is furnished with 6 pairs of iverticula, which are ramified in the same manner as the remaining diverticula, but are, however, somewhat smaller than these. (Plate I, Fig. 7).

The proboscis is slightly longer than the body. The stylet apparatus does not differ from the type commonly found among pelagic nemerteans. 21 proboscideal nerves are developed.

The proboscis sheath terminates 5 mm. from the hinder end; its wall is comparatively thin, and the structure different from that found in all other pelagic nemerteans, inasmuch as the layer of circular muscle fibres is situate on the inner side of the longitudinal layer.

The lateral nerve stems extend far into the parenchyma, lying between the dorsal and ventral branch of the intestinal diverticula. Beneath the intestine they form strong transverse anastomoses in the parenchyma, in addition to which several transverse anastomoses were found dorsally and ventrally between the circular and longitudinal muscle layers of the body wall, originating in nerve branches from the lateral nerves.

At the fore end of the body, 6 pairs of testicles are developed (Plate I, Fig. 7), and are here not arranged metamerically, but more or less displaced, the testicular region being, approximately shaped like a horse-shoe.

The discharge ducts are of greatly varying length, leading to external apertures roughly arranged in two groups close behind the brain; only the apertures from the hindmost testicles are somewhat nearer the caudal region. The testicular wall contains a layer of circular musculature.

Habitat: St. 92 (Lat. 48° 29′ N; long. 13° 55′ W.) ^{23}—$^{24}/_{7}$, depth abt. 1333 metres (2000 metres of wire).

Dinonemertidæ nov. fam.

Pelagic nemerteans of frequently considerable size. Body broad and flattened. A caudal fin is developed by extreme flattening of the tail. Mouth and proboscis pore distinctly separate. The diverticula of the intestine very numerous, with but little or no ramification; the ventral branch always rudimentary or altogether lacking. Testicles in two single rows in the head, at times greatly reduced in number.

Dinonemertes Laidlaw 1906.

Large species. Body broad and flattened, but relatively thick owing to high developement of the parenchyma. Mouth opening situate in front of brain. The diverticula of the intestine vithout lateral ramification. The brain centrally situated. The proboscis sheath does not extend into the rear third of the body. The muscle layers in the wall of the proboscis sheath separate, not interwoven.

Dinonemertes investigatoris Laidlaw 1906.
(Plate I, Figs. 1—3).

Synonyms:
Dinonemertes investigatoris Laidlaw 1906 (14).
Dinonemertes investigatoris Brinkmann 1912 (in Murray and Hjort (18) p. 577).

Prior to the return of the "Michael Sars" with the material collected, this species, a giant form among pelagic nemerteans, was only known from the type specimen taken during the cruise of the "Investigator" near the Laccadive Islands, and briefly described by Laidlaw.

Had not this description been accompanied by a good habitus figure, it would hardly have been possible to recognise the species: by the aid of this however, and with the further assistance of a series of sections kindly placed at my disposal by Mr. Laidlaw, I was able to identify as belonging thereto a couple of specimens from the material of the "Michael Sars", both female, the one fullgrown, the other young.

The very considerable size of the species will be seen from the following measurements:

	Length.	Greatest breadth.	Greatest thickness.
I	203 mm.	56	15
II	107 „	23	7

Figs. 1 and 2 (Plate I) give a good idea of the form, remarkable for its enormous breadth in proportion to the length, the parallel sides, and the marked flattening of the tail, which forms a true caudal fin. The difference in shape of the fore part of the body as between the grown and the younger specimen (Plate I, Fig. 3) is due to the fact that the latter has cast its proboscis, and that the rhyncocoel has been emptied of the rhyncocoelomic fluid, causing a contraction of the head.

With regard to appearance in a living state, it is stated that the animal is transparent, with the intestine a bright red. As will be seen from the figures, the transparency has been lost in these specimens which were preserved in formalin, the intestine being only visible through the thinner caudal region.

An examination of the anatomical structure having been made, the results may be briefly summed up as follows:

The muscle layers of the body wall are but very sligthly developed in comparision with the considerable size of the animal; this is especially the case with the circular layers which nowhere exceed 0.05 mm. in thickness. The longitudinal musculature can, in the median region dorsally and ventrally, attain a thickness of 0.5 mm.; laterally, both layers are very thin. Between these layers are interposed a few scattered bundles of diagonal musculature.

The mouth opening is situate subterminally; the oesophagus is lacking. The stomach and pyloric tube, which have no exact mutual limit, have, in the larger specimen, an aggregate length of 14 mm., which is relatively short. The stomach is however, capacious, and its wall so folded as to permit a high degree of expansion.

The intestine is narrow, and furnished with about 70 pairs of diverticula, these lacking altogether the ramifications so frequently encountered in other pelagic nemerteans; the only indication of such development — noticeable moreover in the forepart of the body alone — is a slight pouch-like protrusion on the dorsal side, to some degree overlapping the edge of the rhynchocoel, and an extremely attenuated rudiment of a ventral branch.

The intestinal cæcum is short, and furnished with three pairs of diverticula, the foremost originating terminally.

The structure of the proboscis resembles in essentials that common to the remaining pelagic nemerteans; its length is about twice that of the body. The stylet basis is strongly curved, and armed with numerous stylets. At least 30 proboscideal nerves are developed. The proboscis pore is situated terminally, leading into a short rhynchodæum. The proboscis sheath, extending out from this, is likewise short, reaching only to within the middle third of the body. The circular musculature of the proboscis sheath is strongly developed and forms a layer in the outer portion of which the longitudinal musculature lies enclosed, not however, as interwoven bundles, but forming a distinct thin layer by itself. This does not altogether apply to the extreme fore-part in the cerebral region, where the arrangement more resembles that found in the *Drepanophorus*.

The vascular system exhibits various peculiarities. The mediodorsal vessel forms a small net of anastomosing branches as it passes through the wall of the proboscis sheath; they reunite however, immediately after passing through, and form again a single, undivided vessel. Metameral vascular anastomoses are lacking. The most remarkable feature in the vascular system is however the course of the lateral vessels. These run, in other forms — excepting only such complications as may arise in the nephridial region — straight down through the sides of the animal, following the lateral nerves, whereas in the present species they are intricately intertwined, forming a close mass of loops, partly surrounding the ovaries, and again extending up between or even above the intestinal diverticula. Examination has shown conclusively that no anastomoses are formed between the loops. The importance of this peculiar arrangement doubtless lies in the fact that it provides a means of conveying to the ovaries a sufficient quantity of nutriment during the development of the eggs, which are exceptionally large; this explanation is supported, *inter alia*, by the circumstance that the loops increase considerably both in number and size with the growth of the animal.

There are about 50 pairs of ovaries, each forming a large curved organ, and containing, when fully developed, some 6—8 eggs, which attain a size of no less than 2.5 mm.

Habitat:

The type specimen[1]) was taken east of the Laccadives, (Lat. 12° 2′ N; long. 73° 46′ E) at a depth of 1154 fathoms. The implement used was a bottom trawl, the individual was however doubtless taken during the hauling up; both the specimens from the "Michael Sars" are certainly pelagic. These latter were taken at St. 81 (Lat. 48° 2′ N; long. 39° 55′ W) on the $^{12}/_{7}$ 1910, and St. 64 (Lat. 34° 44′ N; long. 47° 52′ W) on the $^{24}/_{6}$ 1910, depth 2000 metres (3000 metres of wire). The horizontal area of distribution is thus extensive, the species having been found both in the Indian Ocean and in the Atlantic.

