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A

MONOGRAPH

OF THE

BRITISH ANNELIDS.

VOL. II.—PART I.

POLYCHÆTA.

NEPHTHYDIDÆ TO SYLLIDÆ.

PAGES 1—232; PLATES XLIII—L, COLOURED, AND LVII—LXX, UNCOLOURED.

BY

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DEDICATED

TO

THE RT. HON. LORD REAY, LL.D.(St. Andrews),

G.C.S.I., G.C.I.E., ETC.,

RECTOR OF THE UNIVERSITY 1884–86,

WHOSE LONG-CONTINUED INTEREST IN THE MARINE WORK AT ST. ANDREWS HAS BEEN A SOURCE OF SINCERE SATISFACTION.

TEMPORARY PREFACE.

The present Part contains a larger number of species than Part II of the previous volume, and the majority are more or less brilliantly coloured, not a few, for example, in the Phyllodocidæ, Hesionidæ, and Syllidæ being amongst the most beautifully ornamented Invertebrates; indeed, many vie with the gaudy tints of butterflies and birds or the burnished splendour of beetles. Fortunately some of the finest of them had been drawn from life by the late Mrs. Günther (Roberta McIntosh), and their softness and beauty did not suffer at her hands.

It is perhaps well to note that the author does not feel warranted in adopting any of the recent classifications of the Polychæta, *e. g.* that of Professor Benham ('Cambridge Natural History,' ii, 1896), which has certain features of Levinsen's classification, because none relieves the difficulties encountered in the older and more simple classification into errant and sedentary forms by Audouin and Edwards. Thus in such a system as Benham's, incongruous families are grouped together (*e. g.* the Nephthydidæ between the Nereidæ and Amphinomidæ), and the arrangement has the support neither of structure nor development. The Polychæta, indeed, do not lend themselves readily to the systematist, and it is safer at present to place the families in series according to their natural and structural relationships, reserving further consideration of the subject for the summary. There are notable differences in the structure of the body-wall, the arrangement of the great nerve-cords and the neural canals, the digestive system and other features, but even these do not readily conduce to systematic arrangement. They are thus in contrast with the Nemerteans, the classification of which in 1868–9 on a structural basis has never been disputed, though modern nomenclature may sometimes obscure the original facts.

Dr. Goodrich has kindly drawn the segmental organs typical of the Nephthydidæ, and his experience of these is great.

I have to thank Dr. Allen, the Director of the Plymouth Marine Laboratory, who exerted himself to procure such of the southern types as were not readily obtainable in the fresh condition elsewhere.

To Miss A. H. Walker, the artist who has faithfully aided me throughout the work on the Annelids, special acknowledgments are due. Her pencil and brush have been of great service.

I have to acknowledge the courtesy of the Carnegie Trust in having given aid for three years in regard to the artist and in section-making. Without such help it would have been impossible to overtake the work in time for issue in 1907. Moreover, the

Carnegie Trust has granted a sum of £100 for 1907–8, and this, together with a balance, will be utilized for the heavy expenses of the coloured plates. By this liberality the Ray Society will be the more able to take in hand the next part (similar in size and in the number of plates), which lies ready for printer and lithographer.

To Mr. Kappel, Librarian of the Linnean Society, and Mr. White, Librarian of the Royal Society, my best thanks are due for their valued aid with books.

Lastly, I have to thank Mr. Hopkinson, the Secretary of the Ray Society, for the great pains he has taken in the arrangement of the figures in the coloured plates, the verification of certain references, for general interest and advice in the course of the work, and especially for his careful revision of the proofs.

W. C. M.

Gatty Marine Laboratory,
St. Andrews;
October 10th, 1907.

FAMILIES, GENERA, AND SPECIES, OF THE BRITISH MARINE ANNELIDS.

(ANNELIDA POLYCHÆTA, *continued.*)

Family VI.—Nephthydidæ,[1] *Grube*, 1851.

Head flattened, quadrangular or rhomboidal, rarely nearly hexagonal, a short tentacle at each anterior angle, and one (palpus, Kinberg, tentacular cirrus, Ehlers) a little posterior (1st segment) and ventro-lateral in position, or both may be absent. Eyes two or none. A small ciliated organ at each lateral groove posteriorly.

Body elongate, almost tetragonal in section, though convex dorsally and flattened ventrally. Segments similar. Vent terminal with a single cirrus (rarely two, Ehlers) beneath. Peristomial segment fused with that behind. Proboscis large, sub-cylindrical,

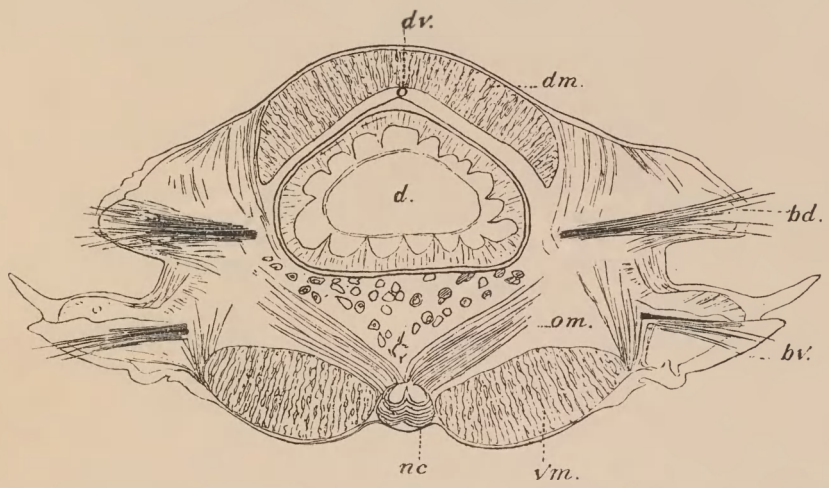

Fig. 34.—Section of *Nephthys cæca*, about the anterior third. *bd*, dorsal division of the foot; *bv*, ventral division; *d*, alimentary canal; *dm*, dorsal longitudinal muscle; *dv*, dorsal blood-vessel; *nc*, nerve-cord; *om*, oblique muscle; *vm*, ventral longitudinal muscle.

ovate or obovate with or without a double arch of bifid papillæ, a pair of horny teeth or none. Alimentary canal simple—slightly moniliform.

Divisions of the foot widely separated, flattened, bearing a spine and double row of diverse bristles (barred and serrated or rarely with lyriform tips) in each in front, the dorsal lobe, further, having superiorly a lamella and other processes, and a small dorsal cirrus in connection with the branchia; the ventral lobe has a lamella with or without other processes and a ventral cirrus.

[1] The title *Nephthya* was used by Savigny for a group of Alcyonaria including *Spongodes*.

A dorsal and a ventral blood-vessel (with a cardiac dilatation in front), and two lateral trunks.

Body-wall (Fig. 34) in section powerfully muscular, the dorsal longitudinal muscles often fusing in the middle line and having an accessory band at the shelving edge.

Nerve-area (see Fig. 37, p. 6) shaped like an inverted crown. Four conspicuous neural canals—the inferior the larger, occur on each side of the median line (*N. cæca*), besides a variable number of others. To the exterior lie the tough limiting membrane, the hypoderm, and the cuticle.

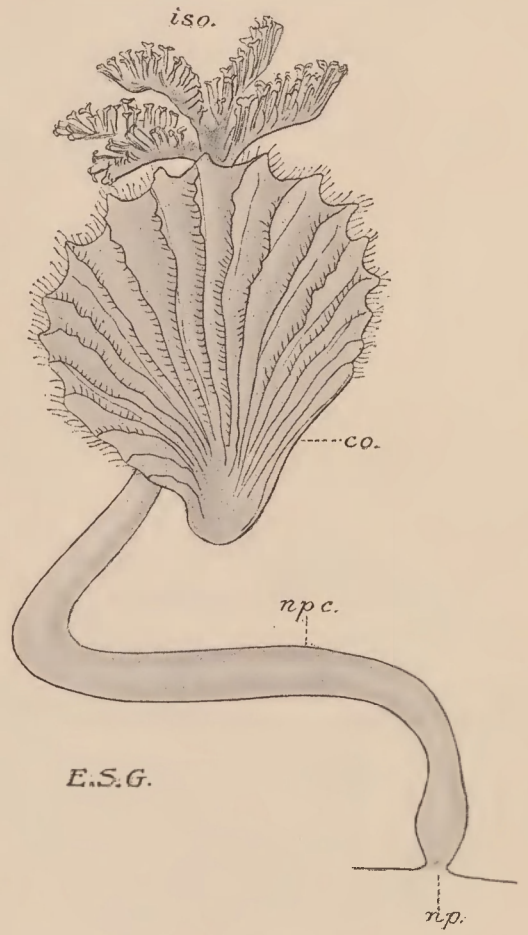

Fig. 35.—Magnified drawing of the segmental organ of Nephthys by Dr. Goodrich. *co*, ciliated organ ; *iso*, internal end of the nephridium with solenocytes ; *npc*, nephridial canal ; *np*, nephridispore.

The structure of the body-wall in *Nephthys Hombergii* as shown by Emery [1] does not differ essentially from the foregoing.

Segmental organs (Fig. 35) are long, slender tubes opening ventrally near the base of the foot ; end blindly internally in a tuft of three to five branches with rows of solenocytes (Fig. 36). An incomplete genital funnel in some passing into a sac in which are waste products (Goodrich). F. H. Stewart[2] pointed out at St. Andrews the exact

[1] 'Mitth. Zool. Stat. Neapel,' VII, p. 371, pl. 13.

[2] 'Ann. Nat. Hist.,' ser. 7, vol. v, p. 161, pls. ii and iii, 1900.

position of the various parts of the organ and increased the information concerning the excretion of solid matters and other physiological features. The mode of exit of the genital products is unknown.[1]

Goodrich has again examined the structure of the organ, and is of opinion that with regard to the products of excretion they lie in a kind of sac formed of peritoneal epithelium. Louis Fage[2] does not adopt F. Stewart's view that the amœbocytes from the phagocyte organ enter the nephridial tube, but is inclined to think that they pass into it by simple osmosis. Fage concludes by mentioning that the ciliated organ, shaped like the shell of a *Pecten*, is present, and is largest in the middle and posterior regions, but

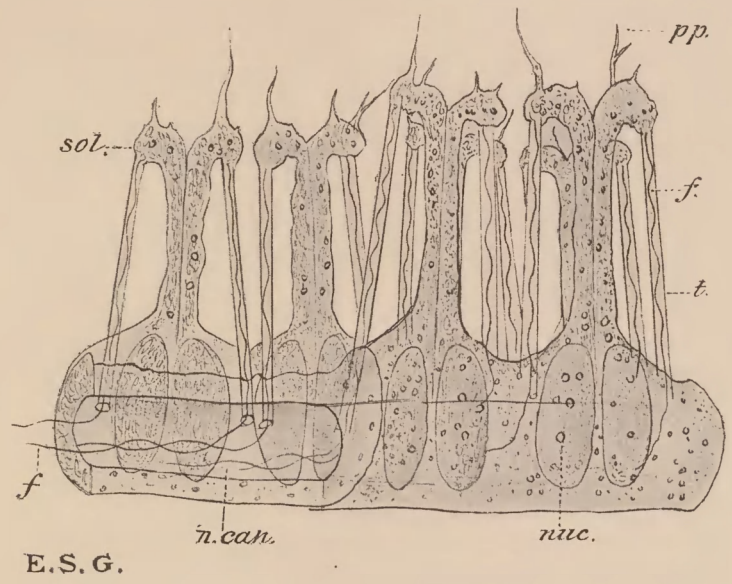

Fig. 36.—Highly magnified representation of the solenocytes and segmental (nephridial) canal by Dr. Goodrich. *f*, cilia; *nuc*, nuclei; *pp*, protoplasmic process of a solenocyte; *sol*, solenocytes; *t*, tubes connecting solenocytes with the nephridial canal.

has no internal opening, so that it is, he says, impossible for the genital products to find their way outward by this means. He thinks that the ciliated organ only conducts the solid particles of the cœlom to the phagocyte organs.

The eggs appear to be demersal, but the larvæ are pelagic.

As a family the Nephthydidæ are characterised by great uniformity in the structure of the bristles, so that it would not be easy to distinguish the species by this means, and thus they differ from the majority of the Annelids. The characters of the feet, however, are distinct, and whilst the sexual variations may not be fully known, their structure may be considered reliable in discriminating the various forms.

Few species possess eyes, yet several with such, *e.g. Nephthys Verrilli*, were described in the collection of the 'Challenger,'[3] and this was a form allied to the *N. picta* of Ehlers in the structure of the feet.

[1] I am indebted to Dr. E. S. Goodrich for these figures (35 and 36).

[2] 'Ann. Sc. Nat.' 9e sér., p. 286. Figs. 11–16, pl. vi, figs. 5 and 6. He chiefly investigated *Nephthys Hombergii*.

[3] Vol. xii, p. 163, pl. xxvi, f. 6, 7, pl. xxxi*a*, fig. 8.

No British species shows the large foliaceous branchiæ occasionally seen in foreign species, as in the *N. phyllobranchia* of the 'Challenger.'

Though not falling within the British area it may be mentioned that *Nephthys* (*Aglaophamus*) *inermis*, Ehlers, occurs in European waters, having been procured in the 'Porcupine' Expedition of 1870 off Cape Finisterre in 81 fathoms.[1] It may occur yet nearer Britain. Ehlers procured it from Florida.

Nephthys cæca and others are found at all parts between tide marks in North Uist in muddy sand, and therefore Dr. Drummond's opinion that they are only found at very low-water requires qualification. Moreover, since in this island very heavy showers of rain fall after they are uncovered by the tide for a considerable time, they can scarcely be so sensitive to fresh water as supposed.

The various members of the family are used as bait.

Certain features, and especially the structure of the bristles, suggest affinity between the Nephthydidæ and the Ariciidæ, and future investigation may throw light on this subject.

Linnæus included the marine Annelids under the great group of the Vermes, and the Nephthydidæ were generally ranged amongst the Nereids, one of the groups of the Vermes Mollusca. A similar arrangement was followed by Otho Fabricius, and by O. F. Müller, who placed the majority under his Vermes Helminthica.

Savigny in his 'Système' (1820) arranged the Nephthydians under his family Nereides, but he observed their distinction from the other members of the group, and hence he separated them as a sub-section—*Nephthys*. They are characterised by a proboscis furnished with tentacles at the orifice; antennæ—both exterior and middle—equal; no tentacular cirri; all the cirri short—almost absent; branchiæ distinct.

Of the genus *Nephthys* he gave a detailed and fairly accurate description so far as he went, though he observed only a single row of bristles.

Notwithstanding these remarks he on a later page was inclined to place the *Nereis cæca* of Otho Fabricius under a new genus—*Aonis*. As the form referred to is only *N. cæca*, it is unnecessary to refer further to this lapsus.

Audouin and Milne Edwards (1834) placed this family along with *Glycera* and *Goniada* in the second tribe of the *Néréidiens non tentaculés*. Their description was on the whole good, though they misinterpreted the dorsal cirrus.

Grube (1851) in his 'Familien der Anneliden' grouped the Nephthydea under his Tribe Rapacia as the fifth family between the Lycoridea and Phyllodocea. In his subsequent papers he does not seem to have directed further attention to the systematic position of this type, though in the Annelids of the 'Gazelle' (1877) he put them between *Goniada* and *Cirratulus*.

Dr. George Johnston arranged his Nephthacæ between the Nereids and the Phyllodocids.

Kinberg[2] did not much change the characters of the family as described by Grube. His chief features were—the flattened head with two antennæ (tentacles) and two palpi,

[1] 'Ann. Nat. Hist.,' ser. 7, vol. v, p. 254.

[2] "Annulata Nova." 'Öfver. Af. k. Vet-Akad,' Förh., 1865, No. 2.

the cylindrical proboscis with its terminal and lateral papillæ and its two maxillæ, together with the fusion of the dorsal cirrus and the branchia, and the lamellar (he called it branchial) condition of both divisions of the foot. He adopted a similar arrangement to that of Grube—placing the Nephthydea between the Nereidea and Phyllodocea.

Malmgren first (1865) placed the Nephthydea (Grube) after the Phyllodocea, but in his later publication (1867) he altered this arrangement, for they come between the Sigalionidæ and the Phyllodocidæ. The author may have found that their relationships were such that they most naturally occupied this position.

In his remarks on the general characters De Quatrefages (1865) explains the so-called compound bristles of certain species as the result of partial fractures of these organs, with a proneness to split at an angle to the long axis. He describes the cephalic ganglia as subdivided into a main and three accessory ganglia connected by a seventh ganglion elongated transversely. He finds an ocular apparatus joined with the main mass (cerveau) though there may be no trace of eyes. The œsophageal connectives give the twigs to the rudimentary feet of the buccal segment. He states that instead of one ventral vessel two distinct trunks exist. He divided the group into three divisions, those with four, those with three, and those devoid of antennæ (tentacles). The latter division, however, was due to a misapprehension.

Claparède (1868) emphasises the fact, first pointed out by Leydig, that the muscular fibre separates into two distinct layers—one axial—the other cortical. This is well seen in *Nephthys*.

A distinct advance on the treatment of the Nephthydidæ was made by Ehlers (1868), who corrected and arranged the known facts as well as added to our knowledge of the subject. The segmental organs he did not observe. He divided the family into two genera, viz., those with four tentacles and a single caudal cirrus (*Nephthys*), and those with two tentacles and two anal cirri (*Portelia*). The latter genus, however, has no British representative, and considerable confusion has been caused by the inclusion of the well-known *N. cæca*, O. Fabricius, under it. In classifying the known species of the genus *Nephthys* he made use of the length of the posterior lip in each division of the foot.

Langerhans divided the Nephthydidæ into two groups according to the number of longitudinal rows of papillæ in the proboscis. The first of these has 14 longitudinal rows of papillæ on the proboscis, as in *N. Grubei* and others. In the second group the proboscis has 22 rows, as in *N. cæca*.

Levinsen [1] (1883) placed the Nephthydidæ (his Nephthydæ) as the second group of his Phyllodociformia, and thus prominently kept up the relationship with that family without associating it with others considerably divergent in structure.

Pruvot [2] (1885) found in *Nephthys* a stomato-gastric centre (anterior division of the brain), and an antennary centre (middle and posterior divisions). A nuchal organ is present posteriorly. The group agrees with *Phyllodoce* in this respect.

[1] Vidensk, 'Meddel. Nat. Hist. Kjöbenhavn, Aaret 1882,' 1883, p. 180.

[2] 'Arch. Zool. Expér,' sér. 2, III, p. 48–49, 1885.

Genus XXIX.—Nephthys, *Cuvier*, 1817.

Head as in the family; both tentacles present. Rarely with a pair of eyes. Proboscis of two regions, with 22 distal rows of papillæ in extrusion, a double arch of bifid papillæ round the aperture, and a pair of horny teeth internally. Body and feet as in the family. Foot with the dorsal and ventral cirri either conical or foliaceous. Lamellæ generally well developed. Bristles of two kinds, shorter barred bristles anteriorly in each division, and elongated forms with a flattened though narrow blade serrated at the edge (from minute rows of spikes) behind. From the formation of the foot they all occur on the anterior surface. Nerve-cords in the typical position. Segmental organs as in the family.

In *Nephthys cæca* the dorsal muscles fuse in the middle line which is only distinguished by being the thinnest part of the sheet. They widen on each side and end in transverse

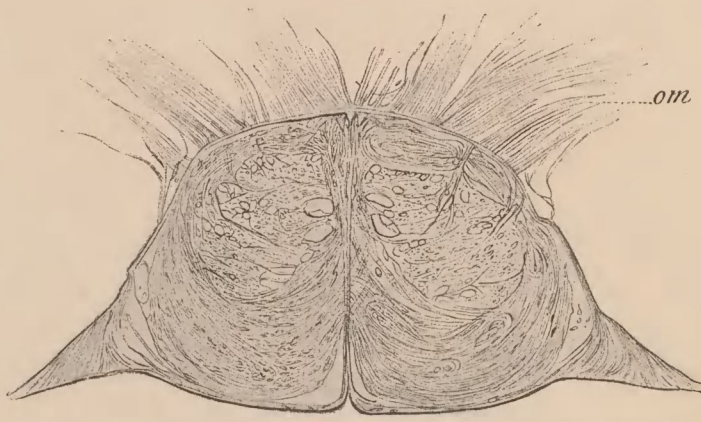

Fig. 37.—Magnified view of the nerve-area of the ventral cord of *Nephthys cæca*. The fibres of the oblique muscles (*o.m.*) occur below.

section in an outer flap quite free from the thin circular layer of the region. From the shelving outer edge of the longitudinal layer on each side to the border of the foot two series of powerful fibres are conspicuous. The first is a horizontal layer which commences as a narrow continuation of the circular and passes outward in a somewhat fusiform manner to the dorsum of the foot. The second assumes the form of strong oblique bands which slope from above downward and outward from the dorsal edge to the foot. Besides these a separate longitudinal band occurs at the shelving tip of the great dorsal layer.

The ventral longitudinal muscles form, in transverse section, two large ovoid masses on each side of the median nerve-cords. They are bounded externally by a strong band of oblique fibres from above, whilst superficially they have the cuticle, hypoderm, and some circular fibres.

The fasciculi of both dorsal and ventral longitudinal muscles have their long axes directed inward, and thus a somewhat radiate aspect is given to the transverse sections.

The nerve-area in the centre is shaped somewhat like an inverted crown, the convex

edge in section being inferior. Into the straight upper edge, as well as the upper lateral region, the powerful oblique muscles are inserted—separated from the nervous tissue only by the tough sheath. The action of these and of the adjoining longitudinal ventral muscles would not appear to support the theory of quiescence of the trunks advocated by some zoologists.

The area (Fig. 37) is subdivided by a median septum which passes from the ventral fissure to the dorsal edge, though in some sections it is obscured dorsally. The broad circumference of the area forms a dense plexus of fibres with intervals; whilst the upper median region on each side is composed of more lax tissue (which stains differently) viz. of prominent fibres—transverse or oblique in direction—with granular and gelatinous intermediate substance as well as small spaces in the preparations. On each side of the median line in this area are two conspicuous neural canals, the inferior the larger, the next considerably less, besides a variable number of others. There are, especially near the two large inferior canals, and at the outer border of the central area, several deeply stained granular nerve-cells. In some sections four canals are seen on each side of the middle line and in a diminishing series from below upward, in others only two with various minor apertures are visible.

To the exterior of the nerve-cords is the tough layer of limiting membrane which splits into fibres at the ventral median raphe. At the outer angle ventrally is a triangular area occupied by oblique fibres which slant mainly from without and below inwards. It is difficult to say whether any traces of circular fibres (circular coat) exist between the limiting membrane and the cuticle, though such is probable.

Cunningham[1] (1888) observes: "In *Nephthys*, instead of the typical canal on the inner side of each (nerve-)cord, there are two large canals, one above the other, with a smaller one between them. There is also a smaller canal in the external side of each cord, and still smaller ones in the substance of the cords. The nerve area here is not separated from the epidermis."

Following the hint of Savigny, Cuvier separated the genus (under the name of *Nephthys*) from the Nereids; and soon a more complete account of the characters was published by Adouin and Milne Edwards.

The generic characters given by De Quatrefages (1865) are, briefly, those of his predecessors.

Kinberg's[2] description of the genus was:—"The two antennæ and the two palpi similar in form, marginal; bristles both annular and smooth; the two maxillæ nail-like and depressed." He at the same time established two new genera, viz. *Aglaophamus* and *Aglaopheme*. The former, originally from Banks Strait, has also been found in Europe.[3]

Ehlers (1868) grouped the various forms under the genus *Nephthys* thus:—(1) The posterior lamellæ in both divisions of the foot in all the segments long, *e.g.*, *N. cæca*. (2) The posterior lamellæ of the inferior division in all the segments long, *N. Hombergii*,

[1] 'Q. J. Micr. Sc.,' N.S., vol. xxviii, p. 270.
[2] 'Öfvers. K. Vet. Akad.,' Förh., No. 4, p. 239, 1865.
[3] 'Ann. Nat. Hist.,' ser. 7, vol. v, p. 262.

N. cirrosa. (3) The posterior lamellæ of both divisions of the foot long—only in the anterior segments, *N. discors*. (4) The posterior lamellæ in both divisions of the foot in all the segments short, *N. ciliata*, *N. longisetosa*, *N. incisa*. He comprehended under Nephthys, *Aonis*, Savigny, *Diplobranchus*, De Quatrefages, and *Aglaophamus*, Kinberg.

In P. Tauber's critical revision [1] of 'Danish Annulata,' four species of *Nephthys* are entered, but he includes *N. longisetosa*, Œrsted, under *N. Hombergii*, and appears to be inclined to do the same with *N. incisa*, Mgrn. One of the species is *N. paradoxa*, Malm.

Levinsen [2] in his systematic account of the Norwegian Annelids gives eight species of *Nephthys*, but as *N. Malmgreni* and *N. minuta* of Théel and *N. paradoxa* and *N. emarginata* of Malm are four of them, further revision is needed.

Baron de Saint-Joseph [3] points out the importance of the foot in diagnosing the various forms, and the necessity for contrasting these organs from the same region of the body. In criticising Wiren, who groups certain species together on account of the variations of the feet in any given example, he truly observes that though these variations do occur in each, yet they essentially differ from each other.

The large foliate organs of *N. trissophyllus*, Grube, from Naples, show how these lamellæ can be developed. Moreover, the great elongation and comparative straightness and slenderness of the bristles of this species are diagnostic.

I.—Group without a long unpaired cirrus.

1. Nephthys cæca, *O. F. Müller*, 1776. Plate XLIII, fig. 1; fig. 2 var. *ciliata*; Plate LVII, figs. 1–5; Plate LXVI, figs. 1–3—foot; Plate LXXVII, figs. 1–1^{e}—bristles.

Specific Characters.—Head rounded in front; eyes usually absent (two small on 1st segment, St. Joseph) and two papillæ (sensory) at posterior part of head. Body twelve or more inches long, 130–136 segments; exserted proboscis with twenty-two distal rows of papillæ, five, or occasionally six, being in each row. The lip with ten forked papillæ and a median simple one at each side. Dorsal lamella of the foot fan-shaped and prominent, its deepest part being external; dorsal cirrus short and tapering; branchial process coiled externally, of moderate length, with a semicircular flap of the spinigeous lobe at its base anteriorly. Ventral division with a large, broadly lanceolate and pointed lamella continuous with the fleshy lobe of the region; ventral cirrus of moderate size slightly flattened and conical. Subulate (barred) bristles typical. The capillary bristles have a flattened blade with a close series of fine spikes. Segmental organs opening at the base of the feet ventrally. Tail terminating in a single long cirrus. Muscular walls of body typical.

[1] Kjöbenhavn, 1879.
[2] Vidensk, 'Meddel. f. d. naturh. For. Kjöbenh.,' 1883.
[3] 'Ann. Sc. Nat.' 8^{e} sér. xvii, p. 1, 1894.

Synonyms.

1758. *Nereis cærulea*, Linn. Syst. Nat., ed. 10, i, p. 654.
1767. „ „ idem. Ibid., ed. 12, i, pt. 2, p. 1086.
1776. *Nais cæca*, O. F. Müller. Zool. Dan. Prodr., p. 219, No. 2653.
1780. *Nereis cærulea*, Fabricius. Fauna Grœnl., p. 298.
„ „ *cæca*, idem. Ibid., p. 304.
1789. „ *ciliata*, O. F. Müller. Zool. Dan., iii, p. 14, pl. 89, f. 1—4.
1791. „ *cærulea*, Linn. Gmelin Syst. Nat., ed. 13, I, pt. 6, p. 3117.
„ „ *cæca*, Gmelin. Ibid., p. 3119.
1799. „ „ Fabricius. Skriv. Nat. Selsk., v, p. 185, Tab. iv, figs. 24—29.
1806. „ „ Turton's Gmelin, iv, p. 90.
1820. *Aonis* (*Nereis*) *cæca*, Savigny. Syst. Annel., p. 45.
1825. „ *cæca*, De Blainville. Dict. Sc. Nat., xxxiv, p. 451.
1828. „ „ idem. Ibid., lvii, p. 483.
1829. *White Worm, Lurg or Lurgan*, Drummond. Loud. Mag. Nat. Hist., ii, p. 121.
1835. *Nephthys margaritacea*, Johnston. Ibid., viii, p. 341, fig. 33.
1842. „ *cæca*, Œrsted. Kroyers' Nat. Tids., p. 123.
1843. „ „ idem. Grönl. Dorsibr., p. 193 (41), f. 73, 74, and f. 77—86 (excl. fig. 78).
„ „ *longisetosa*, idem. Ibid., p. 195, fig. 75 and 76.
1844. „ *bononensis*, De Quatrefages. Ann. Sc. Nat., 3e sér. 14, p. 352, pl. 9, fig. 2.
„ „ *margaritacea*, Thompson. Ann. Nat. Hist., xiii, p. 439, and Rept. Brit. Assoc. 1843, p. 273.
1845. „ „ Johnston. Ann. Nat. Hist., xvi, p. 456.
1851. „ *cæca*, Grube. Fam. Annel., pp. 53 and 128.
1853. *Nereis* (*Nephthys*) *lineata*, Dalyell. Pow. Creat., ii, p. 146, pl. 21, f. 4—10.
„ *Nephthys ingeus*, Stimpson. Mar. Invert. Grand Manan, p. 33.
1860. „ *cæca*, Packard. Annel. Caribou, Canad. Nat. and Geol., vii, p. 418 (*fide aut.*).
1862. „ „ Sars. Geol. og Zool. Reise, p. 50.
1863. „ „ Stimpson. Annel. Greenland, Proc. Acad. N.S. Philad., p. 140.
1865. „ *cæca*, Malmgren. Nord. Hafs-Ann., p. 104, Tab. xii, fig. 18.
„ „ *margaritacea*, De Quatrefages. Annelés I, p. 423.
„ „ *bononensis*, idem. Ibid., p. 425.
„ „ *Œrstedi*, idem. Ibid., p. 427.
„ *Portelia cæca*, idem. Ibid., i, p. 433.
„ *Nephthys margaritacea*, Carrington. Annel. of Southport, p. 8.
„ „ „ Johnston. Cat. Brit. Mus., pp. 167 and 342, fig. 34.
1866–69 „ *cæca*, Packard. Mem. Bost. Soc. N. H., i, p. 294.[1]
1867. „ „ Malmgren. Annel. Polych., p. 18.
„ „ „ Parfitt. Trans. Devon. Assoc., ii, pt. 1, p. 231.
1868. „ „ Ehlers. Borstenw., ii, p. 588, pl. xxiii, figs. 10—34.
1869. „ *ciliata*, McIntosh. Rept. Brit. Assoc., 1868, p. 337.
1871. „ *margaritacea*, Grube. Mit. ueb, St. Vaast-la-Hougue, p. 100.
1874. „ *cæca*, McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 195.
„ „ „ Malm. Köngl. vet. o. vitt. samhälles i Göteborg Handl., xiv, p. 77.

[1] These Annelids (of Labrador) were also mentioned by the same author in the 'Canadian Naturalist and Geologist,' viii, p. 418, etc, 1863.

1874. *Nephthys cæca,* Malm. Amer. Journ. Sc., x, p. 39.
1875. „ „ Verrill. Proc. Amer. Ass. Sc., 1873, p. 370.
„ „ „ McIntosh. Mar. Invert. St. Andrews, p. 118.
„ „ „ Möbius. Unters. Deutsch Meer., p. 168.
1878. „ „ McIntosh. Trans. Linn. Soc., 2nd ser., i, p. 501.
1879. „ „ Tauber. Ann. Danic., p. 83.
„ „ „ Théel. K. Sv. Vet. Akad. Handl., xvi, No. 3, p. 30.
„ „ „ Verrill. Check List., U.S. Comm. F. and F., sep. copy, p. 7.
1880. „ (*cæca*) *margaritacea,* Graber. Arch. f. Micros. Anat., xvii, p. 289, pl. xxviii., fig. 14, and pl. xxix, fig. 15—18.
1881. „ *longosetosa,* R. Horst. ("Willem Barents" Exped., 1878.) Niederl. Arch. f. Zool. Suppl. 1, 5, p. 8, Taf. f. 1.
„ „ *ciliata,* idem. Ibid., p. 7.
1883. „ *cæca,* Wiren. Chætop. 'Vega' Exped., p. 392.
„ „ „ Levinsen. Vidensk. Meddel. Foren., Kjöben, p. 217 (Syst.-geogr. Overs. Nord. Annel., p. 60).
1886. „ „ Schack. Anat. Histol. Untersuch., Kiel.
1890. „ „ Malaquin. Rev. Biol., v, Annel. Boulon, 32.
„ „ *bononensis,* idem. Ibid.
„ „ *cæca,* Marenzeller. Annel. Beringsm., p. 1.
„ „ „ Giard. Bull. Sc. Fr. Belg., t. xxii, p. 76.
1891. „ „ Hornell. Trans. Biol. Soc. Liverp., vol. v, p. 244 (exclus. synon.).
1893. „ „ Levinsen. Vidensk. Ud., "Hauchs," p. 337.
1896. „ „ Michaelsen. Polych. deutsch Meere., p. 25.
1899. „ „ (sexual var.), McIntosh. Nat. Sc. (May), p. 375.
1900. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 257.
1901. „ „ Whiteaves. Geol. Surv. Canada, No. 722, p. 82.
„ „ „ Johnson. Proc. Bost. Soc. Nat. Hist. vol. xxix, No. 18, p. 401.
1904. „ „ Allen. Journ. M.B.A., n.s., vol. vii, p. 225.
1906. „ „ (movements) Bohn. Ann. Sc. Nat. 9^{e} sér., t. iii, p. 107.
„ „ „ (segm. org.) Fage. Ibid., p. 286.

Habitat.—Common everywhere around the shores of Britain from Shetland to the Channel Islands in sand near low-water mark, and extending some distance shorewards. In the outer Hebrides it would seem occasionally to be in the way of deluges of rain, but probably the moist sand preserves it from the injurious influence of fresh water, as described by Dr. Drummond. It is often accompanied by *Arenicola* in the sand or muddy sand. It is also tossed on shore in storms after dislodgment from its sandy retreats or its haunts amidst fragments of shells and nullipores.

Extends to the shores of France (Zostera-fields, De Quatrefages), Northern Europe, Spitzbergen, and Greenland. American coasts, both east and west.—Pacific, Puget Sound (Johnson). Canada (W.C.M.).

Head (Plate LVII, figs. 1 and 2) more or less square, truncate anteriorly with a short conical tentacle at each angle. Behind and beneath the latter is another somewhat broader conical tentacle (palpus, Kinberg). In lateral view the head is shovel-shaped—thinning off towards the tip. In the slanting (converging) furrows at each side posteriorly is a little elevation or flap (with a lens-like apparatus, Ehlers). Brain reddish.

Mouth (Plate LVII, fig. 2) situated between a pair of crescentic fleshy lips, which at their anterior attachment show a little fold or papilla—it may be sensory in function. Posteriorly, at the mouth, the lips also have a free curve in front of the median elevation indicating the proboscis. The latter in extrusion is a massive pinkish iridescent organ shaped like a float or pear (Plate LVII, figs. 3 and 4), and scabrous from flat papillæ, especially towards its distal region, which has twenty-two longitudinal rows of them. These increase in length distally, and each row has about five, or occasionally six papillæ, which in ordinary spirit-preparations have a tendency to be directed backward. In some, one or two small isolated papillæ are scattered here and there on the region behind the former. The median dorsal region has two rows which run forward to the peak at the wide band which marks the dorsal angle of the aperture of the organ, and the terminal papilla on the left or right is a little longer and more slender than the rest. On the ventral surface a similar arrangement holds, one of the rows having an advanced and somewhat longer papilla. From each row a band proceeds to the groove between the terminal ridges of the lips, ten of these ridges being boldly marked (Plate LVII, fig. 4), whilst a small median at each side completes the series. Each ridge is separated from the adjoining ones at the margin of the lip and is continued a short distance inward (in extrusion). From the outer side of the free tip arise two flattened tapering papillæ, the outer being somewhat longer. The dorsal and ventral rows of the papillæ diminish a little on each side of the middle line, the intermediate one at each side, which is single, being the shortest. On slitting the proboscis a shelf occurs inside the dorsal and ventral lips, then the smooth wall of the canal trends inward for a short distance and breaks up into four prominent muscular ridges, with deep intermediate grooves. One furrow therefore occurs opposite the middle of each lip, and another at the intermediate line. At the distal end (in extrusion) of each central furrow is a conical blackish horny tooth, the base having a visible spur directed to the left (Plate LVII, fig. 5). The four muscular ridges, in all probability, can be protruded to the tip of the organ, and thus the horny teeth will grasp the prey. When it penetrates the sand uncovered by the tide it strikes the surface with the proboscis more frequently than in *Glycera*, and is soon immersed.

In some large examples the proboscis is deeply coloured with black pigment best marked in the long papillæ of the lips and distal rows, and which increases the iridescence of the organ.

In an example from Salthill, Co. Dublin, a hollow process projected from the base of the extruded organ, the tip of the diverticulum being warty.

Body.—Elongated (ranging to a foot or more in length), slightly tapered anteriorly, and more distinctly so posteriorly, and with numerous segments, 140—150. Colour pearl-grey with pinkish iridescence. This is but slightly marked in the middle line either dorsally or ventrally, for a comparatively smooth surface of a fine pearly lustre occupies those regions. The dorsum is convex, the ventral surface usually has a median groove, which in front splits at the central prominence and runs forward on each side to terminate at the mouth. The region in the fork is marked by a close series of longitudinal furrows, which in extrusion of the proboscis are much stretched so as to reach from side to side.

The peristomial segment is peculiarly flattened, and separated dorsally by a more distinct lateral cleft. It bears dorsally a foot-papilla with a spine and a palisade of barred bristles (curved backward) in front, and a line of slender elongate simple bristles behind the spine. To the exterior is a flattened dorsal cirrus with a subulate tip. Below and slightly in front of the foregoing is a tuft of simple, slender and straight bristles which taper to a point, while at the outer border is a short cirrus—flattened like the foregoing and with its upper basal edge slightly extended or bulging. The two cirri form the tentacular cirri of Ehlers.

The second foot presents well-marked dorsal and ventral divisions, though smaller than in the typical form. Dorsally the end of the spine is in the centre of a rounded area or papilla which has in front a backwardly curved row of long barred bristles of large size and with long filiform tips. On the posterior curve of the papilla is a row of long tapering bristles of the same type as the serrated forms, but the serrations have not yet attained distinctness, though traces are visible. They also curve backward. A short cirrus flattened especially at the base arises from the posterior and outer edge of the division. A small lamella with a free edge passes from the inner border of the spine-papilla. The inferior division has a broadly lanceolate lamella of smaller size than in the succeeding feet, but is similar in outline. The somewhat flattened ventral cirrus occurs at its inferior border. The fleshy part of the foot terminates superiorly, in front of the foregoing, in a short blunt cone. The long tapering bristles, with slightly flattened blades above the shaft, hold their normal position in front of the lamella, while the barred kind —still with long hair-like tips—form an anterior row separated from them by the spine-papilla.

The third foot has superiorly a somewhat elongated fan-like lamella to the inner side of the lanceolate and flattened dorsal cirrus. The bristles have the same disposition—the anterior barred forms being long and curved backward. The small lamella to the inner border of the spine-papilla is better marked than in the former foot. The dorsal cirrus is much flattened and of irregular outline, being bifid at the tip and extended at its outer and basal edge. The inferior division has a larger lamella, and the ventral cirrus is lanceolate. The fourth foot shows the branchial lamella dependent from the lower edge of the base of the dorsal cirrus. It is a comparatively small process, but has the characteristic hook-like curve. The dorsal cirri diminish in size while the branchiæ and lamellæ increase from before backward.

Anteriorly the typical foot (Plate LXVI, figs. 1 and 2) presents a large fan-shaped lamella projecting like a crest from the posterior border of the upper division, its free inferior edge coming off at a blunt angle from the outer. The fleshy base of the foot, with the posterior part of which this is continuous, slopes from above downward and outward, and terminates in a rounded disc or lobe above the cirrus. Immediately below is a short tapering cirrus, and after an interval or notch the hook-shaped branchial process, which is of moderate length and has a slight papilla at the base externally. A semi-circular flap lies over the base of the branchial process anteriorly, being the inferior termination of the flattened lamina between the two rows of bristles. No free flap guarding the camerated bristles anteriorly occurs in this species. In front of the lamella is a row of pale elongate

serrate bristles (Plate LXXVI, fig. 1), which extend outward fully three times the longer diameter of the fan. The serrated edge, simple in lateral view, presents a close series of transverse spikes (Plate LXXVI, fig. *d*) as indicated by various authors. Beyond the serrated region the bristle extends as an extremely attenuate process and tapers to a fine smooth point. A narrow fleshy ridge with the tip of the spine projecting externally next follows with a row of the pale barred tapering bristles in front. These show a series of transverse bars (Plate LXXVI, fig. 1 *b*, and *c*, c^1) which in lateral view (*d*) have an interrupted edge. The bars are probably modifications of transverse rows of spikes—forming the so-called camerated arrangement. Dr. Thomas Williams was thus incorrect in saying that one of the rows of bristles is placed in front and the other behind the cirral lamina.

The foregoing constitutes the dorsal division of the foot, and it is separated by a considerable interval from the ventral division, the intermediate region being occupied by the branchial process.

The inferior lamella is broadly lanceolate, pointed, and with the longer edge ventralward. It is continuous with the fleshy lobe, the tip of which slopes from below upward and outward, the reverse of the arrangement in the upper lobe. The fleshy part terminates superiorly in a thickened adherent point. The long pale bristles similarly pass out close to the base of the lamella, and extend about the same distance. A narrow fleshy ridge (corresponding to the foot proper) separates them from the row of barred bristles in front. The conical ventral cirrus is slightly flattened and of moderate size.

In the posterior feet both dorsal and ventral lamellæ, branchiæ, and dorsal and ventral cirri diminish as in *N. Hombergii* (Plate LXVI, fig. 8), and in the last feet only a minute trace of the cirri remain. The bristles also decrease in length but retain the same fundamental arrangement.

The body terminates in an anus, with a median cirrus ventrally.

Loxosomæ were studded on the branchiæ of a large example sent from Montrose Bay by the late Dr. Howden. De Saint Joseph mentions *Cothurnia maritima* as common on the bristles of those at Dinard, and a form probably identical is found at St. Andrews and elsewhere, in great numbers, on the same organs; indeed Infusoria are very frequently found parasitic on the Nephthydidæ.

A form (Var. *ciliata*, Plate XLIII, fig. 2) which approaches *N. cæca* in the feet, and which may be Dr. Johnston's *N. longisetosa*, occurs at St. Andrews and Montrose occasionally in May and June. The largest examples were about six inches long, and they ranged from this downward to two or three. In structure the foot (Plate LXVI, fig. 3) has longer divisions, a long, narrow dorsal cirrus, and the superior lamella is slightly less. The length of the slender bristles, which give a remarkably hairy appearance and great breadth to the animal, is diagnostic. The foot generally agrees with that of *N. cæca*, but the superior lamella is often distinctly less and does not project so far outward. The spinigerous region, moreover, ends in a more distinctly rounded flap than in the ordinary form—projecting outward above (and in front of) the dorsal cirrus. No special differentiation occurs in the fleshy parts of the inferior lobe, although the upper part of the fillet from the barred bristles is somewhat more distinct. The bristles consist

of long delicate simple bristles without the marked blade of the serrated forms, and tapering to a fine point. They are of great length, are pale (Plate LXXVI, fig. 1 *e*), and never attain the diameter of the more distinctly serrated forms, a few of which are found at the ventral margin of the inferior division and elsewhere. The latter are recognised by their yellowish hue, a colour which enables even broken fragments in the upper division to be readily recognised. Why these long, smooth, or very minutely serrated bristles should be developed in this way is unknown. No sexual elements were observable in the examples after preservation. No change occurs in the barred bristles. It may be noted that Ehlers likened the foot in *Nephthys* to the epitokous condition in *Nereis*.[1] If such be an epitokous condition it would not therefore be complete.

The weight to be placed on small changes in the development of parts of the foot, *e. g.* enlargement of lobes, is not yet sufficiently understood.

Reproduction.—At the reproductive season (*e. g.* towards the end of March at St.

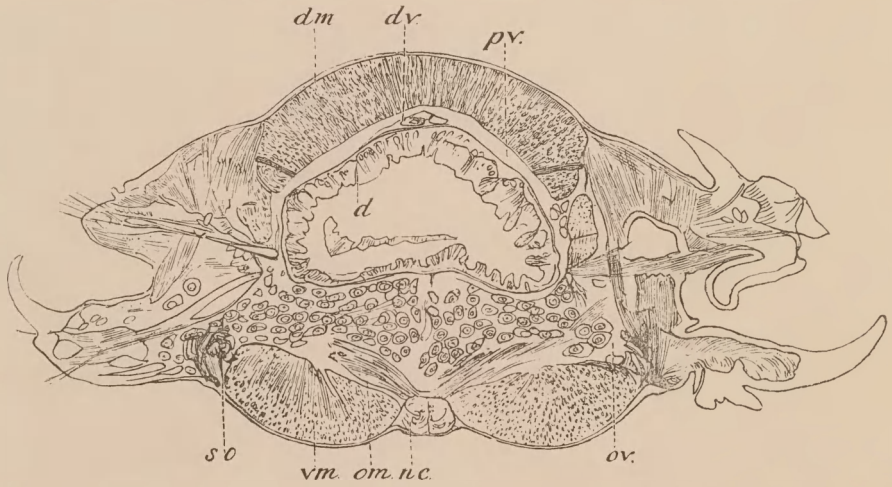

Fig. 38.—Section of a female *Nephthys cæca* distended with ova. *s o.* Segmental organ (nephridium). *d.* Alimentary canal. *d. m.* Dorsal longitudinal muscle. *d. v.* Dorsal blood vessel. *n. c.* Nerve cord. *o. m.* Oblique muscles. *ov.* Ova. *p. v.* Perivisceral (cœlomic) space. *v. m.* Ventral longitudinal muscles.

Andrews) the body-cavity is filled with large ova (Fig. 38), which in section are found chiefly below the gut and in the cavities of the feet, though they also pass above the gut. The changes in the thickness of the muscular development in this condition may be ascertained by contrasting this figure with Fig. 34. In the males a similar condition prevails, the sperms likewise appearing above the gut and the dorsal vessel.

The larvæ of Nephthys have been long known, though their association with the genus was not always understood. Thus a larva described by Busch[2] apparently agrees with a stage figured by Claparède and Mecznikow with curved tufts of cilia.

Claparède and Mecznikow[3] found several stages, though they were uncertain as to the relationships of some, and the same may be said in regard to Fewkes.[4]

[1] 'Borstenwürmer,' ii, p. 584.

[2] 'Beobach.,' p. 68, Taf. viii, fig. 7.

[3] 'Beiträge,' 1869, p. 187, figs. 3, 3 *a*, and 3 *d*.

[4] 'Stud.,' 1884—85, p. 180, Plate iv, figs. 1—12.

An early stage is described and figured by Claparède and Mecznikow in the form of the usual trocophore. It is pear-shaped without trace of segmentation, and with a ring of cilia in front of the mouth, and a pencil of cilia anteriorly at the apex· The alimentary canal bends forward toward the sensory area anteriorly—the dilated region being greenish—and then curves backward to the conical posterior end. A brown eye-spot is on each side.

Both Claparède and Mecznikow, and Häcker, describe and figure the next stage. Häcker (1896) gives the first metatroch stage of *Nephthys scolopendroides* as somewhat pear-shaped with a green-flecked anterior end and a pair of eyes. Two brown pigment-lines occur behind the prototroch, and green and red pigment behind the paratroch. The stomodeum is transverse with a three-lobed upper lip. The mid-gut has brown and blue pigment and oil globules, and the anus has blue pigment. This author finds that the prototroch has an upper small and two lower streaks or grooves (Reifen). The paratroch is one-rowed. The sides of the larva are crenate (four segments), but without bristles in one elsewhere procured.[1]

A stage in which the large globules of yolk occur far forward, just behind the eyes, is given (Plate L, fig. 1). No colour is present. Short bristles are distinct in three segments, and they do not yet show the transverse striæ. Round diatoms occurred in the alimentary canal. The madder-brown tip to the tail is more diffused, not clearly forming two bands. The mouth in the sketch is on the under surface, so only the large globules are seen. In a larval form with eight bristled segments (Plate L, fig. 2) the head is broad and horseshoe-shaped, with a general pinkish-yellow hue, and two madder-brown eyes. The proboscis is indicated behind—as far as the commencement of the second body-segment. The alimentary canal following has numerous large clear globules, and terminates posteriorly in a narrow rectum, and a vent at the median short style. The colour of the gut is bluish-green. Two boldly ciliated regions are present—the preoral and anal. The latter is marked by a double madder-brown band—one on each side of the cilia. A short foot behind the head bears the first bristles, and thereafter seven pairs occur. At the side of each segment is a small foot-lobe. The larva swims actively by aid of its cilia. The lateral bristles are strong and have the characteristic transverse markings of *Nephthys*. Diatoms and *débris* were in the alimentary canal. In Fig. 3 is an example captured a few days later (28th October) in which the general form of the head and body has undergone alterations.

Two later stages are figured and alluded to by Claparède and Mecznikow, one in which there are eight pairs of feet, eyes with lenses, and teeth in the proboscis. Both rings of cilia persist. In the more advanced stage the body is elongate and the preoral ring of cilia less distinct. The characteristic bristles occur on the feet. The authors suppose that the species is *Nephthys scolopendroides*—a common one at Naples.

The older stage, of date October 28th (Plate L, fig. 3) presents a more distinctly differentiated head, which is separated from the peristomial segment, and the area of the proboscis is clearly outlined. The greenish-blue colour of the intestine is still conspicuous. Though only nine pairs of bristle-tufts occur, the form is considerably older than that

[1] Plankton Exped. ‘ Pelagic Polych.,’ p. 10, taf. i, fig. 4.

represented in Fig. 2. Similar advanced stages were procured in the Bay of Kiel by Leschke in November and December.

De Saint Joseph says that, like *Nephthys scolopendroides*, *N. cæca* is mature from November to April.

Habits.—Abundant in sand near low water-mark along with *Magelona* and other forms, and it bores through the moist sand with great rapidity. It is likewise procured in considerable numbers under stones on a sandy and gravelly (shell) surface with a slight coating of mud, in company with a few specimens of *Cirratulus*. In a vessel of sea-water the branchiæ are borne in a loop at each side, and now and then jerked a little.

It forms an excellent bait for flat and other fishes, and is used whenever it can be obtained. As might be anticipated, therefore, it is not uncommon in the stomachs of cod and haddock.

The Dutch author Seba[1] (1734) figures what has been considered a *Nephthys*, but as it is from Amboina and resembles an *Amphinome* or *Hermodice*, the interpretation is somewhat doubtful.

The early description of O. Fabricius (1779) is fairly accurate, both in regard to external appearance and habits, but he represents two caudal cirri in his figure—an error probably due to the artist.

Colonel Montagu (1808) in all probability represents this species (MS. vol. Linn. Soc., Plate VIII, fig. 3) as *Nereis cæca*.

Savigny (1820) simply copied the observations of Fabricius, but he saw that a new genus was necessary.

Dr. G. Johnston (1835) corrected several points in the earlier descriptions, and increased our knowledge of its habits and haunts. He thought the lamellæ of the feet were useful in swimming, which probably they are, though the powerful muscles of the body-wall are even more important.

Œrsted (1845) made further improvements in the description and figures, and differentiated the species from *N. Hombergii*. The finer characters of the bristles escaped him.

Busch's fig. 6, Taf. VIII[2] (1851), shows a young larva of *Nephthys* or *Nereis* with the hook-like tuft of cilia on each side in front of the eyes, and two posterior papillæ. It may however relate to another form, as the tufts are behind the eyes in those figured by other authors. Fig. 5 of the same memoir would seem to be a younger stage.

The *Nereis* (*Nephthys*) *hirsuta* of Dalyell[3] may be a small example of this species or of an allied form.

De Quatrefages (1865) seemed to be in considerable perplexity concerning this form —of which he made three species, viz. *N. margaritacea*, *N. Œrstedii*, and *Portelia cæca*. He had perhaps relied too much on uncertain figures. From the same author's description and the remarks of M. Malaquin, *N. bononensis*, De Quatref., is probably the same species.

[1] 'Thesaurus,' i, pl. lxxxi, fig. 7.

[2] 'Beobach. u. Anat. u. Entwickel. Wirb. Seethiere.'

[3] 'Pow. Creat.,' ii, p. 145, pl. xxi, fig. 1—3, 1853.

Ehlers (1868) gives a minute account of the structure of this species, though he did not make out that of the segmental organs.

V. Graber[1] makes the œsophagus of *Nephthys cæca* one of his types in describing the structure of the region in the annelids, the layers from within outwards consisting of the intima, the pigmented protoplasmic (hypodermic?) layer, with glands, the *subfibrosa*, the muscular, and externally the peritoneal.

Wirén[2] considers, after quoting the descriptions of the feet, that the *N. ciliata* of Malmgren (1865) is this form, as is also the *N. cirrosa* and *N. ciliata* of Ehlers, the *N. emarginata* of Malm, and the *N. longisetosa* of Horst.

Théel's *N. Malmgreni* from the Norwegian North Atlantic Exped., 1879, and Hansen's *N. atlantica* are united by Wirén.

Möbius[3] was of opinion that this species included *N. ciliata*, *N. Hombergii*, and *N. incisa*, but the finer points of distinction were not considered. Théel[4] was inclined to a similar view, but thought further researches were necessary.

2. Nephthys Hombergii, *Lamarck*, 1818. Plate XLIII, fig. 6; Plate LVII, figs. 6–7 *a*; Plate LXVI, figs. 4–8—feet; Plate LXXVII, figs. 2–5—brist.

Specific Characters.—Head rectangular, more elongated than in *N. cæca*, tentacles more slender; posterior pair larger than the anterior (Ehlers); inferior tentacular cirrus with its wide base merging into the anterior lip. Body with 130 segments. Proboscis with a slightly longer terminal papilla in the mid-dorsal line. Dorsal lamella broad and low, projecting beyond the tip of the foot; dorsal cirrus short. Branchia (commencing at the fifth foot) large, with a process at its base, and often curved inward; tongue-shaped inner flap guarding base of bristles, and another, somewhat pointed, occurs at the tip of the foot. Lamella of the ventral division large, directed upward and outward, broad and truncated toward the tip. Ventral cirrus short and broadly lanceolate. Capillary bristles shorter than in *N. cæca*, shafts long with an expanded blade bent downward at an angle and tapering somewhat quickly to a delicate point. The edge is finely serrated. The barred (anterior) bristles approach those of *N. cæca*, the tips perhaps being shorter. Bristles throughout dark.

Synonyms.

1555. *Scolopendra marina*, Rondelet. Insect. et Zooph., in Piscibus Marinis, pt. 2 (Univ. Aquat. Hist.), p. 108, fig. 1.

1818. *Nephthys Hombergii*, Lamarck. Anim. s. Vert. v, p. 314.

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[1] "Die Gewebe u. Drüsen d. Anneliden-Œsophagus," lxvii Bd. der 'Sitz.-ber K. Akad. d. Wiss.' 1 Abth. März.-Heft., 1873, 2 pls.

[2] Chætop, 'Sibirisk och Berings Haf. "Vega" Exped.' Stockholm, 1883.

[3] 'Die zweite deutsch Nordpol.,' 1869–70.

[4] 'Kongl. sv. vet. Akad. Handl.,' B. 16, p. 24.

1820. *Nephthys Hombergii,* Savigny. Syst. des Annel. p. 34.
1825. *Nereis scolopendroides,* Delle Chiaje. Memoire, ii, pp. 401, 424, Tav. xxviii, (1) fig. 8.
„ „ *Hombergii,* De Blainville. Dict. Sc. Nat., t. xxxiv, p. 438.
1828. *Nephthys* „ idem. Ibid., t. lvii, p. 483, and Chætop., Tab. 18, f. 1.
1833. „ „ Aud. and Ed., Ann. Sc. Nat., t. 29, p. 257, pl. xvii, figs. 1—6, and copied in Cuv. Règ. Anim., pl. xv, fig. 2, Edit. Illust.
1834. „ „ Aud. and Ed., Annél., p. 235, pl. v*b*, figs. 1—6.
1837. „ „ Cuvier. Règ. Anim., tom. iv, p. 173, pl. xv, f. 2 (and Edit. 1820).
1838. „ „ (circulat.), H. Milne Edwards. Ann. Sc. Nat., 2e ser., x, p. 211, pl. xii, figs. 3 and 3*a*.
„ „ „ idem. Règne Anim. Ill., pl. 1*a*, figs. 3 and 3*a*.
1840. „ *neapolitana,* Grube. Actin., Echin., u. Würmer, p. 71.
„ „ *Hombergii,* idem. Ibid., p. 71.
1841. „ *scolopendroides,* Delle Chiaje. Descrizione, iii, p. 99, v, p. 105, Tav. 99, f. 11, Tav. 102, f. 8, 23, 24.
1842. „ *longisetosa,* Œrsted. Kroyers Naturh. Tidsskrift, iv, 2, p. 123.
1843. „ „ idem. Grönl. Dorsibr., p. 195, figs. 75 and 76.
„ „ *assimilis,* idem. Annul. Dan. Consp., p. 33, figs. 93, 100.
1851. „ *Hombergii,* Grube. Fam. Annel., p. 53, 128.
„ „ *neapolitana,* idem. Ibid., p. 53, 128.
„ „ *assimilis,* Williams. Rep. Brit. Assoc., pp. 188, 199, 235.
1853. „ „ idem. Ann. Nat. Hist., ser. 2, vol. xii, p. 404, pl. xiv, f. 7A and B.
1865. „ *Hombergii,* Carrington. Annel. Southport, p. 8.
„ „ *longisetosa,* Johnston. Cat. Brit. Mus., p. 172.
„ „ *Hombergii,* idem. Ibid., p. 173.
„ „ *longisetosa,* Malmgren. Nord. Hafs.-Ann., p. 106, tab. xii, fig. 20 (*fide* Tauber).
„ „ *Hombergii,* De Quatrefages. Annel., i, p. 420.
„ „ *assimilis,* idem. Ibid., p. 429.
„ „ *scolopendroides,* idem. Ibid., p. 429.
1867. „ *longisetosa,* Malmgren. Annel. Polych., p. 19 (*fide* Tauber).
1868. „ *Hombergii,* Ehlers. Borstenw., ii, p. 619, taf. xxiii, figs. 7 and 42.
„ „ *scolopendroides,* Claparède. Annél. Nap., p. 176, pl. xvi, fig. 1.
1869. „ „ Claparède and Mecznikow. Zeits. f. w. Zool., xix, p. 25 (sep. abdr.), taf. xiv, f. 3.
1873. „ *assimilis,* Kupffer. Jahresb. Com. deutsch. ' Pommerania,' 1871, p. 150.
1874. „ „ Malm. Kongl. Vet. o. Vitt. Samhälles i Göteborg, Handl. xiv, p. 78.
„ „ *Hombergii,* McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
„ „ *emarginata,* Malm. Op. cit. Göteb., xiv, p. 77, tab. i, fig. 1.
1875. „ *Hombergi,* Ehlers. Zeits. f. wiss. Zool., xxv, p. 19.
„ „ „ McIntosh. Invert. and Fishes, St. Andrews, p. 118.
„ „ *cæca,* Möbius. Jahresb. Com. deutsch, p. 168.
„ „ *emarginata,* Malm. Americ. J. Sc. and Arts, x. p. 39 (*fide aut.*).
1878. „ *ciliata,* Lenz. Jahresb. Com. deutsch, p. 13 (?).
1879. „ *atlantica,* Hansen. Nyt Mag. f. Nat., xxiv, p. 4.
„ „ *assimilis,* idem. Ibid., p. 268.
„ „ *Hombergii,* Langerhans. Zeits. f. w. Zool., xxxiii, p. 302, pl. xvi, fig. 38.
„ „ *Hombergi,* Tauber. Annul. Danic., p. 84.
„ „ „ Théel. Annél. Nouv. Zemb. (K. Sc. Vet. Akad. Handl., t. xvi, No. 3), p. 26.
1879. „ *assimilis,* Hansen. Nyt Mag. f. Naturvid, xxiv, p. 268.

1879. *Nephthys scolopendroides,* Marion and Bobretzky. Ann. Sc. Nat. 6e sér. viii, Art. No. 7, p. 16, pl. xv, fig. 2.
1883. „ *Hombergii,* Levinsen. Vidensk. Meddel. Foren Kjöbenh., p. 217 (Syst.-geogr. Overs. Annel. nord., p. 60).
1885. „ *scolopendroides* (*Hombergii*), Pruvot. Arch. Zool. Expér., 2e sér., iii, p. 225.
„ „ „ Carus. Fauna Med., p. 223.
„ „ „ Jaquet. Mitth. Zool. Stat. Neap., vi, p. 364 and pl. xxii, fig. 75—81.
1886. „ *longisetosa,* Harvey Gibson. Verm. Liverp., p. 152.
1886–7. „ *scolopendroides* (struct. muscles), Emery. Mitth. Zool. Stat. Neap., vii, p. 371, p. xiii.
1890. „ *Hombergii,* Malaquin. Annél. d. Boulon., p. 33.
1891. „ „ Hornell. Trans. Liverp. Biol. Soc., vol. v, p. 244.
1893. „ *assimilis,* Levinsen. Vidensk. Ud. "Hauchs," p. 337.
1894. „ *Hombergii,* De Saint Joseph. Ann. Sc. Nat., 8e sér. xvii, p. 3, pl. i, figs. 1—13.
1896. „ *scolopendroides,* Roule. Camp. 'Caudan,' p. 449.
1900. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 258.
1901. „ „ idem. Ibid., vol. viii, p. 222.
1902. „ „ Marenzeller. Polych. Grund., p. 12.
1904. „ *Hombergii,* Allen. Journ. M. B. A., N. S., vol. vii, p. 225.
1905. „ *scolopendroides* (=*N. longisetosa* Johnst.), Graeffe. Arbeit. Zool. St. Triest, xv, p. 322.
1906. „ *Hombergii,* Fage. Ann. Sc. Nat., 9e sér., iii, p. 287, figs. 11—14.

Habitat.—From Shetland to the Channel Islands—along both shores, and occurring alike in the tidal region and in deep water. W. coast of Ireland. Dredged at a depth of 96 fathoms in the 'Porcupine' Expedition of 1869.

Frequent on the French shores, and in the Mediterranean. Rare on the shores of Sweden and in the Baltic (Malmgren). Madeira (Langerhans) where it frequents water from 10 to 20 fathoms in depth. 3—400 metres (Roule) 'Caudan' in the Gulf of Gascony.

Head pentagonal (Plate LVII, fig. 8), more elongated than in *N. cæca*, and with very well marked tentacles.

In the preparations no sense-organ or ciliated papilla is observable. Ehlers states that it is present on each side in the converging groove. The lobes at the sides of the mouth are more pointed. Delle Chiaje gives his form two distinct eyes, and though such are not often seen, yet in a good example from St. Magnus Bay, they are present at the base of the anterior tentacles (Plate LVII, fig. 8).

The peristomial segment has the foot divided into a dorsal and a ventral division, each of which has a spine-papilla and the two kinds of bristles. The dorsal cirrus is minute, but the ventral is large. The long dark bristles are directed forward on each side of the head.

The branchiæ begin on the fifth foot (St. Joseph says fourth segment).

The *Body* has similar proportions to that of *N. cæca*, but is considerably less, no example yet met with having attained the proportions of the species just mentioned. It is iridescent pinkish in life, bluish-white along the median line dorsally and whitish laterally, with bright red branchiæ along the sides.

The proboscis (Plate LVII, fig. 6*a*) in extrusion presents similar rows of papillæ distally to those in *N. cæca*, but the last or terminal of the median dorsal is considerably

longer and more slender than the others, so that it is a conspicuous process. The number of papillæ in each row is two or three, and thus the species, as De St. Joseph observes, is distinguished from *N. cæca*. Moreover, each often rises from the distal edge of a thickened base like the stump of an injured papilla. In some only the truncated stump remains. In a large Neapolitan example the two median dorsal rows converge distally, and beyond the point of junction the long cirrus arises. On the ventral surface the median row agrees with its fellows.

The typical foot (Plate LXVI, fig. 4) is distinguished from that of *N. cæca* by the less prominent superior lamella, which has a shorter vertical diameter though its elongation transversely carries its outer edge beyond the tip of the foot. The bristles are also darker (brownish). In front a tongue-shaped flap, guarding the base of the bristles, occurs superiorly, while another small flap of similar shape is situated inferiorly, a view from the front thus presenting a bifid surface. Below the point of the spine is a prominent papilla. No part of the foot is more diagnostic when contrasting it with the homologous region in *N. cæca*. Its free margin is often sinuous or incurved. Beneath the short dorsal cirrus, which is separated by a deep notch, is the richly ciliated (two rows of cilia, St. Joseph) branchia often curved inwards in the preparations, and a little less massive than in *N. cæca* though not shorter. The outer part of its base is enlarged into a projecting papilla, which in the variety *kersivalensis*[1] (Plate LXVI, figs. 5 and 6) forms a short cirrus. The serrate bristles are much shorter than in *N. cæca*, have long cylindrical shafts, and an expanded blade—bent downwards at an angle—tapering somewhat quickly to a delicate point (Plate LXXVII, fig. 2), the edge being finely serrated, and thus in all respects contrasting with the corresponding bristle in *N. cæca*. St. Joseph speaks of minutely spinose bristles in the superior division of the posterior segments—modifications of the elongated forms. The barred bristles (Plate LXXVII, fig. 3) do not offer much for comment except perhaps that the bars are somewhat closer, and the region is shorter. They form a vertical curved palisade in front of the spine-papilla, while the long serrated forms present in the line of insertion a considerably smaller arc, and the tips are incurved superiorly and inferiorly, so that the form of the bristle is diagnostic—a flattened and pointed hair-pencil. The longer dorsal bristles are near the inferior margin, the longer ventral near the superior margin. Moreover, the ellipse formed by the insertions of the two groups of bristles differ in so far as the dorsal have a gap superiorly, while the ventral have it inferiorly. In the ventral division the lamella is largely developed, directed upward and outward, and with a characteristically broad and somewhat truncated tip. In front are two small lamellæ—flap-like in character and spatulate in outline—which guard the bristle-bundles, and make a duplication of the bifid arrangement in the superior division. Instead of the elongated spinigerous region of *N. cæca*, the part, as in the superior division, is ovoid, but the papilla is superior instead of inferior. The bristles agree with those of the dorsal division, except that the tips of the serrated forms are longer. The ventral cirrus is short and broadly lanceolate in outline.

[1] From the old name of Lochmaddy, North-Uist, where it is plentiful.

Posteriorly the lamellæ, branchiæ, and cirri diminish, and the gap between the dorsal and ventral divisions is greater. The bristles, however, retain their characteristic features.

Occasionally a specimen, *e. g.* from Bressay Sound, shows the lower lobe of the foot somewhat like that of *N. cæca*, but the dorsal lobe and the structure of the bristles enable ready diagnosis to be made. A similar condition is observed in examples from Denmark.

Many years ago a series common in the Outer Hebrides and elsewhere had been separated from *N. Hombergii* by the fact that the ventral lamella in the anterior third was much less than in the typical form, and both lamellæ posteriorly decreased more decidedly. The process at the base of the branchia is also longer (Plate LXVI, fig. 5 anterior and fig. 6 posterior foot). Extended examination, however, shows this to be a younger stage in the growth of *N. Hombergii*, intermediate forms leading from the one to the other, and it may be called variety *kersivalensis*. The chief distinction is that in the variety *kersivalensis* the ventral lamella in the anterior third is much less than in the type, and both lamellæ posteriorly decrease more decidedly.

Such distinctions, however, may be sexual. The capillary bristles of the variety (Plate LXXVII, figs. 4 and 5) show a somewhat more marked curve.

Reproduction.—Specimens under two inches in length from the west Voe of Burra, Scalloway, in July, had eggs far advanced and floating freely in the perivisceral chamber.

Claparède (1868) mentions that the ova are red, as indeed was shown by Delle Chiaje.

Claparède and Mecznikow[1] describe the telotrochous larva of this species at Naples. The youngest stage is monotrochous with a whip of cilia in front and a ring behind the mouth, in front of which is a pale reddish pigment-band. The alimentary canal has mouth, pharyngeal region, stomach (with greenish pigment), and intestine terminating in an anus at the posterior end and ciliated throughout. A pair of red eyes is present in the larval prostomium in which the greater part of the alimentary apparatus lies. The monotrochous becomes a telotrochous larva by the appearance of rings behind that at the mouth, and the development of the anal ciliated ring. The lateral rings by-and-by develop bristles, the alimentary canal becomes elongated as in the figures of the British examples, and a form like the *Naveda*-larva of A. Agassiz and others is found. Such young forms are remarkable for the greenish or bluish colour of the stomachal region of the gut, whilst in the pharyngeal two teeth appear. Their oldest form had seven pairs of feet with bristles. The authors probably procured these larvæ at Naples in November or early in December.

Var. VASCULOSA.

Fine examples of *Nephthys Hombergii* were forwarded from Montrose Bay by the late Dr. Howden in 1870. The same year it was dredged in 25 fathoms in Bono Bay by the 'Porcupine.' The head agrees with the typical form. The feet (Plate LXVI, figs.

[1] 'Zeitschr. f. w. Zool.,' Bd. xix, p. 25 (sep. abdr.), taf. xiv, figs. 3, 3*a*—3*d*, 1868.

7 and 8) are distinguished by the great development of the inferior lamella. Dorsally the lamella agrees very closely with that of *N. Hombergii*. The spinigerous lobe shows no boss or process below the spine as in the Neapolitan form, but this feature is absent in various examples both from the Mediterranean and elsewhere. The free flaps from the fillet—superiorly and inferiorly—are somewhat less developed than in the ordinary examples, some having a tendency to diminution. The dorsal cirrus is shorter and less filiform, but the branchia is similar. The inferior division again presents a much larger foliaceous lamella, forming a thin fan which often overlaps the adjoining edge of the upper lobe. The greater part of the lamella is occupied by arborescent blood-vessels—leaving a narrow marginal belt of translucent tissue. The brownish capillary bristles are in two groups in each division of the foot, the upper division having the upper group shorter, while in the ventral division the lower is the shorter. They and the barred forms appear to correspond with those of *N. Hombergii*, though they are somewhat more slender. Posteriorly all the processes of the foot are diminished, especially the branchia and the inferior lamella.

It is interesting that this vascular modification of the inferior lamella occurs not infrequently in examples from Montrose, and yet has not been found elsewhere than in the Mediterranean.

In the intestine of an example from Montrose were muddy sand, bristles, and shreds of tissue of its prey (other Annelids).

In all probability Montagu's Plate LXIX[1] represents this form. The branchia is apparently turned outward.

If Cuvier's species as described by Savigny (1820) be the common form then the title *N. Hombergii*, Cuv., has the priority. Savigny's remarks are by no means distinctive, since he does not indicate the characters of the ventral division of the foot with sufficient precision in contrast with the dorsal. As French authors, however, identify Cuvier's specimens with this species it is well to accept it. Besides, this decision is substantiated by the adoption of the same title by Lamarck in 1818.

The early description and figure of Delle Chiaje (1825) give no diagnostic features for the species, nor does his later publication ('Descrizione') add further information. Grube, however, had in the meantime found the same form in the Adriatic and Mediterranean, as Delle Chiaje himself notes, and though he separated it from *Nephthys Hombergii*, Aud. and Ed., it would appear, and as Claparède considered, that it refers to that (the present) species. Grube, indeed, subsequently associated it with Œrsted's *N. assimilis*. It would have been difficult to connect Delle Chiaje's species with that of Milne Edwards' if the workers at Naples had not satisfied themselves, for he describes and figures two very distinct eyes which are not often seen in the British representatives, and the presence of two caudal cirri in the figure is another discrepancy.

Audouin and Milne Edwards (1834) give a vivid description of the movements of this species and its powers of burrowing in the sand. They allude also to its use as bait by the fishermen.

De Quatrefages (1865) separated the *N. Hombergii* of Audouin and Milne Edwards'

[1] MS. drawings by Miss Dorville, 1808, Library Linnean Society.

from Cuvier's form, naming the latter *N. Cuvieri*, but it is doubtful from the description of the author or of Cuvier whether any distinction exists.

After describing the species, Ehlers (1868) furnishes a digest of the literature, pointing out the confusion into which it had lapsed. His view that the *Nephthys longisetosa* of Johnston was probably this species was in consonance with Malmgren's opinion and with the appearance of the examples in the British Museum. He further thought that the *Nephthys Cuvieri* of De Quatrefages was the same or a closely allied form.

Some authors place the *Nephthys emarginata* of Malm (1874) under *N. cæca*, but a careful examination of his figure would lead to the view that it rather pertains to this species.

Langerhans (1879) gives an interesting account of the connective-tissue apparatus (Band apparatus) of this species, with various figures. The central apparatus is internal to the nerve-cord, and branches proceed to both lobes of the foot.

Ehlers and Théel (1879) consider that this species is indicated in Œrsted's 'Grönl. Dorsib.,' pp. 195–6, figs. 75 and 76, and the figure given by the author is certainly ambiguous—more resembling an imperfectly preserved example of *N. Hombergii* than *N. longisetosa*, though the dorsal lamella is stated to be triangular.

Tauber (1879) seems inclined to include the *Nephthys Johnstoni*, *N. nudipes*, and *N. pansa* of Ehlers under this form, and is doubtful as to the separation of *N. incisa*, Malmgren.

De St. Joseph (1894) gives a somewhat minute account of this species, but unfortunately his figures are indifferent. Like Delle Chiaje, he mentions the occurrence of two small eyes at the posterior border of the first segment. He supposes the *N. longisetosa* of Johnston to be the same, but this is doubtful, since the description may refer to the long bristled variety of *Nephthys cæca*. Besides the structure of the exterior he describes the circulatory, muscular, and nervous systems, the presence of striated muscular fibres in the median ventral bands being a feature of note. He found the sexual elements developed from November to April.

A careful account of the nervous system of this species is given by Pruvot[1] in which he points out the single cerebral mass without inferior cerebral lobes or secondary ganglia. Each œsophageal connective, double at its origin, is single thereafter, and gives off the stomato-gastric nerves. The ventral ganglionic chain is normal, and it has one neural canal inferiorly (the others apparently having escaped his notice).

3. Nephthys ciliata, *O. F. Müller*, 1789. Plate LXVI, fig. 9—foot; Pl. LXXVII, figs. 6, 6 *a*, and 7—brist.

Specific Characters.—Head longer than broad, with a wide anterior border and more slender tentacles than in *N. cæca*. Proboscis in extrusion generally papillose, with

[1] 'Arch. Zool. Expér,' 2e sér, iii, p. 225, pls. xi and xii, 1885.

twenty-two distal rows of slender, elongated papillæ—five to seven in number in each. A median cirrus in front of the rows in the mid-dorsal line. Body 90—135 segments, of medium size and generally typical in outline. Foot with the dorsal lamella rounded, its greatest vertical diameter being median, and its axis directed upward. At its outer edge is a smaller rounded lamella. Dorsal cirrus slender and long. Branchial process of moderate length coiled outward. Inferior lobe sinuous below the small terminal lamella, with a small papilla at the inner border of the latter superiorly. Ventral cirrus large and conical. Bristles brownish, comparatively short, the serrated forms having a distinct curvature of the dilated region beyond the shaft, and a serrated edge. The barred forms are finely tapered.

Synonyms.

1789. *Nereis ciliata*, O. F. Müller. Zool. Danica, iii, p. 14, Tab. lxxxix, figs. 1—4.
1791. „ „ Gmelin's Linnæus Syst. Nat., ed. 13, I, pt. 6, p. 3120.
1806. „ „ Turton's Gmelin, iv, p. 90.
1843. *Nephthys longisetosa*, Œrsted. Grönl. Dorsib., Tab. vi, fig. 78.
„ „ *borealis*, idem. Annul. Danic. Consp., p. 32, fig. 4.
„ „ *ciliata*, H. Rathke. Beitr. Fauna Norweg., p. 170.
1851. „ „ Grube. Fam. Annel., p. 53, 128.
1853. „ „ (*borealis* Œrsted), Stimpson. Mar. Invert. of Gr. Manan, p. 33.
1865. „ *borealis*, De Quatrefages. Annel. i, p. 428.
„ „ *ciliata*, idem. Ibid., p. 429.
„ *Diplobranchus ciliatus*, idem. Ibid, p. 434.
„ *Nephthys ciliata*, Malmgren. Nord. Hafs-Ann., p. 104, Tab. xii, fig. 17.
1867. „ „ idem. Annel. Polych., p. 17.
1868. „ „ Ehlers. Die Borst., ii, p. 629, Taf. 23, f. 36.
1872. „ „ G. O. Sars. Bid. Kundskab Christ. Fauna, iii, p. 23.
1873. „ „ Kupffer. Exped. Ostsee "Pommerania," p. 150.
„ „ „ Verrill. Amer. Journ. Sc. and A., vi, p. 411, pl. iv, f. 4.
„ „ „ Möbius. Jahresb. Com. deutsch Meere, p. 113.
„ „ „ Kupffer. Ibid., p. 150.
„ „ „ Verrill. Invert. Vinyard Sound, U.S. Comm. F. and F., p. 583.
1874. „ „ Smith and Harger. Tr. Conn. Acad., iii, p. 16, pl. v, f. 1.
„ „ „ Malm. Köngl. Vet. o. Vitt. Samh. i Göteborg Handl., xiv, p. 76.
„ „ „ Verrill. Proc. Amer. Assoc., etc., for 1873, pp. 351, 367, pl. v, f. 7.
1875. „ *cæca*, Möbius. Jahresb. Comm. w. Untersuch., etc., p. 166.
1878. „ *ciliata*, Leuz. Jahresb. Comm. w. Untersuch. deutsch, 1874—75, p. 13.
1879. „ „ Verrill. C. List, U.S. Comm. F. and F. (sep. cop.), p. 7.
„ „ „ McIntosh. Trans. Linn. Soc., 2 ser., vol. i, p. 501.
„ „ „ Hansen. Nyt. Mag. f. Naturvid., xxiv (Annel. Norske Nordhav. Exped.), p. 268.
„ „ „ Théel. Acad. Handl. Stockholme, Bd. xvi (Annél. Nouv. Zemb.), p. 24.
1881. „ „ Horst. Niederland. Archiv f. Zool., Suppl. Bd., 5, p. 7.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöben., p. 217 (Syst-geogr. Overs. Nord. Annel., p. 60).

1886. *Nephthys ciliata*, idem. Ann. Kara-Hav. Led., p. 8.
1890. „ „ Malaquin. Rev. Biol. du Nord Fr., p. 32 (Annel. Boulon.).
1893. „ „ Levinsen. Vidensk. Ud. "Hauchs," p. 337.
1898. „ „ Michaelsen. Zool. Ergebn., ix, Grönl. Annel., p. 126.
1900. „ „ Fauvel. Annél. Cherbourg, Mém. Soc. nationale des Sc. nat., etc., Cherbourg, tome xxxi, p. 309 *et seq.*
„ „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 258.
1901. „ „ idem. Ibid., vol. viii, p. 222.
„ „ „ Whiteaves. Geol. Surv. Canada, No. 722, p. 82.
1902. „ „ Marenzeller. Polych. des Grundes, Denkschr. d. K. Akad. d. Wiss., Wien, lxxiv Bd., sep. abdr., p. 11.
1903. „ „ Moore. Polych. Japan, Proc. Acad. Nat. Sc. Philad., June, 1903, p. 433.

Habitat.—Bressay Sound, 10 fathoms; St. Magnus Bay, 90—100 fathoms; generally on muddy ground or in sandy mud.

O. F. Müller procured it in the first instance from the Faröe Islands, and it stretches to Greenland and the eastern Canadian waters as well as to America.

Malmgren gives Spitzbergen, Scandinavia, and Iceland, and Ehlers the European and American shores of the North Atlantic (Verrill). Kara Sea, Nova Zembla (Théel).

The most abundant Norwegian species collected by Canon Norman; Behring's Sea (Marenzeller).

Head longer than wide, with a broad and slightly convex anterior border and more slender tentacles than in *N. cæca*, the anterior being lateral in position, the posterior ventro-lateral.

The peristomial segment shows the dorsal and ventral spine-papillæ and the two kinds of bristles in each.

Proboscis.—In extrusion the terminal papillæ are more slender and elongated than in *N. cæca* or *N. Hombergii*, and the body of the organ therefore is generally more papillose. There are about five papillæ in each row, the anterior being longer and more slender than in the common species. Moreover, shorter papillæ are dotted over the organ almost to the base. In the median line dorsally a long slender anteriorly directed cirrus occurs a little in front of the other rows.

Body slightly tapered in front, more so posteriorly, and terminating in a caudal cirrus.

The typical foot (Plate LXVI, fig. 9) is distinguished from that of *N. cæca* by the fact that the superior lamella is smaller and more rounded, its greatest vertical diameter being towards the middle, and the axis directed dorsally (upward), whereas the greatest vertical axis in *N. cæca* is directed obliquely outward. The slight development of the lamellæ, indeed, at once differentiates the species. The dorsal lamella is continued to the tip of the foot where the edge bends downward, and its tissue becomes continuous with that of the dorsal cirrus and branchia. The dorsal cirrus at the base of the branchial process is rather slender and long. The branchial process is of average length, though in some it is short. Immediately in front is the spinigerous region of the foot which has the peculiarity

of forming a free lamella guarding the capillary bristles in front, so that they lie in a fissure between it and the posterior lamella. This spinigerous flap has the spine a little beyond its middle, and thereafter it ends in a rounded or disc-like free lamella at the edge of the foot. The anterior base of the foregoing has a slight fillet from which the barred or camerated bristles project. The bristles have a distinct curvature (Plate LXXVII, fig. 6) along the dilation above the shaft, and this is spinose or serrated. The barred forms (Plate LXXVII, fig. 7) are finely tapered, and perhaps less robust than those of *N. cæca*.

The inferior division has a short posterior lamella which superiorly in the large examples rises as a free rounded lobe. The spinigerous region forms another lamella anteriorly from the upper border to the lower, an interval, however, occurring between it and the cirrus. The capillary bristles arise between it and the posterior lamella, and thus lie in a deep pit. The barred bristles spring from a line marked by a ridge of skin, which superiorly ends in a distinct flap or lamella at the commencement of the spinigerous region.

The conical ventral cirrus is comparatively large. The ventral bristles agree with the superior in having a well-marked series of spikes on the curved and dilated portion above the shaft. On the whole *N. ciliata* has comparatively short and slender bristles.

The figures of O. F. Müller in the 'Zoologia Danica' (1789) are recognizable not so much in minute detail, as in the firm outline and general contour of figs. 1 and 2. The description of the plate, moreover, bears out this interpretation, though the author adheres to there being two caudal cirri, but as only traces of these were left in the specimens which Mohr had sent him from Faröe, the mistake is explained. He correctly discriminated it from the *N. cæca* of O. Fabricius. He distinguished it from the *gigantea* (Seba Thesaur, I, 81, fig. 7) of Linnæus by the third series of bristles, whilst from *Nereis cæca* (Fabricius, 'Fauna Grœnlandica') it differs by the absence of "scales" between the feet, Müller's form having only fleshy fimbriæ.

H. Rathke (1843) described this as a new species, but in all probability it is the same form. He gives no figures.

Œrsted (1843) at first confused the species with *N. longisetosa*, but soon corrected himself, and gave an excellent figure of a foot in his 'Conspectus.'

The formation of a new genus by De Quatrefages (1865) for this species rested on misapprehensions, somewhat increased by his entering Rathke's *Nephthys ciliata* and Œrsted's *N. borealis* as separate forms.

Dr. Johnston did not separate the species from *N. cæca*.

Malmgren's account and figures, with the supplementary note in the 'Annulata Polychæta,' readily define the species from allied forms.

Ehlers (1868) corrected the synonymy up to date, and gave a reliable description without figures.

Smith and Harger's figure (1874) might do for either *Nephthys ciliata* or *incisa*, though it more nearly approaches the latter. These and other Annelids described in their paper were dredged on St. George's Bank.

Dr. H. Théel (1879) criticises under this species Malmgren's figures of the feet, since he did not accurately compare the same feet in each species, or at least from the same region of the body.

Tauber (1879) includes *Nephthys cirrosa*, Ehlers, and probably *N. lactea*, Malmgren, under this species.

Shepotieff describes and figures the bristles and bristle-sacs with their muscles [1]—his careful investigations being made chiefly on sections of the parts.

4. Nephthys hystricis, *McIntosh*, 1900. Plate LVII, figs. 8, 9; Plate LXVI, figs. 10 and 10 *a*—feet.

Specific characters.—Head elongated from before backward, with rather pointed subulate tentacles anteriorly, the broader second pair following after an interval. Peristomial segment ventrally with two broad flaps and a symmetrical series of furrows. Body resembling that of *N. ciliata*. Proboscis comparatively short, with slender papillæ in twenty-two rows. The mid-dorsal pair converge on the long tentacle immediately in front, and the rows on each side of the mid-ventral line converge in a more marked manner, but there is no median filament. As a rule, four papillæ occur in each row, but in some traces of a fifth are seen, and in the ventral pair (on each side of the median line) are six short papillæ. Foot with a long, little elevated, dorsal lamella, which does not extend so far outward or droop at the tip, as in *N. Hombergii*. It also approaches in form that of *N. ciliata*, but differs in the shape of the dorsal lamella, and in the fact that in front of the capillary bristles the spinigerous region forms a low cone with the spine at the apex, the barred bristles arising in the fissure between it and a large flap or lamella formed by the fillet guarding the bristles, whereas in *N. ciliata* the spinigerous region itself forms the free flap. The dorsal cirrus is somewhat thick, separated only by a shallow notch from the branchia, which is of moderate size, has a papilla at its outer base, and is curved outward. Bristles similar to those of *N. Hombergii*, but thinner. Inferior division of the foot with a small lamella posteriorly, another nearly as prominent formed by the fillet for the barred bristles, the conical spinigerous lobe lying between. In several views, therefore, the tip is trifid.

Synonyms.

1900. *Nephthys hystricis*, McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 259.
1901. „ „ idem. Ibid., vol. viii, p. 222.
1902. „ „ Marenzeller. Polych. Grund., p. 14.

Habitat.—Dredged in the 'Porcupine' Expedition of 1869, 110 fathoms; 370

[1] 'Zeitsch. f. wiss. Zool.,' Bd. lxxvii, p. 593, Taf. xxvii, f. 5—17, 1904.

fathoms; 422 fathoms; off Ireland. From various stations in the Mediterranean during the 'Porcupine' Expedition of 1870; 9 miles off Cape Finisterre; 81 fathoms east of Cape de Gatte, 6 miles from shore, 60—160 fathoms; Stations 6 and 8, 1870. Dredged in the 'Porcupine' Expedition of 1870, Bono Bay, 25 fathoms; No. 36, 128 fathoms, 1870; No. 2, 305 fathoms, and off Cape Sagres, 45 fathoms; Sidi Ferrara? 45 fathoms. 'Knight Errant,' August 24th, 1882, Station 18, 516 fathoms. Royal Irish Academy's Expedition, 1885, Berehaven. A closely allied if not identical form was obtained by Canon Norman in Lervig Bay, Norway, in 1878, in considerable numbers.

Head (Plate LVII, fig. 8) elongated from before backward, with rather pointed anterior tentacles, the second pair being a little behind and ventro-lateral in position. Posteriorly the head is bounded by the collar with a median notch, and a four rayed mark is situated on the head a little in front.

The peristomial segment shows two broad lips anteriorly and a symmetrical series of furrows posteriorly. The ventral cirrus anteriorly is small, as in *N. ciliata*.

In all the Irish specimens the proboscis is ejected, so that the head is distorted (Plate LVII, fig. 8). Its transverse diameter is greater than the antero-posterior. The anterior edge is straight with a small subulate tentacle at each side. A broader ventral one follows after a short interval.

The body is incomplete in all the examples, but it resembles that of *N. ciliata*.

The proboscis (Plate LVII, figs. 8 and 9) is comparatively short with slender bifid papillæ in twenty-two rows. The median dorsal pair converge on the long tentacle immediately in front. The rows on each side of the ventral median line converge even in a more marked manner, but there is no long median filament. The papillæ are longest distally and diminish backward. Four are distinct and in some is a trace of a fifth, though in the pair on each side of the ventral line there are more (at least six), but they are short. Under the lens the rest of the basal region is smooth. The acute bifid papillæ which form a border to the aperture at the tip are very distinct, either projecting prominently or folded over the aperture, the tips crossing in a regular and symmetrical manner. The long dorsal tentacle projects as far as the latter (*i. e.* to the closed aperture). In some the distal region is pale madder brown.

The typical foot (Plate LXVI, fig. 10) approaches that of certain varieties of *N. Hombergii*, such as var. *kersivalensis*, insofar as it has a long, little elevated lobe, which, however, does not pass so far outward or droop so much at the outer end as in the form mentioned. It stands indeed horizontally. The aspect of the foot also approaches that of *N. ciliata*, but it differs in minute characters, such as in the form of the dorsal lamella, the condition of the spinigerous region, and other particulars. In front of the capillary bristles the spinigerous region forms a low cone or pyramid of considerable thickness with the spine at the apex, the barred bristles arising in the fissure between it and a large flap or lamella formed by the fillet guarding the bristles (Plate LXVI, fig. 10 *a*). There is thus an essential difference between it and *N. ciliata*, in which the spinigerous region itself forms the free flap. The dorsal cirrus is somewhat thick, and is only separated by a shallow notch from the branchia, which is large and

curved outward. The bristles are similar in curvature to those of *N. Hombergii*, but are more translucent (thinner), and the serrated edge is less rigid, and often disappears, apparently by friction. The barred bristles offer no feature of note. The inferior division has a small lamella posteriorly, another nearly as prominent formed by the fillet for the barred bristles, while the conical spinigerous lobe lies between. In many views, therefore, the tip is trifid, and quite diverges from that of *N. ciliata*.

The foot of the Mediterranean examples agrees with that in the Irish forms, the only difference being the greater distinctness of the spinigerous papilla between the lamellæ in the upper division, but as the Irish specimens are badly prepared and preserved this may be more apparent than real. The bristles of those from the 'Porcupine' are certainly longer. In both their colour is dull yellow, and their structure seems to agree.

The branchial process, which is of moderate size, has a well-marked papilla or process at its outer base; as shown for instance in Malmgren's figure of *N. assimilis*, Œrst.[1] It is, however, more distinctly defined than the latter.