Nectonemertidæ (Verrill 1892) Brinkmann emend.

Slender, small to medium sized forms, with almost parallel sides. The body relatively small and only sligtly flattened. The hinder end is shaped into a higly developed caudal fin narrowing at the root. The diverticula of the intestine lack ventral branch. The male, when mature, has a pair of large lateral tentacles a little beyond the fore end.

Nectonemertes Verrill 1892 (partim).

Syn. *Hyalonemertes* Verrill 1892.

Characters of the family.

Nectonemertes mirabilis Verrill 1892.

(Plate II. Figs. 14—22).

Synonyms:

♂ *N. mirabilis* Verrill 1892 (20).
N. mirabilis Bürger 1895, 1904, 1905 (3, 4, 5).
N. mirabilis Coe 1905 (7).
N. Grimaldi Joubin 1904, 1906 (12, 13).
N. pelagica Cravens & Heath 1907 (8).
N. japonica Foshay 1912 (9).
♀ *Hyalonemertes atlantica* Verrill 1892 (20).
Hyalonemertes atlantica Bürger 1895, 1904, 1905 (3, 4, 5).
♂ & ♀ *Nectonemertes mirabilis* Brinkmann 1912, 1915 (1, 2).
Nectonemertes mirabilis Brinkmann in Murray and Hjort, 1912 (18).
non; *N. mirabilis* and *H. atlantica* Bürger 1907 (1912) (6).

From the list of synonyms given above[2]) it will be seen that my view as to this species differs essentially from those of previous writers. This may be explained by the fact of my having had so large a quantity of material to deal with, comprising no less that 82 specimens from the present expedition alone.

First of all, with regard to Verrill's two "species", a perusal of the works quoted shows that of *N. mirabilis* 16 specimens are known, all being males, while *H. atlantica* is represented by two individuals, both female. The only noteworthy difference Verrill has been able to demonstrate as between the two "species" — apart from the difference of sex — is the existence of the two lateral tentacles which characterise the former. An examination of the "Michael Sars" material from this point of view revealed the fact that all specimens with tentacles were male, all others with genital organs so far developed as to be visible through a magnifying glass, being female.

As long as only 16 and 2 specimens respectively were known, it was of course permissible to regard the peculiar distribution of the sexes as possibly accidental; when, however, the same was found to be the case with the 82 from the „Michael Sars" the accident theory was no longer tenable and another had to be sought. And in my opinion, the true explanation is that we have here to deal with males and females of one and the same species.

This hypothesis is strongly supported by the fact that the tentacles exhibit a series of gradual stages af developement from young to full-grown specimens (Plate II, Figs. 16—22); it is advanced to a certainty by the fact that I have succeeded in demonstrating that the development of the tentacles progresses simultaneously with that of the testicles. Further confirmation is moreover afforded by the fact that a like secondary sexual difference can be shown to exist in two other species of the same genus.

N. mirabilis has been very closely investigated by Cravens and Heath; the specimens which they found to differ from Verrill's first description, and which they therefore placed under the new species *N. pelagica* have all been found to fall within the range of variability of the present species; the same applies to *N. Grimaldi* Joubin, as also *N. japonica* Foshay.

Thorough demonstration of this will be found in the monograph on pelagic nemerteans by the present writer;[1]) it will here suffice to indicate the area of distribution of the species, as evidenced by the finds made by the „Michael Sars".

The specimens of *N. mirabilis* hitherto known were taken at widely different localities, Verrill found it off the east coast of North America, Cravens and Heath off the west coast of California, Joubin off the west coast of Europe, while Foshay brought it from Japan. The species

[1]) Laidlaw states that this was a male. On examining his section series, however I found it to be a female with eggs almost mature.

[2]) In the preliminary survey of the more prominent species among the material, (in Murray & Hjort p. 577) I mentioned *N. lobata* Joubin as synonymous with *N. mirabilis*. Closer investigation subsequently showed this to be erroneous; the form belongs to the genus *Balænanemertes* Bürger (6).

[1]) Vide Introduction.

thus appears to be of very considerable horizontal distribution. The "Michael Sars" investigations show it as extending throughout great areas of the North Atlantic, being, however, of most common occurrence in the western half of that sea.

As to the depth at which *N. mirabilis* lives, this has up to now been an entirely open question. Verrill (20) writes "whether they occurred at the surface or near the bottom I am unable to say;" he considers the form as pelagic, but bases his opinion merely upon its shape and structure, which he very correctly notes as highly adapted to pelagic life. Joubin (12) succeeded in showing that the animal really was pelagic, but neither he nor subsequent investigators have been able to say anything as to the depths at which it lived.

The "Michael Sars" expedition has now, thanks to the thoroughness of the methods there introduced by Dr. Hjort, furnished all requisite information for elucidation of this question. The plan adopted was, it will be remembered, to take a large number of horizontal hauls simultaneously at the same station but from different depths, these hauls being of so long duration — several hours — as to assure an overwhelming quantitative superiority of the material actually collected at the depth desired, when compared with the amount which might accidentally find its way into the net while being hauled in. It is thus possible, by comparing the results of the different hauls, to determine the depth at which an organism lives. This can of course, only be ascertained with absolute certainty in the case of species which are numerously represented: fortunately, however *N. mirabilis* was taken in such quantities at certain stations as to furnish thoroughly adequate material for the purpose.

The accompanying table (p. 11) shows the distribution of the material among the different stations and at the various depths; all hauls made at these stations are here noted, including also those with negative result as regards *N. mirabilis*.

The depth is reckoned as equivalent to $^2/_3$ of the length of wire out. This calculation is unfortunately not based upon direct measurement by self-registrering apparatus attached to the nets; no such attempt was made during the expedition, and the experiment would also undoubtedly involve considerable technical difficulty. In thus disregarding Dr. Hjorts estimates of depth, according to which the depth of the catch should be set at about half the length of wire out, I am acting upon my own experience from this and other expeditions, which leads me to believe that the true position may be most nearly gauged by taking $^2/_3$ or possibly even a little more. To reckon with $^1/_2$, or even less — down to $^1/_3$ — as suggested by Lea (15) would, from the observations noted below, be entirely misleading.

At Station 102 of the present expedition (depth by sounding 1098 metres) a series of pelagic hauls was made with nine implements, the lowest working on 1500 metres of wire. According to the estimate of Hjort and Lea, this net would have fished some 300 metres above the bottom; the catch, however included a nudibranch *(Cuthonella abyssicola)* [1]) which is a decided bottom organism, and (according to Ørjan Olsen 19 p. 6) three specimens of a pycnogonide, *Nymphon grossipes,* which is beyond all reasonable doubt a bottom form. This net must thus, with 1500 metres of wire out, have reached a depth of 1098 metres, i. e. a little over $^2/_3$ of the length of wire.

In the course of an expedition made in 1914 on board the research vessel "Armauer Hansen" belonging to the Bergen Museum, similar observations were made. At Station 3 the soundings showed a depth of 1400 metres, and the lowest haul in a series corresponding to that above mentioned brought up bottom organism in large numbers, the length of wire out being 2000 metres. At Station 4, the depth was taken immediately before and after the haul, showing 830 and 770 metres respectively; here also the lowest net in a series, working with 1200 metres of wire, brought up quantities of bottom material. In both cases therefore, the nets must have fished at a depth equivalent to about $^2/_3$ the length of wire.

And finally, direct measurements (Jespersen 11) tend in the same direction.

I have been at some pains to justify my estimate as to depth in proportion to length of wire, this factor being, as we shall subsequently see, of the utmost importance when considering the distribution of the species in connection with the hydrographical conditions.

We may now commence with the hauls from Stations 80 and 81, as shown in the table here given. The nets fishing here at depths of 0, 66, 133, 200, 400 and 666 metres brought up not a single specimen of *N. mirabilis;* the hauls from deeper levels however, produced 29 and 22 specimens respectively. This in itself warrants the conclusion that the upper limit of distribution at these two stations must lie at about 1000 metres and that the specimens were actually caught at this or greater depths; not taken accidentally while hauling in. This is rendered the more probable by the size of the implements used: the young-fish trawl — a very large net — worked at 666 metres with negative result for both stations whereas the small $^3/_4$ metre nets fishing at 1000 metres brought up 7 and 2 specimens respectively.

[1]) According to verbal statement by Konservator Grieg.

Nectonemertes mirabilis

Catches made by the "Michael Sars" 1910.

Calculated depth (2/3 of the length of wire out). meter	Length of wire out meter	Station and duration of haul. (H = hours). 6 June 53 6 H.	62 During night	64 During whole day	30 June 70 5 H.	11 July 80 6 H.	12 July 81 3 H.	13 July 82 3.5 H.	84 4 H.	17 July 87 3 H.	18 July 88 6.5 H.	21 July 90 3 H.	25 July 92 4 H.	7 Aug. 101 3 H.	Total number of *N. mirabilis* caught in each depth
0	0	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	0
66	100	1 sn. ÷	1 sn. ÷	1 sn. ÷	3/4 sn. ÷	×	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	0
133	200	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	×	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	0
200	300	y. ÷	y. ÷	y. ÷	y. ÷	×	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	0
400	600	y. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷ (700 m. wire)	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	0
666	1000	1/2 sn. ÷ (1100 m. wire)	y. ÷	y. ÷	×	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	0
1000	1500	y. ÷ (1600 m. wire)	×	×	3/4 sn. III (1200 m. wire)	3/4 sn. VII	3/4 sn. II	3/4 sn. IV	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	16
1333	2000	1/2 sn. ÷ (2400 m. wire)	y. II	y. I	y. ÷ (1700 m. wire)	y. XVI	y. XVII	y. ÷	y. VI	y. I	y. III	y. II	y. III	y. I	52
1666	2500	3 In. I (2600 m. wire)	3/4 sn. ÷	3/4 sn. ÷	×	3/4 sn. I	3/4 sn. ÷	3/4 sn. I	3/4 sn. I	3/4 sn. ÷	×	×	×	3 In. ÷	1
2000	3000	×	3 In. ÷	3/4 sn. I	×	3 In. V	3 In. III	3 In. ÷	y. I	y. ÷	×	×	3 In. ÷	×	10

3/4 sn., silknet of 3/4 meter's diameter. 1 sn., silknet of 1 meters diameter. y., Dr. C. G. Joh. Petersen's young fish trawl. 3 In., large net. Ring 3 metres in diameter, met a strimps net. ×, no haul. ÷ no nemerteans in the haul. I, II . . . number of *N. mirabilis* caught.

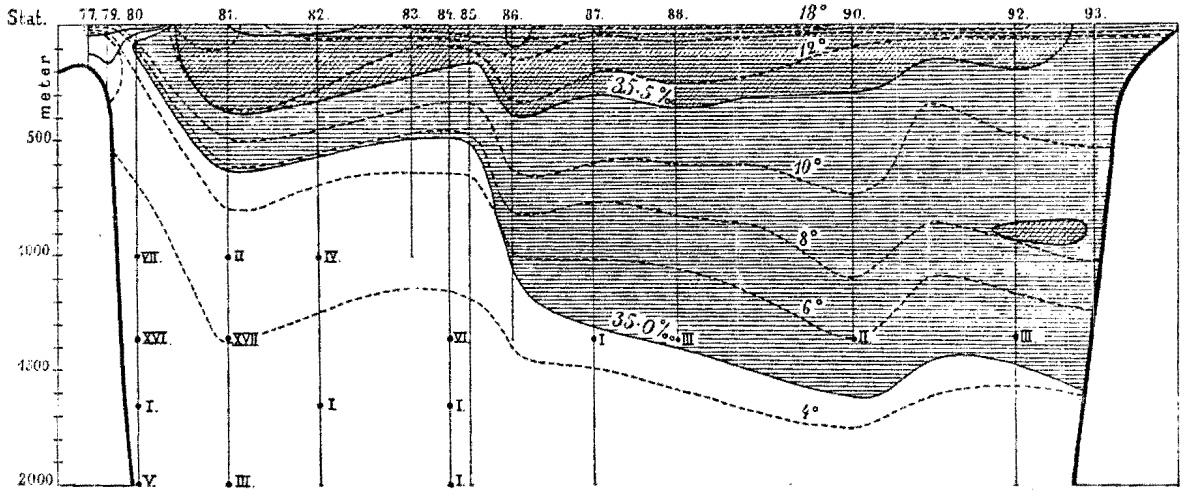
The quantity of *N. mirabilis* from the remaining stations, albeit comparatively small, yet fully serves to confirm the observations made at 80 and 81; the 66 nets worked at these stations in depths of less than 1000 metres — including one young-fish trawl from each station at 666 metres — made but a single catch of the species (St. 70, 3 spec.) at 800 metres, while a single capture is recorded (St. 82) at 1000 metres depth, and beyond these, only at 1333 metres or deeper.

The lower limit of distribution cannot be determined by this method; with a species of relatively infrequent occurrence it is impossible to ascertain, by comparison of the hauls, whether or not the nets fishing below 1000—1333 metres may have taken the specimens found while being drawn up through upper portion of the area of distribution.

The extensive hydrographical investigations made partly at the same stations as the zoological, afford an opportunity of seeking to characterise the vertical distri-

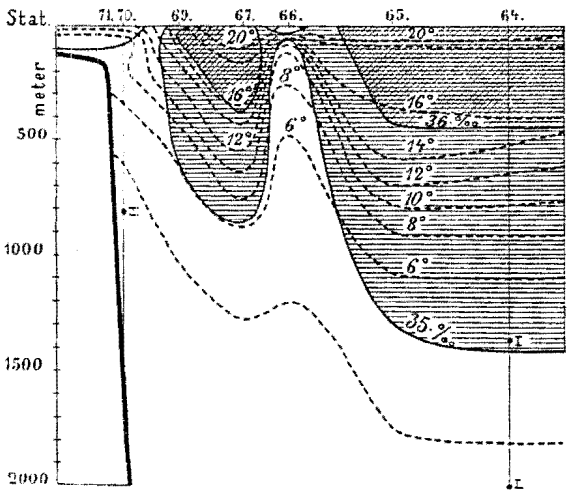
bution of the species according to the water layers in which it is found.