This form approaches *N. ciliata* in the structure of the foot, yet differs in the longer dorsal lamella (which thus extends further outward), in the form of the dorsal cirrus, and in the basal process of the branchia. The terminal lamella of the foot is different. The median dorsal cirrus of the proboscis also seems to be longer. It is no nearer *N. cirrosa*, Ehlers, from which it differs in the great width of the dorsal lamella.

A Norwegian example collected by Canon Norman shows a more distinctly bilobed fillet in front of the camerated bristles superiorly.

A variety procured in the 'Porcupine' east of Cape de Gatte, nine miles from shore, in 6 to 160 fathoms, had more slender bristles, which apparently had undergone some change and had lost the serrations on the edge.

5. Nephthys longisetosa, *Œrsted*, 1842. Plate LVII, fig. 10–12; Plate LXVI, fig. 11—foot; Plate LXXVII, figs. 8–8*b*—brist.

Specific Characters.—Head somewhat shield-shaped; the anterior tentacles marked by a translucent stripe at the base in front, long and slender; second pair also long and lanceolate. Proboscis distinguished by fifteen (Théel says fourteen) rows of numerous papillæ, viz. eleven to fifteen in each row. Dorsal lamella of the foot elevated and prominent (triangular, Œrsted), with an accessory rounded process. Dorsal cirrus large and lanceolate, closely connected with the base of the branchia, only a shallow notch intervening, and the branchia is often curved inward. Ventral lobe with a tongue-shaped lamella above the dorsal edge at the tip, and only a narrow lamella beyond the foot. Both barred and serrated bristles are yellow or brownish with a metallic sheen, and largely developed, the latter presenting a gentle curve from base to apex, the minute spines being traceable from the short shaft to the tip.

[1] Op. cit., Taf. xii, fig. 19 *b*.

Synonyms.

1842.	*Nephthys longisetosa,*	Œrsted.	Kroyers Nat. Tids., iv, 2, p. 123.
1843.	,,	,,	idem. Grönl. Dorsibr., p. 195, figs. 75 and 76.
1851.	,,	,,	Sars. Nyt Mag. vi, p. 208 (Reise i Lofoten og Finmarken), 1849.
1865.	,,	*longosetosa,*	De Quatrefages. Annel. i, p. 428.
,,	,,	,,	Malmgren. Nord. Hafs-Annul., p. 106, Taf. xii, fig. 20.
1866–69.	,,	*longisetosa,*	Packard. Mem. Bost. Soc. N. Hist., i, p. 293.
1867.	,,	,,	Malmgren. Annel. Polychæt., p. 19.
,,	,,	,,	Parfitt. Cat. Annel. in Tr. Dev. Assoc., ii, pt. 1, p. 231.
,,	,,	*longosetosa*	(Stimpson) Packard. Mem. Bost. Soc. N. H., p. 294. (?)
1871.	,,	,,	Ehlers. Annel. from Spitzbergen, Sitzungsb. Phys.-Med. Soc. Erlangen, iii, p. 79.
1878.	,,	,,	Marenzeller. Nordpol. Exped., Denkschr. Mat.-Nat. class d. Kaiserl. Akad. Wien, p. 395.
1879.	,,	,,	Verrill. C. List U. S. Comm. Rept., p. 7.
,,	,,	,,	Hansen. Nyt Mag. f. Naturvid. (sep. copy), xxiv, p. 268.
,,	,,	*Malmgreni,*	Théel. Annél. Nouv. Zemb., p. 26, pl. i, f. 17^{5}, and pl. ii, f. 17^{10}.
1881.	,,	,,	Horst. Niederl. Arch. Zool., Suppl. Bd. i, 5, p. 10.
1883.	,,	,,	Levinsen. Syst. Geogr. Nord. Annel (Vidensk, etc.), p. 216.
1896.	,,	*longisetosa,*	Michaelsen. Polych. deutsch. meere, p. 24.
1900.	,,	,,	McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 260.
1901.	,,	,,	Whiteaves. Geol. Surv. Canada, No. 722, p. 82.

Habitat.—St. Magnus Bay, Shetland, 100 fathoms, and in 70 fathoms, Outer Haaf, Skerries (J. G. J.). Station 8 in the Färoe Channel ('Knight Errant'). Station 10 in the Färoe Channel ('Knight Errant'), March 2nd, 516 fathoms; August 24th, 82 fathoms. 'Porcupine,' 1870, 447 fathoms, No. 31; Sidi Ferrara?, 45 fathoms; 374 fathoms, No. 25.

Œrsted's specimen came from Godthaab. Extends to the Atlantic shores of America (Verrill), Strait of Magellan (Ehlers). Canada (W. C. M.). Fragments were procured off Anticosti in 100—210 fathoms, 1871, and off Port Hood, Canada, 1873, by Dr. Whiteaves.

The *head* (Plate LVII, fig. 10) is somewhat shield-shaped, with a slightly convex anterior margin. The anterior tentacles are marked off by a translucent stripe in front; and thus appear to rise considerably within the margin. They are comparatively long and slender. The second pair are lanceolate and also long. The dorsal cirrus of the first foot is remarkably large, its outline being lanceolate.

The *body* is slightly narrowed in front, more so posteriorly, and distinguished by the strong curved bristles which stand somewhat stiffly out on each side. Ventrally again the enlarged lanceolate lamella formed by the ventral cirrus is characteristic.

The proboscis in extrusion (Plate LVII, fig. 10) is distinguished by the well-marked basal region; and the very numerous papillæ in its distal rows, which are fifteen in number. Malmgren states that there are but fourteen. Moreover, the latter author also limits the number of the papillæ in these rows to seven, whereas they are much more numerous in the present examples, viz. eleven to fifteen.

When partly withdrawn, the organ *in situ* (Plate LVII, fig. 11) presents a button-

shaped tip of ruptured radiate muscular bands which are fixed to the next region. On each side a strong series of fibres forms a triangular muscular sheet, narrow posteriorly, which is inserted into the hollow of the constriction about a third from the front. Thereafter the organ gently dilates, again to contract posteriorly where it joins the gut. A slight ridge, commencing behind the pit at the muscular belt, marks the dorsal median line, and a slight furrow the corresponding part of the ventral surface. This region has fine transverse lines as in the proboscis of the Aphroditidæ.

When the organ is completely retracted, the protractor muscles form long bands (Plate LVII, fig. 12) from the snout backward to the dense proboscis, the special triangular bands at each side, again, acting on the latter in eversion, so as to tilt it outward.

The typical foot is not much produced, and shows dorsally an elevated and conspicuous lamella of a semicircular or truncated broad ovoid form (Plate LXVI, fig. 11) with a continuation appearing as a small rounded process or flap while the interfascicular lobe slants from above downward and outward with a prominent papilla for the spine, after which the margin recedes. A small free flap occurs at the outer margin of the fillet guarding the base of the barred bristles. The base of the branchia is closely connected with the dorsal cirrus, only a shallow notch separating them. The cirrus is lanceolate, broad and flattened at the base, pointed at the tip. It is interesting that the same structure in *N. trissophythus*, Grube, from Naples, is largely developed into a thin lamella like the cordate leaf of the lime. The branchia is often coiled inward. The barred bristles offer no diagnostic feature except their strength (Plate LXXVII, fig. 8*a*). The long serrated bristles are remarkably strong, with a pale yellow metallic sheen, and curve backward. The flattened blade gently bends from the shaft, its convex edge being minutely serrated with rows of spikes (Plate LXXVII, fig. 8 and 8*b*).

The inferior division presents two flaps superiorly, the upper edge of the bristle-fan passing between them. The anterior lamella is the larger, is tongue-shaped, and has a further modification of the small process observed in other forms, *e.g.*, *N. ciliata*, O. F. M. The lower angle of the same fillet often has a small free flap. The spinigerous region forms an acute triangle with the spine at the apex. The inferior lamella is comparatively small and somewhat resembles an ovate leaf, but there are considerable differences in regard to the development of this lamella, the Zetlandic form especially having it well-marked with the tip pointing upward and outward. The ventral cirrus is large and lanceolate with a central rib, and an articulation at its base. Both barred and serrated bristles are largely developed, the latter presenting a gentle curve from base to apex, the minute spines being traceable from the short shaft to the tip.

In contrast with *N. cæca*, the inferior oar of the foot in *N. longisetosa* is less prominent, and does not project so far outward. The bristles of the entire foot are also much more strongly marked (not longer), and have a decided curve backward. In *N. longisetosa* those with the serrations at the side are broader at the dilated portions. The inferior lobe is little developed, and thus strongly contrasts with several of its allies. The inferior cirrus is lamellate, and broader than in most. The serrations on the edges of the bristles are less conspicuous than usual; or they resemble the slated markings of wool rather than sharp and independent serrations. This gives a character to the bristles. The process at the base of the sickle-shaped cirrus is rather long and lanceolate.

The head is less rounded in front than in *N. cæca*, and the anterior tentacles more prominent and larger.

In what appears to be the northern variety of this species from Finmark the dorsal lamella is smaller, the accessory lobe little developed, the dorsal cirrus shorter and broader, the branchia much larger, but still rolled inward, the ventral lamella much less and the cirrus smaller and less foliaceous. The bristles in this form are more slender than in the British, but the serrations are distinctly separated. The barred forms are also more slender. While the lamellæ both dorsally and ventrally are thus smaller, the setigerous region in both divisions is more prominent and acute.

A form dredged by Canon Norman near Bergen in 1878 differs from the foregoing in the much darker bristles, which have, however, the same backward curve. The body somewhat resembles that of *N. cæca*, though the specimens are smaller. The head shows in one of the preparations two opaque specks posteriorly, but they do not seem to be eyes. The proboscis is enclosed. The foot presents a considerable dorsal lamella of a rounded form and extending to the tip. In front of it are the dark capillary bristles, then a much less spinigerous region than in *N. longisetosa* so that the barred bristles are quite close to the others. What is, however, the most marked feature is the presence of a small rounded flap superiorly and inferiorly in front of all the bristles, and this is apparently a development of the fillet in front of the barred bristles. The dorsal cirrus is small instead of large, and separated by a slight notch from the branchia, which is large, though not long, and curved outward. The inferior division has a somewhat smaller posterior lamella than *N. longisetosa*, and the cirrus is much less—forming a simple conical process. Both kinds of bristles appear to be more slender than in *N. longisetosa*, but the larger size of the latter probably makes the difference more pronounced.

The foot thus differs in the shape of the dorsal lamella, which is somewhat higher than in the example from Finmark, and in the pointed nature of the superior lobe. The dorsal cirrus and branchia are similar. The ventral lobe is also acutely pointed. The ventral cirrus is acute, and the long curved bristles have remarkably distinct serrations. The specimens are small and imperfect.

Nephthys longibranchiata, of the 'Porcupine' Expedition, differs from the allied form, *N. longisetosa*, Œrst., by the broader and less elevated superior lamella, by the shorter and more obtuse process at the base of the branchia, by the greater size and length of the branchia, by the rounded tip to the inferior lobe, the projection of the spine-tip, and the much smaller inferior cirrus.

Malmgren (1865) considered that Œrsted had this species in view in his 'Grönlands Annulata Dorsibranchiata,' but the figures are so unsatisfactory that doubt must always remain. He certainly describes the dorsal lamella as triangular. Malmgren also (1867) pointed out that the specimens so labelled in the British Museum by Dr. Johnston, from Berwick Bay, Holy Island, and the Firth of Forth, pertained to *Nephthys Hombergii* and a new species.

Such forms as *Nephthys phyllocirra*, Ehlers,[1] make a close approach to this species.

[1] 'Florida Annel.,' p. 131, Taf. 38, fig. 7—11, 1887.

6. Nephthys Grubei,[1] *McIntosh*, 1900. Plate LVII, figs. 13 and 14; Plate LXVII, fig. 1—feet; Plate LXXVI, figs. 9 and 9 *a*—bristles.

Specific Characters.—Head elongated from before backward, with a straight anterior edge, which is somewhat narrower than in *N. longisetosa;* tentacles at the outer border, conical, tapering, with a translucent area at the base internally. Second pair follow close on the first, and have the form of an acuminate leaf, whereas in *N. longisetosa* they are further removed from the first, as well as proportionally longer and more pointed. Distinct papilla, probably sensory (nuchal organ), at each posterior angle of the head. Proboscis included, but the arrangement of the parts around the mouth is similar to that of *N. longisetosa*. First foot diverges from that mentioned in the presence of a subulate dorsal process or cirrus, besides the lanceolate ventral one. The typical foot has the dorsal lamella narrowed at its attachment, broader and somewhat truncated distally, the reverse occurring in *N. longisetosa*. Instead of a distinct flap externally there is only a trace in the shape of a fillet. Dorsal cirrus less, branchia longer than in that species and curved inward. Pointed spinigerous lobe produced further outward, and at a different angle: fillet guarding bristles convex upward. In the inferior division the posterior lamella smaller, spinigerous lobe longer and more acute, whilst anteriorly the upper fillet is smaller. Ventral cirrus smaller and less tapered. Both barred and capillary bristles are more slender than in *N. longisetosa*, though in both the transverse bars of the serrated bristles extend downward till the full diameter of the shaft is reached.

Synonym.

1900. *Nephthys Grubei*, McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 260.

Habitat.—Dredged at Station 8 by the 'Knight Errant,' 17th August, 1880, in 540 fathoms.

The *head* (Plate LVII, figs. 13 and 14) is elongated from before backward, with a straight anterior edge which is somewhat narrower than in *N. longisetosa*. The tentacles at the outer angle are conical, tapering, and have a translucent area at the inner border. The position of the second pair differs from that in *N. longisetosa*, for they follow inferiorly close on the anterior pair, and have the form of an ovate acuminate leaf; whereas in *N. longisetosa* they are separated by a considerable space from the anterior pair, and they are proportionally longer and more pointed. At each angle of the head posteriorly is a conspicuous papilla, probably a sense-organ (nuchal organ), the corresponding organ in *N. longisetosa* being inconspicuous. The lips inferiorly (Plate LVII, fig. 14) somewhat resemble those of *N. Hombergii*, but have a more acute filament.

The proboscis is included.

The first foot differs from that in *N. longisetosa*, for it has a well-marked subulate

[1] Named after Professor Adolph Edouard Grube, of Breslau, than whom no more earnest student of the Annelids existed in his day.

dorsal process or cirrus, besides the lanceolate ventral one; whereas in *N. longisetosa* only a small papilla exists dorsally, and the ventral cirrus is much longer.

In the typical foot (Plate LXVII, fig. 1) the dorsal lamella is narrowed at its attachment, broader and somewhat truncated distally, the reverse being the case in *N. longisetosa*. Instead of a distinct flap externally, only a trace in the shape of a fillet occurs: the dorsal cirrus is evidently less, while the branchia is larger, though it is likewise curved inward. The spinigerous lobe is produced much further outward as a pointed process, and has a different angle. Moreover, the fillet guarding the barred bristles has a convexity directed upward.

In the inferior division the posterior lamella is considerably smaller, the spinigerous lobe longer and more acute, whilst anteriorly the upper fillet is somewhat smaller. The ventral cirrus is lanceolate, and shorter and less tapered than in *N. longisetosa*.

Both capillary and barred bristles (Plate LXXVI, figs. 9 and 9 *a*) are more slender than in *N. longisetosa*, and in both the transverse bars of the serrated bristles extend downward till the full diameter of the shaft is reached.

7. Nephthys Johnstoni, *Ehlers*, 1875. Plate LVII, figs. 15 and 16; Plate LXVII, figs. 2 and 2 *a*—feet; Plate LXXVI, figs. 10 and 11—bristles.

Specific Characters.—Head shield-shaped, with a broad and somewhat convex anterior border; a slender tapering tentacle at each angle, and an oblique translucent patch at its inner base. The second pair of tentacles arises latero-ventrally after a considerable interval. Proboscis with rather long rows (twenty-two) of papillæ distally, and a median cirrus dorsally and ventrally. Between the rows of the distal bifid papillæ of the aperture is a simple papilla dorsally and ventrally. The anterior folds or lips in front of the mouth are large. The dorsal lamella of the foot has a similar curvature to that of *N. ciliata*, but it extends further outward, and only a trace of the rounded terminal lobe appears. The setigerous region stands prominently upward and is smoothly rounded externally. No free flap to the anterior fillet guards the barred bristles. The dorsal cirrus is a variable filiform process. The branchia is not large and is curved externally. The ventral lamella is large and ovato-lanceolate, and the ventral cirrus lanceolate, larger than in *N. ciliata*, though less than in *N. longisetosa*. The capillary bristles are longer and less rigid than in *N. longisetosa*, and the serrations very fine, the long distal region being smooth. The barred region in the anterior bristles is long, and slightly fusiform.

Synonyms.

1843.	*Nephthys longisetosa,*	Œrsted.	Grönl. Annul. Dorsibr., p. 195, figs. 75 and 76.
1865.	„ „	Johnston.	Cat. Brit. Mus., p. 172. (?)
1874.	„ *Johnstoni,*	McIntosh.	Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
1875.	„ „	idem.	Invert. and Fishes, St. Andrews, p. 119.
„	„ „	Ehlers.	Zeitsch. f. w. Zool., Bd. xxv, p. 38, Taf. iii, f. 3 and 4.
1900.	„ „	McIntosh.	Ann. Nat. Hist., ser 7, vol. v, p. 261.

Habitat.—Southport Sands (Dr. Carrington); West Sands, St. Andrews, after storms (E. M.); St. Magnus Bay and Balta, Shetland (J. G. J.); 'Porcupine,' 1869, 85 fathoms, on "Porcupine Bank," off Ireland.

Greenland (Œrsted).

The *head* (Plate LVII, fig. 15) has a broad and slightly convex anterior border with the slender and tapered tentacle at each angle. A feature, apparently not unfrequent, is the presence of a translucent, oblique, elongated patch at the inner base of this tentacle. The second tentacle is broader, with a pointed tip, and occurs after a considerable interval. Posteriorly the elongated head terminates in two flattened lobes with a slight median furrow. A sense-papilla occurs at each side. The lips (Plate LVII, fig. 16) inferiorly approach the type of *N. Hombergii*, but the filament is longer, and the arrangement of the furrows is different. The latter, however, is not of much value.

The *body* has the usual shape and terminates posteriorly in the somewhat short anal cirrus (Ehlers).

The proboscis has rows of rather long papillæ distally, about six in each row, and besides, a long median cirrus both dorsally and ventrally just beyond the rows. There are $\frac{10}{10}$ bifid papillæ guarding the aperture in the distal region, and the gap between them has a single simple papilla.

The first bristled foot has its dorsal fascicle directed upward and the tips turned backward, the whole forming a prominent fan. No dorsal cirrus is present, but the ventral is long, lanceolate, and pointed.

The typical foot (Plate LXVII, figs. 2 and 2 *a*) has considerably longer bristles than in *N. ciliata*. The dorsal lamella has a similar curvature to that in *N. ciliata*, but has, in addition, a small and inconspicuous accessory lobe beyond its diminished outer end—continuous with the base of the cirrus. The spinigerous region forms a prominent ridge and ends externally in a smoothly rounded border without the distinct lobe as in *N. ciliata*. The fillet at the base of the barred bristles is distinct but does not rise into a flap. The dorsal cirrus is a filiform process, though this does not seem to be an important character, since, as in the dorsal lamella, considerable variety exists in the same specimen. The branchia is not large, and is curved externally.

The lower division has a large posterior lamella, often sinuous inferiorly and of a broadly ovato-lanceolate form. The setigerous flap is oblique externally, and the fold running from the base of the barred bristles presents a flap superiorly.

The capillary bristles both dorsally and ventrally are comparatively long but have very minute serrations (Plate LXXVI, fig. 10), a feature when contrasted with such as occur in *N. longisetosa*. The serrations, moreover, are limited only to the lower region of the bristle, the long tip being bare. In the camerated[1] bristles (Plate LXXVI, fig. 11) the transverse bars proceed far downward, the widest region of the bristle being thus included in the camerated part. When contrasted with those of *N. longisetosa*, they are considerably shorter and smaller. The ventral cirrus is lanceolate, larger than in *N. ciliata*, but considerably less than in *N. longisetosa*.

[1] So termed from the peculiar arrangement of the rows of spikes.

Loxosomæ occur on the feet of those from St. Magnus Bay, Shetland.

It is possible, as Ehlers thought, that Dr. Johnston's *N. longisetosa* refers to this species. He considered that it approached *N. Hombergii* (Aud. and Ed.), though differing from it, and he courteously named it after the British author.

Œrsted's *Nephthys longisetosa* (1843) makes so close an approach to this species that it may be included under it.

8. Nephthys cirrosa, *Ehlers*, 1868. Plate LVII, figs. 17 and 18; Plate LXVII, fig. 3 —foot; Plate LXXVI, figs. 12 and 13—bristles.

Specific Characters.—Head longer than broad, seven-sided, with a pair of conical tentacles in front, and a longer pair, latero-ventrally situated, considerably behind. A small (nuchal) papilla on each side posteriorly. The translucent area to the inner side of the anterior tentacles is distinct in some examples. Mouth a triradiate slit, for a fissure runs forward between the anterior flaps. Proboscis of the normal shape, with twenty-two rows of rather long papillæ anteriorly in extrusion—each row having six or more papillæ, which diminish in length proximally. Shorter papillæ occur over the general surface of the organ. A single dorsal median cirrus is present, as in *N. ciliata*, only it is slender. The terminal arches of bifid papillæ are normal. The first foot has two bristle-tufts and a comparatively large ventral cirrus. Foot with an arched dorsal lamella of considerable breadth, highest in the middle. No other flap. Dorsal cirrus of average length, subulate and rather slender. Branchia of moderate size, slightly coiled outward. The ventral division has a posterior lamella of moderate size, directed upward, and with a small flap superiorly over the base of the bristles. The ventral cirrus is prominent and somewhat conical. Bristles rather long and curved, pale golden; longer forms show a marked curve of the blade and a finely serrated edge. Barred forms with a spindle-shaped "camerated" region. Moreover, a little modification of the parts of the foot brings it close to *N. hystricis*, which, however, may readily be distinguished by the longer bristles, the larger spinigerous lobe, the smaller lamellæ superiorly and inferiorly, and the free flaps from the fillet guarding the barred bristles in both divisions of the foot.

Synonyms.

1868. *Nephthys cirrosa*, Ehlers. Die Borst. ii, p. 624, Taf. xxiii, figs. 6, 38, and 39.
1883. „ *cæca*, Wirén. Chætop. 'Vega' Exped., p. 392.
1890. „ „ Malaquin. Annél. Polych. Boul., p. 33.
1894. „ „ De Saint-Joseph. Annél. Pol. Dinard, Ann. Sc. Nat., 8th sér., xvii, p. 20, pl. fig. 19.
1900. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 261.
1901. „ „ idem. Ibid, vol. viii, p. 222.
1904. „ „ Allen. Journ M.B.A., n.s., vol. vii, p. 225.

Habitat.—The Channel Islands, Herm and Guernsey. In sand under stones at Galway, Ireland.

Shores of France, Dinard and Croisic (Baron de St. Joseph); Norway (Canon Norman); Strait of Magellan (Ehlers).

The *head* (Plate LVII, fig. 17) is longer than broad, somewhat translucent, and seven-sided. The anterior border is curved between the conical tentacles, which usually have a small translucent speck at their inner base. A longer pair occurs behind after a considerable interval, and latero-ventral in position.

The mouth has a triradiate outline, for between the two triangular flaps in front is a fissure which runs into the transverse furrow behind. Posteriorly a striated elevation occurs, which tapers off about the fourth foot. The proboscis (Plate LVII, figs. 17 and 18) has twenty-two rows of rather long papillæ, each row having six or more papillæ. Shorter papillæ are distributed over the general surface. A single dorsal median cirrus is present, as in *N. ciliata*, but it is more slender. The terminal arches of bifid papillæ are normal.

The typical foot (Plate LXVII, fig. 3) has a rather long low lamella, which extends outward beyond the tip, its highest point being about the centre, and thus differing from that of *N. Hombergii*. No other flap is present. The dorsal cirrus is of average length and subulate. The branchia is of moderate size and curved outward. The spinigerous lobe is narrow and flattened. The fillet guarding the base of the barred bristles projects as a small ridge externally.

The inferior division posteriorly has a terminal lamella of moderate size directed upward. It differs in shape, and is less developed than that of *N. Hombergii*. A small flap, a process of the fillet guarding the base of the bristles, occurs superiorly over the base of the upper bristles. The spinigerous lobe is bluntly conical and of some thickness. The ventral cirrus is of considerable size.

The capillary bristles (Plate LXXVI, figs. 12 and 12 *a*) have a rounded shaft and a long flattened curved blade tapering to a fine point, the edge being minutely serrated. Under the microscope many of these are yellow. They are comparatively long and pale golden to the naked eye, with a marked curve backward. The camerated bristles have a cylindrical shaft—dilating as it approaches the barred region, which forms a long spindle terminating in a tapering tip (Plate LXXVI, fig. 13). The crescentic fold between the feet ventrally probably indicates the opening of the segmental organ.

This form comes near *N. longisetosa*.

In an example from Herm, about four inches long, the superior lamella rose higher than usual, and had a different shape, since the outer edge was abrupt, and the inner edge also in some was more or less steep. The inferior lobe was less developed than in some examples of *N. Johnstoni*. A little further modification of the foot would bring this form within touch of *N. ciliata*.

This species and *N. Johnstoni* come very near Œrsted's *N. longisetosa*[1] from Greenland, the former, perhaps, most closely.

[1] 'Grönl. Annul. Dorsibr.,' p. 195, figs. 75, 76.

The species was first differentiated by Prof. Ehlers (1868), who had procured a small example from England through Mr. W. Stimpson of the United States.

Wirén (1883) considers this to be only a variety of *Nephthys cæca*, Fabr., just as he joins to the same species *Nephthys ciliata*, O. F. Müller, N. *longisetosa*, Œrsted, and *N. emarginata*, Malm.

De St. Joseph (1894) describes a pair of minute eyes at the inferior border of the first segment. He also points out the larger serrations at the flattened commencement of the blade of the capillary bristles. He is of opinion that the *Portelia rosea* of De Quatrefages may be this species. He distinguishes this form by the larger size of the branchiæ about the thirtieth segment.

9. Nephthys incisa, *Malmgren*, 1865. Plate LVII, figs. 19 and 20; Plate LXVII, fig. 4 —foot; Plate LXXVI, figs. 14 and 15—bristles.

Specific Characters.—Head somewhat shield-shaped, slightly wider in the middle, and marked by two pale lateral areas which map out the surface. Anterior and ventro-lateral tentacles small and conical. Proboscis with twenty-two rows of minute papillæ, and a long dorsal and ventral cirrus. Foot with a rounded dorsal lamella extending nearly to the tip of the organ. Small dorsal cirrus leaf-like and pointed, separated by a shallow notch from the somewhat massive though short branchia, which has the tip bent outward and forward. It diminishes and disappears posteriorly. Spinigerous lobe small; hidden between the rows of bristles. Fillet guarding the base of the barred bristles developed into a free flap superiorly and inferiorly. Inferior division trifid, the anterior fillet projecting most superiorly. Neither flap is much developed, and the spinigerous lobe is conical. Bristles dark-brown, the anterior having the barred region beyond the widest part, and the capillary forms being curved and minutely serrated.

Synonyms.

1853. *Nephthys ingens*, Stimpson. Mar. Invert. Gr. Manan, p. 33 (*fide* Verrill?); and *N. circinata*, n.s. idem., and ditto, Amer. J. Sc. and Arts, 1875, vol. ix, June, p. 414.
1865. „ *incisa*, Malmgren. Nord. Hafs-Annul., p. 105, Tab. xii, f. 21.
1867. „ „ idem. Annul. Polych., p. 18.
1868. „ „ M. Sars. Fortsatte Bemœrk., p. 10.
1873. „ „ Kupffer. Exped. Ostsee, 'Pommerania,' p. 150 (Jahresb. Com. deutsch.).
„ „ „ G. O. Sars. Bid. Kundskab. Christ. Fauna, iii, p. 23.
„ „ *ingens*, Verrill. Amer. Journ. Sci. and Arts, vol. v, p. 103.
1874. „ *incisa*, Malm. Op. cit., Göteb., p. 77.
„ „ „ (or *ingens*), Smith and Harger. Trans. Conn. Acad., iii, pp. 16, 18, 22, and 39.
„ „ *ingens*, Verrill. Proc. Amer. Assoc. Sc., 1873, p. 347, pl. ii, fig. 2.
„ „ „ idem. Peabody Acad. Sc., vi Rep., p. 60.

1875. *Nephthys incisa,* Ehlers. Zeitsch. f. w. Zool., xxv, p. 19.
1876. „ „ McIntosh. Proc. Roy. Soc., xxv, p. 216.
„ „ *ingens,* Verrill. U. S. Comm. F. and Fish., p. 583.
1879. „ *incisa* (= *ingens,* Stimpson), Verrill. C. List, U. S. Comm. F. and F., p. 7.
„ „ „ Webster. 32nd Rep. N. Y. Mus. Nat. Hist., p. 104.
„ „ *ingens,* idem. Trans. Albany Instit., p. 213.
1883. „ *incisa,* Levinsen. Vidensk. Meddel. Foren. Kjöben., p. 217.
1884. „ „ Webster and Benedict. Ann. Chæt. Mass. (from U. S. Rep. F. and F. for 1881), p. 702.
1893. „ „ Levinsen. Vidensk. Ud. 'Hauchs,' p. 338.
1900. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. v, p. 262.
1901. „ „ Whiteaves. Geol. Surv. Canada, No. 722, p. 83.

Habitat.—Connemara, Galway, 1871 (A. G. Moore).

Extends to Greenland ('Valorous' Expedition), East American shores (Verrill), Canada; 'Porcupine' Expedition, 1869, 6—80 fathoms; 'Porcupine,' 1870, nine miles off Cape Finisterre, 81 fathoms.

Head (Plate LVII, figs. 19 and 20) somewhat shield-shaped, nearly of the same breadth from front to back, though it is a little wider in the middle; marked by two pale lateral areas, which map out the surface. Anterior and ventro-lateral tentacles small and conical.

The mouth (Plate LVII, fig. 20) has a short filament towards the anterior part of each lip.

Proboscis with twenty-two rows of minute papillæ. A short median cirrus occurs in the smooth distal region both dorsally and ventrally (Malmgren).

The species is characterised by the dark brown bristles, the slight development of the lamellæ, and the wide space between dorsal and ventral divisions. The typical foot (Plate LXVII, fig. 4) presents in the anterior region of the body a rounded dorsal lamella, as in *N. longisetosa*, Œrst., though it has a different shape, is smaller, and extends nearly to the tip, whereas the lobe in the latter does not. At the tip of the foot and placed behind the former is the small leaf-like dorsal cirrus, acute at the tip, and separated only by a shallow notch from the somewhat massive short branchia, which is coiled with the tip outward and forward. The two processes (cirrus and branchia) move freely together, and are separated from the dorsal lamella. The spinigerous region is comparatively small, and is hidden between the rows of bristles. The fillet guarding the base of the barred bristles is developed into a considerable free flap superiorly and inferiorly, so that it and the dorsal lamella hold the bristles between them.

The inferior division presents a somewhat trifid condition, the posterior flap or lobe projecting sufficiently to guard the bases of the bristles, while the fillet in front is better developed and projects more superiorly. The conical spinigerous region is thus guarded by the rows of bristles and the flaps. The ventral cirrus is small and conical.

In the middle of the body the branchia becomes a short and slender process directed

inward and uncoiled, but the dorsal lamella is distinct. By-and-by only the dorsal cirrus is visible, the branchia having disappeared.

The anterior bristles (Plate LXXVI, fig. 15) are olive coloured, and have comparatively short barred tips, the widest part of the bristle being below the barred region. The capillary bristles are short, the blade rather broad, flattened, doubly curved, and the edge finely serrated (Plate LXXVI, fig. 14).

There is some hesitation in identifying this form with Malmgren's, and the condition of the specimen leaves room for further investigation.

Parasitic Infusoria occur on the species both in British and Arctic waters.

The *Nereis incisa* of O. Fabricius[1] has no connection with this family, being a *Nereis*.

So far as the figures and descriptions go, the *Nepthys minuta* of Théel[2] (1879) would appear to be closely related to this form. Not even the presence of ova in the small examples dealt with would lead to any other conclusion.

The *Nephthys atlantica* of Hansen[3] (1879) is another form which resembles this species.

10. Nephthys pansa, *Ehlers*, 1875.

Specific Characters.—Head as in allied forms (?). Anterior tentacles more slender than the posterior. The long, massive, and dark-coloured proboscis has three or four

Fig. 39.—Extruded proboscis of *Nephthys pansa*, Ehlers. After Ehlers. Enlarged.

triangular papillæ in each of the twenty-two rows. Foot short and thick. The dorsal division has a very slightly developed lamella. The cirrus and branchia arise from the under surface of the division. The cirrus is short and conical; the branchia forms a flat conical leaf. The bristles are dark. The inferior division is even shorter than the dorsal.

[1] 'Skr. Naturh. Selsk.,' 5, p. 160, Tab. iv, f. 1—3, 1799.

[2] 'Annel. N. Zembla,' p. 28, Tab. ii, f. 18.

[3] 'Nyt Mag.,' 24, p. 6, pl. iii, fig. 1 and 2, and 'Den Norske Nord-Exped.,' p. 31, Tab. iv, f. 1—4.

Synonyms.

1875. *Nephthys pansa,* Ehlers. Zeitsch. f. w. Zool., xxv, p. 40, Taf. iii, f. 1 and 2.
1881. „ „ Horst. Niederl. Arch. Zool. Suppl., Bd. 1, p. 7.

Habitat.—Dredged in 426—458 fathoms on July 30th, 1869, 51° 1′ N., 11° 21′ W., in the ‘ Porcupine ’ Expedition of that year.

Fig. 40.—Foot of *Nephthys pansa,* after Ehlers. Enlarged.

As only a single specimen of this form (about 66 mm. in length) was procured in the ‘ Porcupine ’ Expedition of 1869, the minute details of its structure are in need of further examination (Figs. 39 and 40). It seems to approach *Nephthys incisa* and *N. nudipes*, as Ehlers states, but whether it is a variety of the former or a distinct species appears to be an open question. The form of the branchia is certainly peculiar.

FAMILY VII.—Phyllodocidæ.

Head bluntly conical, trapezoidal, cordiform, or sub-oval; sub-tentacles two, as short subulate organs (Grube); tentacles two or three, the unpaired posterior. Eyes two, posterior, generally small, rarely four. Large eyes exceptional, and in some probably only in the epitokous forms. Body long and vermiform, rounded or depressed, segments numerous; caudal cirri two, short. Buccal segment with one to four pairs of tentacular cirri. Proboscis long, bipartite, with short papillæ; no jaws. Blood colourless. Feet as a rule simple, with one spine and a fascicle of compound bristles; capillary bristles in certain epitokous forms. Dorsal and ventral cirri foliaceous.

In the Phyllodocidæ the body-wall as a rule (Fig. 41) has much less massive muscles than in the Nephthydidæ. The cuticle lies on a thick cellular hypoderm within which are the basement-membrane and the circular muscular layer. The nerve-cords are in the mid-ventral line and more or less in approximation. The oblique muscles generally pass down on each side of the nerve-cords to be inserted into the basement-membrane, though these muscles may decussate quite beneath them and thus press the nerve-cords inward. No neural canals occur in this family in Britain. The dorsal longitudinal muscles are

separated by a cleft, though in some, as *Phyllodoce grœnlandica*, the separation at the dorsal margin seems to be incomplete. On the other hand the separation is pronounced in *Eteone picta*.

In this family the segmental organs consist of a nephridium, simple or ramified, shut off from the cœlom and covered with solenocytes. At the moment of reproduction a ciliated funnel appears, becomes connected with the nephridial tube, and conducts the sexual elements externally (Goodrich and Fage). It was probably the movement of the cilia of the segmental organ that Huxley [1] observed at the bases of the feet of *Eulalia viridis*.

Like other soft marine worms the Phyllodocids were placed under the Vermes Mollusca of Linnæus; and subsequent authors, for a considerable time, followed a similar course.

Savigny (1820) first separated this group as the eleventh genus of his Family Nereides, giving a fair account of the principal characters. He was followed by Œrsted, who made it the second division of the Nereids.

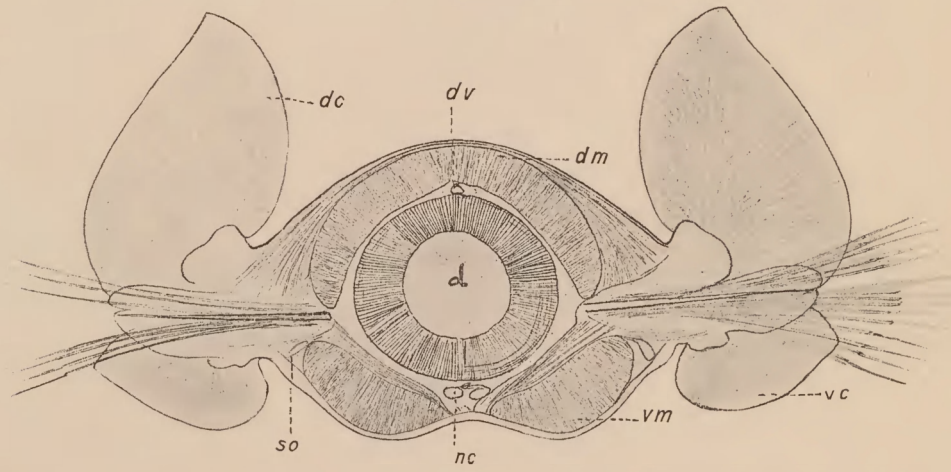

Fig. 41.—Section of the anterior region of *Phyllodoce lamelligera*, L. *d*, intestine; *dm*, dorsal longitudinal muscles; *dc*, dorsal cirrus; *dv*, dorsal blood-vessel; *nc*, nerve-cords; *so*, segmental organs; *vc*, ventral cirrus; *vm*, ventral longitudinal muscles.

De Quatrefages (1865) divided the family into two great groups, viz. the Phyllodocidæ proper, and the Alciopidæ, and he pointed out the distinctions between them. He arranged the genera of the Phyllodocidæ according to the structure of the feet, the nature of the tentacles, and the tentacular cirri.

The Phyllodocea were described by Kinberg (1865) as having the "antennæ and palpi" equal (for so he diagnosed the anterior tentacles), a single tentacle or none; pharynx long, protrusible and devoid of jaws, branchiæ foliaceous. He distinguished *Phyllodoce* from *Eulalia* by the presence of the median tentacle in the latter. He followed De Quatrefages in retaining *Carobia*.

Ehlers (1868) describes the family as possessing an elongated nearly equally segmented body. Head with tentacles and eyes. The two or three following segments bearing four pairs of tentacular cirri—with or without feet. The rest of the segments distinct. Feet not prominent, with jointed bristles; dorsal and ventral cirri leaf-like. Proboscis forming a long, closely papillose tube, and followed by a straight thick-walled stomach.

[1] 'Med. Times and Gazette,' July 26th, 1856.

He showed, as indeed Claparède had already done, the erroneous nature of the view of Dr. Williams[1] that the cœlomic fluid circulated in the leaf-like cirri. These consist of cuticular and hypodermic tissue with glands. The blood is coloured but without corpuscles. Dr. Williams, however, had correctly stated that the cirri are not permeated by blood-vessels.

Grube[2] gives the following arrangement for the Phyllodocidæ :—

I.—Tentacles five.

Notophyllum.

Eulalia, Sav.

(*a*) *Eulalia*, sans str.
Eumida.
Sige.
(*b*) *Pterocirrus.*

II.—Only two tentacles and two sub-tentacles.

Myriocyclum.
Kinbergia.
Chætoparia.
Phyllodoce.

Langerhans (1879) quotes Grube's classification of the family from the 'Annulata Semperiana,' viz.: (1) All the tentacular cirri springing from one segment—*Genetyllis*, Mgrn. (2) Three pairs of tentacular cirri from the same segment. A pair of bristle-bundles on the second segment—*Anaitis*, Mgrn. (3) Three pairs of tentacular cirri and bristle-bundles on first, or on first and second segments. One pair on the following :—*Carobia* (De Quatref.) Marenz. (4) Both of the first segments bear two pairs of tentacular cirri, as in *Phyllodoce Paretti*, *P. corniculata*, etc. In the second division with five "antennæ" (tentacles) and four pairs of tentacular cirri he has the following groups: *a*, Proboscis well furnished with papillæ: (1) All the tentacular cirri similar—*Eulalia*; (2) *Cirrus tentaculus ventralis* with a broad border—*Pterocirrus*. *b*, Proboscis with a ring of papillæ in front—*Eumida*. *c*, Proboscis smooth, without papillæ—*Sige*.

Levinsen (1883) followed Malmgren so far as to place the Phyllodociformia after the Aphroditiformia, the Nephthydidæ being a sub-division.

Pruvot, after a careful examination of the nervous system of the group, proposed in 1885 the following classification :—

I. Five antennæ. A. The first three dorsal cirri subulate: *Eulalia* (including Eulalia, Sav.; Kinbergia, Quatref.; Eracia, Quatref.; Eumida, Mgrn.).
B. The first two dorsal cirri subulate (*Eulalia incompleta*, Val.?; *E. obtecta*, Gr.?).

[1] 'Philos. Trans.,' 1852, ii, p. 627.
[2] 'Schles. Gesellsch.,' November 19th, 1879.

II. Four antennæ.
- A. The first three dorsal cirri subulate: *Phyllodoce* (Phyllodoce, Sav.; Lugia, Quatref.; Carobia, Quatref.).
- B. The first two dorsal cirri subulate:
  1. Dorsal cirri on all the segments;
  2. The third segment without a dorsal cirrus.
- C. Only the first dorsal cirrus subulate. The second without a dorsal cirrus (*Eteone*).

He alludes to the inextricable confusion in the classification of the Phyllodocidæ, and points out that the innervation of the dorsal and ventral cirri and their form give important data. The ventral cirri pass insensibly from the foliaceous to the subulate, but the dorsal change their type abruptly at the second or third segment. In other instances a segment deprived of dorsal cirri is intercalated between the dorsal subulate and the ventral foliaceous. He insists on the fact that the appendages of the buccal segment (so-called tentacular cirri) receive their innervation from the first ventral ganglion. Moreover, he regrets that the name "buccal segment" should be applied to a double ring as in the Eunicidæ, or, as in the Phyllodocidæ, to three segments which have distinct appendages and nerve-supply, whereas the first feet of the Nephthydidæ and Opheliaceæ receive their nerve-supply from the ganglion of the œsophageal connectives. He would therefore arrange the cephalic segments thus: a *stomato-gastric* with its appendages—the palps; an *anterior antennary* carrying the two anterior lateral antennæ; a posterior antennary bearing the median and the two posterior lateral antennæ. The median antenna (tentacle) receives a nerve-trunk formed by the union of two nerves, and hence he supposes that the median was originally paired.

Gravier (1900) describes the Family (in which he includes *Lopadorhynchus* and the Alciopidæ) as having a head (prostomium) provided generally with four or five tentacles (his antennæ). First segments of the body, in variable number, with reduced parapodia or modified tactile organs. Foot in the other segments uniramous (exceptionally biramous). Dorsal and ventral cirri foliaceous. As a rule—compound bristles. Tail (pygidium) with two subulate or foliaceous cirri.

He divides the group into three tribes, the first—or Phyllodocidæ proper—are littoral, the second and third—Lopadorhynchidæ and Alciopidæ—are pelagic.

He classifies them after Grube and others according to the number of their tentacles and tentacular cirri, thus:—

Four tentacles	Two tentacular cirri (one on each side)		*Eteone.*
	Three ,, ,,		*Mystides.*
	Four ,, ,,		*Phyllodoce.*
	Five ,, ,,		*Kinbergia.*
Five tentacles	One tentacular cirrus		*Porroa?*
	Four tentacular cirri	foot uniramous	*Eulalia.*
		,, biramous	*Notophyllum.*

Development.—Alex. Agassiz[1] has described the young stages of a form which he calls *Phyllodoce maculata*, from the condition in which the larva has only a few indistinct

[1] 'Ann. Lyceum Nat. Hist. New York,' viii, p. 333, pls. x and xi, figs. 46—51, 1866.

segments behind the enlarged head, to that in which there are about fifteen rings behind the prostomium, and the anal cirri are present.

Claparède and Mecznikow[1] (1869) give an account of the development of *Phyllodoce* at Naples and Odessa, but it is not known if the same species is referred to. The youngest stage is like that of *Nephthys*—monotrochous, the anterior portion of the larva being larger than the posterior, and a characteristic curved tuft (Naples) or tufts (Odessa) of cilia occur on the ventral surface anteriorly as Busch noticed. Segmentation begins behind the mouth, a pharynx appears in front, bristles form in the feet, tentacles, and tentacular and dorsal cirri develop, the alimentary canal becomes deep green, and there are short anal cirri—this stage being only a little younger than that procured at St. Andrews on June 15th, 1898, and figured (Plate L, fig. 6).

Claparède (1868) notes that the eggs in the Phyllodocidæ penetrate into the extruded proboscis.

The young *Phyllodoce maculata*, according to Häcker (1896), is on the second day a protrochophore, on the fifth day a typical monotrochous trochophore (McIntosh), tenth day an early metatrochophore, and at four weeks with specific characters (Agassiz).

He further describes a telotroch trochophore of a *Phyllodoce* from Naples in spring, in which what he calls the umbrella (viz. the prostomium) is about half the length of the body. It bears a large tuft of cilia on the ventral surface, a larger and a smaller pigment-speck (eye) on each side in front of prototroch, and a broad belt (paratroch) posteriorly. The gut (mitteldarmes) is greenish and shows a pair of sac-like appendages.