On the hydrographical charts given below I have noted the places of capture, with number of specimens in roman numerals at the side. Not a single one of the 82 specimens in the material was taken in water of more than 6°, and nearly all in layers of less that 35 ‰ salinity.[1])



Hydrographical section, "Michael Sars" 1910". Newfoundland to Ireland. After Helland Hansen in Murray and Hjort (18) pag. 115.

In this figure and the section below the depths of the hauls is reconed as equivalent to $^2/_3$ of the length of Wire out.



Hydrographical section, "Michael Sars" 1910. Newfoundland to Sargasso Sea. After Helland Hansen in Murray and Hjort (18) pag. 298.

Save for some unimportant differences, the charts show, with as high a degree of accuracy as could possibly be obtained in such investigations, that *N. mirabilis* is a distinctly stenohaline and stenothermic species of marked bathypelagic character, its upper limit of vertical distribution being determined by the water layers to which it is confined. It will be seen from the charts that this becomes deeper at the eastern stations, where the isotherms and isohalines are lowered by the water masses of the Gulf Stream. The species is thus not found in the intermediate and upper layers of the Gulf Stream, which again serves to explain the fact of its never being encountered in the Norwegian Sea. Hydrographical charts of the connecting waters between the Atlantic and the Mediterranean (e. g. Jespersen 11) show that the Atlantic waters typical of the species do not penetrate into the Mediterranean; here accordingly, the species has not been found. On the other hand, the connection between these Atlantic water layers and the equivalent strata in the Pacific serves to explain the occurrence of the species in that sea.

Habitat:

Verrill (1892):

"Albatross", St. 2036 (Lat. 38° 53' N; long. 69° 25' W) Bottom trawl 1735 fathoms, 1 spec.

— St. 2076 (Lat. 41° 13' N; long. 66° 1' W) Bottom trawl 906 fathoms, 1 spec.

— St. 2229 (Lat. 37° 39' N; long. 73° 17' W) Bottom trawl 1423 fathoms, 1 spec.

— St. 2236 (Lat. 39° 11' N; long. 72° 09' W) Bottom trawl 636 fathoms, 1 spec.

— St. 2428 (Lat. 42° 48' N; long. 50° 56' W) Bottom trawl 826 fathoms, 1 spec.

— St. 2724 (Lat. 36° 47' N; long. 73° 25' W) Bottom trawl 1641 fathoms, 1 spec.

[1]) The hauls at Stations 53, 62 and 101 are not noted on the hydrographical sections; according to information received from Prof. Helland Hansen, who is dealing with the hydrographical material of the expedition, the nature of the water layers at the mentioned stations was such that the catches here likewise fall within the given limits of temperature and salinity.

Joubin (1904):

"Princesse Alice", St. 1849 (Lat. 36° 17′ N; long. 28° 53′ W) Plankton haul (vertical) 3000—0 metres 1 spec.

Craven & Heath (1906):

"California" (Monterey Bay) On fishing lines, 400—500 fathoms depth, 3 spec.

"Albatros", St. 4393 (south coast of California) bottom trawl, 2113—2259 metres depth, 2 spec.

Foshay (1912):

Near Misaki, Japan, depth? net used? 6 spec.

„Michael Sars (1910):[1])

St. 53	(Lat. 34° 59′ N;	long.	33° 01′ W)	5/6	1	spec.
St. 62	(„ 36° 52′ N;	„	39° 55′ W)	20/6	2	„
St. 64	(„ 34° 44′ N;	„	47° 52′ W)	24/6	2	„
St. 70	(„ 42° 59′ N;	„	51° 15′ W)	30/6	3	„
St. 80	(„ 47° 34′ N;	„	43° 11′ W)	11/7	29	„
St. 81	(„ 48° 02′ N;	„	39° 55′ W)	12/7	22	„
St. 82	(„ 48° 24′ N;	„	36° 53′ W)	13/7	5	„
St. 84	(„ 48° 04′ N;	„	32° 25′ W)	15/7	8	„
St. 87	(„ 46° 48′ N;	„	27° 46′ W)	17/7	1	„
St. 88	(„ 45° 26′ N;	„	25° 45′ W)	18/7	3	„
St. 90	(„ 46° 58′ N;	„	19° 06′ W)	21/7	2	„
St. 92	(„ 48° 29′ N;	„	13° 55′ W)	23/7	3	„
St. 101	(„ 57° 41′ N;	„	11° 48′ W)	6/8	1	„

Nectonemertes primitiva nom. nov.
(Plate II, Figs. 11—13.)

Syn. *Nectonemertes mirabilis* Bürger (1907) 1912 (6).

After having shown that *N. mirabilis* and *H. atlantica* Verrill were male and female of one and the same species, the tentacles on the sides of the head being a secondary sexual character of the male, it appeared natural to consider the specimens shown in Figs. 11—13 (Pl. II), — which are entirely identical in structure save for the tentacles and genital organs, and differ characteristically from *N. mirabilis*, — as male and female of another species.

Comparison shows, that the species is identical with that represented by a single specimen described by Bürger as *N. mirabilis*.

With regard to the appearance of the animal in a living state, the reader may refer to Bürger's description and figure. The preserved specimens are, as will be seen by comparison, shorter, relatively broader, and with the tail flipper far more developed than *N. mirabilis*. The species is considerably smaller than the foregoing.

[1]) Implement and depth not noted here, these being included in the table p. 11.

	Length	Greatest breadth	Greatest thickness
♂	12 mm.	4	2
♀	14 „	4	2

The tentacles were only 1.5 mm. long, which must undoubtedly be ascribed both to considerable contraction and also to the youth of the specimen, which was not fully mature.

Of specific points of difference when compared with *N. mirabilis*, the following may be noted:

The stomach is narrower and shorter than in the mentioned form, and already in the cerebral region leads into the pyloric tube, the length of which is only 0.8 mm. The cæcum also is smaller, and has but four pairs of diverticula, which are relatively small.

The genital organs of the male exhibit a most striking difference of species. The testicles of *N. mirabilis* are numerous, and arranged in two oval groups ventrally in the head, whereas in the present case, there are but four pairs of testicles, arranged in a double row (Pl. II, Fig. 12) their discharge ducts extending forward in the head.

The ovaries also are considerably less numerous, there being 10 pairs developed. And as there are 50 pairs of intestinal diverticula, the numbers by no means permit of one pair of ovaries being placed between each two pairs of diverticula.

Habitat:

Bürger (1912):

"Valdivia", St. 66 (Lat. 3° 55′ S; long. 7° 48′ 5″ E) vertical net 3000—0 metres.

"Michael Sars", St. 51 (Lat. 31° 20′ N; long. 35° 7′ W) 5/6 at 666 metres depth, (1000 metres of wire).

— St. 53 (Lat. 34° 59′ N; long. 33° 1′ W) 5/6, at 200 metres depth (300 metres of wire).

The material from the „Michael Sars" shows that the species lives at remarkably slight depths.

Nectonemertes minima Brinkmann 1915.
(Plate II, Fig. 23).

Syn. *Hyalonemertes atlantica* Bürger (1907) 1912 (5).
Nectonemertes minima Brinkmann 1915 (2).