Another form is in a more advanced condition (metatrochophore), with eight tentacular cirri (rudimentary), and indications of a number of segments posteriorly. The prototroch has a brown band of pigment before and behind it. A larger and a smaller eye occur in each side of the prostomium, the gut is greenish, and the tail is disc-like.

He mentions and figures a "Scheitelorgan" of the larva of *Phyllodoce*, like a ciliated pigmented cell in a pit.

He homologises the anterior pair of antennæ with the Scheitelantennen of the larva, whilst the unpaired sense-organ on the ventral side of the umbrella (prostomium) he thinks the Scheitelorgan.

The same author[2] describes a Nectochæte stage of *Phyllodoce* with four tentacular cirri, but without eyes or tentacles, and therefore younger than that in Fig. 6, Plate L.

Gravier (1900) observed that the Phyllodocidæ fed on Terebellidæ, Spionidæ, Hermellidæ, Sabellidæ, Syllidæ, and even their own species (*Eulalia viridis*), and De St. Joseph found another *Eulalia* in the intestine of *Eulalia pallida*.

De St. Joseph mentions the occurrence of a female Copepod on *Eulalia pallida*; *Herpyllobius arcticus*, Steenstrup and Lutken, on *Pterocirrus macroceros*, Grube; and one of the Orthonectidæ, viz. *Rhopalocera pterocirri* in the same species. Gravier met with colonies of *Vorticella* on *Phyllodoce mucosa*. Gregarines of various kinds are common in the intestine—fixed to the epithelial lining, as in the Nemerteans.

The Phyllodocidæ are to a large extent littoral, frequenting the tidal region, under stones, in moist sand near low water, on mussel-beds, in fissures of rocks, as well as in the

[1] 'Zeitsch. f. w. Zool.,' Bd. xix, *sep. abdr.* p. 27, Taf. xv, fig. 2.

[2] 'Plankton Exped. pelag. Polychæt.,' p. 11, Taf. i, f. 5 and 5*a*, 1898.

laminarian region, on oyster-shells and similar ground (Gravier). *Genetyllis* and *Phyllodoce Paretti* and other forms, however, range to deep water—*Genetyllis oculata* of the 'Challenger' coming from a depth of 500 fathoms. At the time of reproduction some become pelagic, and develop a dorsal series of long natatory bristles.

The colours of those from the deep sea are of the same character as those from shallow water.

Genus XXX.—NOTOPHYLLUM, *Œrsted*, 1843. Char. emend.

Body linear, tapered gently at each extremity, dorsum convex, ventral surface grooved and flattened. Two considerable eyes. Tentacles five, four anterior and one median. Tentacular cirri on two segments (Grube), four on each side, two shorter in front and two longer posteriorly. Superior division of the foot little differentiated, yet with a spine and a few simple bristles, and supporting a large irregularly reniform dorsal cirrus, the series being imbricate and almost covering the back and the feet. The inferior division has a much smaller vertical and somewhat reniform lamella, and a spine with many bristles, the shafts of which are curved distally and end in a dilated region having a series of spikes guarding the base of the long sabre-shaped distal blade, which has its edge very minutely serrated. The ventral border of the foot has a prominent process or mamilla, to which the inner edge of the lamellar cirrus is attached. Ganglia of the ventral cords large, resting on the sheath, with the circular muscular fibres externally, the oblique passing down on each side. In the interganglionic areas the insertions of the oblique muscles are nearer each other. The dorsal longitudinal muscles are completely separated and very broad. The ventral longitudinal muscles are compact.

Notophyllum is said by Gravier[1] to have a small nerve-cord running above the two great cords. The sections of the British forms did not show this clearly, and thus differed from those of *Nereis diversicolor*, in which a third interganglionic cord with a neural canal is present.

1. NOTOPHYLLUM FOLIOSUM, *Sars*, 1835. Plate XLV, fig. 1; Plate LXVII, fig. 5—foot; Plate LXXVII, fig. 21—bristles.

Specific Characters.—Head forming a rounded cone, with two considerable eyes, occasionally with cuticular lenses. A ciliated flap or lappet on each side of the head posteriorly. Tentacles, five; two occur on each side of the snout, are flattened, and somewhat pointed and shorter than the median. Two shorter and two longer tentacular cirri on each side. All these processes, as well as the head, are greenish-yellow with darker grains. Body linear, gently tapered anteriorly, convex dorsally, flattened ventrally, with a rectal papilla in the centre posteriorly. Proboscis smooth. Dorsal lobe of the foot directed upward and prolonged inward as a narrow process from which the great and more or less horizontal and irregularly reniform dorsal lamella (cirrus) springs. A slender spine and a few tapering smooth bristles occur towards the ventral edge of the

[1] 'Bullet. Sc. Fr. Belg.,' 29, p. 331, pl. xix, f. 19.

region. Inferior division with a smaller obovate or irregularly reniform lamella, and many slightly curved bristles with tapering terminal processes serrated at the edge. The tip of the shaft is dilated and fibrillated, with a distal series of spikes. Body pale, iridescent, darker on the ventral surface. The dorsal lamellæ are bordered with dark brown, dotted with white grains, and show a fiery iridescence.

Synonyms.

1835. *Phyllodoce foliosa,* Sars. Beskriv. og Iagttag, p. 69, t. 9, f. 26.
„ „ „ idem. Nyt Mag., 7B, p. 386.
1843. *Notophyllum viride,* Œrsted. Consp. Annul., p. 26, f. 87.
„ „ „ Koren. Nyt Mag., ix, p. 95.
1844–45. „ *polynoides,* Œrsted. Kroyer's Nat. Tids. (Forteg. ved. Dröbak), p. 409, pl. ii, fig. 12.
1851. „ „ Grube. Fam. Annel., pp. 57 and 129.
„ „ *foliosum,* idem. Ibid.
1853. „ „ Sars. (Fauna of Adriatic). Nyt Mag. f. Nat., 7B, p. 386.
1856. „ *polynoides,* Koren. (Norske Fjords). Nyt Mag. f. Nat., 10B, p. 95.
1865. „ „ Malmgren. Nord. Hafs-Annul., p. 93, T. xiv, f. 33.
„ „ *viride,* De Quatrefages. Annel. II, p. 153.
„ „ *polynoides,* idem. Ibid., p. 154.
„ „ *foliosum,* idem. Ibid., p. 162.
1867. „ *polynoides,* Malmgren. Annul. Polych., p. 19.
„ „ „ Malm. Zool. Obser., 7H, p. 77.
1869. „ „ McIntosh. Trans. R. S. Edinb., xxv, p. 410, pl. xv, figs. 9, 9*a*, and 9*b*.
1873. *Notophyllum polynoides,* Kupffer. Jahresb. Comm. Deutsch. ('Pommerania'), p. 150.
„ „ *foliosum,* Sars. Bidrag. Christ. Fauna, iii, p. 24 (sep. copy).
1874. „ *polynoides,* Malm. K. Vet. o. Vitt. Samh. Göteb. Hand., xiv, p. 79.
„ „ *foliosum,* McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 119.
1879. „ „ Tauber. Annul. Danic., p. 86.
1883. „ „ Levinsen. Vid. Meddel. Foren. Kjöbenh., 1883, p. 204.
„ *Trachelophyllum Lütkenii,* idem. Ibid., p. 52.
1893. *Notophyllum foliosum,* idem. Vidensk. Udbytte. 'Hauchs,' p. 326.
„ „ „ Marenzeller. Zool. Ergeb., ii, p. 7, Taf. ii, f. 4.
1901. „ *polynoides,* McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 223.
1904. *Eulalia obtecta,* Allen. Journ. M. B. A., N.S., vol. vii, p. 223.

Habitat.—Shetland (J. G. J.); Lamlash Bay, Arran (Dr. Howden); Bay of Galway (Dr. E. P. Wright); St. Andrews Bay, deep-sea fishing boats (E. M.); common in dredgings, Plymouth (Allen).

Norway (Œrsted, Sars, Norman, and Koren); Sweden; Adriatic (Sars); Marseilles (Marion).

Head forming a rounded cone with two large dark eyes, which occasionally show a central lens-like thickening; between them is the well-developed and pointed median tentacle which generally projects in a slanting direction—forward and upward. On each side posteriorly a somewhat flattened lobe or lappet extends backward and slightly outward,

the median region having darker pigment. The absence of these amongst other points in Malmgren's description and figure had probably misled Levinsen. The oral tentacles (two on each side) are finely pointed, somewhat flattened, and shorter than the median. The buccal segment has two longer and two shorter tentacular cirri on each side, the former being frequently carried along the dorsum under the two anterior lamellæ (cirri), and over those behind. All these processes, like the head, are of a pale greenish yellow with darker grains. The mouth opens on the under surface, the prostomium in front having a ridge on each side with a hollow between, thus forming a channel leading to the mouth. The under lip resembles a somewhat broad cushion.

Body linear, from $1\frac{5}{6}$ in. to $2\frac{1}{2}$ in., and from 80—110 segments, gently tapered at head and tail, and for the most part overlapped dorsally by the large imbricate cirri. The dorsal surface is convex, and each segment is crossed by several impressed lines, arranged symmetrically. The ventral surface is flattened, and frequently grooved in the centre. The rather small anterior region of the proboscis in protrusion forms an ovoid or somewhat elliptical mass, which, under a lens, is apparently smooth, though its surface is covered with minute granules under a higher power. It is thus practically smooth. The tail is terminated by a blunt papilla indicating the vent.

The dorsal cirri are bordered with brown which increases in depth in those kept in confinement, and are speckled with white grains. The body is pale, iridescent dorsally, darker on the ventral surface, which is marked by minute dark grains on each segment. The lobes of the feet have blackish tips, the inferior papillæ forming a row of rounded granular spots on each side. During the various motions of the animal the dorsal cirri present very fine iridescence of a fiery hue, as if from the reflection of red-hot coal. The softness and beauty of the species is accurately indicated in the coloured figure.

The dorsal lobe of the foot (Plate LXVII, fig. 5) is directed upward, with a pointed prolongation inward, to which the great lamella is attached. The spinigerous papilla is at its outer border, but its translucent, tapering bristles are few (about two) and smooth. This lobe bears the large, more or less horizontal, dorsal cirrus which is described by Malmgren as elliptico-subrectangular or unequally reniform. The new or regenerated lamellæ are more or less reniform, especially posteriorly, whilst the older cirri incline to an elliptico-subrectangular shape. The new lamellæ are pale, smooth at the edges, and minutely speckled with white grains. When fully developed the edge presents slight frills, and the coloured border is rich blackish-brown, which glistens now and then with the purplish-red iridescence of the surface of the lamella, enlivened here and there by groups of white grains. The first lamellæ are smaller, and more elongated than those behind.

The inferior division has a trunk not much less than the dorsal, and it carries a small obovate or irregularly reniform, more or less vertical, cirrus, the free border of which is marked by blackish brown pigment. Internal to the lamella, and connected with it, is a large lobe, or papilla, which is also marked by black grains, and thus a conspicuous moniliform row occurs along each side of the ventral surface. The first pair of ventral lamellæ are nearly lanceolate, and are borne at a different angle from their successors, forming a pair of ventral processes, which stretch behind the labial cushion. This modification of the ventral division is common in the Annelids.

The ventral bristles (Plate LXXVII, fig. 21 *a*, *b*, *c*) spring from the tip of the lobe, and they are seldom visible from the dorsum, even during the movements of the animal. The shafts of the bristles have a distinct curve, and striæ pass from the base of the spikes for a short distance obliquely downward. On each side of the dilated end of the shaft a series of short spikes occur, thus, as it were, embracing the base of the terminal sabre, which is of moderate length and finely serrated at the edge.

Reproduction.—Two female specimens, procured by my late friend Dr. Howden of Montrose, at Lamlash, Arran, in August, were laden with mature eggs.

The species is more sluggish than the ordinary examples of the Phyllodocidæ, and, when irritated, coils its body in a somewhat stiff manner. The colours, after seven months' confinement in Perthshire, were considerably altered, the dorsal cirri becoming much darker—brownish green, and the burnished-red iridescence was not visible.

Louis Fage[1] shows that the nephridia proper of this form resemble generally those of *Eulalia viridis*, but that the solenocytes are studded with structures like palpocils so that they are hirsute.

A figure given in Montagu's MS. drawings (1808) in the library of the Linnean Society (Plate LXIV, fig. 5) appears to refer to this species. Only three tentacular cirri are observed on each side. Though thus early indicated, this form was not recognized recently at the Plymouth Laboratory, being confounded with *Eulalia*.

The early description of Sars (1835), as given in the 'Beskrivalser,' leaves little doubt that this was the species before him, the only ambiguous feature, indeed, being the outline of the inferior lamella (cirrus), a condition, however, probably due to the state of the specimen. Even the ventral papilla internal to the latter is clearly shown. It would be difficult to find any other form to answer the clear description of the author.

Œrsted (1843), in his 'Conspectus,' apparently without a knowledge of the previous paper of M. Sars, correctly separated the genus from *Phyllodoce* since it has a bifid foot. He overlooked the fifth (median) tentacle, but he described the ventral mamilla of the foot. There is little to separate his descriptions of *Notophyllum viride* and *N. longum*, and the somewhat elementary figures do not give much aid in this respect. His fig. 87, Plate V, however, clearly refers to *N. foliosum*.

In his earlier publication ('Nordiska Hafs-Annul.,' 1865) Malmgren gave a good description of the genus, improving on the brief account of Œrsted. He, however, did not associate the *N. polynoides* of the latter with the *N. foliosum* of Sars, and, while in his later publication ('Annel. Polychæt.,' 1867) he grouped the *N. longum* of Œrsted with the present form, he appeared to have doubts about the species originally described by Sars. He had reasons for excluding Schuarda's *Notophyllum*[2] from his generic description.

The *Notophyllum japonicum* of Marenzeller[3] appears to approach the northern species very closely.

The *Trachelophyllum Lutkeni* of Levinsen (1883) is this species.

[1] 'Ann. Sc. Nat.,' 9e sér. iii, p. 281, figs. 6 and 7, 1906.

[2] 'Wirb. Thiere,' ii, p. 87.

[3] 'Sudjap. Annel.' (op. cit.), p. 126, Taf. iii, fig. 1, 1879.

Marenzeller[1] describes and figures two ciliated lappets on the head (one on each side). They are single in front, bifid behind. He therefore considers the *N. alatum* of Langerhans to be the same form, especially as Levinsen mentions them in the northern species.

Allen finds this species common in dredgings off Plymouth, but all the examples are small, though adult. Like certain northern forms the size diminishes in southern waters.

Genus XXXI.—Eulalia, *Œrsted*, 1843.

Head furnished with five tentacles, the median arising in front of the eyes.[2] First segment free from the head. Four pairs of tentacular cirri with or without feet beneath (first pair attached to first segment, Œrst.). Dorsal cirri (Œrsted's branchiæ) arranged in various ways. Ventral cirri nearly horizontal. Cerebral lobes with a special ophthalmic lobe; median tentacle supplied by two nerves which unite at its base; stomato-gastric branches arising from œsophageal connectives (Pruvot).

Claparède includes *Eumida*, Malmgren, and *Eracia*, De Quatrefages (= *Eumida*) under this genus. He rather approves of the vagueness of the descriptions of the segments bearing tentacular cirri since it is impossible to fix hard and fast limits to these.

Grube (1879) defines *Eulalia* as having the dorsal cirri lancet-shaped or pointed, more or less constricted at the base.

Sub-genus Eulalia, sans str., Grube, 1879.

Dorsal cirri oval-elongate, not pointed.

1. Eulalia bilineata, *Johnston*, 1840. Plate XLIII, fig. 5 (var.); Plate L—fig. 4, head; Plate LXVII, figs. 6 and 7—foot, etc.; Plate LXXVII, figs. 23 and 24—bristles.

Specific Characters.—Head somewhat longer than broad; eyes two, black, placed towards the posterior border of the head. Anterior tentacles subulate, rather short. Median tentacle very short, arising just in front of eyes. Tentacular cirri likewise somewhat short—only a little longer than the diameter of the body. Length from one and a half to three inches, the body being tapered anteriorly, and diminished more distinctly posteriorly, where it terminates in two subulate or sometimes clavate cirri. Colour dull yellowish, greenish-yellow, or straw, the proboscidian region of the body being paler. Ventral surface slightly greenish, a pale greenish band, most distinct anteriorly, passing

[1] "Polychæt. des Grundes.," 'Zool. Ergebn.,' ii, p. 7, Taf. ii, fig. 4.

[2] The exceptional position of the median tentacle, viz. at the extreme posterior border of the head, in Ehlers' *Eulalia imbricata*, is noteworthy.

along the base of the feet, and in some a faint, interrupted double line occurs in the middle. Ripė females are of a fine pea-green, a faint, interrupted double line extending along the middle. On the other hand, the ripe males are whitish-yellow and the posterior region of the body is enlarged. At the base of each foot dorsally is a dark speck. The dorsal cirrus is ovato-lanceolate, and the ventral has a similar shape. It (ventral) is not so prominent as the setigerous process, which bears bristles having the dilated ends of the shafts distinctly spinous. The shape of the foot approaches that in *E. trilineata*.

Synonyms.

1840. *Phyllodoce bilineata*, Johnston. Ann. Nat. Hist., iv, p. 227, pl. vi, f. 7—10.
1851. „ „ Grube. Fam. Annel., pp. 56 and 129.
1865. „ „ Johnston. Cat. Brit. Mus., p. 177, pl. xvi, f. 7—10.
„ „ „ De Quatrefages. Annel., ii, p. 137.
„ *Eulalia* „ Malmgren. Nord. Hafs-Annul., p. 99, Tab. xiii, f. 26.
1867. „ „ idem. Annul. Polych., p. 25.
1874. „ „ McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
„ „ „ Malm. K. Vet. o. Vitt. Samh. Göteb. Handl., xiv, p. 80.
1875. „ „ McIntosh. Invert. and Fishes, St. Andrews, p. 120.
1879. „ „ Tauber. Annul. Danic., p. 89.
1881. „ „ Langerhans. Canar. Annel., Nov. Act. Leop., xli, p. 113.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöben., p. 205.

Habitat.—On oysters near Prestonpans, in the Firth of Forth; Berwick Bay, rare (Dr. Johnston); in fissures of shale and sandstone north of the pier, St. Andrews; under stones at the East Rocks, St. Andrews, where it is abundant (E.M. and R.M.), and between tide-marks, St. Peter Port, Guernsey; dredged also in the Sound of Harris in 6—8 fathoms; under the crust of *Corallina officinalis* in company with *Polydora*, near low-water mark, Lochmaddy, North Uist.

Finmark (Malmgren). Canaries (Langerhans).

Head (Plate L, fig. 4) somewhat ovoid, longer than broad. Eyes two, black, placed towards the posterior border of the head and larger than in Malmgren's figure. Anterior tentacles subulate, rather short; median tentacles very small, arising just in front of the eyes. The tentacular cirri are likewise somewhat short, being only a little longer than the diameter of the body, and therefore Dr. Johnston's form—with these organs three times the diameter of the body—differs.

Body from one and a half to three inches in length, tapered anteriorly and more distinctly diminished posteriorly, where it terminates in two subulate cirri. The general colour is dull yellowish, greenish-yellow, or straw-coloured, with a distinct greenish-olive or brownish line along each side, rather within the bases of the feet, and often presenting a crenated appearance from the folding of the segments—especially anteriorly. The proboscidian region of the body is paler from the hue of the proboscis. The ventral surface is slightly greenish, a pale-greenish band passing along the bases of the feet to the posterior end, but being most distinct anteriorly. In some examples a faint, inter-

rupted double line extends along the middle. When filled with ova, *e.g.* in May, they are of a fine pea-green hue with the two dark-brownish lines. On the other hand, the ripe males (July) are whitish-yellow from the contained sperms, the posterior region of the body especially being enlarged. In spirit-preparations a dark speck is observed on the dorsum at the base of each foot; whilst in life a dark spot occurs on each side of the segments ventrally.

The typical foot somewhat resembles that in *Eulalia tripunctata*, and it is doubtful if the species could be distinguished readily by the outlines of the feet when mounted. The bristles (Plate LXXVII, fig. 23 *a* and *b*) are also very similar, the only feature being the presence in this species (*E. bilineata*) of a more distinctly spinous region at the enlarged distal end of the shaft, the slightly longer bristles and their more evident curvature.

Both dorsal and ventral cirri are pale and ovato-lanceolate. The ventral is not so prominent as the tip of the setigerous process.

Reproduction.—Both males and females are ripe in the summer months from May to July, the females in this condition being pea-green, and the males whitish-yellow—the posterior half of the body being much enlarged. The sperms (Plate LXVII, fig. 7) are comparatively large, have a globular head and a long tail. Their vitality seems to be considerable.

Moreover the feet of the males have long simple bristles (Plate LXXVII, fig. 24) dorsally in addition to the ordinary forms, so that an epitokous condition is present. They also swim readily: even the separate fragments pass swiftly through the water with a wriggling screw-motion. In the ripe forms the muscular walls of the body are thinner.

Habits.—A restless species—constantly pushing its snout here and there and throwing its mobile body into various folds and loops. It is common in the tidal region, lurking in crevices of the fissured rocks along with *Spio*, in cavities on the under surface of stones, and under empty shells to which it adheres. It is slender and graceful, moving in captivity about the vessel swiftly and with somewhat regular undulations.

In his original description in 1840 Dr. Johnston omitted the short median tentacle, but in the 'Catalogue of Worms in the British Museum' he adds that Mr. Dyster observed it.

The *Eulalia saxicola* of De Quatrefages [1] appears to be most nearly related to this form.

Such species as the *Eulalia gracilis* of Verrill [2] approach this form in the closest manner, and further examination may render separation unnecessary.

The *Eulalia quadrilineata* of De St. Joseph [3] from Cape Coz is an allied species.

An Eulalia from deep water off St. Andrews Bay, which has only been seen in spirit, differs from the foregoing species in its larger size, greater development of the dorsal lamella, and the slightly broader tips of the bristles. The head is somewhat ovate, with the long diameter antero-posterior, and with a pair of small black eyes situated near the posterior border. The anterior end is small, and the body gently dilates from before

[1] 'Annel.,' ii, p. 119, 1865.

[2] 'Invert. Vineyard Sound, U.S. Comm. F. and F.,' 1878.?

[3] 'Ann. Sc. Nat.,' 8e sér., t. v, p. 327, pl. xviii, figs. 127—130, 1898.

backwards, and probably again diminishes towards the tail, but the posterior region is absent. At the tenth foot the dorsal lamella is ovate with a somewhat blunt tip. The setigerous process is bifid, and the ovate or reniform ventral lamella extends beyond its tip. The dorsal lamella considerably increases in size at the fortieth foot, but the ventral remains nearly the same. The shafts of the bristles (Plate LXXXIV, fig. 5) are somewhat slender, with a slight curve distally, the enlargement and its spines resembling the parts in *Eulalia bilineata*. The terminal process begins with a broad base, and rapidly diminishes to a hair-like tip. The edge is finely serrated, and the serrations appear to be continued on the shaft a considerable distance downwards.

This may be a large example of *E. bilineata*, and is a male laden with sperms.

2. Eulalia nebulosa, *Montagu*, MS. (1808). Plate XLIII, fig. 6; Plate LVIII, figs. 1 and 2—head; Plate LXVII, figs. 8 and 9—feet; Plate LXXVII, fig. 1—bristle.

Head broadly conical, the median tentacle arising a little in front of the eyes, which are large and blackish-brown. Tentacles pale, with a dark speck at the base of the median, one at the base of the anterior pair of tentacular cirri, and another on the enlarged part of the latter pair. Body five to ten inches long, somewhat soft in texture, tapered considerably anteriorly and more evidently so posteriorly, where it terminates in an attenuated tail with the anus at the tip. Only one or two examples—out of dozens—presented two small and somewhat clavate anal cirri. The finely tapered tail is characteristic. It is of a dull yellowish or pinkish hue, minutely speckled on the dorsum with dark green touches which are symmetrically arranged—a long lozenge occurring in the middle line in front and a bar behind—stretching between the feet of opposite sides. Montagu figures a row of six spots at the segment-junction, and four on the space behind. Ventral surface pale. Proboscis very long, with a rasp-like series of minute papillæ. Dorsal cirrus large and cordate, the margin dull green, and some have a **V**-shaped mark in the centre of the process and one or two rows of dark specks above it. The pedicle is large. Setigerous lobe bifid; bristles pale, with an enlarged and bevelled tip, while the terminal blade is moderately long, and with a finely serrate edge. The ventral cirrus is ovate-acuminate.

Synonyms.

(1808). *Eulalia nebulosa*, Montagu. MS., Linnean Soc.
1860. *Phyllodoce* (*Eulalia*) *punctifera*, Grube. Arch. f. Naturges., t. i, p. 83, Taf. iii, f. 5.
1867. „ *nebulosa*, Parfitt. Trans. Devon Assoc., ii, pt. 1, p. 233 (near Griffithsiæ, *fide* Parfitt).
1885. *Eulalia punctifera*, Carus. Fauna Medit., ii, p. 242.
1888. „ „ De St. Joseph. Ann. Sc. Nat., 7e sér., t. v, p. 289, pl. xii, f. 155—157.
1897. „ „ Gravier. Bull. Sc. Fr. Belg., t. xxix, p. 308, pl. xvi, f. 17; pl. xvii, f. 1, 11, 12; pl. xviii, f. 5; pl. xix, f. 1—5, 20; pl. xx, f. 10, 11; pl. xxiii, f. 2.
1904. „ „ Allen. Journ. M. B. A., n.s., vol. vii, p. 223.

Habitat.—Abundant at St. Peter Port, Guernsey, and at Herm, under stones between tide-marks amongst muddy gravel, and occasionally in mud under dead limpet-shells. Col. Montagu dredged specimens about four inches long at Torcross in 1813. Plymouth (Allen). Mediterranean (Grube).

Head (Plate LVIII, figs. 1 and 2) broadly conical; the median tentacle springing from the surface a little in front of the eyes, which are two, large, blackish-brown. Tentacles pale, with a dark speck at the base of the median, one at the base of the posterior pair near the eyes, and another at the enlarged part of the latter pair. The tentacles and cirri generally are of moderate length and somewhat thick. In many preserved specimens a dark brown speck of pigment remains on each side just in front of the median tentacle.

Body five to ten inches long, somewhat soft in texture, tapered considerably anteriorly but much more so posteriorly, where it ends in a long slender tail, having two small cirri at the tip, which, however, are rarely seen. It is of a dull yellowish or pinkish hue minutely speckled on the dorsum with dark green touches, which are symmetrically arranged—a long lozenge occurring in the middle line in front, and a bar behind—stretching between the feet of opposite sides. Montagu's figure shows one row of six spots at the segment-junction, and another series of four on the space behind. Sometimes the hue of the dorsum is less pale orange and more of a dull yellowish tint. The ventral surface is pale. After preservation in spirit a narrow transverse bar (dorsally and ventrally) characterizes each segment-junction. It is wider in the middle and tapers off at each margin.

In the coloured figure (which I owe to the courtesy of Dr. Allen of the Plymouth Marine Laboratory) each segment is marked by a transverse row of brownish dots, the outer on each side being the larger, and behind is a row of smaller dots.

The proboscis (Plate LVIII, fig. 2) is remarkable for its great length, narrow cylindrical form, and dense series of minute papillæ, so that its surface is rasp-like. In some the entire alimentary apparatus seems to be ejected (in spirit) through a rupture of the body-wall. The fixed end of the proboscis is firm and muscular, and is succeeded by a short glandular region with thinner walls; then the firm proboscis increases in diameter to its junction with the alimentary canal proper, a well-marked constriction occurring at this point. The first part of the region is firm, but it soon becomes thin and glandular. The specimens are somewhat softened.

The contents of the alimentary canal were sandy mud containing foraminifers, masses of *débris* of *Nephthys* with bristles, bristles of other annelids, and sponge-spicules.

The typical foot (Plate LXVII, figs. 8 and 9) presents dorsally a large and somewhat cordate cirrus, the colouration of which is subject to some variation. Thus many have a dull green border dorsally, whereas in those from Herm the centre of the lamella had a dark V-shaped mark, with one or two rows of dark specks above it. The lamellæ spring from a prominent peduncle (ceratophore), which in the preserved specimens forms a feature of the dorsum—especially as in many they are devoid of lamellæ. The lamellæ vary a little in shape at the base, from the nature of the supporting peduncle, the anterior (at the tenth foot) presenting a truly cordate base, whereas at the ninetieth foot the broad base is nearly flat. The hypodermic tissue is arranged in a fan-like manner from the base

outward on both sides in each papilla. The setigerous process is deeply bifid, the upper limb being the larger. The pale bristles have a slightly bent shaft with an enlarged, bevelled, and slightly bifid tip, which is more or less smooth, for articulating with the terminal whip, which has a moderately elongate, flattened blade with a finely serrate edge (Plate LXXVII, fig. 1).

Attached somewhat behind the inferior border of the setigerous process is the ovate acuminate inferior cirrus, the edge of which is rounded internally and pointed externally. The hypodermic streaks run from the base outward to the free edge. The tip does not extend so far outwards as that of the setigerous process.

Reproduction.—In the posterior region of a large example in July, masses of eggs, apparently ripe, occurred. When distended with ova, as in July and August, the body-wall in section is very thin, the dorsal and ventral longitudinal muscles forming narrow bands, and even the nerve-cords join in the general flattening. The wall of the alimentary canal, however, remains of considerable thickness.

The species is characteristic of the southern shores, and is soft and delicate. Slight interference results in rupture and disintegration—especially in warm weather. Thus in few examples is the tail furnished with cirri, and on the long, tapered region the feet are very minute, leaving the terminal anus prominent.

3. Eulalia viridis, *O. F. Müller*, 1776. Plate XLIII, fig. 7, var. *aurea*; Plate XLIV, fig. 1; Plate XLIV, fig. 5, var. *ornata*; Plate LVIII, fig. 3—head; Plate LXVII, figs. 10 and 11—feet; Plate LXXVII, figs. 2 and 2 *a*—bristles.

Specific Characters.—Head bluntly conical and pale throughout; eyes two, black, and occasionally an additional speck occurs external to each. Tentacles subulate, slightly tapered. First pair of tentacular cirri somewhat lanceolate, tapered, and attached to the first segment on each side; the second and third are longer, and are attached to the succeeding segment, whilst the fourth springs from the third segment. Body linear, one to four inches long, slightly tapered anteriorly and more so posteriorly, and terminating in two lanceolate caudal cirri. Colour of a rich deep green, or grass-green, paler in the region of the proboscis, and dorsally each segment has two dark belts. Ventral surface marked by a median moniliform line of dark olive, and posteriorly with a dark touch at each foot. Proboscis with twenty-two or twenty-three papillæ terminally in extrusion, but a variety has only fourteen.

Dorsal cirrus lanceolate with a tapering tip; setigerous region short; bristles in two groups pale, the enlarged ends of the shafts minutely spinous, the terminal blade short, rapidly tapered, and with bold serrations on the edge.

Ventral cirrus ovate and slightly acuminate, projecting a little beyond the tip of the setigerous lobe.

Synonyms.

1767. *Nereis viridis*, Linn. Syst. Nat., ed. 12, i, pt. 2, p. 1086.
1776. „ „ O. F. Müller. Zool. Danic. Prodr., No. 2636.

1870. *Nereis viridis,* Fabricius. Fauna Grœnl., p. 297.
1789. „ „ Bruguière. Encycl. Méth., Vers, i, p. 134, Tab. lvii, f. 7—11.
1791. „ „ Linn. Gmelin's edit. (13), i, pt. 6, p. 3117.
1799. „ „ Adams. Trans. Linn. Soc., v, p. 8.
1800. *Die grüne Nereide,* O. F. Müller. Naturges. einiger Wurm-Arten, p. 162, Taf. ii, f. 1—6.
1802. *Nereis viridis,* Bosc. Vers, i, p. 171.
1806. „ „ Turton's Gmelin, p. 88.
1807. „ „ Ibid. Brit. Fauna, p. 135.
1812. „ „ Pennant. Brit. Zool., iv, p. 94.
1825. „ „ De Blainville. Dict. Sc. Nat., t. xxxiv, p. 445.
1828. *Nereiphylla viridis,* idem. Dict. Sc. Nat., t. lvii, p. 466, pl. xiii, f. 2.
1833. *Phyllodoce clavigera,* Aud. & Ed. Ann. Sc. Nat., t. xxix, p. 248, pl. xvi, f. 9—13.
„ „ *Gervillei,* idem. Ibid., p. 250.
1834. „ *clavigera,* idem. Annel., p. 226, figs. 9—13.
1840. „ *viridis,* Johnston. Ann. Nat. Hist., iv, p. 228, pl. vi, f. 11—14.
1842. *Eulalia viridis,* Œrsted. Kroyer's Nat. Tids., p. 122.
1843. „ „ idem. Grönl. Annul. Dorsib., p. 188.
„ „ „ idem. Consp. Annul. Danic., p. 27, f. 22, 30, 85, 86, 88.
„ *Phyllodoce clavigera,* H. Rathke. Beitr. Fauna Norweg., p. 170.
1844. „ „ De Quatrefages. Ann. Sc. Nat., 3e sér., 14, p. 357, pl. ix, f. 9.
„ *Nereis viridis,* Thompson. Rep. Brit. Assoc. for 1843, p. 273.
1844–5. *Eulalia viridis,* Œrsted. Kroyer's Nat. Tids., p. 410.
1849. *Phyllodoce clavigera,* Cuvier. Règ. Anim. Illust., pl. xiii, fig. 3.
„ „ *viridis,* Leuckart. Archiv f. Naturges., p. 202.
1851. „ (*Eulalia*) *viridis,* Grube. Fam. Annel., pp. 56 and 129.
„ *Eulalia viridis,* Sars. Nyt Mag., vi, p. 209.
1864. „ *virens,* Ehlers. Borst. i, p. 159, Taf. vii, f. 1—5.
„ *Phyllodoce* (*Eulalia*) *viridis,* Grube. Insel Lussin, p. 81.
1865. „ *viridis,* Johnston. Cat. Brit. Mus., p. 178, pl. 16, f. 11—15, and p. 342.
„ *Eulalia* „ Malmgren. Nord. Hafs-Annul., p. 98, Tab. xv, f. 39.
„ „ „ De Quatrefages. Annel. ii, p. 122.
„ „ *clavigera,* idem. Ibid., p. 118.
„ *Phyllodoce Gervillei,* idem. Ibid., p. 139.
1867. „ *viridis,* Parfitt. Trans. Devon. Assoc., ii, pt. 1, p. 232.
„ *Eulalia* „ Malmgren. Annul. Polychæt., p. 25.
1873. „ „ Sars. Bidrag. Christ. Fauna, iii, p. 24.
1874. „ „ Malm. Op. cit., p. 80.
„ „ „ McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
„ „ „ Marenzeller. Sitz. Akad. Wien, sep. abdr., p. 18.
1875. „ „ McIntosh. Invert. and Fishes, St. Andrews, p. 120.
1878. „ „ idem. Trans. Linn. Soc. Zool., i. p. 502.
1879. „ „ Tauber. Annul. Danic., p. 88.
„ „ „ Langerhans. Zeitsch. f. w. Zool., xxxiii, p. 309.
1881. „ „ idem. Canar. Annel., Nov. Act. Leop., xli, p. 113.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöben., p. 205.
1885. „ *clavigera,* Pruvot. Arch. Zool. Expér., 2e sér., t. iii, p. 291, pl. xiv, f. 9—11.
1886. „ *viridis,* Harvey Gibson. Proc. Lit. Phil. Soc. Liverp., xi, p. 152.
1888. „ „ De St. Joseph. Ann. Sc. Nat., 7e sér., t. v, p. 283, pl. xii, f. 154.
„ „ *ornata,* idem. Ibid., p. 291, pl. xii, f. 158—161.

1890. *Eulalia viridis,* Malaquin. Annél. Boulon., p. 43.
„ „ *ornata,* idem. Ibid., Rev. Biol. Nord., Tav. iii, p. 99.
1891. „ *viridis,* Hornell. Trans. Liverp. Biol. Soc., vol. v, p. 246.
1893. „ *ornata,* Levinsen. Vidensk. Ud. 'Hauchs,' p. 327.
1897. „ *aurea,* Gravier. Bull. Sc. Fr. Belg., t. xxix, p. 309, pl. xvi, f. 2—6.
„ „ *viridis,* idem. Ibid., p. 308, pl. xvi, f. 16; pl. xviii, f. 13—15; pl. xxi, f. 2, 3; pl. xxii, f. 3—6.
1903. „ „ McIntosh. Mar. Invert. S. Africa, vol. iii, p. 34.
1904. „ *ornata,* Allen. Journ. M. B. A., N.S. vol. vii, p. 223.
„ „ *aurea,* idem. Ibid., p. 223.
1905. „ *viridis* (= *E. virens,* Ehlers, and *E. guttata,* Clap.), Græffe. Arbeit. Zool. Stat. Triest, xv, p. 325.
1906. „ „ De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 224.

Habitat.—Abundant under stones in rock-pools and other places near low water-mark and in the fissures of shelving rocks about half tide level, where groups of five or six may be found, and also under tangle-roots at St. Andrews, as well as all round the British shores, from Shetland to the Channel Islands. It also ranges to deeper water, as off the Bell Rock (E. M.), and in Galway Bay (Dr. E. P. Wright).

Shores of France (De St. Joseph); Faröe (Willemoes-Suhm); Greenland (O. F. Müller and Œrsted); Madeira and Canaries (Langerhans); South Africa, col. Gilchrist (McIntosh); Behring's Sea (Marenzeller).

Head bluntly conical and pale throughout. Eyes two, of moderate size, black, and occasionally an additional speck occurs external to either, probably due to brownish-green pigment deposits. The latter can with difficulty be detected in spirit-preparations. Tentacles subulate, slightly tapered; median tentacle similar; tentacular cirri greenish, four on each side. The first pair is short, somewhat lanceolate, tapered, and attached to the buccal segment (one on each side); the second and third which are longer are fixed to the succeeding segment, whilst the fourth springs from the third body-segment, and beneath is a modified foot with a few bristles, and an ovate ventral cirrus.

Body linear, $1\frac{3}{4}$ to 4 in. in length, rounded dorsally and flattened ventrally, slightly tapered anteriorly and more distinctly so posteriorly, and terminating in two lanceolate and somewhat darker caudal cirri. The inner curve of the caudal styles is longer than the outer. Colour of a rich deep green or grass green, paler in the region of the proboscis. The lamellæ are tinted of the same rich green, with a darker portion near the base, and in some males are pale olive. In others each segment shows dorsally two dark belts—narrower in the middle, broader externally—each being interrupted by a dark spot. When ova are present in these varieties the posterior half has the ground-colour of a deep green. The ventral surface is marked by a median moniliform line of dark olive, supplemented posteriorly by a dark touch at each foot. A variety from the tangle-roots of Bressay Sound is deep yellow, duskier on the dorsum, which, as in the previous form, has two brownish lines, on each side of a central stripe. A lateral border of brown also occurs on each side. The lamellæ and under surface are yellow. Others from the Outer Hebrides are greenish-yellow, yellowish-orange, or grass-green dotted with minute black grains, and with a darker line at each segment-junction, while a dull madder-brown

variety also is met with. The ventral surface is somewhat pale, with a pale central line. The head is shorter and more rounded than in the green forms.

The variety *ornata* (the *Eulalia ornata* of De St. Joseph) has a double bar in each segment in three sections, the middle touches being most distinct, as seen in the figure (Plate XLIV, fig. 5) courteously given by Dr. Allen of the Marine Biological Association at Plymouth.

The *Eulalia aurea* of Gravier appears to be a variety closely resembling that from the tangle-roots of Bressay Sound, and the figure of which (Plate XLIII, fig. 7) is also given by Dr. Allen.

The green pigment of this species has been examined by Dr. Marion Newbigin,[1] and it appears to be similar to that found in other Invertebrates, *e. g. Chætopterus*.

Externally the proboscis (Plate LVIII, fig. 3) presents anteriorly (*in situ*) a massive greenish portion with ribs, and posteriorly an elongated cylindrical region of a paler green. The anterior massive region has a series of greenish glandular papillæ on its inner surface. The narrower portion succeeding is, on the other hand, lined only by rounded cells, the outer layer being pale and firm.

Two varieties in regard to the row of terminal papillæ in extrusion occur, viz. one with twenty-two or twenty-three papillæ, the other with only fourteen. The firmness of the body in those showing the latter is marked.

The first foot, as indicated, occurs in the form of a short setigerous process with a few bristles and a small ovoid ventral cirrus under the fourth tentacular cirrus. The next foot is normal, though somewhat small, having a lanceolate dorsal cirrus with its ceratophore, a bifid setigerous region with bristles, and a somewhat ovate ventral cirrus.

The tenth foot (Plate LXVII, fig. 10) has a pointed lanceolate dorsal cirrus (lamella), the inner edge of which is nearly straight, or has only a slight curve at apex and base, whilst the outer edge has a convex curve which reaches its maximum about a third from the base and then is sloped inward. The short setigerous region is bifid, with the typical bristles, and the ventral cirrus is ovate with a blunt tip.

The dorsal division of the typical foot (Plate LXVII, fig. 11) bears a lanceolate cirrus with a tapering tip, the midrib being nearly median, with the pinnæ stretching obliquely outward and forward superiorly, and nearly at right angles posteriorly. The bifid setigerous process is somewhat short and bears a series of pale bristles, the shafts of which are slightly curved distally and the ends enlarged and minutely but distinctly spinous (Plate LXXVII, figs. 2 and 2 *a*). The terminal spear is comparatively short, rapidly tapered, with rather bold serrations inferiorly, slanting outwards and upwards, that is, towards the delicate tip. The serrations are more evident than those of *Eumida sanguinea*, though the terminal blade in the latter is longer. The pale spine separates the two groups of bristles in each foot. The inferior cirrus is ovate and slightly acuminate, and projects a little beyond the tip of the setigerous process, though in life it appears scarcely to do so. These lamellæ vary a little in acuteness in specimens from different localities.

Reproduction.—Many ripe males and females are found in July. The females are

[1] 'Quart. Journ. Micr. Sc.,' n.s., vol. xli, p. 427.

greenish inferiorly, whereas the ripe males are whitish on the ventral surface—from the masses of sperms. The latter have a globular head and a long tail like those of *Nereis* or *Lepidonotus*, and are much larger, for instance, than those of *Cirratulus tentaculatus*.

Lo Bianco[1] gives November as the month in which the sexual products are present in the Neapolitan examples.

Louis Fage[2] has recently described the segmental organs of this form, the nephridia rarely having more than three divisions, fan-like in outline, the border being formed of the solenocytes from which small tubes lead to the duct, whilst the "pavillon" or genital duct is funnel-shaped and leads to the exterior, becoming specially enlarged at the epoch of reproduction, and transmitting the sexual products, as in other members of the family.

Habits.—In the groups of adults procured in the fissures of the shelving rocks, amidst muddy *débris*, only occasionally are a few small forms, about $1\frac{3}{4}$ in. long, procured. In confinement they remain at the side of the vessel, while rapid undulatory motions take place from head to tail, probably in connection with respiration. No ciliated band, however, was observed on the lamellæ. They also seek shelter under Ascidians and sponges, and if prevented, sometimes coil themselves into a rounded knotted mass. Some take shelter both in the sea and in confinement in tubes of *Serpula* and *Sabellaria*, to which they cling with tenacity. The movements of this species have been recently described by G. Bohn[3] as largely due to what he terms "thigmotactisme." Bright light causes disordered movements.

They tinge the spirit at first of a pink colour, and become themselves of various shades of straw colour or pale brown.

They are chiefly littoral, but occasionally come from deeper water.

O. F. Müller's description (1771) of this, as of other Annelids, is remarkable for its general accuracy, and the same may be said of his figures in the "Nat. einiger Wurm-Arten."

Audouin and Milne-Edwards (1834) described a *Phyllodoce Gervilleii*, which only differs from their *P. clavigera* in the absence of the median tentacle and the brevity of the tentacular cirri. It is possible that this absence may have been accidental, as no other species so closely approaches it. De Quatrefages followed, so that he represented this form by three species.

The *Eulalia virens* of Ehlers (1864), from the Adriatic, comes so close to this species that it is doubtful if it can be separated.

It is difficult to identify the *Phyllodoce ellipsis* of Dalyell, or the *P. Griffithsii* and *P. cordifolia* mentioned by Johnston in the Catalogue of the Annelids in the British Museum (1865). Grube thought *P. Griffithsii* resembled his *Eulalia punctata* from St. Vaast la Hougue.

This species seems to be subject to considerable variation in colour, for so far as can be observed, the *E. ornata* of De St. Joseph (1888) differs only in this feature. At any rate, those examples forwarded from Plymouth by Dr. Allen did not show sufficient

[1] 'Mitth. Zool. Stat. Neapel,' xiii, p. 486 (1899).

[2] 'Ann. Sc. Nat.,' 9e sér., iii, p. 274, figs. 1, 2, and 3; pl. vi, fig. 1–3.

[3] 'Ann. Sc. Nat.,' 9e ser., iii, p. 67, 1906.

distinction in the buccal segment, in the structure of the feet, or other characters, to warrant specific separation. The colouration, as described by De St. Joseph, is certainly striking, consisting of a brownish ground colour, with two parallel greenish bands on each side of a central spot in each segment. The ventral surface is slightly violet.