I have recently given a preliminary description of this species based upon material from another expedition, in which it was shown that Bürger had been dealing with a female specimen, which he had erroneously endeavoured to identify with Verrill's *H. atlantica* (*N. mirabilis* Verrill ♀). The male is easily distinguished from the two foregoing species, partly by its small size, and partly by the fact that the testicles, which are placed in a single row on either side of the head, have laterally

directed discharge ducts opening approximately at the lateral edge of the head.

The material from the "Michael Sars" included three specimens of this species, all female. These are by no means so easily distinguished from the foregoing species as the males; they can however, be recognised, *inter alia,* by the extremely reduced stomach and pyloric tube; by the fact that the numerous (about 60) intestinal diverticula are still distinctly developed behind the caudal commissure right out to the anus, and by the lack of ramification. The intestinal cæcum is furnished with three pairs of diverticula.

Habitat: St. 98 (Lat. 56° 33′ N; long. 9° 30′ W) $^{5}/_{8}$ closing net, 1000—550 metres.

St. 101 (Lat. 57° 41′ N; long 11° 48′ W) $^{6}/_{8}$ abt. 1300 metres depth (2000 metres of wire).

Phallonemertidæ nov. fam.

Pelagic nemerteans of medium size, the body slender with almost parallel sides, flattened ventrally, and rounded dorsally. The hinder end is broad, and much flattened, forming a caudal fin. The intestinal cæcum well developed, the diverticula of the intestine only showing traces of a ventral branch, but otherwise with fairly considerable ramifications. The lateral nerves are situate ventrally close to the inner side of the body wall. The testicles are placed in two single rows at the fore end, each testicle terminating in a cylindrical penis.

Phallonemertes nom. nov.

Syn. *Bathynectes* Brinkmann 1912 (1).[1])

Characters of the family.

Phallonemertes Murrayi Brinkmann 1912.

(Plate II, Figs. 24—25.)

Syn. *Bathynectes Murrayi* Brinkmann 1912 (1).

Some years ago I made a preliminary communication as to this highly peculiar species, which is distinguished by the fact, that the papillæ forming the aperture of each separate testicle are greatly extended, being apparent as penis-like appendices on the under side of the head. (Plate II, Fig. 24). For the general structure, the reader may refer to my original description; it will here suffice to set forth the facts bearing upon the distribution of the species. The "Michael Sars" expedition brought home 17 specimens from the following stations:

[1]) The name has been changed, as it was found to have been previously used for a genus of crustaceans.

St. 53 (Lat. 34° 59′ N; long. 33° 1′ W) $^{8}/_{6}$ 2600 m. wire 3 spec.
„ 64 („ 34° 44′ N: „ 47° 52′ W) $^{24}/_{6}$ 3000 - „ 2 „
„ 81 („ 48° 02′ N; „ 39° 55′ W) $^{12}/_{7}$ „ - „ 8 „
„ 82 („ 48° 24′ N; „ 36° 53′ W) $^{13}/_{7}$ „ - „ 1 „
„ 84 („ 48° 04′ N; „ 32° 25′ W) $^{15}/_{7}$ „ - „ 1 „
„ 92 („ 48° 29′ N; „ 13° 55′ W) $^{23}/_{7}$ „ - „ 2 „

In addition to these, one specimen was taken by the "Ingolf" Expedition in 1895 at St. 38 (Lat. 59° 12′ N; long. 51° 05′ W) $^{30}/_{7}$ bottom trawl, depth 1870 fathoms, and one by the "Thor" expedition of 1906, at St. 76 (Lat. 49° 27′ N; long 13° 33′ W) 2800 metres of wire.

From this it will be seen, that the species is at present only known fron the North Atlantic. Here also, Dr. Hjort's method of serial hauls furnishes interesting information as to the vertical distribution. We find, in the first place, that the species is undoubtidly pelagic — the „Ingolf" specimen must thus have been taken while hauling in — and further, that it is distinctly bathypelagic. This will be seen from the table opposite, showing all positive stations for the species on the "Michael Sars" expedition and noting all implements used at these stations. Although the catch was in no case large, there can be no reasonable doubt that the specimens were taken at about the depth where the implements concerned were working. The upper limit of distribution cannot therefore be much above 2000 metres, and is undoubtedly never higher than abt. 1333 metres, at which depth a young-fish trawl was drawn at five of the stations with negative result as regards the species in question.[1])

If we compare the depths of these hauls with the chart on p. where the hydrographical condition for the last five stations are noted, it will be seen that the species is a stenothermic and stenohaline bathypelagic form; the temperature of its habitat as there indicated varying between 3° and 4°, the salinity only between 35 ‰ and 34.9 ‰.

Chuniellidæ nov. fam.

Medium sized forms. Body pointed at hinder end. Tail more or less applanated, without, however, forming any caudal fin. The longitudinal muscle layer of the body wall strongly developed dorsally and ventrally, but laterally thin. Lateral nerves ventrally situated, immediately inside the musculature. Intestinal diverticula without ventral

[1]) In allowing even this amount of latitude for the upper limit of distribution, I do so only to be absolutely on the safe side: the bundary might doubtless without imprudence be placed as low as 1666 metres, at which depth the hauls were likewise negative. I have not done so, however, because the small $^{3}/_{4}$ metre net used at that depth is of so slight fishing capacity that a species of so infrequent occurrence might well have escaped it.

Phallonemertes Murrayi.
Catches made by the "Michael Sars" 1910.

Calculated depth (2/3 of the length of wire out). meter	Length of wire out. meter	Station and duration of haul. (H = hours). 53 6 H.	64 During whole day	81 3 H.	82 3.5 H.	84 4 H.	92 4 H.	Total-number of specimens
0	0	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	0
66	100	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	0
133	200	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	1 sn. ÷	0
200	300	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	0
400	600	y. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	0
666	1000	1/2 sn. ÷ (1100 m. wire)	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	0
1000	1500	y. ÷ (1600 m. wire)	×	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	0
1333	2000	1/2 sn. ÷ (2400 m. wire)	y. ÷	y. ÷	y. ÷	y. ÷	y. ÷	0
1666	2500	3 In. III (2600 m. wire)	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	3/4 sn. ÷	×	3
2000	3000	×	3 In. II	3 In. VIII	3 In. I	y. I	3 In. II	14

For explanation of the al notation, see the table pag. 11.

branch. Musculature of the wall of the proboscis sheath composed of an inner layer of longitudinal and outer of circular fibres. Testicles numerous, arranged in two longitudinal rows in the head, along the lateral nerves.

Chuniella nov. gen.

Characters of the family.

Chuniella lanceolata nov. sp.
(Textfig. 1).

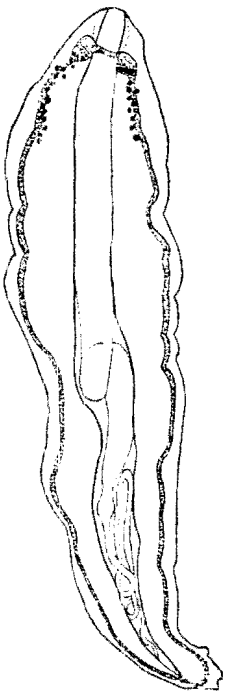
This species presents a combination of characters rendering it impossible to place it in any of the other families; I have therefore, despite the fact that only one specimen exists, and this moreover, evidently a very young individual, found it necessary to give it a separate family and genus, to which, as far as can be seen from the descriptions, Bürger's (6) *Drepanophorus pelagicus* and *Planktonemertes agassizi* likewise belong.