The form with fourteen papillæ on the proboscis is that found at Dinard by De St. Joseph (1888), who considered the following as varieties, viz., *Phyllodoce clavigera* (Aud. & Ed.), *Eulalia viridis* (Œrst.), *P. viridis* (Johnston), *E. virens* (Ehlers), and *E. guttata* (Claparède).

Hornel (1891) thought the green colour was not protective.

Gravier [1] shows a strong transverse band of muscle passing from side to side below the gut and above the nerve-cords in this form. Between it and the outer portion of the oblique muscle above it, lies the segmental organ, the internal ciliated funnel and the external opening of which (just within the base of the ventral cirrus) are also figured.

A closely allied form is *Eulalia aurea* (Gravier),[2] which is of a bright golden hue, with a violet band along the middle line of the dorsum, and a dark line on each side, or rather a kind of arch in each segment, this alone being continued in front. The eyes are large and circular; the paired tentacles short, the median longer, and inserted in front of the eyes. The first segment bears a pair of tentacular cirri; the second two pairs, with a minute bundle of bristles between. The dorsal (tentacular) cirrus extends to the twelfth segment. The third segment bears the fourth pair of tentacular cirri, accompanied by a bundle of bristles and a minute ventral cirrus. The dorsal cirri are elongate, with a blunt point. The ventral cirri are a little less, and relatively large. Anal cirri are foliaceous, and double the length of the dorsal cirri of the region. The bristles have a hook at the end of the shaft which is covered with minute spines. The terminal blade is very short, and shows oblique striation. Proboscis is entirely covered with minute papillæ. The end has a ring of twenty papillæ.

It belongs to the type of *E. viridis*, with elongate, lancet-like, dorsal cirri. Gravier says it is distinguished by its colouration, by the remarkable length of the proboscis, by its dorsal cirri being less acuminate, and also by its bristles—the terminal piece of which is short. It has not been thought necessary to separate this form from *E. viridis*.

4. Eulalia (Pterocirrus) macroceros, *Grube*, 1860. Plate LVIII, fig. 4—head; Plate LXVII, fig. 12—foot; Plate LXXVII, fig. 3—bristle.

Specific Characters.—Head rather large and long, with two large circular black eyes, in front of which arises the large, subulate, and long median tentacle. Occasionally a dark line occurs behind each. The other tentacles are also comparatively large and long. The first pair of tentacular cirri is normal, but somewhat short. The dorsal of the second pair is of considerable length, whilst the ventral forms a long, lanceolate, and

[1] 'Bull. Sc. Fr. Belg.,' t. xxix, pl. xxii, fig. 3.
[2] Op. cit., t. xxix, 1896, p. 309, pl. xvi, fig. 2—6.

foliaceous process. The dorsal of the third pair is shorter than the preceding, and the ventral is small (De St. Joseph).

Body about an inch or two in length, slightly tapered anteriorly, and more so posteriorly, where the great elongation of the feet give a character to the region. Colour straw-yellow to pale-brown, with a dorsal bar going to the bases of the feet. Dorsal cirrus lanceolate, with a pointed tip. Setigerous lobe tapered a little towards the bifid extremity. Bristles with the end of the shaft slightly dilated and bevelled, with a minute spike or two at the tip, and a single oblique line. The somewhat long terminal piece tapers to a fine tip, is obliquely striated, and distinctly serrated. The ventral cirrus is slipper-shaped, lanceolate at its tip, and extends a little beyond the setigerous region.

Synonyms.

1860. *Phyllodoce* (*Eulalia*) *macroceros*, Grube. Arch. f. Nat., Bd. xxvi, p. 82, Taf. iii, f. 4.
„ „ „ „ idem. Ausflug nach Triest, p. 141, Taf. iii, f. 4.
1864. „ „ „ Ehlers. Borst., i, p. 165, Taf. vii, f. 6–10.
1868. „ (*Pterocirrus*) *velifera*, Claparède. Annél. Neap., p. 250, pl. xvii, f. 2.
1874. „ „ *macroceros*, Marenzeller. Sitz. Akad. der Wiss. Wien, Bd. lxix, p. 424, sep. abdr., p. 18.
1875. „ „ „ Marion & Bobretzky. Ann. Sc. Nat., 6e sér., t. ii, p. 63.
„ „ „ *velifera*, idem. Ibid.
1888. „ „ „ De St. Joseph. Ibid., 7 sér., t. v, p. 300, pl. xii, f. 170—174.
1897. *Pterocirrus macroceros*, Gravier. Bull. Sc. Fr. Belg., t. xxix, p. 308, pl. xvi, f. 15; pl. xx, f. 12; pl. xxii, f. 8, 9.
1904. „ „ Allen. Journ. M. B. A., n.s., vol. vii, p. 223.
1905. *Eulalia* „ (= *E. volucris*, Ehlers, and *Eracia volucris*, Clap.), Græffe. Arbeit. Zool. St. Triest., xv, p. 325.
1906. „ (*Pterocirrus*) *macroceros*, De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 225.

Habitat.—Dredged off St. Peter Port, Guernsey, in 15 fathoms on shelly ground in 1868. Plymouth (Dr. Allen).

Quarnero (Grube). Amongst nullipores and Bryozoa, at Triest (Marenzeller). Common in the Gulf of Marseilles (Marion and Bobretzky), Mediterranean, Atlantic.

Head (Plate LVIII, fig. 4) large and long in life; bluntly conical in spirit, with two large circular black eyes, with or without lenses. The subulate tentacles are comparatively large and long, the median (the longest) arising in front of the eyes. They thus correspond with Claparède's *Eulalia velifera*, and differ from his *E. marginata*. The first pair of tentacular cirri is normal in outline, but somewhat short. The second has dorsally a subulate process of considerable length (extending to twelve segments, De St. Joseph), whilst the ventral is foliaceous and lanceolate. This shows no striated border as in *E. limbata*, Claparède, neither is the tentacular differentiation visible at the posterior border. The whole forms, in spirit, a leaf-like process, a little more opaque towards the posterior border.

Body of a straw-yellow colour, or with brownish dorsal bars, slightly tapered

anteriorly, more distinctly so posteriorly, where the great elongation of the feet and the lamellæ give a character to the region. Posteriorly it terminates in two thick cylindrical cirri (De St. Joseph).

The proboscis has fine conical papillæ at the basal region in extrusion, but they increase in size and become coarse towards the tip, which has a series (12—15 ?) of papillæ. Forty-eight large blunt papillæ surround the entrance to the stomach (De St. Joseph). The last-named author found fragments of Fuci and often gregarines in the alimentary canal.

The foot has a prominent lanceolate dorsal cirrus (Plate LXVII, fig. 12) with a pointed extremity. The setigerous process beneath tapers towards the tip, which is slightly bifid, the superior division being the more prominent and acute. The bristles are pale and comparatively short with a very slight curvature. The distal end of the shaft is a little dilated and bevelled, but only shows traces of spikes at the end, the translucent region being otherwise structureless, except for a single oblique striation. The somewhat long terminal blade tapers rather abruptly to a fine tip, and has delicate oblique lines and serrations (Plate LXXVII, fig. 3) which slope distally. The process at the tip of the bristle is certainly longer than Claparède shows in his *E. limbata*. Unfortunately, he has figured neither feet nor bristles in the other species. He describes the dilated end of the shaft as having asperities, and the terminal piece in his figure [1] is poorly represented. The serrations, though not easily seen, come considerably further downward, beyond the split at the articulation, and the tip is longer and more tapered. This author gives an interesting account of the mucus-glands and bacilliporous follicles of the dorsal and anal cirri. The inferior lamella (cirrus) is also somewhat lanceolate, the tip extending a little beyond that of the setigerous region.

Reproduction.—Marenzeller (1874) found that the females had in August dark bluish green eggs—occupying all the segments except a few anteriorly and posteriorly. De St. Joseph describes the eggs as green.

Grube's original description and figure (1860) are, as De St. Joseph observes, fairly accurate, and could scarcely refer to any other form, though the reniform outline of the eyes has not since been observed. The *Eulalia volucris* of Ehlers is a synonym for the same form according to De St. Joseph, though Ehlers describes the third pair of tentacular cirri as having the ventral cirrus leaf-like as well as that in front. Ehlers (1864) gives a careful account of the structure of the proboscis, which has about forty short papillæ at the opening into the stomach. He also describes the leaf-like anal cirri which were absent in Grube's example.

Claparède in 1868 distinguished the group to which this form belongs, characterizing it by the foliaceous condition of the ventral tentacular cirrus of the second segment, and making it a sub-genus under the name of *Pterocirrus*.[2] He described three species, but he had apparently overlooked the description of Grube, so that his *Eulalia* (*Pterocirrus*) *velifera* is synonymous with Grube's *E. macroceros*. It may be questioned, indeed, whether the other species—viz. *Eulalia* (*Pterocirrus*) *limbata* and *E. marginata*—have not a closer connection with his *velifera* than at first appears. Marenzeller points

[1] Op. cit., pl. xii, fig. 170.

[2] 'Annel. Nap.,' 248, and Suppl., p. 98.

out that the dark line shown by Grube and Claparède behind each eye is not constant, and it was not present in the small example from the Channel Islands (1868), and that the ventral leaf of the second pair of tentacular cirri has a spine.

De St. Joseph, at Dinard, met with comparatively large examples—viz. 5 centimètres in length, 6 mm. across the dorsal cirri, and with 116 segments. He found the parasitic crustacean, *Herpyllobius arcticus* (Steenstrup) fixed to the side of one specimen.

5. Eulalia tripunctata, *McIntosh*, 1874. Plate XLIV, fig. 3; Plate LVIII, fig. 23—head; Plate LXVII, fig. 13—foot; Plate LXXVII, fig. 4—bristle.

Specific Characters.—Head bluntly conical, flattened and pale, with four rather short tentacles at the tip, and a median between the well-marked black eyes, which are posterior in position. The first pair of tentacular cirri occurs on the buccal segment, the second segment bears two pairs. The long posterior tentacular cirri are only once and a half the breadth of the body. The latter is about two and a half inches long, narrow, gently dilating behind the head, and again diminishing gradually towards the attenuated tail, which has two short, baton-like or fusiform cirri, flattened dorsally and ventrally. A slender papilla occurs in the centre between them. Of a pale yellow colour, with three rows of black spots on the dorsum, the lateral commencing on the first segment and behind the attachment of the foot, and the central on the intermediate fold at the segment-junction, so that they form a triangle. The ventral surface is pale yellow, with a faint lateral row of dark grains at each side in the middle of the body. The dorsal cirrus is ovato-lanceolate—probably nearly lanceolate in life. The setigerous lobe is comparatively short, indistinctly bilabiate (De St. Joseph), with short pale bristles, the shafts of which in lateral view are bevelled at the enlarged end. The terminal blade is short, and rapidly tapers to a point. The serrations on the edge are very minute. The ventral cirrus is ovato-lanceolate, the tip extending fully as far as the setigerous process.

Synonyms.

1874. *Eulalia tripunctata,* McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
1875. „ „ idem. Invert. and Fishes, St. Andrews, p. 120.
1888. „ *Claparedii,* De St. Joseph. Ann Sc. Nat., 7e sér., t. v, p. 285, pl. xi, f. 144—148.
1904. „ „ Allen. Journ. M. B. A., n.s., vol. vii, p. 223.

Habitat.—From the *débris* of the deep-sea fishing-boats, St. Andrews, May, 1868 (R.M.); between tide marks, Herm; dredged amongst dead shells off St. Peter Port, Guernsey.

Plymouth (Allen). Shores of France (De St. Joseph).

Head.—Pale throughout, flattened, bluntly conical, with four rather short tentacles at the tip, and a median between the well-marked black eyes, which are situated posteriorly. There are three tentacular cirri, the posterior the longest, yet the latter are only once and a half as broad as the body.

Body about two and a half inches in length, much elongated proportionally, narrow,

gently dilating behind the head, continuing for a long distance of nearly equal calibre, and again diminishing gently towards the attenuated tail. The segments are distinctly marked, and are flanked by a series of lanceolate lamellæ (cirri) of a deeper yellow than the rest of the body, and which become ovato-lanceolate in spirit. The tail is terminated by two rather short baton-like cirri, which are flattened dorsally and ventrally. In preservation the body is rounded dorsally, and slightly flattened anteriorly on the ventral surface. In life it is coloured throughout of a pale yellow, with three rows of black (or greenish, De St. Joseph) spots on the dorsum of the body. The lateral rows commence on the first segment, and the central about the fourth. These spots are arranged in a regular manner, the central being on the intermediate narrow fold, or pseudo-segment, at the junction, and the lateral just behind the attachment of the foot on each side, so that they form a triangle. The under-surface is pale yellow, without spots anteriorly and posteriorly, but towards the middle it is marked with a faint row of dark grains at each side.

The proboscis is irregularly covered anteriorly by obtusely conical papillæ, and has a crown of fourteen papillæ at the "stomach" (De St. Joseph).

The foot (Plate LXVII, fig. 13) has dorsally an ovato-lanceolate cirrus, probably nearly lanceolate in life. The setigerous process is comparatively short, slightly bifid, and bears a series of short, pale bristles. The shaft has only a slight curvature, chiefly marked just below the enlarged end, which is rounded when viewed antero-posteriorly, bevelled and hoof-like when seen laterally. The terminal process is short, translucent, and rapidly tapers to a point (Plate LXXVII, fig. 4). The serrations on the edge are so minute that they are observed with difficulty.

The inferior cirrus is also ovato-lanceolate, the tip extending fully as far as the setigerous process.

The muscular fibres are firm and tough in the preparations, presenting in some the appearance of the glandular secretion of *Panthalis*.

Reproduction.—De St. Joseph found that the females (in spring?) were distended with greenish eggs; whereas the males, when filled with sperms, have the two posterior thirds of the body dull reddish.

This seems to be a widely distributed species, but is not common in the north.

Dr. Allen kindly sent me a drawing of a specimen—his "*Eulalia* ? brick-red"—of a general pale pink, with rather more than the middle third of the body of a reddish hue (Plate XLIII, fig. 8). No specks were visible. Nothing distinctive occurred about the head, which resembled that of *Eumida*, and the caudal cirri were lanceolate and narrow, inclining to subulate, as in *Eumida*. The precise relationships of this form, therefore, are in need of further investigation.

6. Eulalia imbricata, *Ehlers*, 1875. Fig. 42, head.

Specific Characters.—Head somewhat massive, pentagonal, eyeless. Median tentacle in the angle at the nuchal border of the head.

Body flattened, tapered for a short distance anteriorly, and terminating posteriorly in two elongate-ovoid caudal cirri. Foot with a large and broadly ovate dorsal cirrus (lamella), an elongate-ovoid ventral cirrus, and a bilabiate setigerous region with bristles having the ends of the shafts dilated and furnished with two long spines, whilst the tapering terminal pieces are serrated (Ehlers).

Synonym.

1875. *Eulalia imbricata,* Ehlers. Zeitsch. f. w. Zool., Bd. xxv, p. 43, Taf. ii, f. 15.

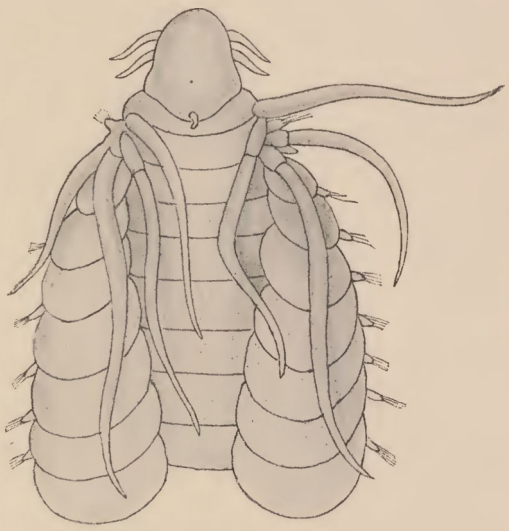

Fig. 42.—Head of *Eulalia imbricata* (after Ehlers).

Eulalia (?) imbricata, *Ehlers*, 1875.

Habitat.—Dredged in the 'Porcupine' Expedition of 1869 in 664 fathoms, on July 2nd, at Station 23, 56° 9′ N., 14° 10′ W.

Head (fig. 42, after Ehlers) somewhat large, pentagonal, with the greatest breadth posteriorly. The four anterior tentacles arise further from the tip than usual, whilst the small median tentacle springs from the extreme central process of the head posteriorly. No eyes. The head thus differs from the general type of the genus.

Body about 13 mm. in length, 2 mm. broad, and has seventy segments. It is flattened, tapered anteriorly, and yellowish-white in spirit. The first three segments bear four pairs of tentacular cirri, the longest reaching from the third to the tenth segment. The last segment has two elongate-ovoid anal cirri.

The average foot has a broadly ovoid dorsal lamella (cirrus). The setigerous process is two-lipped, the lower being larger than the upper. The distal end of the shaft of the bristles is enlarged and two-spined, whilst the edge of the terminal sabre is serrated. The ventral lamella (cirrus) is elongate-ovoid, and extends about the length of the setigerous lobe.

This interesting species is remarkable for the structure of its head and the foliaceous condition of the dorsal cirri. In the position of the median tentacle it differs from all other forms in the genus, and further investigation of the type is necessary.

Besides the foregoing, several varieties of *Eulalia* occur from Galway, deep water off St. Andrews Bay, and elsewhere. In these the eyes vary considerably in size, some being larger, others smaller than in the type, and the dorsal cirri are shorter or longer.

Genus XXXII.—Eumida, *Malmgren*, 1865.

Eumida, Claparède (1868) states, is distinguished by the presence of a small but normal lamellar ventral cirrus below the last tentacular cirrus. He would, therefore, for the moment make *Eumida* (*Eracia*, De Quatref.) a sub-genus of *Eulalia*. Five tentacles, median on the vertex; four pairs of tentacular cirri. First segment soldered to the head-lobe (Levinsen), and first pair of tentacular cirri spring from it. The arrangement of the dorsal and ventral longitudinal muscles and other features as in *Phyllodoce* and *Eulalia*.

1. Eumida sanguinea, *Œrsted*, 1843. Plate XLIII, figs. 9 and 10; Plate XLIV, fig. 4; Plate XLVIII, figs. 1 and 2; Plate LVIII, fig. 22—head; Plate LXVII, figs. 14 and 15—feet; Plate LXXVII, fig. 5—bristle.

Specific Characters.—Head rounded, cordate, broader than long, the large black or brownish-black eyes thus being prominent. Anterior tentacles of moderate length, subulate; median, somewhat shorter, arising in front of the eyes. Tentacular cirri of moderate length, the dorsal in each pair being the longer, and all taper from the base to the filiform tip, which in the posterior pair is finely attenuate; the ventral of the second pair is slightly flattened and approaches a narrow lanceolate form. Body one and a half to three inches in length, of considerable proportional bulk, soft, and mobile; somewhat narrowed in front, and tapered posteriorly, where it ends in two fusiform or subulate styles. Colour light greenish-brown, yellowish, straw-coloured, or almost translucent anteriorly, with a faint straw-coloured line along the centre and a dusting of brownish grains. The first segment has a white bar or white grains. In many a narrow white or yellowish bar occurs at each segment-junction. In spirit it is generally madder brown. Proboscis long, transversely rugose behind the tip, which has twenty papillæ (Malmgren). In the typical foot (sixtieth) the dorsal cirri are sub-vertical, broadly ovate, with an acuminate tip, while the base is sub-cordate. It is borne on a long pedicle (ceratophore). Spinigerous process comparatively long and bifid. The translucent shafts of the bristles have a distinct shoulder, a bevelled tip with spinigerous ridges, and a minutely serrated terminal blade, longer than in the ordinary *Eulalia*, and tapering to a fine tip. The ventral cirrus is broadly lanceolate, with a somewhat acuminate tip, which does not quite reach that of the spinigerous lobe, and thus is shorter than in the tenth foot.

Synonyms.

1843. *Eulalia sanguinea,* Œrsted. Annul. Danic. Consp., p. 28, f. 80—82.
1851. *Phyllodoce* (*Eulalia*) *sanguinea,* Grube. Fam. Annel., pp. 56 and 129.
1865 *Eumida sanguinea,* Malmgren. Nord. Hafs-Annul., p. 97, Tab. xiv, f. 28.
„ *Eulalia* „ De Quatrefages. Annel., ii, p. 123.
1867. „ „ Malmgrem. Annul. Polychæt., p. 25.
1873. „ „ Kupffer. Jahresb. Com. deutsch. ('Pommerania'), p. 150.
1874. *Eumida* „ McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
„ „ „ Malm. Op. cit. Göteb., p. 80.
1875. „ „ McIntosh. Invert. and Fishes St. Andrews, p. 119.
„ *Eulalia* „ Möbius. Jahresb. Com. deutsch. ('Pommerania'), p. 170.
1879. „ „ Tauber. Annul. Danic., p. 88.
1883. *Eumida* „ Levinsen. Vid.-Med. Foren. Kjöben., p. 205.
1888. *Eulalia pallida,* De St. Joseph. Ann. Sc. Nat., 7e sér., t. v, p. 294.
1893. „ „ Levinsen. Vidensk. Ud. 'Hauchs,' p. 327.
1897. *Eumida communis,* Gravier. Bull. Sc. Fr. Belg., t. xxix, p. 310, pl. xvi, f. 7—10.
1901. „ *sanguinea,* McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 223.
1904. *Eulalia pallida,* Allen. Journ. Mar. Biol. Assoc., n.s., vol. vii, p. 223.
1905. „ „ Graeffe. Arbeit. Zool. Stat. Triest, xv, p. 325.
1906. „ „ De St. Joseph. Ann. Sc. Nat., 9e ser., t. iii, p. 224.

Habitat.—Under stones near low water-mark amongst the rocks, and from the *débris* of the lines from deep water, St. Andrews (E.M.); Outer Hebrides (Lochmaddy), both between tide-marks and in the Laminarian region, and Sound of Harris; on shells from deep water off the Channel Islands; as well as between layers of rock near low-water mark (W. C. M.). In 80 fathoms, St. Magnus Bay, Shetland (J. G. J.). On greyish sand, stones, and coral at 164 fathoms in the 'Porcupine' Expedition of 1869. A species abundant in both tidal and deep waters all round the British shores.

It extends to the Baltic, Norway, and Finmark.

Head (Plate XLIII, fig. 9) rounded, cordate, broader than long; pale, or with a slightly pinkish hue, straw-coloured or greenish, the large black or brownish black eyes thus being prominent, and they apparently enlarge in ripe examples. Anterior tentacles of moderate length and subulate; the median, somewhat shorter, arises in front of the eyes. The tentacular cirri are also of moderate length, the dorsal in each pair being the longer, and all taper from the base to the filiform tip, which in the posterior pair is more finely attenuate. The ventral of the second pair is broader and slightly flattened, approaching a narrow, lanceolate form. As in *Eulalia* the first pair springs from what Œrsted termed the base of the head, but which probably represents a fused peristomial region, the second and third from the following segment, which is united with the former, and the fourth from the succeeding segment, a rudimentary foot (as in *Eulalia viridis*) being beneath it. In some a pale area intervenes between the eyes, and occasionally a few white grains are found in the same region. In several from St. Peter Port, Guernsey, the tentacular cirri, opposite the white post-cephalic belt, were white.

Body $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in length, of considerable proportional bulk, soft and

mobile. It is rounded dorsally, flattened ventrally, somewhat narrowed in front, and tapered posteriorly, where it terminates in two fusiform or subulate cirri. In colour it is light greenish brown, or straw-colour, occasionally almost translucent anteriorly, with a faint, straw-coloured, or yellowish line along the centre, greenish white, or pale brownish, with a dusting of brownish grains. The posterior region is more opaque. The first segment is marked by a pure white bar, or by white grains, and in many a narrow white or yellowish bar occurs at each segment-junction. In one from St. Peter Port, Guernsey, the body was of a fine light purple or mauve hue, with a white silvery bar across each segment and whitish specks between the eyes. Some are pale greenish brown, faintly marked by transverse lines on the dorsum and by a dull yellowish or brownish line in the centre from the intestine, while a variety is very prettily banded with dark green in a large bar anteriorly in each segment and a smaller behind, the effect being heightened by the pallor of the lamellæ and the tentacles. The ventral surface is pale or marked by the salmon-tint of the viscera.

In section the oblique muscles pass below the nerve-cords on each side, and meet at their insertion in the middle line. The arrangement of the dorsal and ventral longitudinal muscles is typical.

Proboscis (Plate LVIII, fig. 22) long, transversely rugose behind the tip, which has twenty papillæ.

It is seldom that the organ is everted by the mouth in the preparations. It is generally detached anteriorly and thrust out by a rupture of the body-wall.

The cœlomic fluid is mixed with many large flattened cells (August) measuring fully $\frac{1}{500}$ of an inch in their longer diameter, while the ordinary corpuscles are less than $\frac{1}{2500}$ of an inch.

The wall of the alimentary canal is richly glandular.

Dr. Allen forwarded a drawing of a form from Plymouth, which he termed *Eulalia* sp. B, of a pale greenish hue anteriorly, slightly pinkish posteriorly, the general aspect agreeing with that of *Eumida*, the white bar behind the head being conspicuous. In the coloured drawing, however, the median tentacle is considerably longer than the anterior or paired tentacles—a feature less marked in the preserved form with the proboscis extruded. The shape of the foot and the general aspect of the proboscis appear to agree with *Eumida sanguinea*, of which this appears to be a fairly characteristic example.

In the typical foot (Plate LXVII, figs. 14*a*—tenth, and 15—sixtieth) the dorsal cirri are borne subvertically, and are broadly ovate with an acuminate tip, while the base is subcordate, and the hypodermic granules are arranged in very regular and close streaks, so that the appearance is characteristic. The streaks proceed from a central region more opaque and areolar than the marginal. The papilla bearing the process is elevated, so that the space between the lamella and the spinigerous lobe is marked. The spinigerous process is comparatively long, and bifid, and the inferior broadly lanceolate cirrus arises from a distinct shoulder inferiorly and posteriorly. Its tip is also somewhat acuminate, and does not quite reach that of the spinigerous region, and therefore is proportionally shorter than at the tenth foot. When seen antero-posteriorly a single large median spine occupies the centre, and a series of smaller spines trend off on each side. The translucent bristles have a distinct shoulder and a spinigerous bevelled tip

in lateral view (Plate LXXVII, fig. 5), in which position the very slight curvature of the tip of the shaft is visible. The terminal blade is longer than in the ordinary examples of *Eulalia*, tapers to a fine tip, and is minutely serrated along the edge.

Coiled vessels occur at the base of the dorsal cirrus, but none have been traced into it. Cilia seemed to be arranged along the basal part of the foot.

Reproduction.—Ripe ova occur towards the end of May, and it is probable that the breeding period extends to August. Ripe males came from four fathoms in Valencia Harbour on May 13th, 1870 (J. G. J.), and from Lochmaddy in August. A ripe female occurred in August under the spreading crust of *Corallina officinalis* at Herm. Beyond the enlargement of the body no change of external appearance takes place in this condition, but in section the whole cœlomic space and the cavities of the feet in the males are distended with sperms, and the wall of the gut appears to be thinner. In the females the early ova occur in masses in the feet. Allen observes that at Plymouth it (his *Eulalia pallida*, and also his greenish *Eulalia* B, with white bar) breeds from May to July, and that the eggs are green.

Young examples of about sixteen segments were procured in the bottom tow-net on June 16th, and others of seventeen bristled segments on October 22nd. A white band occurs behind the head, the rest of the body being of a pale straw-colour. Eyes comparatively large, black. Some of the young forms at a later stage, from deep water, are of a madder-brown colour.

Habits.—The body is very mobile, constrictions taking place at various points (Plate XLIII, fig. 9) and again disappearing. It is an active and restless species, moving backward and forward, or in confinement swimming with considerable speed in a serpentine manner at the surface or through the water of a vessel, and evading capture with adroitness. A vermicular contraction and dilatation often occur posteriorly—as if water entered the rectum. The vitality of fragments, *e. g.* the posterior end, is great.

It is difficult to say whether the *Nereis ellipsis* of Dalyell [1] is this form or a *Eulalia*.

The *Eulalia punctifera*, Grube,[2] from Cherso in the Adriatic, approaches this form very closely.

De Quatrefages[3] (1843) described and figured a *Phyllodoce saxicola* which had five tentacles, and which accordingly in the 'Annelés' was termed *Eulalia saxicola*—a form which appears to be one of the varieties of *Eumida sanguinea*.

It is doubtful if such species as Claparède's *Eulalia* (*Eumida*) *pallida*[4] merit specific distinction. The form mentioned would appear to be a variety. His *Eulalia* (*Eumida*) *guttata*[5] also is a closely allied form. *Eumida sanguinea* is variable in colour, and the pale examples from Plymouth (=*Eulalia pallida*, Allen) differ in no material way from the type (which is absent from the list of the local annelids). De St. Joseph found a female parasitic copepod on this form at Dinard.

[1] 'Pow. Creat.,' ii, p. 152, pl. xx, figs. 7—10, 1853.
[2] 'Archiv f. Naturges.,' 1860, p. 83.
[3] 'Magasin de Zoologie,' 1843, p. 1 (sep. copy), pl. i, figs. 1—6.
[4] 'Annel. Nap.,' p. 246, pl. xvi, fig. 6, 1868.
[5] Ibid., Suppl., p. 97, pl. ix, fig. 2.

The differences of Webster's *Eumida maculosa*,[1] dredged on shells in 5—10 fathoms off the Virginian coast, seem to be very slight—indeed only of coloration.

A variety with a larger ventral cirrus was procured in Galway in 1868 by Professor E. P. Wright, of Dublin, the main feature being the size of the lanceolate ventral cirrus, the pointed tip of which projected considerably beyond the setigerous process. The minute structure of the bristles agreed with that in *E. sanguinea*. Malmgren gives *Sige fusigera* a lanceolate and pointed ventral cirrus like the foregoing, but there is no reason for separation in the present case.

The points of distinction claimed by Gravier (1897) for his *Eumida communis*, viz., coloration, rounded form of the dorsal cirri, great development of the setigerous lobe next the ventral cirrus, and the condition of the bristles, do not seem to form stable grounds on which to base separation from *E. sanguinea*.

The foot of *Eulalia* (*Pterocirrus*) *microcephala*, Claparède,[2] as subsequently shown by De St. Joseph,[3] would readily be taken for that of *Eumida sanguinea* or one of its many varieties.

Several varieties of *Eumida sanguinea* occur in the deeper water of St. Andrews Bay, the eyes being larger in one, the setigerous lobe of the foot more prominent in others, the dorsal cirri smaller than usual and the ventral varying in length, but the median tentacle remains shorter than the lateral and the bristles do not differ from the type. One specially soft form shows slight differences in the structure of the end of the shaft of the bristles, which are more abruptly truncated.

Genus XXXIII.—ANAITIS, *Malmgren*, 1865.

Head broad, rounded anteriorly, slightly sinuous posteriorly, somewhat indistinctly separated from the first segment. Four short tentacles. Two eyes of moderate size. Four tentacular cirri on each side, the first, second, and third fixed to the first segment, the fourth to the second segment. Superior cirri of the feet large and imbricate backwards. Ventral cirri compressed, a little longer than the setigerous part of the foot. The latter is ovate, diminishing at the tip, and slightly bifid. Bristles numerous, compound, terminal sabre long and tapered, minutely serrated on the edge. Two sub-globose anal cirri.

I have some hesitation in adopting this genus—the species included in it requiring more exhaustive examination.

Grube (1879) described the posterior border of the head in *Anaitis* as arising from a median arch, whilst Levinsen thought it was soldered with the first segment. There are, it is stated, three pairs of tentacular cirri. Grube places *Phyllodoce Paretti*, Blv., here. *Anaitis rosea*, McI., he ranges under the group B^2, in which segment 2 is smaller.

Claparède (1868) notes that the essential distinction between this and *Phyllodoce* is

[1] 'Trans. Albany Instit.,' ix, p. 15, pl. iv, figs. 38—41, 1879.
[2] 'Annel. Nap., Suppl.,' 1870, p. 98, pl. ix, fig. 3.
[3] 'Ann. Sc. Nat.,' 9e sér., t. iii, p. 225, pl. v, figs. 99—103, 1906.

the occurrence of the four pairs of tentacular cirri on three segments in the latter and on two in the former. He, however, observes that it is still uncertain whether the buccal segment does not represent two fused segments. In some a minute ventral cirrus occurs under the last pair of tentacular cirri (*e. g. Anaitis cephalotes*, Claparède).

1. Anaitis rosea, *McIntosh*, 1877. Plate XLIII, fig. 4; Plate LXVIII, fig. 13—foot; Pl. LXXVII, fig. 10—bristle.

Specific Characters.—Head somewhat ovoid, slightly tapered in front, little differentiated from the first segment. Eyes comparatively small; situated at the posterior third. In front of them is a bright rose-red band slanting downward and backward, and curving to join the larger rose-red area. A pinkish band from the tip of the snout joins the latter behind the eyes, thus isolating a pale area around each eye. A broad belt of rose-red occurs in rear of the eyes, and a pale wedge impinges behind into its centre. Tentacular cirri as in *Phyllodoce*. Body tapered in front, and more distinctly so posteriorly, rose-red dorsally, marked along the centre by a yellow band which is flecked with reddish grains. Surface generally is pale buff. Foot with a prominent pedicle bearing a lanceolate dorsal cirrus, and a slightly bifid setigerous process. The enlarged ends of the gently curved bristles are spinulose along the terminal curves, and the blade is elongate, tapering, and finely serrated. The ventral cirri are lanceolate, acutely pointed, and project beyond the tip of the bristle-bearing process. Tail terminated by two short curved cirri.

Synonym.

1877. *Anaitis rosea*, McIntosh. Journ. Linn. Soc., xiii, p. 161.

Habitat.—In the sand near low-water mark, East Sands, St. Andrews, September, 1876. In 8 fathoms amongst sand in the Bight of Vatsland, north of Bressay Sound, Shetland.

Head.—Somewhat ovoid in outline, slightly tapered in front, while posteriorly it is hardly differentiated from the succeeding segment. The two circular eyes are situated at the posterior third and are comparatively small. It is pale anteriorly as likewise are the tentacles, which are subulate and tapering. In front of each eye is a bright rose-red band, slanting downward and backward and then curving to join the larger rose-red area. Moreover a pinkish band from the tip of the snout joins the latter behind the eyes, thus mapping off the pale area around each eye. A broad belt of rose-red occurs in rear of the eyes, into the centre of which impinges a pale wedge from behind, so that the lateral roseate regions as seen from the dorsum are somewhat triangular. The same rose-red hue tints the bases of the tentacular cirri, which have the normal arrangement, viz. two shorter in front and two longer behind.

Body 1½ inches long, somewhat tapered in front and more distinctly so posteriorly, of a fine rose-red dorsally, marked along the centre by a yellow band—from the fourth segment to the tip of the tail. For the first three segments the band is flecked with reddish grains, but thereafter it is bright yellow. On each side the surface is minutely

dotted with red grains, and throughout these have a tendency to be arranged in transverse bars or streaks. The general tone of the rest of the body and of the lamellæ is pale buff. Besides the latter hue the ventral surface shows a rose-red band from the line of the first tentacular cirrus to that of the first foot, so that when the animal rests on the side of the glass vessel it closely resembles the abundant Nemertean *Amphiporus lactifloreus*, Johnston —with its reddish ganglia.

The superior division of the foot (Plate LXVIII, fig. 10) has a prominent pedicle carrying a lanceolate cirrus which thus projects from the body.

The inferior division is slightly emarginate, and has a spine and a series of pale bristles with rather slender shafts and enlarged distal ends—spinulose along the terminal curves (Plate LXXVII, fig. 10). The terminal tapering blade is elongate and finely serrated along the edge, and the striæ on it slope from the point and edge downward and backward. The ventral cirri are also lanceolate, but much more acutely pointed, and project beyond the tip of the bristle-bearing process.

That so beautiful a species should for a considerable part of its life inhabit the sand is one of those curious features so difficult to explain on any modern theory of coloration.

The *Anaitis lineata* of Claparède[1] (1870) from Naples has certain resemblances to this species in general structure if not in coloration.

2. ANAITIS KOSTERIENSIS, *Malmgren*, 1867. Plate LVIII, fig. 6—head; Plate LXVIII, figs. 14 and 15—feet; Plate LXXVII, fig. 11—bristle.

Specific Characters.—Head somewhat rounded in spirit; eyes of considerable size. Tentacular cirri comparatively short and with finely tapered tips. Body apparently rather short and broad as well as soft, tapered more posteriorly than anteriorly. Foot with a broad and massive pedicle which bears the cordate and foliaceous cirri. The setigerous region forms a short cone with a bifid tip. Bristles with a comparatively small distal enlargement, which is split by the insertion of the terminal blade—with a spine on each side. The ventral cirrus is elliptico-subacuminate, and its tip projects considerably beyond the spinigerous regions.

SYNONYMS.

1867. *Anaitis kosteriensis*, Malmgren. Annul. Polych., p. 142.
1869. „ „ (?) McIntosh. Rep. Brit. Assoc. (1868), p. 337.
1874. „ „ Malm. Op. cit., Göteb., p. 79.

Habitat.—Dredged during the 'Porcupine' Expedition of 1869 off Bundoran in Donegal Bay in 20—35 fathoms.

Malmgren's sole specimen was procured from the Island of Koster, Sweden.

Head (Plate LVIII, fig. 6) somewhat rounded in spirit, with two eyes of considerable size. Tentacles absent. Tentacular cirri comparatively short and with finely tapered, almost capillary, tips, the anterior apparently having the usual proportion to the posterior.

[1] 'Annel. Nap., Suppl.,' p. 94, pl. ix, f. 4.

Body about 2 inches in length, apparently rather short and broad as well as soft. The dorsum is almost bare, for the large dorsal cirri do not much encroach on it. The tail is absent, but the body tapers much more in this region than anteriorly, though, as already indicated, the proportional breadth throughout is considerable. The bristles freely project on each side beyond the lamellæ. The segments have a prominent fold dorsally at their posterior border, a pit on each side at the base of the lamellæ indicating the commencement of the succeeding ring.

The foot (Plate LXVIII, figs. 14 [10th] and 15 [35th]) shows a broad and massive dorsal division which is directed upward and bears the large, foliaceous, and somewhat cordate cirrus which is more or less oblique in position—that is, is not quite horizontal.

The inferior division forms a short cone with a bifid tip and a pale spine. The translucent bristles (Plate LXXVII, fig. 11) are of considerable length, the shaft being slightly curved and the distal enlargement comparatively small and of peculiar formation. The front of the shaft ends in a somewhat conical process with a bifid tip. The processes slope from behind to the serrated edge of the blade. The posterior border again shows a marked step at the base of the cone, and from this the long and very finely attenuate distal blade takes its origin (as if articulated), its front edge, which is finely serrated, trending from the spinous tip of the cone. When the terminal blade snaps, the distal end of the shaft thus presents a somewhat trifid appearance. The structure of such a bristle differs materially from that in *Anaitis rosea*, and shows with other features the necessity for the relegation of that species to another genus. Malmgren's artist had caught the peculiarity, though somewhat indistinctly.

The inferior cirrus is more or less elliptico-subacuminate, and its tip projects considerably beyond the bifid apex of the setigerous region.

Claparède's *Anaitis pusilla* [1] (1870) is an allied form.

3. Anaitis Jeffreysii,[2] *n.s.* Plate LVIII, fig. 7; Plate LXVIII, figs. 16 and 17—feet; Plate LXXVII, fig. 12—bristle.

Specific Characters.—Head ovoid, narrowed anteriorly, and cordate posteriorly; two eyes near the posterior border. Tentacles subulate with delicately tapered tips, and the second pair of tentacular cirri is unusually long and also finely tapered. Body iridescent. Dorsal cirrus large and irregularly reniform; setigerous process elongate and bifid. Shafts of the bristles have dilated ends with spinous curves on each side of the base of the long finely tapered and serrated terminal blade. Ventral cirrus more or less lanceolate.

Habitat.—Dredged off Valencia Harbour, west coast of Ireland, May 31st, 1870 (J. G. J.).

Head (Plate LVIII, fig. 7) somewhat ovoid, narrowed anteriorly, cordate posteriorly, and with two moderately large eyes towards its posterior border. Tentacles subulate with delicately tapered tips. The second pair of tentacular cirri appears to be more slender and elongated than usual, and the tips are finely tapered.

[1] 'Annel. Nap., Suppl.,' p. 96, pl. ix, f. 5.

[2] Named after my old friend and veteran explorer of the British seas. The type represented by Dr. Gwyn Jeffreys is now almost extinct.

Body linear, rounded dorsally, and flattened ventrally—both surfaces being iridescent. The ventral surface has a broad median groove which has a slightly moniliform appearance from the depressions at each segment-junction. The large dorsal cirri cover a considerable portion of the lateral regions, notwithstanding the length of the feet posteriorly.

The dorsal division of the foot (Plate LXVIII, figs. 16 [10th] and 17 [40th]) is short anteriorly, but is considerably longer posteriorly. It bears a large irregularly reniform cirrus, the hilus of which is situated nearer the lower than the upper border, and which, as a transparent object, presents a radiated arrangement of its hypoderm from the region of the hilus. These organs appear to be borne obliquely, and overlap each other along the sides of the body.

The tip of the inferior division presents an elongated and sharply conical process superiorly, then a dimple, and a slightly receding margin inferiorly. The spine seems to issue just beneath the conical process. The shafts of the bristles (Plate LXXVII, fig. 12) have a slight curvature with a terminal dilatation, the distal edges of which have minute spines, and they slope downward to a step from which the long, finely tapered, and distinctly serrated blade springs. The proximal end of the latter is thus bevelled. The inferior cirrus resembles the greater part of a lanceolate leaf, with an acute tip, but one edge is attached. The tip is more acute in the posterior part of the body, as likewise is the superior conical process.

In the *Anaitis peremptoria* of Claparède,[1] from Naples, the ventral of the first pair of tentacular cirri is very long, the dorsal and the succeeding pairs being shorter.

Genus XXXIV.—*Phyllodoce*, Savigny (1820), Char. emend.

Head elongated, often longer than broad, oval or egg-shaped, or cordate posteriorly. One pair of circular eyes. Occasionally two rudimentary nuchal organs; four short tentacles, four pairs of tentacular cirri, which Pruvot considers as modified dorsal cirri of the ordinary kind, the first pair under the cephalic lobe, second and third on the peristomial segment, fourth on the second segment (Malmgren). Body elongated, flattened; segments two-ringed; dorsal cirri large, lamelliform, sometimes almost rectangular, carried vertically; ventral cirrus much less, fixed to a horizontal pinna.

Distinguished from *Eteone* by the number of the tentacular cirri, from *Eulalia* by the absence of the fifth tentacle, and from both by the form of the cirri and their insertion (Œrsted), whilst *Anaitis* is closely allied.

Vascular system consists of two longitudinal vessels which communicate with each other anteriorly, and which debouch into the posterior part of the body-cavity (Gravier).

Segmental organs.—A pair of ciliated tubes in each segment, the trumpet-shaped atrial opening being on the anterior face of each dissepiment, the external aperture on the ventral face at the base of the parapodium. Goodrich has recently described

[1] 'Annel. Nap., Suppl.,' p. 95, f. 6, 1870.

the ciliated genital funnel as open in front and closed behind, and intimately connected with the segmental organ, which is closed internally, branched, and furnished with solenocytes.[1] At maturity an opening is found at the point of fusion of the two structures, so that the ripe products escape ventrally.

Nervous system.—Cephalic ganglia with antero-superior and postero-inferior lobes, the latter, the antennary centre, most bulky. The antero-superior centres give origin to the stomato-gastric which receive an increment from the œsophageal connectives. Ventral chain with fused ganglia, the connecting trunks being separate, and the first pair larger than the others, and apparently formed by the fusion of three.

Reproductive organs developed from cœlomic epithelium, and shed into the perivisceral space. Goodrich and Jourdan think that the ova escape by the segmental pores.

Gravier[2] describes foot-glands debouching near the segmental aperture ventrally.

Ehlers (1868) characterises *Phyllodoce*, Savigny, thus: "Body elongated, generally flattened, distinctly segmented; head with four tentacles, the first two segments with four pairs of tentacular cirri, and often with a rudimentary foot; the remaining segments distinct, with simple feet bearing a fan-like group of jointed bristles and leaf-like dorsal and ventral cirri."

Grube (1879) made two groups of *Phyllodoce*, viz.: (1) those with the head more or less heart-shaped, having a deep dimple posteriorly (*P. laminosa* and *P. grœnlandica*); and (2) those with the head heart-shaped or rounded, but with the posterior border only a little notched (*P. maculata* and *P. citrina*).

De St. Joseph (1888), after a critical examination of the classification of the "Phyllodoces," adopts the following genera: (1) *Genetyllis*, Malmgren. Achetous buccal segment with four pairs of tentacular cirri; (2) *Phyllodoce* sans str., Czerniavsky. Achetous buccal segment with two pairs of tentacular cirri, other two pairs in the following setigerous segment; (3) *Anaitis*, Malmgren, nec Claparède. Buccal segment achetous, with three pairs of tentacular cirri, second segment with one pair, and with bristles; (4) *Carobia*, De Quatrefages, Marenzeller, rev. (*Anaitis*, Clap., *Phyllodoce*, Mgrm., *Anaitides*, Czerniavsky). Achetous buccal segment with one pair of tentacular cirri, fused or not with the following segment, which has two pairs of tentacular cirri and bristles; or the achetous buccal segment with two pairs of tentacular cirri, fused or not with the following segment, which has one pair of tentacular cirri and bristles; third segment with one pair of tentacular cirri, a setigerous lobe more or less developed, and a foliaceous ventral cirrus.