From the appearance of the specimen, I took it at first for a young stage of *Nectonemertes*, and no special habitus figure was therefore made, but only an outline drawing, which I here reproduce (Textfig. 1, p. 16). A series of sections afterwards made, however revealed quite a different structure.

The development of the testicles shows that we have here to deal with a young specimen, and the dimen-

sions given below can therefore hardly be considered as any standard for the species.

Length 10 mm., greatest breadth 2.25 mm., greatest thickness 1.2 mm.



Textfig. 1, *C. lanceolata*; In the fore end the testicles are seen as black spots.

The circular musculature beneaht the epithelium is extremely thin, properly existing as a layer only in the rear third of the body, where also the longitudinal musculature reaches its greatest development; it is extremely thin laterally, and forms a dorsal and a ventral muscular plate of 65 μ maximal thickness.

Mouth and proboscis pore are separate. Oesophagus lacking. The stomach is small and short, passing over immediately behind the brain into the pyloric tube, which is relatively long. The intestine is narrow, and furnished with about 30 pairs of extremely large but only slightly ramified diverticula; the appearance here should as a matter of fact rather be described as broad, short protuberances than actual ramification; there is no trace of any ventral branch. The intestinal cæcum is very strongly developed, and furnished with five pairs of diverticula. The fore end of the cæcum extends in front of the brain.

The proboscis attains a length about twice that of the body; its stylet apparatus resembles that of the remaining pelagic nemerteans, and there are 21 proboscidial nerves developed.

The proboscis sheath terminates about 1 mm. from the hinder end of the body. The musculature in its wall behind the brain consists of an inner longitudinal and an outer circular layer.

The cerebral ganglions are large. With regard to the lateral nerves it may be noted that their caudal commissure is situate behind the ventral anus.

The specimen examined was a male. The testicles were numerous, 19 being developed on the right side, and 12 on the left; they are only found in the fore-part, where they lie close to the lateral nerves (Textfig. 1), and are still in their first stage of development, forming small sacs about 0.08 mm. long, in which as yet only a single layer of cells with large nuclei is visible; the disharge ducts are not developed.

Habitat: St. 92 (Lat. 48° 29′ N; long. 13° 55′ W). $^{23}/_{7}$. Depth about 1000 metres (1500 metres of wire).

♀ *Armaueriidae* nov. fam.

Fore part of the body broad, the posterior end tapered and ending in a feebly developed caudal fin. The intestinal diverticula without a ventral branch. The dorso-median vessel developed in its full length, but at no place being in connection with the proboscis sheat. Dorsal commissure of the vessels in the head lacking. Testicles arranged in two almost regular rows in the head, never united to groups.

Armaueria nov. gen.

Characters of the family.

Armaueria rubra n. sp.

No figure of the animal was drawn as only the series of sections made me aware of the fact that three specimens — 2 ♂ and 1 ♀ — in the material belonged to the above mentioned new genus and family and that they not, as one should believe judging from the form and size of the body, constituted a species of the well known genus *Pelagonemertes*.

The fore part of the body is rounded and in the proboscis sheat region very thick and only slightly flattened. The caudal fin is feebly developed. The species belongs to the dwarfs among the pelagic nemerteans (5, 3—8,8 mm., with a greatest breadth of ca. 2,5 mm. and a greatest thickness of up to 1.5 mm.).

The circular muscle layer of the body wall is strongly reduced in all parts of the body; in the fore part and the sides of the body the same is the case with the longitudinal muscle layer, but dorsally and ventrally in the middle of the body and towards the tail these muscles form a strong layer 100—115 μ thick.

The opening of the mouth is placed terminally and leads directly into the stomach; this and the pyloric tube are short, and the latter opens close behind the brain in a very wide intestine, furnished with about 25 pairs of unbranched lateral pouches. The intestinal cæcum is short and only provided with one pair of diverticules.

The proboscis is considerably longer than the animal and is coiled up in its sheat. In the part next to the insertion 14 nerves are developed in the proboscis wall but more distally the number is reduced to 7. The armature of the proboscis is like that found in *Drepanophorus*.

The proboscis pore is situated dorsally, leading into a short rhynchodæum, which forms an angle with the proboscis sheat, which is short and of an ovoid shape and generally does not enter the rear half of the body. The musculature of the wall is anteriorly composed of an inner circular and an outer longitudinal layer but close

behind the brain some of the longitudinal fibres penetrate the circular layer, so that these muscles in the greatest part of the wall form a distinct layer within the longitudinal musculature, without beeing interwowen with it as is the case in many forms.

As mentioned in the diagnosis of the family the dorsal commissure of the vessels in the head is lacking and the dorso-median vessel is never in connection with the proboscis sheat and never enters the rhynchocœlomic cavity.

The longitudinal nerve-stems are placed close to the lateral edges of the body.

The testicles form an almost regular row in the head on either side along the nerve-stems; the opening of their ducts are placed lateroventrally. The ovaries are not numerous as only 8 pairs could be counted, the openings of which sometimes are lying outside the stems of the vessel and nerve, sometimes between them and sometimes to the inside of them.

Habitat:

St. 80 (Lat. 47° 34′ N; long. 43° 11′ W) $^{11}/_{7}$ about 1666 metres depth (2500 metres of wire).

St. 81 (Lat. 48° 2′ N; long. 39° 55′ W) $^{12}/_{7}$ about 1666 metres depth (2500 metres of wire).

St. 88 (Lat. 45° 26′ N; long 25° 45′ W) $^{18}/_{7}$ about 1333 metres depth (2000 metres of wire).

Pelagonemertidæ (Moseley) Brinkmann emend.

Small or medium sized pelagic nemerteans. The body usually applanated and fairly broad in proportion to length. The caudal fin is, where present, formed by lateral excrescences from the tail, not by flattening of same. Mouth and proboscis pore separate. Stomach, pyloric tube and intestinal cæcum much reduced. As a rule, the intestinal diverticula of the body form a dorsal and a ventral main branch. The musculature of the proboscis sheath is composed of an inner longitudinal and an outer circular layer. The bundles of muscle fibres following the lateral nerves always developed. The dorso-median vessel rudimentary or lacking. The testicles are found in two groups at the fore end of the head. Rudimentary eyes generally found.

Natonemertes nov. gen.

Body pointed at the hinder end, whithout tail fin, Testicles in two groups behind the brain. Intestinal cæcum with one pair of diverticula.

Natonemertes acutocaudata n. sp.

(Plate II, Fig. 26).

The "Michael Sars" expedition brought home a single specimen of this interesting new genus, which forms a connecting link between *Pendonemertes* and forms like *Pelagonemertes* and *Balænanemertes*.

Length 9 mm., greatest breadth 4 mm., greatest thickness 2.25 mm. The dimensions are those of a comparatively small species: it is probable, however, from the degree of development of the testicles, that the specimen in question had not yet reached its full size.

Colour, in formalin, a pale pink.