Cunningham[3] says: "In *Phyllodoce* no well-marked canals can be distinguished. The (nerve) cords are widely separated from the epidermis."

Leschke[4] procured trochophores of Phyllodocidæ in the Bay of Kiel in July, and older forms in September, October, and November.

[1] 'Q. Journ. Micros. Sci,' vol. 43, N.S., p. 706.

[2] An interesting account of the general structure of the group is given by the author in his thesis, "Recherches sur les Phyllodociens," Lille, 1896.

[3] Op. cit., p. 270, 1888.

[4] 'Wiss. Meer. Biol. Anstalt, Helgol.,' N.F., 7 Bd., p. 117, 1903.

1. Phyllodoce lamelligera, *Gmelin* sec. *Pallas*, 1788. Plate XLV; Plate XLVII, fig. 2; Plate XLIX, figs. 1 and 2 variety; Plate LVIII, fig. 20—head; Plate LXVIII, figs. 1–3—feet; Plate LXXVIII, fig. 6—bristle.

Specific characters.—Head somewhat conical, bluntly rounded anteriorly, and cordate at the base from two projecting processes. The ground colour is olive green, with a black touch in front, and shows pinkish iridescence. Eyes two, large, placed about the middle. Tentacles subulate and short; tentacular cirri with a ringed basal region (ceratophore), three pairs on the first segment and a rudimentary ventral cirrus on the second. (De St. Joseph says: "First pair under the head on buccal segment; second and third pairs on the second segment; fourth pair on third segment." Pruvot gives a similar arrangement.) Both appendages have the same dull, greenish hue as the dorsal cirri. A papilla or boss occurs at each side posteriorly. Body linear, much elongated (14—18 in.), convex dorsally and flattened ventrally, tapered a little anteriorly and more distinctly so posteriorly, where it ends in two rather stout caudal cirri. Segments transversely ringed, shorter and broader anteriorly than posteriorly. The cuticle is remarkably iridescent, and there is a median series of blackish specks, which, with the dull greenish lamellæ, make three touches in each segment. A conspicuous dark belt on the upper and anterior edge of the pedicle of the foot. Ventral surface with dusky pigment and three rows of specks, the median being pale. The proboscis in extrusion is long, dark, and clavate, the basal section being covered with small papillæ, while the distal part has numerous low transverse papillæ, and the terminal, firm disc has about twenty-one papillæ. The dorsal cirri anteriorly are reniform or ovate, at the thirtieth elongate-ovoid, at the sixtieth foot the upper part is wide, so that the whole process forms a broad flap. Posteriorly, they again diminish so as to resemble an acuminate leaf. A ciliated ridge behind the dorsal border of the lamella. Setigerous process somewhat clavate, with a bifid tip. Bristles pale, slightly curved at the distal end of the shaft which has minute spines on the terminal ridges and over the surface. The terminal blade is of moderate length, and has its edge boldly serrated and with striæ sloping dorsalward and backward. The ventral lamella is almost reniform in front, becomes ovato-acuminate behind and longer than the setigerous region; anal cirri subulate.

Proboscis with six rows of papillæ at the base in extrusion, and sixteen to twenty-one papillæ at the opening into the stomach.

Cerebral mass bilobate with a distinct ophthalmic lobe, and the œsophageal connectives give off the stomato-gastric nerves. The ventral chain has more or less fused ganglia, but the cords are distinct (Pruvot).

Synonyms.

1767. *Nereis maculata,* Linnæus. Syst. Nat., ed. 12, i, pt. 2, p. 1086.
1788. „ *lamellifera,* Pallas. Nova Acta Petrop., ii, p. 232, tab. v, figs. 11—17.
1791. „ *lamelligera,* Gmelin. Linn. Syst. Nat., ed. 13, i, pt. 6, p. 3120.
1797. „ „ Shaw and Nodder. Naturalist's Miscell., ix, tab. 311 (*fide aut.*).
1806. „ „ Turton. Linn. Syst. Nat., iv, p. 90.
1807. „ „ idem. Brit. Fauna, p. 135.

1808. *Nereis foliosa,* Montagu. MS. vol. Linn. Soc., pl. i., fig. 1.
„ „ „ Leach. Coll. Brit. Mus. (*fide* Johnston).
1811. „ *lamelligera,* Jameson. Mem. Wern. Soc., i, p. 557.
1812. „ „ Pennant. Brit. Zool., iv, p. 96.
1818. *Phyllodoce laminosa,* Lamarck. Anim. s. Vert., v, p. 317.
1820. „ „ Savigny. Syst. Annel., p. 43.
1825. *Nereis lamelligera,* De Blainville. Dict. Sc. Nat., xxxiv, p. 444.
1826. *Phyllodoce lamellosa,* Risso. Hist. nat. Europ., iv, p. 419 (?).
1828. *Nereiphylla laminosa,* De Blainville. Dict. Sc. Nat., lvii, p. 467.
1829. *Phyllodoce gigantea,* Johnston. Zool. Journ., iv, p. 53.
1830. „ *laminosa,* Bosc. Vers, i, p. 173.
1833. „ „ Audouin and Edwards. Ann. Sc. Nat., t. 29, p. 244, pl. xvi, figs. 1—8.
1834. „ „ idem. Annel. (Lit. France, ii), p. 222, pl. 5A, f. 1—8.
1840. „ *lamelligera,* Johnston. Ann. Nat. Hist., iv, p. 225, pl. 6, f. 1—6. and xiii, p. 438.
1843. „ *laminosa,* Rathke. Beitr. Fauna Norweg., Nov. Act., xx, p. 169 (?).
1844. „ *lamelligera,* Thompson. Report on the Fauna of Ireland (Rept. Brit. Assoc. 1843), p. 273.
1849. „ *laminosa,* (M. Ed.) Cuvier. Règ. Anim. Illust., pl. xiii, fig. 2.
1851. „ „ Grube. Fam. Annel., pp. 55, 129.
1853. *Nereis remex* (*Phyllodoce laminosa*), Dalyell. Pow. Creat., ii, p. 148, pl. 23, f. 1—7.
1864. *Phyllodoce laminosa,* Grube. Insel Lussin, p. 81.
1865. „ *lamelligera,* Johnston. Cat. Brit. Mus., p. 175, pl. xvi, f. 1—6, and p. 342.
„ „ *laminosa,* De Quatrefages. Annel., ii., p. 133.
1867. „ „ Malmgren. Annul. Polych., p. 24, Tab. iii, fig. 17.
„ „ *lamelligera,* Parfitt. Trans. Devon. Assoc., ii, pt. 1, p. 233.
1874. „ *laminosa,* McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 119.
„ „ *Paretti,* Marion and Bobretzky. Ann. Sc. Nat., 6 ser., t. ii, p. 61.
„ „ *lamelligera,* idem. Ibid., p. 62.
1885. „ *laminosa,* Pruvot. Arch. Zool. Expér., 2e sér. t. iii, p. 287, pl. xi, f. 6, 7, and pl. xiv, f. 4—8.
1888. „ (*Carobia*) *laminosa,* De St. Joseph. Ann. Sc. Nat., 7e sér., t. v, p. 274, pl. xi, fig. 133—136.
1890. „ *laminosa,* Malaquin. Annél. Boulon, p. 42 (Rev. Biol. Nord. Fr., t. ii, p. 437).
„ „ „ Giard. Bull. Sc. Fr. Belg., t. xxii, p. 77.
„ „ *lamelligera,* idem. Ibid.
1891. „ *laminosa,* Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 246.
1897. „ *lamelligera,* Gravier. Bull. Sc. Fr. Belg., t. xxix, p. 308, pl. xvii, f. 14—16, pl. xviii, f. 1—4, pl. xix, f. 6—18, pl. xx, f. 1—6, pl. xxi, f. 4—9, pl. xxii, f. 1, pl. xxiii, f. 3—5.
1900. „ „ Fischli. Polych. Ternate, p. 120.
1902. „ „ Marenzeller. Polych. Grund, p. 14.
1904. „ *laminosa,* Allen. Journ. M. B. A., N. S. vol. vii, p. 223.
1905. „ *lamelligera* (=*P. Ehlersii,* De Quatrefages), Græffe. Arbeit. Zool. Stat. Triest., xv, p. 325.

Habitat.—Under stones in pools near low water, from Shetland to the Channel Islands; tossed on shore after storms. It is by no means confined to the Laminarian

zone as Benham[1] seems to think, though it is long since Prof. Jameson received from Mr. Neill examples dredged on oyster-shells in the Forth.

Stretches to the Adriatic (Quarnero)—Ehlers; shores of France (Aud. and Ed., De St. Joseph, etc.). Moluccas (Ternate)—Fischli.

Head somewhat cordate, with the large eyes placed near its middle, and of a pinkish iridescent aspect, the ground colour being olive green, with a dark touch in front. Tentacles subulate. Tentacular cirri with a ringed ceratophore. Both appendages have the same dull greenish hue as the dorsal cirri. At the posterior and outer angle of the head, and just in front of the upper tentacular cirri, is a considerable papilla—probably sensory. A minute papilla also occurs in the centre of the posterior sinus of the head. The two longer tentacular cirri are often borne straight backward and adpressed to the smooth dorsum between the lamellæ.

Body linear, much elongated, from 14 to 18 inches or even 2 feet (Johnston and Dalyell), and with more than 400 segments. Convex dorsally, flattened ventrally, tapered a little anteriorly and more distinctly so posteriorly where it ends in two rather stout caudal cirri. The dorsum is of a fine iridescent bluish hue marked by regularly arranged transverse furrows. Each segment in the middle of the body has a narrow belt in front, succeeded by three others gradually extending in a transverse direction, a fifth twice as deep, and then a part not definitely bounded except by the segment-junction. In the middle line of the dorsum is a series of blackish specks, which, with the dark lamellæ on each side, make three in each segment. A conspicuous dark belt also occurs on the upper and anterior edge of the pedicle of the foot. The ventral surface is likewise iridescent, but the bluish sheen is less developed. In life and in certain lights in the preparations three rows of spots are visible on this surface, the central consisting of a pale speck in the interrupted median band. The dusky pigment is arranged in transverse bands as on the dorsum. The remarkable iridescence of the cuticle of this species is conspicuous in softened preparations.

In general the colour of the dorsum varies considerably, perhaps according to habitat, those most exposed to sunlight being most deeply tinted. In one fully two feet long, which was procured under a large stone about half tide mark, the bluish sheen of the dorsum is most marked in front, yet it does not conceal the two dark bars which cross the segment between the feet and the median dark patches which lie in front and behind them. The segments, moreover, are ringed. Posteriorly the hue is olive with a tinge of russet, and the dark pigment on the dorsum is arranged in two lateral touches and a median a little behind them. A trace of the bluish sheen is noticeable even to the tip of the tail. The general hue of the body is thus darker in front, paler (olive) posteriorly. In the same way the olive green pigment of the cirri is darker in the anterior, paler in the posterior region, the margin of the dorsal cirri being paler. The under surface is pale with a tinge of iridescent pink.

The proboscis in extrusion forms a long, dark clavate organ, the basal section being covered with small papillæ (Plate LVIII, fig. 20). The wall of the organ beneath the basement-membrane is marked by intersecting fibres. The distal region has numerous low transverse papillæ which are not so distinctly arranged in a hexagonal form as in

[1] 'Camb. Nat. Hist.,' ii, p. 314.

P. grœnlandica, though they form rows. The organ terminates in a firm disc with about 21 blackish papillæ at its border. The distinction drawn between *P. laminosa*, with less regular papillæ, and *P. lamelligera*, with the papillæ in rows, does not seem to be of moment.[1] I regard them as synonymous. Gravier shows six nerves running longitudinally in a section of the organ.

The proboscis is followed by a pale, elongated, and tough membranous stomachal region without papillæ, after which comes the gut with its glandular walls.

The perivisceral fluid readily coagulates in sea-water after extrusion. The cut edge of a lamella also exudes a coagulable fluid, and this forms minute vermiform processes at the wounds.

This form is carnivorous, the fæces being loaded with bristles and cuticle of annelids, such as the Spionidæ.

The dorsal cirri are dusky green, paler at the edges and with small pale specks. In some specimens they are brownish green with a pale green margin, thus simulating the condition in *Phyllodoce Paretti*, Aud. and Ed., which has a bright yellow border to its leaflets. In a series of examples from various localities the cirri vary considerably, the Neapolitan examples, perhaps, being most pointed—both dorsally and ventrally. Fine examples from deep water off Montrose had them bluntly rounded in the middle of the body.

The smaller specimens are usually paler than the larger, the bluish iridescence of the dorsum being only faintly marked anteriorly. The majority of those from the Channel Islands are small, with a brownish body and pale green lamellæ. A similar condition would appear to occur at Naples. A variety also was obtained in the West Voe of Scalloway, in which the dorsum was dull yellowish, with the usual central line and cross-bars. The cirri were brownish olive with a dull yellow margin. Some large forms, again, have more of the greenish iridescence than the blue.

The dorsal cirrus (Plate LXVIII, fig. 1) in the anterior segments (tenth) is somewhat reniform or ovate, at the thirtieth it becomes greatly enlarged superiorly so as to assume an elongate ovoid form, rounded and broad inferiorly and diminishing a little superiorly to a rounded tip. At the sixtieth foot (Plate LXVIII, fig. 2) the upper part is wide, so that the whole process forms a broad flap. Towards the tail, the lamella again becomes diminished dorsally, so that it resembles an acuminate leaf. The hypodermic streaks and vessels trend from the margins obliquely downward and inward to a central axis, and thus resemble the midrib of a leaf and its veins. A pale ridge just external to the inner edge of the lamella is conspicuous in the preparations.

In the living form these lamellæ have a band of powerful cilia (visible under a lens), commencing about a third from the apex of the process and coursing to the middle of the pedicle at the base. The cilia are placed just behind the dorsal border of the lamella, and do not follow the boldly marked curve proceeding downward and inward. The lamellæ are highly sensitive, shrinking with a rapid jerk when interfered with.

Parasitic Infusoria are common on the basal portion of the lamellæ. Each can shorten and elongate its stalk, expand and contract its disc, which has a vestibule in the

[1] *Vide* Dr. Marion Newbigin, ' Millport Biol. Station Communications,' i, p. 3, 1900.

centre and a band of cilia around its edge. Free forms—of the greenish hue of the borders of the cirri—become entangled in the mucus surrounding the annelid.

The ventral division of the foot consists of a somewhat clavate process with a bifid tip, from which the spine issues, and beyond which the lamellæ project considerably. The bristles (Plate LXXVIII, fig. 6) have pale shafts slightly curved towards their dilated extremities, which have a series of minute spines, forming a hispid margin on each side of the peak in some, and they are not confined to the edge only, but pass some distance downward on the obliquely striated bulbous region. In certain views the spines, which are slightly curved, appear to increase in size from the lower part of the dilated region to its apex. This explains the appearances frequently observed at the tip. The tapering terminal blade has its edge boldly serrated, and is of moderate length. The serrated edge is split inferiorly, and each limb is spinous. Considerable variation occurs in the length of the spines, which are very long in small examples from Naples. The inferior cirrus is almost reniform in front (tenth), but becomes ovate-acuminate as the fiftieth foot is approached, and continues of this shape to the posterior end. It is fixed to the posterior and ventral border of the inferior division for fully a third of its length and is borne vertically. The variations in the feet may be estimated by comparing fig. 2, Plate LXVIII, with fig. 3, from Naples.

Reproduction.—Some deposited green ova in a gelatinous mass in May. The animal readily secretes a large quantity of mucus and in this the eggs very probably are immersed. A ripe male, which is distinguished by the paler-yellowish hue of the body and the bases of the feet—caused by the masses of white sperms—occurred in June (19th). The sperms have a comparatively large head and long slender tail. Ehlers observes that the female is larger than the male, and Dalyell mentions that young specimens are usually green, but it is doubtful if he had always the same type before him.

A recently developed tail is quite pale, and is thus in contrast with the fine blue segments in front. The dorsum of the pale region has a median row of dark specks, whilst a less distinct speck occurs at the base of each lamella.[1]

When immersed in clean sea-water the animal is for some time very restless, moving its elongated and complex body with ease and grace, first in one direction and then in another. The lamellæ (cirri) reverse their feather-like motions in whole or in part as occasion requires, and apparently act in conjunction with the bristles, and thus the most varied movements are performed as easily by this animal with its feet in hundreds as by one with a few. After it secures a suitable position, no motion of any organ is noticed for considerable periods, the cilia on the lamellæ sufficing for aeration. In this condition the lamellæ are stretched outwards from the body, except at the curves, or when compressed against the glass; while the tentacular cirri are laid straight backwards. By the aid of gelatinous mucus secreted in considerable quantity, it can also swim near the surface of the water, and appears generally to relish the gentle movement of the lamellæ. A regular series of wave-like contractions pass from before backward—about five or six per minute—in some otherwise at rest.

[1] *Vide* A. Michel, "Recherches sur les Régénérations chez les Annél.," 'Bull. Sc. Fr. et Belg.,' 31, ser. 4, 1893, pp. 245—417, pls. 13—19.

It is interesting to note how an animal of such extreme length moves so gracefully in the water, emerging from its folds and coils with ease and dexterity, and making progress over the bottom with considerable rapidity.

The specimens of this species from Naples are but pigmy representatives of the gorgeous Scotch examples, a condition, perhaps, not unexpected in view of the small size of those from the Channel Islands. The head is more elongated, but this may arise from the mode of preparation, and it is noteworthy that whilst these small southern examples were diagnosed as *P. lamelligera*, the large, brightly coloured forms, were termed *P. Paretti*. The lateral papillæ posteriorly, and the median in the sinus of the same region, are not distinguishable. The dorsal lamellæ (Plate LXVIII, fig. 3), moreover, are more rounded, and the posterior ciliated band is very distinct. The tip of the ventral lamella is also more pointed. Judging from the spirit-preparations the pigment would seem to be much less developed than in the large northern examples.

The specimens collected in Shetland were also of comparatively small size, but this may have been accidental.

A variety apparently of this species was sent by Dr. Allen from Rum Bay, Plymouth, where it occurred in sand. The general hue was yellowish brown with white touches on the head, body, and tentacular cirri, the latter indeed being almost white. A white patch—bifid in front—ran forward to the inner side of each eye, and both were separated from the pale area bearing the tentacles by a brown belt—the bifid part being thus prominent. On the dorsum of the body the pale madder-brown pigment was cut into three rows by a touch of white on each side of the median stripe (Plate XLIX, fig. 1). On the ventral surface (Ibid. fig. 2) the median sulcus had a stripe of madder-brown, and a yellowish brown touch, fading externally on each side of it. The dorsal cirri had a central brown touch and a pale margin, and their shape seemed to be more distinctly triangular (or heart-shaped) than in the ordinary form (Plate L, fig. 7). The shape of the head, which agreed with those from the Channel Islands in being more elongate, and its processes, correspond with *P. lamelligera*, and so far as observed the proportions and minute structure of the bristles do not differ in any respect, and the same with regard to the setigerous region and the other parts of the foot. The specimen was much softened and injured before it was minutely examined by other than the artist.

In transverse section of the body-wall of *P. lamelligera* the great depth of the hypoderm and its glandular nature are marked, as also is the strength of the circular muscular coat, and the great extent of the dorsal longitudinal sheets which come down on each side of the oblique muscles. The ventral longitudinal muscles are considerably less.

In this species the nephridial region of the segmental organ is stated by Louis Fage [1] to be four-lobed, but the genital funnel resembles that in allied forms, *e.g.* that of *P. Paretti*.

Col. Montagu (1808), in the MS. volume of drawings by Miss Dorville, represents a comparatively small and pale specimen of this species, and a foot. It is such southern variations which subsequently have given rise to confusion in species. Montagu himself probably referred to one of these variations, as *Nereis argentea*, in Plate XXXII, fig. 2, but whether of this or another species is uncertain.

[1] 'Ann. Sc. Nat.,' 9e sér., iii, p. 263, fig. 10.

Risso's genus *Eunomia* (1826) probably refers to *Eulalia* or *Phyllodoce*, and his *E. tympana* is a reddish form perhaps akin to *Phyllodoce rubiginosa*.

The *Phyllodoce mucosa* of Œrsted[1] may have some relation to a young form of this species.

In the illustrated edition of Cuvier (1849), Milne Edwards shows a variety with a dark spot at the segment-junction near the base of the cirrus on each side.

Ehlers (1864) gives an extended account of the structure of this form which he considered different from Savigny's *P. laminosa*. He points out that the colour of the latter is a beautiful green, that it appears to differ in the form of its bristles, the arrangement of the papillæ of the proboscis, and other details. In alluding to this author's views Miss Newbigin leaves the question undecided.[2]

The *Phyllodoce Kinbergi* of De Quatrefages (1865) would seem to come near this species, if it is not identical therewith. His *P. Rathkii*[3] appears also to be a well-marked pale variety.

Malmgren (1867) considered that Rathke's form though similar did not pertain to this species, which had not yet been found in Scandinavia.

This seems to be the *Phyllodoce marginata* of Gosse from Torbay.

Tauber (1888) is of opinion that *P. maculata*, Müll. and Œrst., *P. Mülleri*, Leuck., *P. teres*, *pulchella*, *badia*, *Rinkii*, *citrina*, *grœnlandica*, *incisa*, *mucosa*, and *assimilis* all belong to *Ph. lamelligera*, Johnston. Further study may lead to a union of such forms as *Phyllodoce lamelligera* and *P. grœnlandica*, but it is advisable to leave them separate at present. Ehlers separates *P. laminosa*, Sav., from *P. lamelligera*, Johnst. Cznerniavski ranges *P. laminosa* under the sub-genus *Genetyllis*.

Giard (1890), like Ehlers, separates the *Phyllodoce laminosa* of Savigny from the *P. lamelligera* of Johnston, which is rare at Wimereaux, and is, he thinks, near the type of *P. Pancerina* and *P. splendens*. So far as British experience goes, the latter suggestion would seem to have slender foundation, but the experienced zoologist of Wimereaux may have reasons—not yet disclosed—for his view.

Goodrich[4] finds a distinction between the solenocytes of *Phyllodoce Paretti*, where they are grouped only at the tips of the branches, and those of *P. laminosa*, in which the cell-bodies are bent round so as to rest on the segmental organs, the latter rather resembling those of *Glycera unicornis* than those of its nearer allies. In the latter species, also, he says cilia are developed on the cœlomic surface between the rows of solenocytes.

2. Phyllodoce Paretti, *De Blainville*, 1828. Plate XLIV, figs. 6, 6 *a* to 6 *c*; Pl. LXXIX, fig. 27—bristle.

Specific Characters.—Head comparatively small, rounded, with two large eyes, which are blackish with a dull yellow rim, the colour being continued posteriorly as a broad band to the edge of the buccal segment. The rest of the head is pale brown, especially

[1] 'Annul. Danic. Consp.,' p. 31, figs. 25, 79, 85 and 89.
[2] 'Communic. Millport Marine Lab.,' i, November, 1900, p. 3.
[3] 'Annel.,' ii, p. 131, pl. ix, figs. 12—14.
[4] 'Quart. Journ. Micros. Sc.,' N. s., vol. xliii, p. 707, fig. 13, 1901.

between and in front of the eyes. The terminal tentacles are large and dull yellow. Posterior border of the head entire. Tentacular cirri long, comparatively thick, tapered at the tip and of the same yellowish colour as the tentacles. Body 6—10 inches in length and 4—5 mm. in diameter, slightly tapered anteriorly and more distinctly so posteriorly. Iridescent bluish, paler in some, with a shade of pink mesially. Ventrally the same bluish iridescent colour prevails. Dorsal cirri of a rich deep green with a border of yellow or greenish yellow. Posteriorly the body terminates in two rather thick anal cirri of the shape and colour of the tentacular cirri. Foot with foliaceous dorsal cirrus which is bluntly cordiform in front, nearly regularly cordiform in the middle, and more or less lanceolate posteriorly. Setigerous region a blunt cone, bifid at the tip, and having a single powerful spine and a fan of nearly straight (the distal curve being slight) translucent bristles, the ends of the shafts being bluntly clavate, so that the region is short and minutely spinous. The terminal process is characteristically small and tapers to a fine point with a serrated anterior edge. Ventral cirrus irregularly reniform or ovato-lanceolate in front, ovato-lanceolate in the middle of the body and more pointed (that is more distinctly lanceolate) posteriorly.

Synonyms.

1828. *Nereiphylle de Paretto*, De Blainville, Dict. Sc. Nat., lvi, 476, et Atlas, pl. xiii, fig. 1.
1829. *Nereis Paretti*, Delle Chiaje. Mem., iv, p. 195, Tav. lxiv, f. 3—5. ?
1833. *Phyllodoce Paretti*, M. Edwards. Ann. Sc. Nat., xxix, p. 248.
1834. „ „ Audouin et Edwards. Annél., p. 229.
1840. „ *Rathkii*, Grube. Actin. Ech. u. Würm., p. 78.
1841. „ *Parettiana*, Delle Chiaje. Discriz., iii, p. 98, et *P. Paretti*, v, p. 104, Tav. 166, f. 3.
1849. „ *Paretti*, M. Edwards. Règ. Anim. Illust., pl. xiii, f. 1.
1851. „ *Rathkii*, Grube. Fam. Annel., pp. 55 and 129.
1865. „ *Paretti*, De Quatrefages. Annel., ii, p. 130.
1870. „ *Pancerina*, Claparède. Annel. Nap. Suppl., p. 92, pl. ix, fig. 1.
1888. „ *Paretti*, De St. Joseph. Ann. Sc. Nat., 7e sér., tom. v, p. 279.
„ „ (*Carobia*) *splendens*, idem. Ibid., p. 278, pl. xi, fig. 138. (?)
1904. „ *Paretti*, Allen. Journ. M.B.A., n. s., vol. vii, p. 224.
1905. „ „ Graeffe. Arbeit. Zool. Stat. Triest., xv, p. 325.
1906. „ *splendens*, De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii. (?)

Habitat.—Guernsey, between tide-marks (Ray Lankester); offshore in depth of 10—15 fathoms, Plymouth (E. J. Allen).

Shores of France (Milne-Edwards, De Saint Joseph). Mediterranean (Delle Chiaje, Grube, Claparède).

Head rounded or ovoid, comparatively small, with two large black eyes surrounded by a yellowish rim, and passing as a band from each to the posterior border of the region. They look both dorsally and laterally. The terminal tentacles are large, fusiform, and with a short slender tip. The upper pair are carried forward slightly sloping from each other. A speck of dark pigment occurs behind the base of each. The ventral pair are usually borne transversely or with the tips pointed downward. Their shape is similar to that

of the dorsal pair. The ventral surface of the head is—like the median dorsal—pale brownish. No distinct depression occurs at the posterior border.

Tentacular cirri vary in length in different examples. In that from Plymouth (Plate XLIV, fig. 6) they are somewhat short, thick but tapered terminally, and have the same yellowish colour as the tentacles. The first or most anterior of the series in life springs from a ceratophore which projects forward at the side of the head, is fusiform in outline and ventral in position. Its yellow is slightly tinged with brown. The next is dorsal but in rear of the foregoing, is carried more or less erect, usually sloping obliquely outward, and forms a long flattened lanceolate leaf, its yellowish hue also having a few brownish touches, sometimes as a band on each side of a midrib of dull yellow on its upper or anterior surface. The third lies below the former towards the ventral border of the buccal segment, is fusiform in outline, slightly flattened and about the same length as the first. The fourth arises from a ceratophore which projects forward from the second ring of the body, and passes horizontally outward, being less prominent than the conspicuous second pair. It is next the latter in size and has a flattened lanceolate outline with a pointed tip—its general yellow being tinged with brown.

Body 6—10 inches in length and 4—5 mm. in diameter, distinctly tapered anteriorly, and more so posteriorly where it ends in two rather thick anal cirri of the shape and colour of the tentacular cirri. The coloration is most striking, the dorsum being of a rich iridescent blue throughout, or in some with a tinge of pink mesially, probably from iridescence, whilst the ventral surface is similarly tinted—only slightly paler. In front the mesial part of each segment—between the feet—is darker, the narrower band at the segment-junction being paler, but throughout the rest of the body the segment-junction is discriminated by a glistening transverse line on each side of a narrow belt. Ventrally the segment-junctions are marked by a straight line anteriorly and by two flattened spindles or crescents behind, so that there is a forward sinus in the middle line.

The lamellæ (dorsal cirri) are of a rich deep green or blackish-green with a border of yellow or greenish yellow, and they have a tendency to be curled and twisted, especially in specimens in confinement, a feature greatly increasing the complexity of the dorsum. The ventral lamellæ which lie behind the setigerous lobes are considerably paler, being light green with bold touches or a belt of brownish pigment within the border, which has a margin of yellow. In some the buccal and the second segments are marked off by the deep madder-brown hue of the two following ventral and dorsal cirri, this colour thus bringing into relief the yellowish tentacular cirri, and the yellow margin of the dorsal cirri.

Few animals—marine, fresh-water, or land—can excel this *Phyllodoce* in the chaste beauty of its coloration, whether viewed in whole or in part. Though the hues are similar throughout the cirri, yet the soft folds and curvatures of each present endless variations, so that whilst the general plan is carried out there is no monotony. The dark iridescent blue of the body gleams as the annelid moves with an ever changing lustre which relieves the dark green and yellow of the foliate cirri.

In one with a reproduced tail, the new segments with their lanceolate dorsal cirri are yellowish, just a tinge of green or bluish-green appearing in the centre of the anterior cirri so as to differentiate the yellowish border. The ventral cirri are yellowish

throughout. The body of the new region is yellowish with a slight shade of green dorsally, a somewhat opaque linear dorsal streak indicating the intestine. Yellow would thus appear to be the fundamental colour, the greens and browns being subsequently formed.

The proboscis has not been extruded in any example. De Saint Joseph found thirty papillæ at the entrance to the stomach.

The foot has dorsally the foliaceous cirrus, which springs from a long pedicle and anteriorly has a bluntly cordiform outline, a regularly cordiform shape in the middle and following regions of the body, and a more or less lanceolate outline posteriorly. In the anterior and middle regions it is flecked with dark pigment in Neapolitan specimens, and in one from Plymouth the dark pigment is even more conspicuous. The setigerous region forms a somewhat long blunt cone with a horizontally bifid tip.

The shafts of the bristles (Plate LXXIX, fig. 27, male) have a very slight distal curve, and the hue is brownish. Moreover, the dilated terminal region is more or less truncate, and thus the spinous area is shortened by the absence or abrasion of the conical end with its larger curved hook-like spines. The contrast with the typical *Phyllodoce lamelligera* is thus marked. The truncate end of the shaft in *Paretti* has a much shorter spinous region, but the trend of the spines is the same. The distal sabre, moreover, is shorter, more filiform towards the tip, and the serrations on the edge are more minute. If the effect of age and special surroundings affected the bristles as just described, then the connection of this form with *Phyllodocera lamelligera* would be clear. In an example from Plymouth the free parts of the bristles were tinted of a brownish hue, the same pigment being greatly developed in the cirri and setigerous region.

Reproduction.—Goodrich and Louis Fage [1] describe the segmental organs as having a largely ramified nephridial lobe, each of the divisions with its solenocytes and tubercles. The funnel is large and crenate.

The *Phyllodoce Paretti*, De Blainville,[1] is a species about which diverse opinions may be taken, more especially as no connected series from the young to the adult condition has been studied. So far as known all those procured in the Channel Islands and in South England have been adult, though, if the *Phyllodoce splendens* is the same form, two young examples, of 7 and 16 mm. respectively, about which, however, there may be doubt, were found by De Saint Joseph.

Grube's[2] original description (1840) of *Phyllodoce Rathkii* agrees with the structure of *P. Paretti*, for he notes the form of the tentacular and dorsal cirri, the nature of the bristles, and the coloration. He found it at Palermo.

Grube's[3] diagnosis is: Mouth-segment scarcely visible from the dorsum; dorsal cirri heart-shaped; the longest tentacular cirrus as long as the fifth segment; on each side only four tentacular cirri, whereas *P. laminosa* has five.[4]

De Quatrefages appears to have made two new species in connection with this form, for his *P. Kinbergi* can scarcely apply to any other European species—notwithstanding

[1] 'Ann. Sc. Nat.,' 9e sér. iii, p. 282, figs. 8 and 9.

[2] 'Actin. Echin.,' etc., p. 78.

[3] 'Fam. Annel.,' p. 129.

[4] The author had misinterpreted the condition in this form.

his figure of the elongated dorsal cirri anteriorly—a feature which may have been due to imperfect preservation. He makes the remark under *P. Paretti* that the appendages of the bristles are very short, and for this reason he emphasises the distinction between it and the former. It may be doubted, however, whether the structure of the bristles was studied with sufficient minuteness, and the figures bear out this view.

Claparède (1870) places much reliance on the relative length of the tentacular cirri as distinguishing his *P. Pancerina* from *P. Paretti*, the former having them very long and thick. It is doubtful, however, if much weight can be placed on this point. The tentacular cirri arise from the same transverse line as in *P. Rathkii* of Grube, whereas Claparède thought such did not exist in the *P. Paretti* of Edwards and Delle Chiaje, nor in the *P. Kinbergi*, De Quatrefages, a species closely approaching *P. Pancerina*. He thought the bristles differed from those of *P. Paretti* in having the terminal piece undulated and somewhat longer—distinctions which may be found in the same specimen.

Marion and Bobretzky (1875) consider that *Phyllodoce Pancerina* (Claparède) is the same as *P. Paretti*, and they separate it from *P. lamelligera* (Johnston). Claparède's form may be a well-marked southern variety, with swollen tentacles and enlarged lamellæ. Delle Chiaje does not show a yellow border to the dorsal cirri in his figure in the 'Memoire,' but mentions it in his description.[1]

The *Phyllodoce splendens*[2] (De St. Joseph), which the author links closely to *P. Kinbergi* (De Quatrefages), *P. Paretti*, De Blainville, and *P. Pancerina* (Claparède), seems to be the same form. It agrees in colour, the small size and shape of the head, and other features. He places the tentacular cirri thus: Two pairs on the buccal, the third pair on the second segment, and the fourth on the third segment, with a rudiment of a foot without a ventral cirrus. The dorsal cirri are cordate at the base, and the eggs green. Fragments of *Synapta inhærens* occur in the stomach. He only found two young ones (16 mm., 82 seg.; and 7 mm., 41 seg.). "Les soies ont la hampe très renflée en avant," and the terminal process is shorter than in *P. Pancerina*, and thus agrees with *P. Paretti*, of which it is probably a variety. The author's *P. papulosa*,[3] from Dinard, also comes very near the present form.

3. PHYLLODOCE GRŒNLANDICA, *Œrsted*, 1843. Plate LVIII, fig. 5—head; Plate LXVIII, figs. 4, 5, 6—feet; Plate LXXVII, fig. 7—bristle.

Specific characters.—Head somewhat ovate, cordate posteriorly; two eyes, tentacles short, tentacular cirri normal. Body of considerable length, four to eight inches; greyish green; segments short. Proboscis in extrusion with six rows of large tubercles anteriorly, numerous rows of smaller conical papillæ posteriorly. Dorsal cirri much developed superiorly, so as to be almost rectangular; ventral cirri ovate-elliptical, and in the middle segments turned upwards (Œrsted); setigerous process bifid, shafts of bristles with enlarged spinigerous tips and a long serrated blade.

[1] p. 176.

[2] 'Ann. des Sc. Nat.,' 7e sér., tom. v, p. 278, pl. xi, fig. 138, 1888.

[3] Ibid., 8e sér., t. v, p. 320, pl. xviii, figs. 117—120, 1898.

Body-wall with a comparatively thick coat of hypoderm under the cuticle, and the circular muscular coat is well developed. The dorsal and ventral longitudinal muscles are large, the former being almost separated by a median fissure, their outer borders in section being very massive, whilst the ventral are somewhat ovoid. The fasciculi in the ventral are flattened in transverse section, and almost all have their ends placed externally and internally, the flat faces being parallel to each other.

The oblique muscles meet or decussate beneath the nerve-cords, the circular coat, the basement membrane, the hypoderm and cuticle being external. In certain sections their attached ends widen into a broad fan.

Synonyms.

1842–3.	*Phyllodoce grœnlandica,*	Œrsted.	Kröyer's Nat. Tids., p. 121.
1843.	„	„	idem. Grönl. Annul. Dors., p. 192, f. 19—20, 22, 29, 30, 31, 32.
„	„	„	idem. Annul. Dan. Consp., p. 32.
„	„	„	Sars. Beskriv., Tab. ii, figs. 19, 21, 22, 29—32.
1851.	„	„	Grube. Fam. Annel., pp. 56 and 129.
„	„	„	Sars. Nyt Mag., vi, p. 209.
„	„	*mucosa,*	Œrsted. Consp. Annul., p. 31, f. 25, 79, 83, and 89.
1853.	„	*grœnlandica,*	Stimpson. Invert. Grand Manan, p. 33.
1863.	„	„	idem. Annel. Greenland, Proc. N.S. Philad., p. 140.
1865.	„	„	Malmgren. Nord. Hafs-Annul., pp. 96, 129.
„	„	„	De Quatrefages. Annel., ii, p. 141.
„	„	*lamelligera,*	Carrington. Annel. Southport (Proceed. Lit. and Philos. Soc. Manch., iv), p. 5 (180).
1866–9.	„	*grœnlandica,*	Packard. Mem. Bost. Soc. Nat. Hist., i, p. 294.
1867.	„	„	Malmgren. Annul. Polych., p. 21.
1871.	„	„	Ehlers. Sitz. phys. med. Soc. Erlangen, iii, p. 79.
1873.	„	„	Sars. Bidrag Christ. Fauna, iii, p. p. 223—4.
1874.	„	„	Malm. Op. cit. Göteb., p. 79.
„	„	„	McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
1875.	„	„	idem. Invert. and Fishes St. Andrews, p. 119.
1878.	„	„	Marenzeller (Nordpol. Exped.). Denksch. d. k. Akad. Wien, 35 Bd., p. 395.
„	„	„	McIntosh. Trans. Linn. Soc., Ser. 2, p. 502.
1879.	„	„	Tauber. Annul. Danic., p. 87.
„	„	„	Théel. K. vet. Akad. Forhl., Bd. 16, 3, p. 34.
1880.	„	„	Grube. Jahresb. Schles. Ges., 1879, p. 214.
1881.	„	„	Horst. Niedel. Arch. Zool., Suppl. Bd. i ("Willem Barent" Exped., 1878), p. 11.
1883.	„	„	Wirén. Chætop. "Vega" Exped., p. 400.
1884.	„	„	Webster and Benedict. Rep. U.S. Comm. F. and F., p. 703.
1896.	„	„	Michaelsen. Polych. deutsch. Meere (Biol. Anst. Helgol., ii Th.), p. 32.
1898.	„	„	De St. Joseph. Ann. Sc. Nat., 8e sér., t. v., p. 326, pl. xviii, figs. 124—126.
1901.	„	„	McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 223 (bis).
„	„	„	Whiteaves. Geol. Surv. Canada, No. 722, p. 82.

Habitat.—Tossed on shore in great numbers after storms on the West Sands, St. Andrews (E. M.), and probably inhabits the sand inshore. Stomach of cod (E. M.). Montrose Bay (Dr. Howden). Connemara, Co. Galway (A. G. More).

The species is common in the seas of Spitzbergen, Nova Zembla, and Greenland, but less frequent in Norway, Finmark, and Sweden. Extends to Canada (W. C. M.) and the American coast. Siberia and Behrings Strait (Marenzeller, Wirén).

Head (Plate LVIII, fig. 5) somewhat ovate with a cordate posterior border, two acute peaks being separated by a deep fissure. It is longer than broad. The eyes are well marked, and occur about the commencement of the posterior third. The tentacles are short and subulate. The tentacular cirri have the usual proportions.

Body slightly tapered anteriorly and much more so posteriorly, rounded dorsally and somewhat flattened ventrally where a median groove occurs. The segments are distinctly marked on both surfaces by deep grooves. The mouth forms a transverse fissure ventrally with various furrows. The slender tail bears two caudal cirri. The animal is of a sandy or greyish-green hue with darker pigment on the edges of the lamellæ. It tinges spirit greenish and becomes so itself. The exserted proboscis is sub-cylindrical, but is often clavate. Proximally twelve rows of elongated papillæ (thirteen to seventeen in each) are ranged in two groups of six, a blank occurring in the mid-dorsal and the mid-ventral line. The distal region (in extrusion) presents a somewhat hexagonal appearance in transverse section, from the disposition of the large tubercles or blunt papillæ which form six rows. Seventeen papillæ surround the aperture, the furrows between them trending inward so as to make a long and slightly tapering process to each papilla, and as the aperture rapidly diminishes, the whole constitutes a fluted basin with a central aperture.

The dorsal division of the foot (Plate LXVIII, figs. 4, 5, and 6) forms a short and massive pedicle bearing the more or less vertical cirrus, which in the anterior part of the body, as at the tenth foot, has a short conical form, whilst at the sixtieth, its dorsal part has become so much developed as to give it almost a rectangular outline, the dorsal margin being nearly straight. Towards the posterior part of the body it again becomes rounded dorsally. The hypoderm of the cirrus has a somewhat radiate arrangement.

The inferior division consists of a bifid setigerous lobe[1]—the spine issuing from the terminal pit. The shafts of the bristles (Plate LXXVII, fig. 7) have a terminal curvature and a dilated end, the sides of which are minutely serrated. The terminal blade is long, finely tapered, and minutely serrated. The ventral cirrus is ovate, elliptical, with an acuminate tip, and is carried nearly vertically at the posterior border of the foot. It is shorter and broader anteriorly, more elongated and more pointed near the tail.

The original description and figures of Œrsted (1843) leave no doubt concerning this species, though perhaps the outlines might be improved. His specimens had from 300—350 segments. He considered that the bristles agreed with those of *P. lamelligera*.

The *Phyllodoce fragilis* of Webster[2] from the Virginian coast seems to be a closely allied form, which occurs elsewhere on the shores of America.

[1] The setigerous process is more elongated in specimens from Southport.

[2] 'Trans. Albany Inst.,' ix, p. 14, pl. iii, figs. 32—37, 1879.

4. Phyllodoce maculata, *Linnæus*, 1767? (*Johnston*, 1842). Plate XLV, fig. 2; Pl. XLVII, fig. 3; Pl. LVIII, figs. 21 and 24; Pl. LXVII, figs. 7 and 8—feet; Pl. LXXVIII, figs. 23 and 24—bristles.

Specific Characters.—Head longer than broad, speckled with yellow, cordate posteriorly. Eyes two, of moderate size. A median and two lateral yellow spots on the dorsum of the first segment. Body long, linear with three dorsal rows of dark spots, the lateral from the lamellæ. Posteriorly a yellowish-white spot appears between the central rows. Proboscis subcylindrical with six rows of small papillæ on each side in extrusion, distally six rows of large tubercles or folds, and terminating in a circle of 16—17 papillæ. Dorsal cirrus of the foot irregularly ovate, the dorsal edge being rounded, or subrectangular throughout the greater part (middle) of the body. Ventral cirrus broadly lanceolate, the pointed tip projecting beyond the setigerous lobe. Spinigerous region rather short, bifid. Bristles with a dilated end to the shaft, and spinigerous curves. Terminal blade of moderate length and minutely serrated.

Synonyms.

1767. *Nereis maculata,* Linnæus. Syst. Nat., ed. 12, i, pt. 2, p. 1086.
1776. „ „ O. F. Müller. Zool. Dan. Prodr., p. 217, nr. 2635.
1780. „ „ O. Fabricius. Fauna Grœnl., p. 298.
1789. „ „ Bruguière. Encycl. Méth., Vers, i, p. 134, Tab. 57, f. 1—6.
1791. „ „ Linn. Gmelin, Syst. Nat., ed. 13, i, pt. 6, p. 3118.
1800. Die gefleckte Nereide, O. F. Müller. Naturges. einiger Würm-Arten, p. 156, Tab. x, f. 1—6.
1806. *Nereis maculata,* Turton's Gmelin, iv, p. 88.
1825. „ „ De Blainville. Dict. Sc. Nat., xxxiv, p. 446.
1829. *Phyllodoce pulchra,* Johnst. Zool. Journ., iv, p. 54.
1830. *Nereis maculata,* Bosc. Vers, i, p. 171.
1842–3. *Phyllodoce maculata,* Œrsted. Kröyer's Nat. Tids., p. 121. (?)
„ „ „ Johnston. Ann. Nat. Hist., iv, p. 227, pl. vii, f. 1—3.
1843. „ „ Œrsted. Grönl. Annul. Dorsib., p. 191, figs. 46 and 48. (?)
1849. „ *Mülleri,* R. Leuckart. Archiv f. Nat., p. 204, Tab. iii, f. 13.
1851. „ *maculata,* Grube. Fam. Annel., p. 55.
„ „ *Mülleri,* idem. Ibid., p. 56.
„ „ *maculata,* idem. Ibid., pp. 55 and 129.
1865. „ „ Johnston. Cat. Brit. Mus., pp. 177 and 342.
„ „ „ De Quatrefages. Annel., ii, p. 138.
1867. „ „ Malmgren. Annul. Polych., p. 144, Tab. iv, f. 16.
„ „ „ Parfitt. Trans. Devon. Assoc., ii, pt. 1, p. 232.
1874. „ „ McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
1875. „ „ Idem. Invert. and Fishes St. Andrews, p. 119.
„ „ „ Möbius. Jahresb. Com. deutsch., p. 170.
1879. „ „ Tauber. Annul. Danic., p. 87.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 205.
1886. „ „ Idem. Kara Hav. Ledorme., p. 7.
1890. „ „ Giard. Bull. Sc. Fr. Belg., t. xxii.
1891. „ „ Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 246.
1893. „ „ Levinsen. Vidensk. Ud. "Hauchs.," p. 326.

Habitat.—Not uncommon amongst the rocks between tide-marks at St. Andrews, under stones (E. M.), and at Lochmaddy dredged on the surface of sandy mud amongst algæ in the laminarian region. Also in sand near low water-mark, St. Andrews.

Iceland (Malmgren). Faröe (Willemoes-Suhm).

Head longer than broad,[1] pale, speckled with yellow, cordate posteriorly. Eyes two, of moderate size. Tentacles subulate with finely tapered tips. Tentacular cirri normal. Immediately behind the eyes (apparently on the first segment) are three bright yellow spots, a central and two anterior. In some the tentacular cirri have a dark spot a little below the tip.

Body from 3 to 4 inches in length, linear, tapering gently anteriorly, with three rows of dark spots, the central being most conspicuous. Posteriorly a yellowish-white spot appears between the dark, central ones. Many have a narrow yellowish bar between each of the brown bars, and as the centre is somewhat imperfect, it has thus the aspect of two specks. The lateral brown spots are due to the dorsal lamellæ. In some the body is of a deep greenish hue on the dorsum with a median dark stripe and a dumb-bell shaped transverse bar (Plate XLVII, fig. 3). Such may be due to the development of ova in March. A dark variety in which the colours are beautifully marked is common amongst the tangles in Bressay Sound and on a sandy bottom in Vatsland Bight. The under surface is pale. The body tapers posteriorly and ends in two lanceolate cirri.

The proboscis in extrusion (Plate LVIII, fig. 21) presents proximally two groups of six rows of papillæ, which are fewer (about ten in each row) than in *P. grœnlandica*. The distal region has a somewhat hexagonal outline in section from the six rows of large tubercles or folds. The aperture presents the same fluted condition as in the former species, with about sixteen papillæ.

When the alimentary canal has been largely distended before section, the cells, especially dorsal, arrange themselves in two series, the outer with large granular nuclei which stain deeply.

The muscular system of this species conforms to the type, though the scale is smaller. The muscular fasciculi are similarly arranged in the dorsal and ventral longitudinal muscles. The oblique muscles pass below the proportionally large nerve-cords to the basement-membrane, which—with the hypoderm and cuticle—are external. A considerable area of granular tissue lies between the cords ventrally.

The dorsal division of the foot (Plate LXVIII, figs. 7 [tenth] and 8 [sixtieth]) bears a cirrus which is irregularly ovate, the dorsal edge being rounded, so that irrespective of size it differs from the typical lamella of *P. grœnlandica*. In the anterior region the lamella has the form of a conical or ovate-acuminate leaf, and posteriorly a similar outline is assumed. In the intermediate region it is sub-rectangular. The bases of these lamellæ are ciliated, and stalked Infusoria are common on them.

The inferior division consists of a rather short bifid spinigerous lobe with the bristles (Plate LXXVII, fig. 23) which have slightly curved shafts with dilated tips finely serrated. The dilated region of such a bristle is grooved so as to guard the origin of the tapering terminal blade, which is of moderate length and minutely serrated. The ventral cirrus is broadly lanceolate, the pointed tip projecting beyond the setigerous lobe.

The dorsal cirri have very little of the greenish pigment anteriorly, so that they are

[1] Malmgren's "latitudine longitudinem superans," referring to spirit preparations.

pale, but towards the latter half of the body the increase of the pigment renders them more conspicuous, especially from the dorsum, as dull greenish processes. A slight change occurs after immersion in spirit, and the minute structure of the dorsal cirrus is rendered indistinct; but the alteration is not so great as might be anticipated. Besides, to remove a foot from a living specimen seriously cripples it and leads to its destruction, and the operation (by no means simple in an entire form) usually results in crushing the foot.

An interesting abnormality was found at St. Andrews, viz., the presence of five anal cirri (Plate LVIII, fig. 24). On the left are a small pair of cirri, posteriorly two larger, whilst a single very large cirrus occurs on the right. So far as appearances go, such would seem to indicate a tendency to form buds. It was observed by my sister (Mrs. Günther) while collecting a number for her coloured drawing.

Reproduction.—The ripe females (June 18th) undergo a considerable change in colour due to the development of the green ova internally. The early development of the ova, which are of a fine green colour, and which are deposited in a somewhat bulky gelatinous mass, and the early larvæ, have been described and figured[1] to the advanced trochophore stage, and by Alexander Agassiz[2] to a somewhat later stage.

Garstang gives January and February as the breeding period of this form at Plymouth, so that if correct it is much earlier than at St. Andrews.

It is very active, and hides in fissures and crevices into which the long, flattened, mobile body fits easily. The flattened snout is pushed hither and thither, while the pliable tentacles and tentacular cirri are readily doubled with safety.

This is the *Nereis maculata* of Montagu (1808) in the MS. volume of drawings in the possession of the Linnean Society, Plate XIX, fig. 3.

Malmgren considers that Johnston's *P. maculata* belongs to a different species, but there is no reason to believe that the British author referred to any other form than the present. The specimen in the British Museum, from Berwick Bay, has been dried, and therefore the characters are indistinct, but it approaches the ordinary form most closely. So far as can be observed, there is nothing in the original description and figures of O. F. Müller[3] to show that he alluded to another species. Œrsted considered that Johnston referred to his form, and therefore the views of De Quatrefages, who instituted the separate species, *Phyllodoce Œrstedii*,[4] for Œrsted's annelid, and those of De St. Joseph, who thought that Œrsted's form, while agreeing with the *P. citrina* of Malmgren, differed from Johnston's, appear to be doubtful.

It is possible that the *Phyllodoce attenuata* of Carrington[5] (1865) is to be referred to this species. It is more difficult to say to what form his *P. clava* is to be relegated.

Grube (Schles. Gesell, 1879) notes that perhaps Johnston's species and the *Eulalia quadricornis* of Œrsted[6] (which may have only four tentacles) are forms pertaining to *Anaitis*, but it is more probable that such is a misapprehension.

[1] 'Ann. Nat. Hist.,' ser. 4, vol. iv, p. 104, 1869.
[2] 'Ann. Nat. Hist.,' ser. 3, vol. xix, p. 240, 1867.
[3] 'Naturges. Wurm-Arten,' p. 156, tab. x.
[4] 'Annel.,' ii, p. 139.
[5] 'Annel. of Southport,' 1865, p. 5.
[6] 'Annul. Dan. Consp.,' p. 28.

Tauber[1] (1879) adopts the opinion that the *Phyllodoce teres*, *P. pulchella*, *P. badia*, and *P. Rinkii* of Malmgren are only varieties of this species; and, still further, that the *Phyllodoce laminosa* of Savigny and Aud. and Edwards, the *P. lamelligera* of Johnston, the *P. remex*, Dalyell, *P. grœnlandica*, Œrsted, *P. citrina*, Malmgren, *P. mucosa*, Œrsted, and *P. assimilis*, Œrsted, are all one and the same species. There is no doubt that several of these, such as *P. citrina*, *P. mucosa*, and *P. grœnlandica*, are very closely allied.

5. Phyllodoce rubiginosa, *De St. Joseph*, 1888. Plate XLVII, figs. 4—5; Plate LVIII, fig. 25—tail; Plate LXVIII fig. 9—foot; Plate LXXVII, figs. 8 and 8*a*—bristles.

Specific Characters.—Head small, rounded, with two large eyes. Anteriorly are four proportionally large tentacles. Two vibratile grooves (nuchal organs) posteriorly. Buccal segment with a pair of tentacular cirri; second segment has two pairs with bristles; third segment carries the fourth pair, and a rudiment of a foot with bristles and a minute ventral cirrus.

Body four inches long and upwards, terminating in two fusiform cirri. From the third to the last segment the middle of the dorsum is marked by green or blue bands, parallel and longitudinal, agreeing the one with the other. Proboscis papillose anteriorly and with eight large papillæ at the entrance to the stomach. The large cordiform and imbricate dorsal cirri are throughout of a fine red colour. These organs are rounded, cordate anteriorly, and carried on a short ceratophore, broadly cordate and pointed in the middle of the body, cordate and still more pointed as well as smaller posteriorly. From a median streak extending from the ceratophore parallel lines radiate to the circumference, and many have touches of dark pigment. Setigerous region a short blunt and bifid cone supported by a single translucent spine, and the bristles are slightly curved towards the end of the shaft, which is truncated and dilated, a little bevelled, and has traces of spinous striæ; terminal piece short or of moderate length, finely serrated, tapered and often bent at the tip. Ventral cirrus about a fourth the size of the dorsal, reniform, somewhat more pointed posteriorly.

Synonyms.

1888. *Phyllodoce* (*Carobia*) *rubiginosa*, De St. Joseph. Ann. Sc. Nat., 7e sér., t. v, p. 282, pl. xi, figs. 141—143.

1904. „ *rubiginosa*, Allen. Journ. M.B.A., n.s., vol. vii, p. 223.

Habitat.—This finely coloured species was first found by De St. Joseph in dredged material at Dinard, and subsequently by Allen in dredgings from various grounds near Plymouth.

Head (Plate XLVII, fig. 4) small, rounded, inserted on the buccal segment, not indented posteriorly, with two large eyes. Anteriorly are four proportionally large tentacles. De St. Joseph describes two vibratile grooves posteriorly, as in other Phyllodocidæ, and which he thinks analogous with the nuchal organs of Syllids and Eunicids. The buccal segment bears a pair of tentacular cirri; the second segment has

[1] 'Annulata Danica,' i. Kjöbenhavn, 1879.

two pairs with bristles; the third segment carries the fourth pair, accompanied by a rudiment of a foot with bristles and a minute ventral cirrus.

Body about four or more inches in length, little tapered anteriorly; much more distinctly posteriorly where it terminates in two fusiform cirri (Plate LVIII, fig. 25) which are broad at the base—tapered distally. In this case, however, the tail appears to be undergoing reproduction. The cirri are not compressed, and from the third to the last segment the middle of the back is marked by green or blue bands, parallel and longitudinal, agreeing the one with the other.

The proboscis is papillose anteriorly, and has eight large papillæ at the entrance to the stomach.

The dorsal cirri (Plate LXVIII, fig. 9) are throughout of a fine red colour, large, cordiform, and imbricate. From a median streak, which extends from the short conical pedicle, parallel lines radiate to the circumference. The setigerous region forms a short blunt bifid cone supported by a single translucent spine, and the translucent bristles (Plate LXXVII, figs. 8 and 8*a*) which project from it are slightly curved towards the tip of the shaft, which is somewhat abruptly dilated, truncated, a little bevelled, and shows only traces of spinous striæ. The terminal piece is short or of moderate length, finely serrated, tapered, and often bent at the tip. The ventral cirrus is about a fourth as large as the dorsal, and is more or less reniform with a tendency to be more distinctly pointed in the posterior part of the body.

This is a southern form of great beauty, and may be a young stage or a variety of a better known form, such as *Phyllodoce Paretti*.

The only British examples of this form are those forwarded from Plymouth by Dr. Allen. So far as shown by an examination of the living specimen, from which the figure (Plate XLVII, fig. 4) was taken, it would seem to approach a variety of *Phyllodoce Paretti*, especially as the dorsal cirri, the ventral cirri, and the bristles resemble each other closely. Both have the tips of the shafts of the bristles somewhat truncated and spinous, and the terminal pieces short, and while the bristles in the larger examples of *P. Paretti* are more deeply tinted brownish those in *P. rubiginosa* are also slightly tinted. Unfortunately the enlarged drawing of the bristle given by De St. Joseph is not sufficiently detailed for accurate diagnosis. Besides, all the examples of the latter sent from Plymouth have been small, so it is probable that slight differences may occur during growth. The shape of the head and eyes, the large size of the tentacles, and the shape of the tentacular cirri more or less correspond. Further examination of the life-history of each form is therefore very desirable.

6. PHYLLODOCE VITTATA, *Ehlers*, 1864. Plate LXVII, figs. 10—12—feet; Pl. LXXVII, fig. 9—bristle.

Specific Characters.—Head short and rounded, with rather short and thick tentacles and tentacular cirri. Eyes two, comparatively large. Body $1\frac{1}{4}$ inches long, dotted with brownish pigment, which also occurs on the anterior lamellæ. Dorsal division of the foot carrying an ovate cirrus of considerable size with smoothly rounded margins. Spinigerous

process large, obliquely truncated below the notch, and extending beyond the ovato-lanceolate ventral cirrus. Bristles comparatively long, slightly enlarged at the tip, and with one or two curved and prominent spikes.

Synonyms.

1864. *Phyllodoce vittata,* Ehlers. Börstenw., i, p. 150, Taf. vi, figs. 7—14.
1865. „ „ Carrington. Annel. Southport, p. 5.

Habitat.—Dredged in 100 fathoms in St. Magnus Bay, 1869 (Dr. J. G. Jeffreys).

Head short and rounded in spirit; eyes comparatively large; tentacles and tentacular cirri somewhat short.

Body about $1\frac{1}{4}$ inches in length, dotted with brownish pigment-grains on the dorsum and on the adjacent anterior lamellæ. Ventral surface pale.

The typical foot (Plate LXVIII, figs. 10, 11 and 12) bears dorsally a considerable broadly-ovate cirrus, its upper border never showing traces of angularity or truncation.

The spinigerous process is large, obliquely truncated below the notch, and carries a series of rather long slender bristles (Plate LXXVII, fig. 9) with a slight curvature towards the distal end of the shaft, which is less dilated than usual and provided with one or two large and various smaller spines on each side. The terminal blade is long, curved, finely tapered, and serrated.

The ventral cirrus is ovato-lanceolate, the tip remaining more or less blunt throughout. It is shorter than the spinigerous process of the foot.

There is some doubt as to the identity of this with Ehlers' form, which came from Quarnero in the Adriatic, but until other and more complete examples are obtained it may be provisionally placed under that species.

This appears to differ from any other British *Phyllodoce.*

The eyes are peculiarly large, head short and rounded, and the tentacular processes short and thick. The tentacles at the tip of the snout are absent, so that this description applies to the tentacular cirri. Dorsum dotted over with brownish pigment-grains, ventral surface pale. The anterior cirri also have some brownish grains.

The dorsal cirri are all modifications of the leaf-shape, not showing any angular or truncated border. The ventral cirrus is somewhat lanceolate, and rather shorter than the bristle-papilla, which has a series of long and strong bristles, with very long and minutely serrated tips, and two conspicuous spikes at the swollen end of the shaft.

Grube states (1879) that the group to which this form (his *B* 2) belongs has on the peristomial segment one tentacular cirrus; on segment 2—two tentacular cirri; and on segment 3—one.

Genus XXXV.—Genetyllis, *Malmgren*, 1865.

Head rounded ovate, with two eyes of considerable size (as in *Notophyllum*). The four tentacles are about the same length as in the latter, and finely pointed. The tentacular cirri have a similar shape, the two anterior being shorter than the posterior.

Body flattened, linear, slightly narrowed anteriorly and more distinctly so posteriorly.

The dorsal cirri are large, more or less vertical, partly covering the dorsum and the feet, though to a less extent than in the previous genus. The inferior cirrus, which is behind the bristles, is vertical. Both are less developed than in *Notophyllum*. Bristles compound, more slender than in the latter, but conforming to the same type. The dorsal spine and scanty bristles of the former genus have disappeared.

This is placed by Grube (1879) under the Phyllodocidæ proper, and not with the Eulalia-group. Segment 2, like segment 3, smaller than the peristomial segment and with two tentacular cirri. Levinsen observes that the eyes and the nuchal appendages are large whilst the dorsal cirrus covers the foot.

In *Genetyllis oculata* of the 'Challenger' the oblique muscles not only pass down by the sides of the nerve-cords, but certain fibres, probably from the vertical, pass above them to the opposite side. The great ventral spine in this form is black.

1. Genetyllis lutea, *Malmgren*, 1865. Plate LXVIII, figs. 18 and 19—feet; Plate LXXVII, fig. 13—bristle.

Specific Characters.—Head rounded—ovate, with two nearly circular black eyes of variable size. Tentacles subulate and tapered. The tentacular cirri also have finely pointed tips. Ventral surface of the prostomium bipapillose with a smaller posterior lip than in *Notophyllum*. Body linear with transverse lines in each segment. The superior division of the foot carries a somewhat reniform cirrus, or rather a lamella almost semi-circular anteriorly with the inner edge reduced, broadly reniform, but with a dorsal peak, and with projecting inner lappets in the middle of the body. The spinigerous region is bluntly conical, bears a yellow spine, and has more slender bristles than in *Notophyllum*, the distal end of the shaft being dilated and obliquely striated, with a series of spikes on the ridge. The terminal blade is of moderate length, obliquely striated, curved, finely tapered, and the edge is minutely serrated. The ventral cirrus is obovate with a slight peak superiorly, and is soldered to the posterior surface of the foot by its inner edge. The colour in life is stated to be fine yellow. In spirit it is a dull yellow.

Synonyms.

1865.	*Genetyllis lutea*,	Malmgren.	Nord. Hafs-Annul., p. 93, Tab. xiv, f. 32.
1867.	„	„	Idem. Annul. Polych., p. 20.
1869.	„	„	McIntosh. Rept. Brit. Assoc. (1868), p. 337.
1874.	„	„	Idem. Ann. Nat. Hist., ser. 4, vol. xiv, p. 196.
„	„	„	Malm. Op. cit. Göteb., p. 79.
1875.	„	„	McIntosh. Invert. and Fishes St. Andrews, p. 119.
1879.	„	„	Tauber. Annul. Danic., p. 86.
1883.	„	„	Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 205.
1893.	„	„	Idem. Vidensk. ud. "Hauchs," p. 326.
1901.	„	„	McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 223.

Habitat.—From the deep sea fishing boats, St. Andrews (E. M.); in 100 fathoms, St. Magnus Bay, Shetland, and off the Hebrides (Dr. Gwyn Jeffreys).

Norway (Canon Norman).

Head rounded, ovate, narrower in front, with two nearly circular black eyes, often with a lens-like thickening; the size of the eyes, however, differs in a series of specimens, showing that too much weight need not be placed on this character. It is probably connected with sexual changes. The tentacles spring from the anterior part of the prostomium, and are subulate organs with finely tapered tips. The two shorter and two longer tentacular cirri have also finely pointed tips. The ventral surface of the prostomium is bipapillose, with a groove leading backwards to the mouth. The latter has a smaller posterior lip than in *Notophyllum*. Occasionally white grains occur behind the eyes, forming a kind of transverse bar.

Body linear, rounded dorsally and flattened ventrally. Dorsally the segments have transverse lines, while ventrally a double line of slight elevations maps out a central area which is but little depressed. No specimen retained a caudal process. Of a uniform dull yellowish colour, paler beneath; the dorsal cirri, especially in front, are darker, from brownish pigment-grains.

The superior division of the foot (Plate LXVIII, fig. 18 [tenth] and 19 [fiftieth]) is considerably shorter than in *Notophyllum*, and has no prolongation upward and inward, or trace of spine or bristles. It carries a somewhat reniform cirrus, which varies a little in outline according to the region of the body, being almost semicircular anteriorly, with the inner edges reduced, broadly reniform, but with a dorsal peak, and with projecting inner lappets in the middle of the body.

The inferior division is represented by a bluntly conical, bifid, free process bearing the bristle-tuft and a yellow spine.

The bristles (Plate LXXVII, fig. 13) have rather long translucent shafts, more slender than in *Notophyllum polynoides*, but also with a backward curve towards the tip. The distal end of the shaft is dilated and marked with fine striæ obliquely directed downward and backward, whilst the free edge has a series of spikes. The terminal process is of moderate length, curved, and finely tapered, the edge being minutely serrated. Fine striæ also run obliquely downward and backward to the dorsal rib at the broader or inferior part of the process.

The inferior cirrus is obovate or oval, with a slight peak superiorly, is soldered to the posterior base of the division by its inner edge, and is thus kept vertical.

This species seems to be an inhabitant of water of some depth. No food of moment seemed to be in the alimentary canal.

Specimens from Shetland in July had many well-developed ova.

2. Genetyllis citrina, *McIntosh*. Plate LXVIII, figs. 20 and 21—feet; Plate LXXVII, fig. 14—bristle.

Specific Characters.—Head rounded ovate, with two rather large black eyes; tentacles probably similar to those of *G. lutea*, but they were absent; tentacular cirri similar. Body about three inches long, much tapered anteriorly. Posteriorly two short caudal cirri. Dorsal surface convex, ventral depressed in centre with an elevated ridge on each side. Of

a brilliant chrome-yellow throughout. Dorsal cirrus unequally cordate, broadly lanceolate, longer posteriorly than anteriorly, and marked by a series of lines and reticulations from a central rib. The ceratophore is a massive short and bluntly-conical process. Imbricate cirri borne more or less horizontally, leaving the centre of the dorsum bare. Setigerous region short, bifid, supported by a black spine, and carrying shorter bristles than in *G. lutea*, with shorter terminal processes.

Habitat.—Procured on a stone coated with corallines, a yellow sponge, and several Ascidians brought up by a fisherman's hook in the Minch, August, 1865.

Head rounded ovate, with two black eyes of considerable size. The four tentacles had been lost before minute examination, but they probably conform to those of the previous species. The tentacular cirri are similarly arranged—two shorter anterior and two longer posterior.

Body about three inches in length, much tapered anteriorly. Posteriorly it terminates in two caudal cirri. The dorsal surface is convex, the ventral marked by the two raised lines on each side of a slightly depressed central area. The proboscis is enclosed.

The entire animal is of a most brilliant chrome-yellow colour, deepest on the middle third, which here and there shows blackish-brown patches on the lamellæ. It tinged the water with a yellowish mucus, and also dyed the spirit in which it was immersed of the same hue.

The dorsal region of the foot (Plate LXVIII, figs. 20 and 21) has a massive short bluntly-conical process, devoid of spine or bristles, and bearing the unequally cordate lamella, which is marked by a series of lines and reticulations from a central rib. The imbricate lamellæ are borne more or less horizontally along the sides of the dorsum, leaving the central part bare. The semicircular gap at the base of the lamella fits the rounded extremity of the division to which it is attached. The short setigerous region is bifid at the tip, and supported by a black spine and a group of bristles, shorter than in *G. lutea* (Plate LXXVII, fig. 14), and with translucent shafts, slightly bent, and with a dilated distal end, which has a few spikes on each side. The terminal process is finely tapered, and shorter than in *G. lutea*. The edge shows no distinct serrations, though the adherence of particles would indicate them. Attached to the ventral and posterior parts of the region is an irregularly reniform lamella (ventral cirrus), vertical in position. The inferior border is rounded, but the superior is truncated and with a tendency to a point at the upper and outer angle. The cirri, both superior and inferior, vary a little in shape throughout the body.

The stone on which it was brought up had a yellowish sponge on part of its surface, but the connection between the Annelid and it is unknown. It crawled actively amongst the Ascidians and other growths to escape capture.

3. GENETYLLIS HIBERNICA. Plate LVIII, fig. 8—head; Plate LXIX, figs. 1 and 2—feet; Plate LXXVII, fig. 15—bristles.

Specific Characters.—Head rounded ovate; eyes two, black and of considerable size; tentacles and tentacular cirri as in allied forms. Body linear, about one inch long, terminating

in an anal papilla—probably flanked by two cirri. Dorsal surface bluish in spirit, ventral surface pale cinnamon, both being iridescent. Dorsal and ventral cirri of a cinnamon colour. Dorsal region of the foot less than in *G. lutea*, the dorsal cirrus ovato-lanceolate in front or ovate posteriorly, veined and carried horizontally, the tip more acute than in the former, but less acute than in *G. citrina*. Setigerous region has a single yellow spine. Bristles have a well-marked dilatation at the end of the shaft and with minute spines guarding the base of the terminal process which is finely tapered. Ventral cirrus borne vertically, reniform. A mamilla (papilla) occurs at the inner border of the foot.

Habitat.—Coast of Galway, Dr. E. P. Wright, 1868.

Head (Plate LVIII, fig. 8) rounded ovoid, with two black eyes of considerable size. Tentacles and tentacular cirri as in allied forms.

Body linear, about an inch long, slightly tapered in front, more so posteriorly, and terminating in the anal papilla, which was probably flanked by two cirri. The dorsum in spirit has a bluish tint, and the ventral surface a pale, cinnamon hue—both being iridescent. The lamellæ were of a cinnamon colour.

The dorsal region (pedicle) of the foot (Plate LXIX, figs. 1 [tenth] and 2 [fortieth]) is less than in *G. lutea*—forming a short truncate process supporting the cirrus, which is comparatively large and cordate, the "bite" at the base being less than in the two foregoing species. The lamella has the same leaf-like series of veins, but on the whole has a more acute tip. It is carried somewhat horizontally, so that in series an imbricate arrangement is produced. The lamellæ are rather more acute posteriorly.

The bifid setigerous process is of average length, and bears a pale spine and a series of translucent bristles, the shafts of which are slightly curved and have a well-marked dilatation at the tip, with minute spines guarding the base of the terminal process, which is finely tapered (Plate LXXVII, fig. 15) and by no means long. The ventral cirrus is borne vertically, and has a somewhat reniform outline. A distinct mamilla occurs at the inner border of each foot.

So far as can be observed this does not appear to be the young stage of either of the foregoing.

Genus XXXVI.—Eteone, *Savigny*, 1820.

Head elongated antero-posteriorly or somewhat trapezoidal in spirit, with or without eyes; two pairs of short tentacles; two pairs of tentacular cirri, the first on the first segment, the second on the following. Body devoid of metallic lustre; segments similar. Proboscis with cordate or with pointed papillæ; an obtuse rigid papilla on each side of the aperture in extrusion. Anal cirri leaf-like. Feet simple; dorsal cirrus sessile, simple, and leaf-like, much larger than the ventral cirrus. Dilated ends of the shafts of the bristles with large hook-like spines and short terminal blades.

Small Annelids—chiefly characteristic of the northern seas, and sparingly distributed.

The body-wall of *Eteone spetsbergensis* (Fig. 43) is distinguished by the massive longitudinal muscles—both dorsal and ventral. The dorsal form a broad arch in section

with a rounded thick inferior border on each side; whilst the ventral have a tendency to a crescentic arrangement of each mass, for the outer border (in section) curves inward dorsally.

The alimentary canal has a thick coat of longitudinal muscular fibres exteriorly—apparently only a basement-membrane with a few circular fibres intervening between it and the nucleated outer cellular layer.

The oblique muscles are of great strength, and thus in section the ventral median line is deeply grooved. They meet in the mid-ventral line in *Eteone spetsbergensis*, but they show intervals in *E. picta*. The nerve-area is thus generally pushed further inward than in *Phyllodoce*, and both trunks and ganglia have a firm sheath with longitudinal fibres. The interganglionic cords are separate. At intervals strong transverse bands of muscle pass above the cords from side to side. The circular muscular fibres are largely developed in the dorso-lateral regions.

Ehlers (1864) characterises the genus thus: Body elongated; head with four

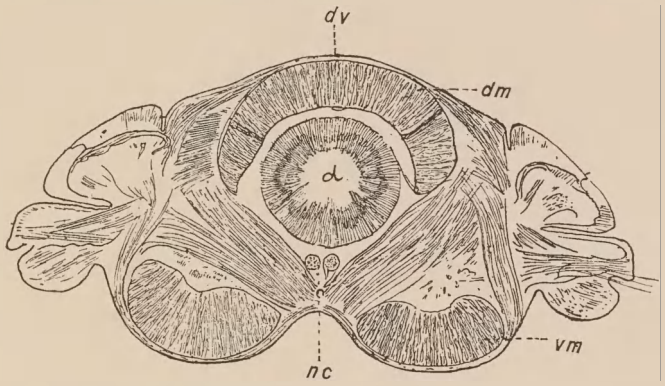

Fig. 43.—Section of *Eteone spetzbergensis*, to indicate the muscles. The same letters are used as formerly.

tentacles; two pairs of tentacular cirri; segments similar with simple feet; dorsal cirrus small, leaf-like, with the base resting on the dorsum, much larger than the ovate ventral cirrus; two leaf-like anal cirri. Claparède (1868) includes *Mysta* in this genus, as also does Levinsen (1883).

Grube (1879) mentions that the tentacular cirri are short, as also the tentacles, which are only a third the length of the short trapezoidal head. Some genera lose the dorsal cirri in the second segment. In others segment 1 has one tentacular cirrus, segment 2 also one. Eyes small, often mere points, and frequently disappear in spirit. Proboscis with two cordate papillæ; upper surface smooth, or covered with pointed papillæ, or ringed, or with sparsely distributed papillæ having minute processes (hook-like). Body does not show metallic lustre, and when coloured has specks. Small as a rule; characteristic of northern and arctic seas and sparingly distributed.

Grube groups the species of *Eteone* as B.—tentacular cirri on first segment; B^2.—only one pair of eyes.

(*a*) Head as broad or broader than long. *E. arctica*, *E. picta*, *E. flava*.

(*b*) Head more or less longer than broad. *E. longa*, *E. pusilla*, *E. spetsbergensis*.

Gravier[1] mentions a strong band of transverse muscular fibres from side to side

[1] 'Bull. Sc. Fr. Belg.,' t. xxix, p. 368, pl. xvii, f. 13.

below the gut in *Eteone foliosa*, De Quatrefages, and apparently in the line between the feet (as it is not figured).

In May (1903) Leschke found larvæ of *Eteone* in the Bay of Kiel.

1. Eteone picta, *De Quatrefages*, 1865. Plate XLV, fig. 3; Plate LXIX, figs. 3 and 4—feet; Plate LXXVII, fig. 22—bristle.

Specific Characters.—Head pale, flattened, shovel-shaped, with an evident constriction opposite the eyes, in front of the swellings from which the tentacular cirri arise, and another a little behind the tip. Eyes black, situated rather near each other at the posterior third of the head. Four short tentacles are attached anteriorly. Two subulate and short tentacular cirri, which are less than the transverse diameter of the head (in preservation). Body from one to three inches long, firm, somewhat flattened, gently dilating behind the head, and again diminishing a little towards the tail, where it ends in two ovoid yellowish cirri. Ground-colour pale yellowish, and each segment laterally has a reddish-brown or rose-red spot opposite the foot, and two others on each side of the middle line. Thus there are four rows in addition to the spots on the dorsal cirri. A patch of yellowish pigment occurs between the foregoing spots in the anterior third of the body. The posterior third is in some pinkish—apparently from the ova. Dorsal cirrus broadly lanceolate or somewhat conical, and firmly fixed to the peduncle by almost the entire base. Setigerous process is bifid and comparatively short. The shaft of the stout bristle is dilated, and, antero-posteriorly, has two hook-like spines of large size (laterally a median curved spine and a smaller in front and behind). The terminal serrated blade is comparatively short, broad at the base, and rapidly tapered to a fine point. Ventral cirrus bluntly lanceolate, reaching almost to the tip of the setigerous process, but shrinking within it at the fiftieth foot. It is borne on a distinct basal process (cerato-phore) which projects from the setigerous lobe of the foot.

Synonyms.

1865. *Eteone picta*, De Quatrefages. Annel., ii, p. 147, pl. 7 bis, f. 18—23.
1874. „ „ McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 120.
„ „ „ Marion and Bobretzky. Ann. Sc. Nat., 6e sér., t. ii, p. 62.
1879. „ „ Tauber. Annul. Danic., p. 91.
1890. „ „ Giard. Bull. Sc. Fr. Belg., t. xxii, p. 77.
1897. „ „ Gravier. Ibid., t. xxix, p. 308, pl. xvi, f. 14; pl. xvii, f. 5—7; pl. xviii, f. 9—11; pl. xix, f. 20; pl. xx, f. 10, 11; pl. xxiii, f. 2.
1904. „ „ Allen. Journ. Mar. Biol. Assoc., n. s. vol. vii, p. 224.

Habitat.—Not uncommon under stones between tide-marks and in fissures of rocks, Guernsey and Herm; Whitby (Dr. Carrington); deep water off St. Andrews Bay, and in the stomach of the cod and haddock, St. Andrews (E. M.).

Head pale, flattened, shovel-shaped, with an evident constriction opposite the eyes—in front of the bosses from which the tentacular cirri arise, and another occurs a little behind the tip. The eyes are black and situated rather near each other at the

posterior third of the head. Four short tentacles are attached anteriorly, and two tentacular cirri spring from the peristomial segment—one laterally and one dorsally. They are subulate and short, less than the transverse diameter of the head (in preservation).

Body from 1 to 3 inches in length, firm, flattened, though more convex dorsally, gently dilating behind the head, and again diminishing, but not much, towards the tail, where it terminates in two ovoid yellowish cirri. The ventral surface has a median furrow. The colour is pale yellowish, especially towards the posterior area of the intestinal tract. Each segment has a reddish or madder-brown spot laterally opposite the foot, and two others on each side of the middle line. Thus there are four rows, besides those made by the spots on the dorsal lamellæ. A patch of yellowish pigment occurs between the foregoing transverse groups of spots in the anterior third of the body. In some specimens the spots are of a deep rose-red, which, with the general iridescence of the surface, gives a striking aspect. The posterior third occasionally is pinkish, apparently from the ova. The under surface is pale.

The foot (Plate LXIX, figs. 3 [twelfth] and 4 [thirtieth]) has dorsally a broadly lanceolate or somewhat conical cirrus, which stands stiffly outward with a slight slope backward. It is firmly fixed to a prominent papilla by almost the whole breadth of its base and is not easily detached. Both papillæ and lamellæ increase in size from before backward, the difference between the tenth and the fiftieth foot, for instance, being marked. The hypodermic streaks form a fan-like arrangement from the central basal region. The setigerous process is bifid, comparatively short, and bears a series of stout, slightly curved bristles (Plate LXXVII, fig. 22), that is, the bristles are curved, when viewed laterally, straight when viewed antero-posteriorly. The distal end of the shaft is dilated, and antero-posteriorly presents two curved hook-like spines of large size, while laterally it shows a median and a smaller curved spine in front and behind. The terminal blade is comparatively short, broad at the base, and rapidly tapers to a fine point. It is minutely serrated on the anterior edge, the points being directed distally.

The inferior cirrus is bluntly lanceolate, extending at the tenth foot almost to the tip of the setigerous process, but at the fiftieth shrinking within it in lateral view. It is borne on a distinct basal process which projects from the setigerous lobe of the foot.

Reproduction.—Some of the examples obtained between tide-marks at Guernsey and Herm in July and August contained masses of minute eggs, but no ripe form was seen.

Habits.—They are very restless Annelids, darting through the water by spasmodic coiling of the body as in other forms, and partial to boring in sand. They often coil themselves into a ball, the posterior end being rolled concentrically. Consequently, most of the examples killed in spirit are coiled or twisted in a characteristic manner.

The *Eteone fucata* of M. Sars[1] approaches this form very closely, though he mentions only three purplish spots on the dorsum—a lateral and two median. The shortness of the upper tentacular cirrus, however, may be diagnostic of the Norwegian form.

Œrsted's *Eteone maculata*[2] is another closely allied form.

[1] 'Bidrag. Christ. Fauna,' iii, p. 26, 1873.

[2] 'Annul. Dan. Consp.,' p. 29.

It is difficult to know what the *Nereis lineata* of Montagu[1] is. It may refer to this species.

2. Eteone arctica, *Malmgren*, 1867. Plate LVIII, fig. 9—head; Plate LXIX, figs. 8 and 9—feet; Plate LXXVII, fig. 18—bristle.

Specific Characters.—Head (in spirit) conical, with the diameters nearly equal, the antero-posterior, however, being the longer. No eyes. Tentacles small and tentacular cirri short. Body elongated, with elevated lateral areas at the bases of the feet in each segment. Two somewhat ovate anal cirri. Proboscis, in extrusion, is papillose at the tip and has minute papillæ apparently in rows on its surface, but the specimens are imperfectly preserved. Dorsal cirrus ovate and separated by an interval from the setigerous lobe. The latter is somewhat conical and bears bristles with two strong though not long spines, besides smaller spikes on the ridges of the dilated ends of the shafts. Terminal sabre wide at the base, but rapidly tapers to a fine point. The ventral cirrus is lanceolate, and extends outward about as far as the tip of the setigerous lobe.

Synonyms.

1867. *Eteone arctica,* Malmgren. Annul. Polych., p. 27, Tab. ii, f. 12.
1871. „ „ Ehlers. Sitz. Phys. Med. Soc. Erlangen, iii, p. 79.
1874. „ „ (?) McIntosh. Ann. Nat. Hist., ser 4, vol. xiv, p. 197.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 120.
1878. „ „ idem. Trans. Linn. Soc. Zool., i, p. 502.
1883. „ „ Wirén. Chætop. 'Vega' Exped., p. 399.
„ „ „ Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 208.

Habitat.—Southport sands (Dr. Carrington, 1866).

Greenland ('Valorous'); Spitzbergen (Ehlers); Siberia and Behring's Strait (Wirén).

Head (Plate LVIII, fig. 9) conical with the diameters nearly equal, though in one the antero-posterior is the longer. No eyes are visible. The tentacles are small, and the tentacular cirri short.

Body elongated, with the lateral areas in each segment forming fillets at the base of the foot. Posteriorly it terminates in two somewhat ovate cirri.

The exserted proboscis shows papillæ at the tip, and minute papillæ in lateral rows on its surface, but the organ is imperfectly preserved and only partially extruded.

The foot carries dorsally an ovate cirrus, separated by a considerable interval from the setigerous process. It thus agrees with the lamella of *E. arctica.* The setigerous lobe is somewhat conical and has a series of bristles with a distinct curvature below the enlarged tip, which has two strong though not long spines besides smaller serrations on the ridges. The terminal process is wide at the base but rapidly tapers to a fine point. The edge is apparently minutely serrated, but the points are seen with difficulty. The ventral cirrus is lanceolate and extends outward about as far as the tip of the setigerous lobe.

Though the eyes are absent, this form would seem to come nearest *E. arctica*, but

[1] 'Trans. Linn. Soc.,' vol. vii, p. 83, 1804.

there are certain differences, such as the shape and length of the ventral cirrus, which Malmgren states is sub-obtuse and distinctly longer than the setigerous lobe. It differs from *E. longa*[1] in the shape of the dorsal cirrus and other points. The condition of the proboscis prevented the determination of the number of the terminal papillæ.

A form which has been described as a separate species, though apparently only a variety of *Eteone arctica*, merits a special description from its characteristic structure.

ETEONE ARCTICA *var.* ROBERTIANA. Plate LXIX, figs. 8 and 9—feet.

Head flattened, bluntly conical, with a distinct furrow on each side. Two subulate tentacles. No visible eyes in the preparation. The fused cephalic and peristomial region is separated by a constriction from the succeeding segment. The tentacular cirri are little tapered and considerably shorter than the transverse diameter of the region. Body of the typical form, terminating in two linear fusiform or almost cylindrical cirri. Pale, slightly iridescent. Dorsal cirrus ovoid at the tenth foot and shorter than the setigerous process, ovato-lanceolate at the thirtieth and projects further outward than the setigerous process. Still further backward it becomes more acutely lanceolate and the peduncle is longer. Setigerous lobe largest anteriorly, bifid, and carries bristles, the shafts of which have dilated tips with a larger and a smaller curved hook and minute spines passing downward to the shoulder. The terminal blade is of average length, is broad at the base, tapers gradually to a fine point and has a serrated edge. The ventral cirrus is lanceolate, about as long as the setigerous process at the tenth foot, and somewhat longer and more acuminate posteriorly.

SYNONYMS.

1874. *Eteonella Robertianæ*, McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
1875. „ „ Idem. Invert. and Fishes St. Andrews, p. 120.

Habitat.—Found when digging for littoral Annelids near low-water mark at the West Rocks, St. Andrews (R. M.). Other pale specimens were sent alive (E. M.).

Head differs from that of the ordinary form by the more evident separation of the fused cephalic and peristomial segments—a constriction dividing them from the succeeding region. The head has a flattened bluntly-conical form with a distinct furrow on each side, and with two short subulate tentacles on each side anteriorly. Two minute but distinct papillæ occur dorsally in the centre of the peristomial segment immediately behind the head. Posteriorly the peristomial segment seems to form a boss at each side, from the posterior part of which two slender and little tapered tentacular cirri proceed. In the preparation they are considerably shorter than the transverse diameter of the region.

[1] Some examples of *E. longa* from Greenland have many small white ova, showing a distinct micropyle, attached to the bristles and other parts.

The *body* is most dilated anteriorly, only narrowing a little immediately behind the head. It then tapers gradually towards the tail, which is terminated by two linear, fusiform, or almost cylindrical cirri. It is rounded dorsally and flattened ventrally, and is pale with a slight iridescence throughout.

The foot (Plate LXIX, figs. 8 [10th] and 9 [70th]) has dorsally a more or less ovoid cirrus which at the tenth foot is comparatively small, and truncated at the base, where it abuts on the peduncle. The setigerous process is greater in diameter and projects further outward. At the thirtieth foot it has become ovato-lanceolate, and extends considerably further than the setigerous lobe. Behind the foregoing it is more acutely lanceolate, and its peduncle is longer. The streaks in the hypoderm of the organ have a fan-like arrangement. The setigerous lobe is largest anteriorly, is bifid, and has a series of pale slightly curved bristles (Plate LXXVII, fig. 18), the shafts of which have slightly dilated tips with a larger and smaller curved hook and minute spines passing downward to the shoulder. The terminal process is broad at the base, tapers gradually to a fine point, and has a serrated edge. It is of average length. The ventral cirrus is lanceolate, about as long as the setigerous lobe at the tenth foot, and somewhat longer and more acuminate posteriorly.

This species seems to approach most closely to *Eteone arctica*, Mgm., from which it differs in the absence of eyes (which, however, occasionally disappear in spirit in other examples), in the ovato-lanceolate superior cirrus, and in the somewhat narrow lanceolate shape of the ventral cirrus, instead of the subobtuse lamella of *E. arctica*. Malmgren's figure (Plate II, fig. 12, *c'*), however, shows a closer approach than his description. The greater size and leaf-like condition of the dorsal cirri in *E. Robertiana* in contrast with *E. arctica* is also a distinguishing feature.

On the whole it would appear that *Eteonella Robertiana* is only a well-marked variety of *Eteone arctica*.

3. ETEONE SPETZBERGENSIS, *Malmgren*, 1865. Plate LXIX, figs. 5 and 6—feet; Pl. LXXVII, figs. 16–16 *b*—bristles.

Specific Characters.—Head somewhat elongated, separated dorsally from the peristomial segment by converging lines ; bluntly rounded in front. Tentacles short, the upper in front of the ventral. Two pale eyes occur posteriorly, but they disappear in the spirit preparations, in which the head is also contracted into a short cone. Tentacular cirri short, the ventral being the longer. Body three and a half inches long, about equally tapered anteriorly and posteriorly, and terminating in two linear fusiform cirri (Malmgren). Several preserved examples show a brownish pigment-band on each side dorsally, within the bases of the feet. Proboscis in extrusion is clavate, with two median and two lateral rows of papillæ, which begin as prominent organs and end in low transverse elevations. On the ventral aspect four longitudinal bands are also present, but they show only low transverse folds or wrinkles. The aperture is dorsal, somewhat triangular, and papillose. Dorsal cirrus at the tenth foot is sub-circular, but posteriorly the peduncle lengthens, and the organ becomes reniform with the larger end external. The setigerous process increases

in size from before backward, and is nearly equally bifid, with a dorsal elevation posteriorly. The dilated ends of the shafts of the bristles have two unequal spines, and a spinigerous ridge on each side. Terminal blade broad inferiorly, tapers to a fine point, and has a serrated edge. The ventral cirrus is oblong-ovate at the tenth foot, and gradually increases in transverse diameter from this region backward. Its outer margin projects a little beyond the tip of the setigerous process.

Synonyms.

1865. *Eteone spetsbergensis*, Malmgren. Nord. Hafs-Annul., p. 102, Tab. xv, f. 38.
1867. „ „ idem. Annel. Polych., p. 26.
1874. „ *andreapolis*, McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 120.
1879. „ *spetsbergensis*, Théel. K. Svensk. Vet. Handl., Bd. xvi, No. 3, p. 31, pl. ii, f. 21 and 22.
„ „ „ Tauber. Annul. Danic., p. 90.
1901. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 223.
1903. „ „ idem. Mar. Invert. S. Africa, vol. iii, p. 35.

Habitat.—Tossed on shore on the West Sands, St. Andrews, after a storm in February. Under a stone on shell-gravel above low-water mark, Lochmaddy.

Extends to Norway (Canon Norman); Canada, Dr. Whiteaves (W. C. M.); and to Nova Zembla (Théel); South Africa (W. C. M.); Behrings Sea (Marenzeller).

Fig. 44.—Head of *Eteone spetsbergensis*, from life.

Head (Fig. 44) somewhat elongated, separated dorsally from the peristomial segment by converging lines, and bluntly rounded in front between the two short tentacles, the upper of which is the shorter, and placed anterior to the other. The tentacular cirri are also short, the inferior being the longer. In the preparation they are about half the transverse diameter of the peristomial segment. Two pale eyes (woodcut) occur at the posterior part of the head, but they disappear in spirit-preparations, in which the head is also contracted into a short cone.