The surface epithelium, of which some portions were preserved, distinctly showed the bulb-shaped sensory organs known from *Nectonemertes*.

The muscle-layers of the body wall greatly reduced, and laterally almost altogether lacking.

Mouth and proboscis pore separate. The stomach very short, passing over already in the region of the brain into a short pyloric tube. The intestine furnished with 15—20 pairs of large, slightly ramified diverticula, showing, where best developed, some trace of ventral branches. The intestinal cæcum is very short and only provided with one pair of diverticula.

The proboscis is long and powerful; the slightly curved stylet base is armed with two rows of stylets. 12 proboscidial nerves are developed. The proboscis sheath extends right out into the tail, terminating immediately in front of the anus. The muscle bundles following the lateral nerves are very thin.

The dorso-median vessel ends blindly shortly after passing through the walls of the proboscis sheath.

The testicles are ovate, and form two groups with four in each, close behind the brain.

Habitat: St. 101 (Lat. 57° 41′ N; long 11° 48′ W) $^{6}/_{8}$, at 1333 metres depth (2000 metres of wire out).

Balænanemertes Bürger (1907) 1912.

Small species. The caudal fin strongly developed. Male and female with short lateral tentacles one on either side of the head. The testicles lie close together in two groups beside or in front of the brain.

Balænanemertes lobata Joubin 1906.

Syn. *Nectonemertes lobata* Joubin 1906 (13).

This species is hitherto known only in Joubin's type specimen, the description of which is unfortunately altogether superficial. Only the large quantity of material available — of which one specimen from the present expedition — rendered it possible to identify it at all.

The specimen in question was slightly larger than the type. Length 7 mm., greatest breadth 2.5 mm., greatest thickness 1.6 mm., length of tentacles 0.8 mm.

No information is available as to the appearance of the animal in a living state.

The shape agrees well enough with Joubin's contour figure; here also the tentacles are seen to project, not from the foremost curvature edge of the head, but from its sides. The shortness of the tentacles is due to contraction.

With regard to the anatomical structure, the following features may be specially mentioned:

The muscle layers of the body wall are reduced, the maximal thickness of the longitudinal layers being only 35 μ.

The stomach and pyloric tube are extremely short, the point of transition between them lying beneath the brain. The intestine shows 22 pairs of large diverticula, placed — in contrast to all other known species of the genus[1]) — at considerable intervals, as in the case of *Pelagonemertes*. They are furnished with some few short pouches but exhibit no other trace of ramification. The same applies to the pair of large diverticula on the intestinal cæcum.

The structure of the tentacles is the same as in *B. chuni* Bürger (6), and the same applies to the proboscis, which has 17—18 proboscideal nerves.

The lateral muscles following the nerve stems are here, in contrast to the mentioned species, only very slightly developed.

The proboscis sheath is considerably longer than in *B. chuni*, without however, extending out into the point of the tail.

The dorso-median vessel terminates slightly in rear of the point where it enters the rhyncocoelomic cavity.

The specimen in question is a ♀ with 7 pairs of ovaries developed, the apertures lying on the inner side of the lateral nerve stems. Only one egg is matured in each ovary.

Habitat: Joubin's type specimen was taken in the North Atlantic. (Lat. 36° 17′ N; long. 28° 53′ W) in a vertical haul 3000—0 metres. The specimen from the "Michael Sars" was taken at St. 84 (Lat. 48° 04′ N; long. 32° 25′ W) $^{15}/_{7}$ at 2000 metres depth (3000 metres of wire).

Balænanemertes Hjorti n. sp.

As regards external habitus, this species follows in nearly all essentials the species, hitherto known with an exception however, in the case of the tentacles, which are here only apparent as short points, despite the fact that the specimen in question was fully mature.

In contrast to *B. chuni* and *B. lobata,* the intestinal cæcum is furnished with two pairs of diverticula. The intestinal diverticula are clearly divided into a dorsal and a ventral main branch, between which are found the lateral nerve and vessel. As a specific character may be further noted the development of a thick muscle layer extending from the insertion of the proboscis down between the proboscis sheath and the ventral cerebral commissure.

The specimen in question is a male, with 7—8 testicles, spherical in form, and containing fully developed spermatozoa.

Habitat: St. 92 (Lat. 48° 29′ N; long. 13° 55′ W). $^{23}/_{7}$, at 1000 metres depth, (1500 metres of wire out).

Balænanemertes lata n. sp.

This species also is known in but a single specimen. And indeed, as regards the smaller species of pelagic nemerteans generally, the number of specimens in the material of the expedition is remarkably small; with the unusually large catches made, however, it is reasonable to suppose that some might have escaped observation.

The species closely resembles *B. Hjorti*, not only in the slight degree of development of the tentacles, but also as regards the intestinal cæcum, which here also is furnished with two pairs of diverticula, though these are here considerably more developed, and with a not inconsiderable degree of ramification. It may be distinguished from the foregoing species by the entire lack of musculature between the proboscis sheath and the ventral cerebral commissure, as also by an altogether extreme development of the muscles extending from the insertion of the proboscis to the dorsal and latero-ventral parts of the body wall.

The testicles are elongated, almost sausage-shaped, some of them opening on the under side of the head.[1])

Habitat: St. 84 (Lat. 48° 04′ N; long. 32° 25′ W). $^{15}/_{7}$, abt. 1333 metres depth, (2000 metres of wire out).

[1]) Only three are mentioned in this report; to these must be added four new species in the rest of the material I have had to work upon.

[1]) It should be noted that the various species of the genus *Balænanemertes* are most intimately related one to another, so much so that only a detailed and richly illustrated description—such as that given in the monograph by the present writer, referred to in the introduction—will be of any use for purposes of absolutely certain identification.

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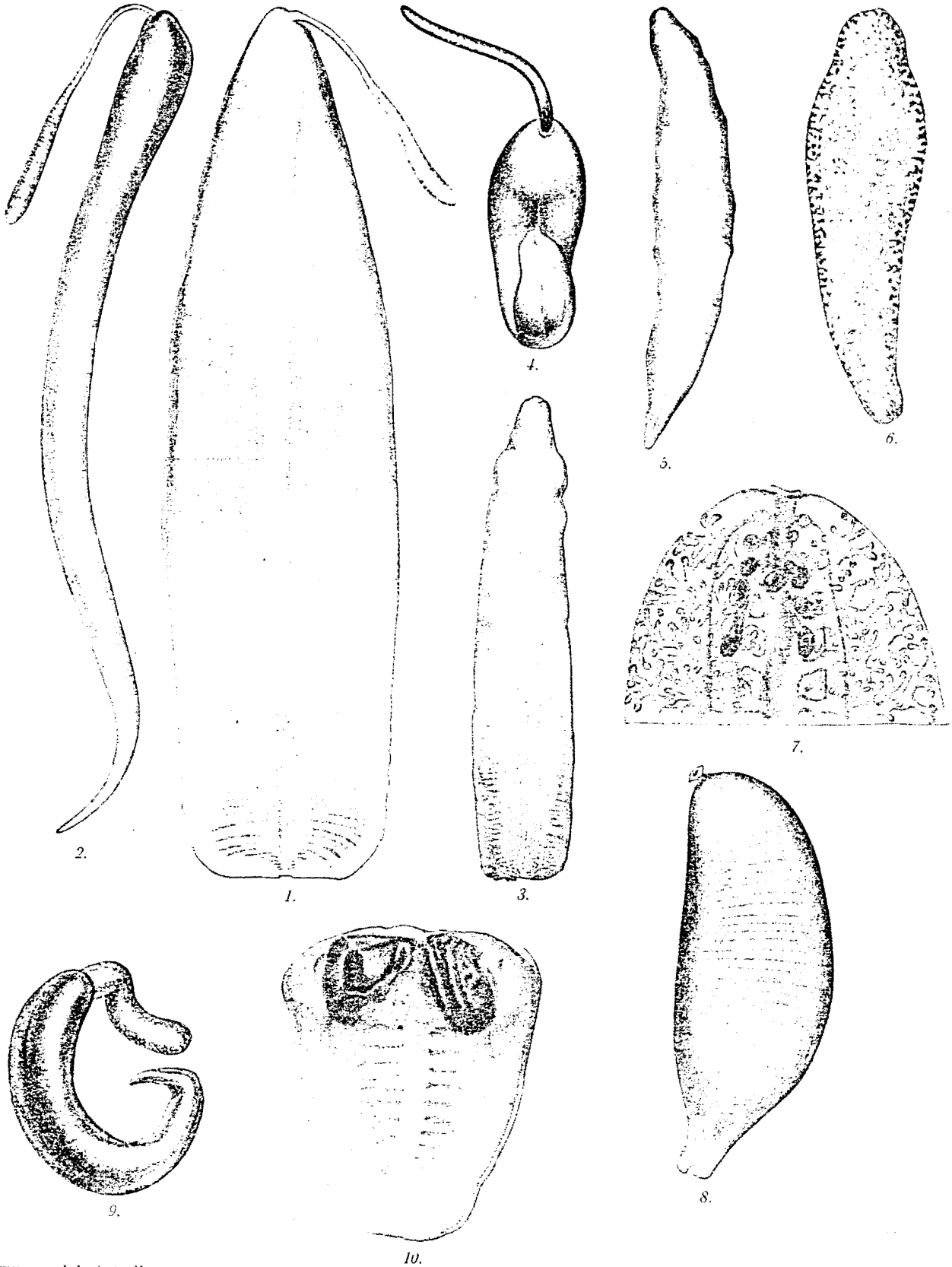
Explanation of the Plates.

Plate I.

Fig. 1. *Dinonemertes investigatoris.* Fullgrown specimen, dorsal view. $^5/_6$ natural size.
" 2. As fig. 1, but lateral view. $^5/_6$ natural size.
" 3. *Dinonemertes investigatoris.* Young specimen, ventral view. $^5/_6$ natural size.
" 4. *Pendonemertes Levinseni.* Ventral view. × 2.
" 5. *Bathynemertes Hubrechti.* Dorsal view. × 1.5.
" 6. *Bürgeriella notabilis.* Dorsal view. × 1.2.
" 7. Forepart of the same specimen as fig. 6, but ventral view after clarification in cedar oil. For the sake of convenience, the first pair of diverticula on the intestinal cæcum have not been included in the figure. × 7.
" 8. *Crassonemertes robusta.* × 3.
" 9. *Plotonemertes adhærens.* Lateral view. × 2.5.
" 10. Caudal region of the specimen shown in Fig. 9; ventral view, showing the double glandular organ of the surface above. × abt. 10.

Plate II.

Fig. 11. *Nectonemertes primitiva* ♀. Ventral view. × abt. 7.
" 12—13. *Nectonemertes primitiva* ♂. Ventral and lateral view. × abt. 7.
" 14—15. *Nectonemertes mirabilis* ♂ (14) and ♀ (15). Ventral view. × 2.4.
" 16—22. Series of males of *N. mirabilis*, showing growth of tentacles. × 3.5.
" 23. *Nectonemertes minima.* Ventral view. × 8.5.
" 24—25. *Phallonemertes Murrayi,* ♂ (24) and ♀ (25) both ventral view. Penes distinctly visible on lower side of head of male. × 2.4.
" 26. *Natonemertes acutocaudata.* × 7.



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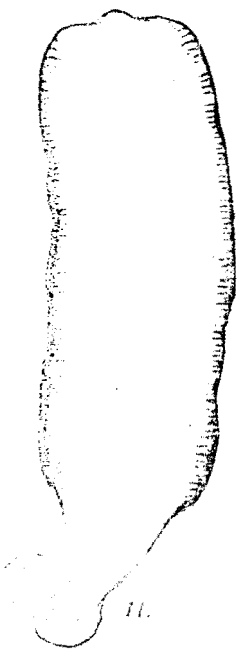

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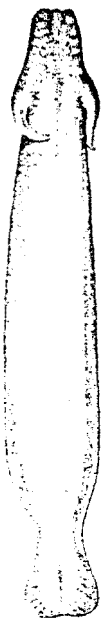

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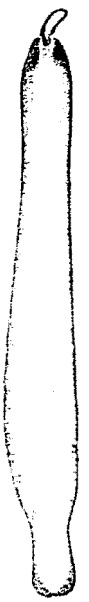

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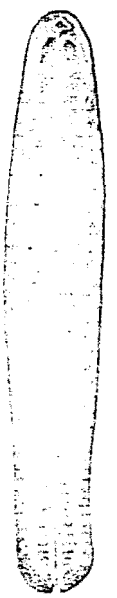

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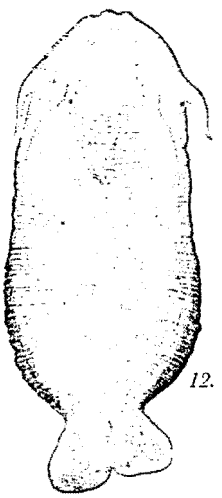

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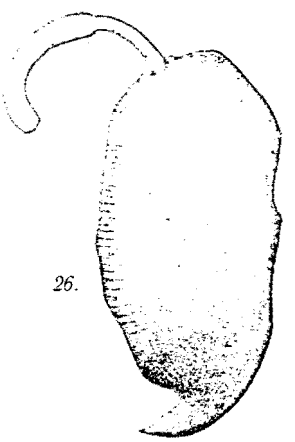

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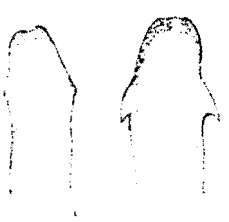

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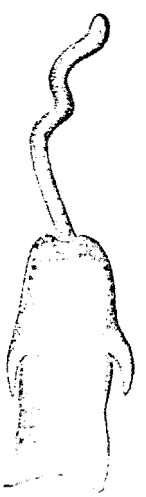

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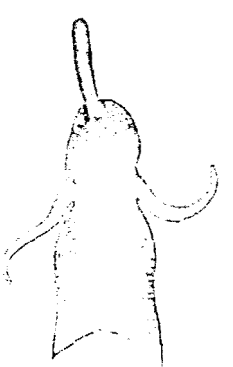

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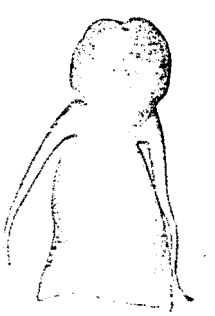

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