Body three and a quarter inches long, about equally tapered anteriorly and posteriorly (Malmgren), somewhat flattened, and with the segments marked in the typical manner. The tail is incomplete, but Malmgren states that it bears two linear fusiform cirri. The colour inclines to pale yellow anteriorly, especially in the lamellæ, which are uniform in tint throughout. After the first third the intestine gives the body a pinkish or skin colour. The surface has a pearly iridescence, especially dorsally. The proboscis in extrusion is clavate, with two median and two lateral rows of papillæ, which begin as prominent organs, and end distally in low transverse elevations. On the ventral aspect four longitudinal bands are also present, but they have only low transverse folds or wrinkles. The aperture of the organ is dorsal, and forms a papillose triangle. Gregarines were common in the intestine of that from St. Andrews. Several examples from Canada show in spirit a well-marked brownish pigment-band within the bases of the feet on each side.

The foot (Pl. LXIX, figs 5 [tenth] and 6 [hundredth]) agrees with that described and figured by Malmgren as characteristic of *E. spetsbergensis*, though the close approach of several to the same type gives rise to some uncertainty. The dorsal cirrus is described as obliquely obovate, and such would fairly apply to it behind the anterior region, but, for instance, at the tenth foot (Fig. 5) it is nearly subcircular, and the peduncle is shorter than in the posterior feet, so that the lamella closely approaches or touches the setigerous lobe beneath. Its outer border extends considerably beyond the tip of the setigerous process. Though somewhat thick the fan-shaped arrangement of its hypodermic strands are visible. From the fiftieth to the hundredth foot (Fig. 6) and posteriorly, the peduncle lengthens, and the lamella becomes almost reniform—only the larger end of the organ is external. Malmgren's description, therefore, of obliquely ovate will apply best to those between the fiftieth and seventieth feet. The setigerous process likewise increases in size from before backward, is nearly equally bifid at the tip (the spine projecting in the split), and presents a dorsal elevation in the posterior feet. The pale bristles (Plate LXXVII, figs. 16, 16*a*, 16*b*) have slightly curved shafts, the tips of which have a shoulder, are dilated, and terminate in a hook-like spine on each side, one being larger than the other. A row of minute spines runs from the larger hook obliquely downward and backward. The terminal blade is broad inferiorly, and tapers to a delicate tip. The edge is serrated. The details of the tip of the shaft vary a little from front to tail. The variations in the bristles are shown in Fig. 16 from St. Andrews, Fig. 16 *a* from Gaspé Bay, Canada, and Fig. 16 *b* from Lochmaddy, North Uist. The inferior cirrus is ovate-oblong, more rounded (shorter) and deeper at the tenth foot, and gradually increases in transverse diameter from this region backward. Its outer margin projects a little beyond the tip of the setigerous process.

Reproduction.—A fragment of what appears to be the same species, procured at Lochmaddy in August, contained the male elements well advanced. A Canadian example had large ova in the cœlomic space and extending into the bases of the feet. It was procured in July.

Habits.—A long, agile, restless annelid, constantly gliding to and fro, and pushing its flattened snout with promptness and facility through mud or sand. When on a suitable site an undulating motion takes place from before backward, apparently to assist in respiration. When irritated it coils itself into a ball and displays many contortions.

4. ETEONE PUSILLA, *Œrsted*, 1843. Plate LXV, fig. 6—head; Plate LXIX, fig. 7—foot; Plate LXXVII, fig. 17—bristle.

Specific Characters.—Head spathulate—a blunt, elongated cone, with the short subulate tentacles at each side anteriorly, and separated antero-posteriorly from each other. Eyes indistinct, only a faint trace of one remaining. Tentacular cirri short and subulate, about half the diameter of the peristomial segment. Body two inches or more in length, normal in shape; anal cirri (*fide* Malmgren) elongate linear-fusiform. Dorsal cirrus obliquely ovate, touching the setigerous process anteriorly (in the preparation), but posteriorly the longer pedicle carries it outward. Posteriorly the lamella is somewhat

rhomboidal. Setigerous process slightly bifid. The terminal dilatations of the shafts of the bristles have a long curved spine and several smaller ones on each side. The distal blade is of moderate length, broad and slightly bulged inferiorly, and tapering somewhat abruptly to a fine point. The edge is minutely serrated. Ventral cirrus irregularly ovate, and more or less pointed posteriorly.

Synonyms.

1843.	*Eteone pusilla,*	Œrsted.	Consp. Annul., p. 30, f. 84.
1851.	,,	,,	Grube. Fam. Annel., pp. 57, 130.
1865.	,,	,,	Malmgren. Nord. Hafs-Annul., p. 102, Tab. xv, f. 37.
,,	*Eulalia*	,,	De Quatrefages. Annel., ii, p. 122 (?).
,,	*Eteone*	,,	idem. Ibid., ii, p. 151.
1867.	,,	,,	Malmgren. Annul. Polych., p. 26.
1874.	,,	,,	Malm. Op. cit., Göteb., p. 81.
1879.	,,	,,	Verrill. Check List, U. S. Comm. F. and F., (sep. copy) p. 8.
1890.	,,	,,	Giard. Bull. Sc. Fr. Belg., t. xxii, p. 77.
1896.	,,	,,	Michaelsen. Polych. deutsch. meere, p. 37.

Habitat.—Dredged in 100 fathoms, St. Magnus Bay, Shetland, 1867 (Dr. Gwyn Jeffreys).

Canadian and American coasts.

Head (Plate LXV, fig. 6) spathulate, forming a somewhat elongated blunt cone, with the short subulate tentacles at each side anteriorly and separated antero-posteriorly from each other. The eyes in the preparation are invisible, or only a faint trace of one remains. The tentacular cirri are also short and subulate, being little more than half the diameter of the post-cephalic segment.

Body about two inches or more in length, nearly equally narrowed anteriorly and posteriorly, though the tip of the tail is the more attenuate. It is rounded dorsally, flattened ventrally, the latter surface having a median groove anteriorly. The anal cirri are absent, but, according to Malmgren, they are elongate linear-fusiform.

The foot (Plate LXIX, fig. 7) bears an obliquely ovate cirrus, which at the tenth foot is more or less sessile, that is, its pedicle or ceratophore is shorter. The lamella, which has its greatest diameter external and the lower edge dependent, thus touches the setigerous process, whereas the longer pedicle, *e. g.* from the thirtieth to the seventieth foot, carries it further outward, a feature still more marked at the hundredth foot. The lamella in the latter has also become somewhat rhomboidal, the long dorsal and ventral edges being straight, the outer and inner rounded. From the thirtieth to the seventieth foot the process projects considerably beyond the tip of the setigerous region, but this condition is less marked at the hundredth foot, probably from the elongation of the latter. The setigerous process is somewhat bifid, and it has a series of slightly curved bristles (Plate LXXVII, fig. 17), the ends of the shafts being enlarged and furnished with a long curved spine and several smaller ones on each side. The distal blade is of moderate length, broad and somewhat bulged inferiorly, and tapered rather abruptly to a fine extremity. The edge is minutely serrated. The inferior cirrus is also irregularly ovate at the tenth foot, with a tendency to a point at the tip, which, with that of the

superior lamella, projects beyond the setigerous region. The inferior lamella becomes more pointed externally from the thirtieth foot backward, and at the hundredth the tip has also a tendency to a point ventrally.

A curious two-jointed parasite occurs on the dorsal lamella of the fiftieth foot.

This species presents certain resemblances to the *Eteone cæca* of Ehlers,[1] from the 'Porcupine' Expedition of 1869, but the latter has no eyes, and the tentacular cirri seem to be longer. The presence or absence of eyes, however, in spirit-preparation is an uncertain character.

Eteone flava, Fabr., a form not uncommon in more northern waters, has not yet been found in British seas. What relationship the *Eteone fucata* of M. Sars[2] has to this or allied forms it is difficult to say. In all probability it is identical with one or other of the forms mentioned by Malmgren.

Genus XXXVII.—MYSTA, *Malmgren*, 1865.

Head bluntly conical. Eyes two, conspicuous, situated at the posterior border. Tentacles short and subulate, as in *Eteone*. Tentacular cirri, two on each side, unequal, subulate, fixed to the first segment. Body linear, slightly flattened, tapered towards each extremity. Two anal cirri. Proboscis long, sub-cylindrical, thickened anteriorly, papillæ ovate-fusiform in linear rows. Foot with the dorsal cirrus sub-orbicular, setigerous lobe bifid; ventral cirrus ovato-lanceolate. Bristles have the ends of the shafts dilated with a large curved spine, and a smaller at the tip with minute spines on the ridges. The terminal blade is wide beneath, tapers to a fine point, and has a serrated edge.

This genus resembles *Eteone*, and by some is made a sub-genus.

1. MYSTA BARBATA, *Malmgren*, 1865. Plate LVIII, fig. 10—head; Pl. LXIX, fig. 10—foot; Pl. LXXVII, fig. 19—bristle.

Specific Characters.—Head (in spirit) bluntly conical, with two conspicuous eyes posteriorly. At the truncated apex are two short subulate tentacles on each side. Tentacular cirri two on each side, a dorsal and a ventral, the former more than twice the length of the latter, thick at the base, but tapering to a fine point. Body slightly diminished towards the head, and more distinctly so posteriorly. A brownish band passes from the head backward within the line of the lamellæ on each side, and a median stripe of similar hue runs along the ridge of the dorsum. Dorsal cirri sub-orbicular, having a longer transverse diameter in the anterior feet, and a longer obliquely vertical diameter in the posterior feet. The setigerous lobe is somewhat small and bifid. The bristles show a large curved spine and a smaller one opposite it, and the ridges of the dilated ends of the shafts are spinous. The terminal blade is wide beneath, tapers to a fine point, and the edge is serrated. The ventral cirrus is ovato-lanceolate.

[1] 'Zeitsch. f. w. Zool.,' Bd. xxv, 1875, p. 42, Taf. ii, figs. 12—14.

[2] 'Videnskab.-Selsk. Forhandl.,' 1871, (sep. copy) p. 4.

Synonyms.

1865. *Mysta barbata*, Malmgren. Nord. Hafs-Annul., p. 101, Tab. xv, f. 34.
1867. „ „ idem. Annul. Polych., p. 26.
1871. „ „ Ehlers. Sitz. Phys. Med. Soc. Erlangen, III, p. 79.
1874. „ „ Malm. Op. cit. Göteb., p. 81.
1879. „ „ Tauber. Annul. Danic., p. 89.
1879. „ „ Théel. K. Vet. Akad. Handl., Bd. xvi, 3, p. 34.
1883. „ „ Wirén. Chætop. 'Vega' Exped., p. 400.
1901. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 223.

Habitat.—Procured in the trawl a little east of the island of May, January, 1891.

Spitzbergen (Ehlers); Nova Zembla (Théel); Norway (Canon Norman); Siberia and Behrings Strait (Wirén).

Head (Plate LVIII, fig. 10) in the preparation bluntly conical, with two conspicuous eyes posteriorly. At the truncated apex are two short subulate tentacles on each side. The tentacular cirri are two in number on each side, viz. a dorsal and a ventral, the former more than twice the length of the latter, somewhat thick at the base, but tapering to a fine point.

Body slightly diminished towards the head and more distinctly tapered posteriorly, somewhat rounded on the dorsum, flattened on the ventral surface, and probably terminated by two cirri posteriorly. A brownish band passes from the head backward on each side within the line of the lamellæ, and a median stripe of similar hue occupies the ridge of the body.

The foot (Plate LXIX, fig. 10) seems to correspond with Malmgren's description and figure, though it must be mentioned that there is considerable difficulty in following the distinctions of the various species given by the author. The somewhat imbricate dorsal cirrus may be described as sub-orbicular, having a longer transverse diameter in the anterior feet and a longer obliquely vertical diameter in the posterior feet, with a tendency to a point externally, where it goes much beyond the setigerous process. The latter is somewhat small, bifid, and bears the bristles (Plate LXXVII, fig. 19), which present a shoulder, from which a denticulated ridge passes to a large curved spine, with a smaller spine opposite it, the blade of the terminal process being between them. It (terminal process) is wide beneath and tapers to a fine point, and the edge is serrated.

The ventral cirrus is proportionately broad anteriorly, narrower and more pointed posteriorly, and it projects considerably beyond the setigerous lobe. Malmgren describes its form as ovate, with a rounded apex. In this form it was rather ovato-lanceolate.

Reproduction.—The specimen is a female laden with minute ova—apparently free in the cœlomic space, so that the breeding season would appear to be in spring (May).

Genus XXXVIII.—Mystides, *Théel*, 1879 (char. emend.).

Tentacles, four long, or short, lateral rather than terminal; tentacular cirri, three on each side, viz., on the first, second, and third segments; eyes, two, large. The British

species has comparatively short tentacles, but they may have been injured. Body linear, elongate, segments numerous (forty-eight, Théel). Dorsal cirrus reniform; setigerous lobe strong, bifid; ventral cirrus ovate or ovato-rectangular. Distal end of shaft of bristle has a hook-like spine with a smaller opposite it.

Théel[1] founded this genus on the great length of the three pairs of tentacular cirri. *Eteone* and *Mysta* have but two tentacular cirri; *Phyllodoce* and *Anaitis* have four. His example had no anal cirri, the body terminating in an obtuse cone.

Levinsen (1883) gave *Mystides* two to three pairs of tentacles, small dorsal lamellæ (cirri), and three pairs of tentacular cirri.

1. Mystides Lizziæ, n.s. Plate LVIII, fig. 11—head; Plate LXIX, figs. 11 and 12—feet; Plate LXXVII, fig. 20—bristle.

Specific Characters.—Head bluntly conical, with two large eyes widely separated and situated towards the posterior border. Anterior tentacles slender and minute, situated laterally. Three tentacular cirri—gradually increasing in length—at each side. They are longer than the homologous organs in *Eteone* and appear to approach in length those of *Mysta*, which, however, has only two. Body about three inches long; segments distinctly marked by a deep furrow in front and by a lozenge-shaped depression after the anterior third. Dorsal cirrus reniform, with a hilus at the base. The posterior differ from the anterior chiefly in their tendency to form a point at the free dorsal edge, and in their smaller size. The setigerous lobe is strong, bifid, and bevelled inferiorly. Distally the dilated ends of the bristles have a curved, hook-like spine directed towards the serrated edge of the terminal blade and with a spinous margin below it. A smaller spine occurs on the opposite side. The terminal blade is broad at the base and gradually tapers to a long and fine point. Its edge is minutely serrated. The ventral cirrus is ovate or ovato-rectangular, barely reaching the tip of the setigerous process at the tenth foot, but more nearly reaching it posteriorly, where the tip is less obtuse. Three madder-brown or purplish bands on the dorsum, viz. a band at each side, and a median, which, however, posteriorly is nearly severed into two by a pale median line. The pale portions between the coloured belts also increase in distinctness posteriorly, so that the animal has a boldly-marked series of bars. The dorsal cirri, with the exception of a few anteriorly, which have a dark speck or two, are pale.

Habitat.—Tossed on the West Sands, St. Andrews, after a storm in February, 1870, when it was picked up by my sister.

Off Cape Sagres, 'Porcupine,' 1870.

Head (Plate LVIII, fig. 11) bluntly conical, with two large eyes, widely separated and situated towards the posterior border. The anterior tentacles are slender and minute (whether from injury or otherwise is unknown), and they appear to be placed laterally rather than at the tip of the snout. Three tentacular cirri occur on each side (on the first, second, and third segments), and they increase in length from the first to the third. They are longer than the homologous organs in *Eteone*, and appear to approach in length

[1] 'Ann. Polych. Nouv.-Zemb.,' p. 35, 1879.

those of *Mysta*, which, however, has only two, and they are also of considerable thickness, though tapered distally. They are much longer than those of Langerhans' *Mystides bidentata*, which was also found by De St. Joseph at Dinard.

Body about three inches in length, flattened, and with the segments distinctly marked by a deep furrow anteriorly, and by a lozenge-shaped depression after the anterior third. It is very slightly tapered anteriorly, but the diminution posteriorly is more pronounced. The ventral surface has a median line anteriorly, and the segments are marked by alternate elevated and depressed transverse bars, the former having an elevated and projecting cushion or boss at each side. The specimens were in spirit before they were observed, but three madder-brown or purplish bands could be distinguished. They were incomplete posteriorly, and Théel's example also was apparently imperfect.

The foot (Plate LXIX, figs. 11 [tenth] and 12 [fiftieth]) has superiorly a large reniform cirrus of considerable thickness, having an umbricate arrangement, and being somewhat cordate at the base. Its hypoderm is coarsely areolar and scarcely streaked. The papilla supporting it is distinct. The anterior (*e.g.* tenth) differ from the posterior feet chiefly in the tendency to form a point on the free dorsal edge, and in their smaller size. The setigerous region is a strong bifid process, bevelled inferiorly, and bearing a series of stout, translucent bristles, with a slight curvature distally. The dilatation at the tip of the shaft is peculiar, presenting distally on each side a curved, hook-like spine directed towards the serrated edge of the terminal blade, and with a denticulated margin beneath. The other side of the distal end has a smaller spinous process (Plate LXXVII, fig. 20), also with a slightly denticulated edge below it. The shoulder is not clearly seen in every bristle, but it is distinct in those near the dorsal edge. The transparent terminal blade is broad at the base, and gradually tapers to a long and fine point. The edge is minutely serrated a considerable distance beyond the base. The minute structure of these bristles, if they agree with the foregoing, is not clearly defined by Théel, but his species was minute.

The ventral cirrus is ovate or ovato-rectangular, barely reaching the tip of the setigerous lobe at the tenth foot, but more nearly reaching it posteriorly where the tip is less obtuse.

The lamellæ of the 'Porcupine' example have a tendency to greater definition and angularity.

Reproduction.—The specimen from St. Andrews is a female, with the eggs fairly developed, though not ripe, in February. De St. Joseph found a female of *Mystides bidentata*, Langerhans, with natatory bristles from the sixty-sixth segment backward, whilst the eggs were greenish.

This form appears to fall under the genus *Mystides* of Théel,[1] a small example of which came from Nova Zembla. The peculiar conformation of the first segment which dorsally overlaps the head, the short lateral tentacles, the long tentacular cirri, the longer dorsal cirri, and the structure of the bristles sufficiently distinguish it. Its comparatively large size, in contrast with its northern relative, and the distinctive coloration are also noteworthy. It is named after my sister, who procured it on the West Sands of St. Andrews.

[1] 'K. Sc. Akad. Handl.,' Bd. xvi, 3, p. 35.

No member of the Alciopidæ has yet been met with in British waters, but there is no reason why such may not be found—*e. g.* off the southern shores of England or off the west coast of Ireland, as at Valencia. The remarkable fauna—both littoral and pelagic—of the latter region would lend countenance to this expectation; as also would that occasionally found in the Moray Frith.

Fig. 45.—Peculiar pelagic type near Syllidæ and Alciopidæ. The caudal cirri are reduced.

In this connection, a minute form (fig. 45), about an eighth of an inch in length, found in the tow-net in St. Andrews Bay, in July or August, 1900, may be mentioned, especially as it does not conform, so far as can be ascertained, to any known species. At first sight it may be mistaken for *Ioida*, but a close inspection shows its marked distinction from that form and from the Syllidæ, as well as its separation from the Phyllodocidæ and Hesionidæ. Unfortunately it had been stained and mounted in balsam before it came under observation, so that the precise structure of the feet and the more delicate processes has yet to be worked out.

The head somewhat resembles that of *Ioida* in carrying two large black eyes on the dorsum, and apparently another pair on the ventral surface. The head-region is small and deeply cleft in the middle line, the two lateral flaps (one on each side) on which the eyes are situated being slightly angular in front, and trending from the median fissure outward and backward, the central part being coarsely fibrillated, as if from ruptured

muscular fibres, the ends of which occur on each side of the first segment-junction. A thin membranous flap dotted with cells and nuclei occurs in the front of each eye, and a projecting narrower process of the same tissue apparently below it, whilst a subulate tentacle, also thickly studded with deeply-stained nucleated cells passes forward a little below the frontal edge. All the structures just described are delicate, and are probably diaphanous during life. Moreover, they differ wholly from the appendages of the male and female buds of *Autolytus*, and do not approach those of the Alciopidæ. A funnel-shaped depression with a median notch ventrally appears to indicate the oral region, which thus is wide, and this segment, which is not clearly differentiated from the head, bears on each side a foot directed obliquely forward and outward, and supported by a strong translucent spine and a series of translucent bristles. The direction of these feet shows that they have special functions—probably both protective and tactile. The bristles are comparatively stout, and have a distinct curvature of the shaft below the terminal dilatation, which is marked by a few oblique central striæ. The distal end is bevelled, and the terminal piece is of moderate length and simply hooked. These bristles are borne by an elongated setigerous region slightly tapered from base to apex. The dorsal cirrus somewhat resembles that of a *Syllis*, being long, slightly tapered and articulated, and the same deeply-stained minute nuclei occur in these as in the cephalic processes, but they are proportionally more numerous. They arise from the base of the foot, and seem to have a short ceratophore, though the state of the preparation rendered this indistinct. A short, simple, subulate ventral cirrus, again, is attached inferiorly a little exterior to the base of the foot. The first foot is somewhat spindle-shaped, and the rest present an ovate or elliptical dorsal process, apparently with a special spine, but as only dorso-ventral views are obtainable further investigation is necessary. Every foot, from the second to the last, is furnished with a very long, translucent tuft of swimming-bristles.

The body has fifteeen segments—diminishing gradually from the head backward, the segment-junctions being boldly marked. The pygidium is slightly bipapillose, and has two long caudal cirri which are longer and larger than the cirri immediately in front. A pale moniliform streak passes from the mouth backward in the central line, and probably represents the alimentary canal.

The foregoing has the general outline of the Syllidæ, and the appendages of the head resemble those of the male of *Autolytus* (*Polybostrichus*), and also of Krohn's *Syllis prolifera*,[1] the jointed cirri and the structure of the bristles especially recalling the latter. The great size of the spines, and the presence of a considerable dorsal spine, however, show divergence, and the minute structure of the head and mouth likewise differs. The whole aspect, however, suggests relationship with a budding form, and in the present uncertainty it is perhaps well to leave it in a separate position.

The precise position of this form must, for the present, remain in abeyance until more material is obtainable, but it conforms to no British type hitherto observed.

[1] 'Archiv. f. Naturges.,' Bd. xviii, p. 66, Taf. iii, fig. 1 (1852).

Family VIII.—Hesionidæ (*Sars*). (Hesionea, *Grube*, 1851.)

Head with two pairs of eyes, and two or three tentacles, and generally two biarticulate palpi. Nuchal organs primitive; ciliated surfaces in direct contact with the exterior (Racovitza). Body of moderate length. Pygidium with 2 anal cirri. Proboscis protrusible, armed or unarmed. Anterior segments (1—4) distinct or more or less fused, each carrying two pairs of tentacular cirri. The other segments uni- or bi-ramous; spines black; superior division generally reduced, furnished with simple bristles; inferior division with compound bristles. Dorsal and ventral cirri filiform, faintly articulated.

Segmental organ.—*Hesione* (*Fallacia*) has a very large genital funnel, not known to open to the exterior, but connected at one point with the open segmental trumpet. Exit of genital products has not been observed. In others, as in *Ophiodromus*, at the moment of reproduction the organ develops a large genital funnel for the transmission of the sexual products (Goodrich). Fage, again, describes a cilio-phagocytic organ in connection with

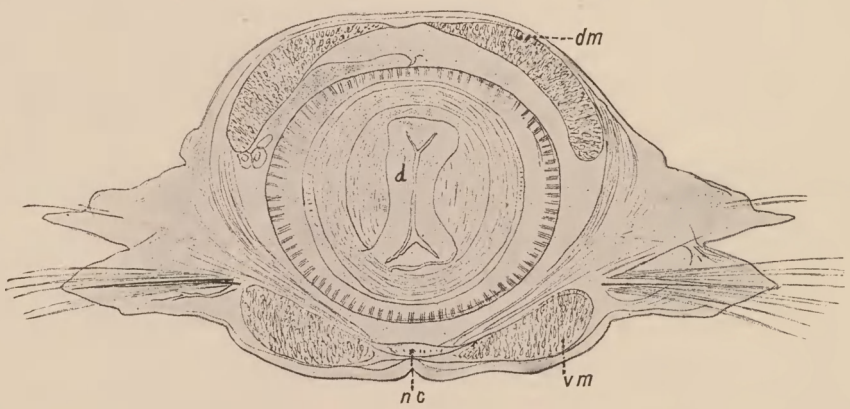

Fig. 46.—Section showing muscles of *Ophiodromus flexuosus*, D. Ch.

the segmental apparatus in *Hesione pantheria*, a form, however, in which it does not transmit the sexual elements.

It is interesting that Dr. Thomas Williams[1] long ago observed that the segmental organs occurred in the hollow of the foot as a beautifully looped, extremely delicate, slender, membranous ciliated tube. Further, that in the female the glandular yellowish mass which spreads into the hollow base of the cirri and feet can be traced into organic connection with the ciliated tube, and with that limb of the loop in which the vessels are most developed. He considered that the ova passed into one of the limbs of the ciliated tube. His description thus nearly approached the general structure as recently shown.

In transverse section of the body-wall (Fig. 46) the dorsal longitudinal muscles are thick externally and tapered to the dorsal median line. The ventral longitudinal muscles are slightly curved and end abruptly internally against the somewhat large nerve-area which has the oblique muscles inserted dorsally, whilst externally are the hypoderm and cuticle. This family, therefore, agrees with *Nephthys* in the relations of the nerve-area.

[1] 'Philos. Trans.,' 1858, p. 127, pl. viii, fig. 21.

The few forms of the Hesionidæ known were grouped by O. Fabricius, Linnæus, and others, amongst the Nereids. They formed the ninth genus of Savigny's Nereids. Subsequent authors generally placed them near the Phyllodocidæ and Syllidæ, though Benham separated them from the former by the Aphroditidæ, with which they have little in common.

Grube first linked the Hesionidæ to the Phyllodocidæ—under the title *Phyllodocea Hesionea*.[1] In his last publication[2] on the Hesionea he defines the segments as often 22, though they may reach 81. The head is rounded, rhomboidal, narrowed in front, heart-shaped, with two or three simple, short, two- or three-jointed tentacles; two or three segmented sub-tentacles (Œrsted's palpi). Two pairs of eyes. On each side three or four (rarely one or two) tentacular cirri, slightly tapered, and sometimes with short segments. Dorsal cirri thread-like, on a ceratophore; ventral and anal cirri shorter and devoid of a ceratophore. Foot simple or bifid; ventral bristles compound. Proboscis long and cylindrical, or shorter and almost ovoid, smooth or sometimes with a crown of papillæ around the opening. In some, a tooth, as in the Syllidæ, or a pair of jaws, or papillæ; occasionally tooth and jaws combined.

His main sub-divisions are: (1) Head with two very short tentacles, without sub-tentacles (or with two). *Fallacia*, *Hesione*. (2) Head with two simple tentacles, and two or three jointed sub-tentacles (palpi). *Magalia*, *Kefersteinia*, *Castalia*, *Periboea*, *Syllidia*, *Psamathe fusca*, Johnst. (3) Head with three simple tentacles and two sub-tentacles. The ventral bristles with three teeth. *Irma*, *Orseis*, *Oxydromus*, *Podarke*, *Gyptis*, *Ophiodromus*, *Tyrrhena*, *Leocrates*, etc. In the foregoing synopsis he makes a special genus (*Kefersteinia*) for *Psamathe*, Johnston, yet likewise includes under a separate sub-section *Psamathe fusca*, Johnston, apparently having overlooked their identity. He noted that in *Stephania flexuosa*, Claparède, the sexes were distinguished by their colouration; and that in the family generally the spines were black. In the Philippine annelids he paid special attention to the armature of the proboscis as an aid in classification. None of the British forms, however, show this condition.

Ehlers (1864), who gives similar characters to Grube, characterizes the Hesionea as having short flattened bodies with comparatively few segments, often brightly coloured and transversely striped. The head is distinct—with tentacles only, or with tentacles, palpi, and four eyes. The following segment has large tentacular cirri. Foot large, single, or with a minute dorsal division; jointed or simple capillary bristles; long dorsal and ventral cirri. Anal segment with lateral processes and anal cirri or papillæ. The extruded proboscis is short and smooth, and is followed by the stomach, the aperture to which has or has not papillæ. He grouped the genera as follows: (A) Head only with tentacles. (1) Four tentacles. *Hesione*, Savigny. (2) Head with five tentacles. *Podarke*, Ehlers. (B) Head with both tentacles and palpi; palpi two-jointed. (*a*) Foot with two well-marked divisions; three tentacles. *Ophiodromus*, Sars. (*b*) Foot with a single division, or with two, the upper tubercular; two tentacles. *Castalia* (Sav.), Sars. Ehlers (3) Palpi three-jointed, longer than the two tentacles. *Periboea*, Ehlers.

[1] 'Fam. Annel.,' p. 58 (1851).

[2] Schlies, 'Gesellsch.,' 1879. See also his work on the 'Philippine Annelids,' 1878.

De Quatrefages (1865) again made a family, the Hesionea, for their reception, holding that they and the Syllids were analogous groups, allied to each other, yet presenting special modifications of the digestive system and other parts. He grouped them according to the condition of the feet, the length of the body, and the number of tentacles and tentacular cirri. His first genus *Myriana* contains a doubtful form, possibly from its length, *Myrianida*. He included several members of the family amongst his Syllids, instituting, for instance, a new genus for *Castalia fusca*—of which he made two species, viz. *Kefersteinia cirrata* and *K. Claparedii*.

Claparède (1868) criticised De Quatrefages for lamenting the absence of correct structural details of the group, for he had overlooked Keferstein's description of *Psamathe*, and yet removed the genus *Kefersteinia* to the Syllidæ without adequate reason.

The Hesionidæ formed one of the families of the Syllidiformia vera of Levinsen [1] along with the Nereidæ, Syllidæ, Nerillidæ, and Sphærodoridæ, and in Benham's [2] more recent classification, which has certain features in common with the foregoing, it is further linked to the Aphroditidæ (a relationship difficult to appreciate) under the sub-order Nereidiformia.

Gravier (1900) arranged this family like his predecessors, viz., according to the uniramous or biramous condition of the feet, the number of tentacular cirri, the condition of the proboscis, the tentacles, and the structure of the feet.

Genus XXXIX.—Ophiodromus, *Sars*, 1861.

Oxydromus, *Grube*, 1853.

Head trapezoidal with two pairs of eyes; tentacles filiform; palpi thick, biarticulate; six long, non-articulate tentacular cirri on each side. Body of moderate length. Proboscis short, sub-globose or shortly cylindrical; unarmed. Feet bifid, sub-equal, cylindrical, each lingule elongate, almost cirriform; dorsal cirrus long, non-articulate; ventral cirrus shorter, arising from tip; dorsal bristles capillary, inferior compound-falcate. Body-wall as in Fig. 46.

Goodrich (1901) observed that the genital funnel in *Ophiodromus* is smaller than in *Hesione*, but is more intimately connected with the segmental organ, so that the internal opening "can scarcely be said to exist as such." [3]

In the genera *Leocrates* (*Tyrrhena*), *Ophiodromus*, and *Irma*, a gradually closer and closer union is established between the funnel and the segmental trumpet. In *Irma*, where the genital funnel is well developed, it is so completely fused with the segmental trumpet that the two organs can be distinguished only by their histological structure. The segmental organ thus acquires a large trumpet-shaped opening into the cœlom and acts both as a genital and an excretory duct (Goodrich).

[1] 'Videnskab. Meddel. Nat. Foren. Kjöbenh.,' 1883, p. 180.

[2] 'Camb. Nat. Hist.,' ii, pp. 258 and 308.

[3] 'Quart. J. Micr. Sc.,' n. s., vol. xliii, p. 714.

1. Ophiodromus flexuosus, *Delle Chiaje*, 1825. Plate LVIII, figs. 12 and 13—head; Plate LXIX, fig. 13—feet; Plate LXXVIII, figs. 1 and 1 *b*—bristles.

Specific characters.—Head small, distinct; eyes four, the anterior pair being the larger and wider apart. Tentacles three—two lateral and a median—besides a pair of palpi, which have a large basal joint, and are external and lateral in position. Body $2\frac{1}{2}$ inches long, dilating behind the head, attaining its maximum about the anterior third, and then tapering to the tail, which has two long cirri. The first four segments bear long tentacular cirri. Colour, various shades of lustrous brown; a whitish streak, often with a bluish lustre, runs backward from the median tentacle, and divides the head into halves. The dorsum is transversely banded at intervals with belts of fine iridescent blue. Ventral surface a deep madder brown. Proboscis large, cylindrical, devoid of papillæ or jaws. Foot elongated, biramous; dorsal division has a long cirrus, a slender, tapering setigerous process, with a spine and a tuft of elongated, slender bristles, the shafts of which are longitudinally striated and have faint transverse touches, after the manner of the ventral series, but less distinct. Ventral division has a long setigerous region enclosing the spine, with, posteriorly, a stiff fan of jointed bristles, the terminal sabres of which have a claw at the tip blocked by a process beneath, and a serrated edge.

Synonyms.

1825. *Nereis flexuosa*, Delle Chiaje. Mem., II, pp. 368, 401, and 425, tav. xix, fig. 8.
1841. „ *flexuosa*, Delle Chiaje. Descriz., III, p. 97, V, p. 103, tav. 129, fig. 8.
1855. *Oxydromus fasciatus*, Grube. Arch. f. Naturges., p. 98, Taf. iv, f. 1 and 2.
1861. *Ophiodromus vittatus*, M. Sars. Forh. Vid.-Selsk. Christ. and Nyt. Mag., XI B, p. 87.
1864. *Oxydromus fasciatus*, Grube. Insel Lussin, p. 82.
„ *Podarke albocincta*, Ehlers. Borstenw., p. 190, taf. 8, f. 2—5 ?.
1865. *Nereis punctata*, Johnston. Cat. Brit. Mus., p. 280.
„ *Ophiodromus vittatus*, De Quatrefages. Annel., II, p. 657.
1867. „ „ Malmgren. Annul. Polych., p. 31.
1869. „ „ McIntosh. Rep. Brit. Assoc. (1868), p. 339.
„ „ „ McIntosh. Trans. R. S. Edin., vol. xxv, p. 410, pl. xv, figs. 7, 8.
1870. *Stephania flexuosa*, Claparède. Annel. Nap., Suppl., p. 118, pl. xii, fig. 1.
1873. *Ophiodromus vittatus*, G. O. Sars. Bidrag. Christ. Fauna, p. 29.
1874. „ „ Malm. Op. cit. Göteb., p. 81.
„ „ *flexuosus*, Marenzeller. Beitr. z. Kennt. Adriat. Annel. in Sitz. Wien Akad., p. 23.
1875. „ *vittatus*, Ehlers. Zeitsch. f. w. Zool., Bd. xxv, p. 44.
1879. „ „ Tauber. Annul. Danic., p. 92.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 238.
1885. „ *flexuosus*, Carus. Fauna Medit., p. 238.
1893. „ *vittatus*, Levinsen. Vidensk. Ud. "Hauchs," p. 328.
1898. „ *flexuosus*, De St. Joseph. Ann. Sc. Nat., 8e sér., t. v, p. 339.
1905. „ „ Graeffe. Arbeit. Zool. Stat. Triest, xv, p. 324.
1906. „ „ Bohn. Ann. Sc. Nat., 9e sér., t. iii, p. 72.

Habitat.—Dredged somewhat frequently on a bottom of tenacious grey clay and mud in 4—8 fathoms in Lochmaddy, and especially in Ardmaddy Bay, and one or two were found at the verge of extreme low water in the same bay under an immersed stone and in sandy mud whilst digging for littoral annelids; on old oyster-beds and amongst tangle-roots in 5—7 fathoms in West Voe, Scalloway, Shetland; 100 fathoms in St. Magnus Bay, Shetland (Dr. Gwyn Jeffreys); 80—110 fathoms off the coast of Ireland, and in 15—20 fathoms in the Bay of Galway, in the 'Porcupine' Expedition of 1869, on a bottom of muddy sand with pebbles; 9—125 fathoms 50 miles west of Valencia, Ireland (Dr. Gwyn Jeffreys); 81 fathoms off Cape Finisterre, 'Porcupine,' 1870; Station IV, bottom, Moray Frith, July, 1894 (Dr. H. C. Williamson).

Extends to Norway (Sars), shores of France, Mediterranean. Burrows of *Synapta* on the shores of France (Perez).[1]

Head (Plate LVIII, fig. 12) small, distinct, with four eyes, the anterior being somewhat larger and wider apart, and sometimes elongated transversely. Tentacles three, a lateral on each side and a median somewhat shorter. The palpi have a thick basal region, the distal being slender and tapering so that the structure resembles a church spire.

Body $2\frac{1}{4}$ inches long, dilates behind the head, attains its maximum about the anterior third, and then tapers to the tail. It is thus fusiform. The tail terminates in two long slender cirri which are shorter, however, than those of the fourth foot from behind. The first four segments bear modified limbs in the form of long cirri. The dorsum is of various shades of lustrous brown, whilst a whitish streak running backward from the central tentacle divides the head into halves. The dorsum is transversely banded at intervals with belts of fine iridescent blue, the bands extending to the tips of the feet. In a specimen $2\frac{1}{4}$ inches long there were a dozen conspicuous belts, besides less evident minor streaks posteriorly. The body-line at the base of each foot has a patch of the same colour, continued across the rugæ of the segment in fine blue lines, but they vary in different specimens. The head in some has the same fine bluish colour. The ventral surface of the body is dark madder-brown. When placed in spirit *Ophiodromus* loses its tints in a moment, and generally breaks into several pieces. The same result happens on immersion in impure sea-water.

The proboscis is large (Plate LVIII, fig. 13), devoid of jaws or papillæ, and in extension it becomes cylindrical, or has a swollen base and a distal rim. The buccal orifice is capable of great dilatation.

The body is garnished at each side with long resplendent tufts of bristles which glance with all the varied hues of the rainbow, while from each foot two long hair-like cirri project. The elongated foot is distinctly biramous (Plate LXIX, fig. 13), thus differing from all the Hesionidæ except Schmarda's *Cirrosyllis* (*Pseudosyllis*, De Quatrefages) and Œrsted's *Castalia*. The dorsal lobe (*a*) consists of the long cirrus (*b*), which springs from a basal segment (ceratophore), and tapers slightly towards the tip, and of the setigerous division, which tapers, as a slender process, outward to a point and envelops the spine. From the upper and posterior part of this division a tuft of slender, elongated

[1] 'Proc. Verb. Soc. Sci.,' Bordeaux, 1904—5.

and tapering simple bristles arises. When fully developed the shaft (Plate LXXIX, figs. 1, 1 *a*, and 1 *b*) is longitudinally striated and has faint transverse touches, after the manner of the ventral series, though much less distinct. The ventral division of the foot presents a setigerous region, likewise carried outwards as a long tapering process (*d*) enclosing the spine, and from the posterior surface of the base of which issues the somewhat stiff fan of compound bristles (Plate LXXVIII, figs. 1 *a* and 1 *b*). As usual in such forms the anterior segments possess bristles with somewhat shorter terminal processes, while the posterior (fig. 1 *a*) have their tips more elongated. Besides, in each foot the tips vary in length, the shorter being met with superiorly and inferiorly. The claw at the tip of the terminal division is somewhat indistinct, from the blocking of its outline by a process beneath. The serratures of the sabre are very fine and scarcely distinguishable towards the tip. The shaft of the bristle is obliquely striated towards the articulation, longitudinally throughout the rest of its extent, except at the pale base, and marked by a close series of transverse striæ.

In structure these bristles differ from allied British forms, *e. g. Castalia fusca* and *Castalia punctata*, each of which has compound bristles, and the peculiarly clawed serrated terminal process. Thus in the first-mentioned the larger size, the structure of the shaft, and the coarser serratures on the terminal process, distinguish it from *Castalia punctata*, while the latter again has a much broader and proportionally larger terminal blade with coarser serratures and a better defined claw than in *Ophiodromus*, and though the shaft of the bristle more closely resembles it than that of *Castalia fusca* yet it characteristically differs therefrom. The distinctions between *Ophiodromus* and the *Pariboea* and *Podarke* of Ehlers are not so clear; indeed, the latter appears to be allied in the closest manner, if it is not identical. Unfortunately Ehlers does not figure the bristles on a large scale, so that their minute structure is uncertain. From the inferior border of the foot arises the inferior cirrus (*e*) which tapers gently towards the tip, and is shorter than the dorsal.

Reproduction.—A large number of orange-coloured ova were emitted from a ruptured female in August, and those procured by Canon Norman off Bergen, Norway, in July showed the same feature. The ova are comparatively large.

Claparède (1870) states that the ova of the Mediterranean examples were of a greenish-brown and 0·11 mm. in diameter.

Habits.—Few annelids display so much activity and irritability. If the head is touched it darts vigorously backward, and if the tail is irritated it rushes as rapidly forward—with a wriggling sinuous motion. It is very sensitive to admixture of the sea-water with fresh. Thus, when conveying living specimens from North Uist in 1865 for a coloured drawing, the jar was replenished with sea-water at Dunvegan. Unfortunately the mists and rains obscured the surroundings of the creek—which had several streams of fresh water debouching into it, and it was mortifying to see the fine examples become pale and die in a few seconds after the dilute sea-water touched them. In other Hesionidæ the changes in colour have been mentioned by several observers. Thus Professor Haswell[1] noticed that specimens of *Halla parthenopeia* changed from bright yellow to deep purple when placed in spirit. Mr. Crossland tells me that in *Halla* (*Aglaura*) *fulgida*, Sav., of the Red Sea: "The worm becomes dark when exposed to the air, whilst fresh

[1] 'Proc. Linn. Soc. N.S.W.,' x, p. 752. (1886.)

water dissolves out the same pink colour as is taken up by 70 per cent. alcohol. The addition of a little alcohol to the sea-water containing the living animal causes the mucus so abundantly secreted by the large dorsal cirri to become purplish. The alcoholic solution is deep reddish-brown by transmitted light, but shows a blue fluorescence when seen from above. These tints remained for several weeks, but gradually faded into a yellowish-brown colour." Yet in pure sea-water it is by no means difficult to keep *Ophiodromus* alive for a long time, and clayey mud is not deleterious. It swims through the water with more grace and even greater agility than *Nephthys*, but breaks into fragments if much interfered with. Even the separated posterior end keeps up a constant and violent motion—darting about in various directions for some time. While rupture of the body thus frequently occurs, yet reproduction of the posterior end readily takes place.

Delle Chiaje's description[1] (1841) is: Head with four tentacles, furnished with a proboscis; body yellowish-brown, banded transversely with white; tail with two cirri; tentacular cirri on six segments. His figures bear a close resemblance to the present species, though the identification is not free from doubt. On the whole it is probable that the northern form is only a variety of the southern, and it may be that it is a commensalistic species on *Astropecten* and *Luidia*, though this has not actually been observed.

The *Hesione Steenstrupii* of De Quatrefages (1865) from Guettary seems to approach this form very closely.

The *Oxydromus fuscescens* of Marenzeller[2] (1875) from the Adriatic appears to be very closely allied.

Levinsen (1883) states that Tauber considers this the *Stephania flexuosa* of Delle Chiaje, but he differs from him.

Genus XL.—Castalia, *Savigny*, 1820.

Head somewhat square, with four eyes obliquely arranged. Tentacles two; palpi biarticulate. Tentacular cirri two to three pairs, filiform and long. Body scolopendriform; proboscis firm, barrel-shaped, aperture papillose, with or without two thickened ventral ridges (so-called jaws). Foot biramous; superior division minute with or without simple dorsal bristles; inferior division large with compound (falcate) bristles, the terminal pieces being bifid. Dorsal cirri longer than the ventral.

This genus was established by Savigny (1820) to include such forms as the *Nereis rosea* of O. Fabricius. All he states is that this species, while agreeing generally with the heterogeneous assemblage of forms under his Nereides, differs in that the tentacular, dorsal, and anal cirri are long and smooth, and that there are two divisions in the foot.

Œrsted[3] describes the palpi as like the tentacles and non-articulate; four tentacular cirri; four eyes; minute, slender, pellucid, and edentulous maxillæ; pinnæ two, superior minute, inferior large trilobed, one spine in superior, three in inferior division; dorsal bristles capillary, ventral falcate.

[1] 'Descriz.,' v, p. 103, Taf. 109, fig. 8.

[2] 'Sitzb. d. K. Akad. d. Wiss.,' i Jahrg. 1875, p. 15, Taf. ii, fig. 1 (sep. copy).

[3] 'Annul. Dan. Consp.,' p. 23. (1842.)

The term Castalia was indicated by Savigny[1] in 1820 as suitable for the *Nereis rosea* of O. Fabricius, and therefore has priority over Dr. Johnston's title *Psamathe* (1836),[2] and though the species described by the authors are different, there is no need to separate them generically. In the original description of Dr. Johnston the proboscis was described as edentulous, and the feet as uniramous, but Œrsted[3] pointed out the presence of teeth, and showed that the feet were really biramous.

Grube[4] (1879) observed that the genus was readily divided into two groups, in the first of which the dorsal division of the foot has from three to five bristles, whereas in the second the dorsal division has few and very small bristles—sometimes only one or two spines.

1. Castalia punctata, *O. F. Müller*, 1788. Plate XLVI, fig. 2; Plate LXIX, fig. 14—foot; Plate LXXVIII, figs. 2–2 *b*—bristles.

Specific Characters.—Head somewhat square, pale yellowish, with two closely approximated red eyes on each side, the anterior pair obliquely elongated and wider apart as well as showing a cuticular lens anteriorly. Two slender tentacles on the anterior border; external to each is a palpus with an enlarged basal segment, and a more slender distal region separated by a shoulder. Three pairs of long slender tentacular cirri, each arising from a prominent ceratophore on first three segments. Body about an inch long,

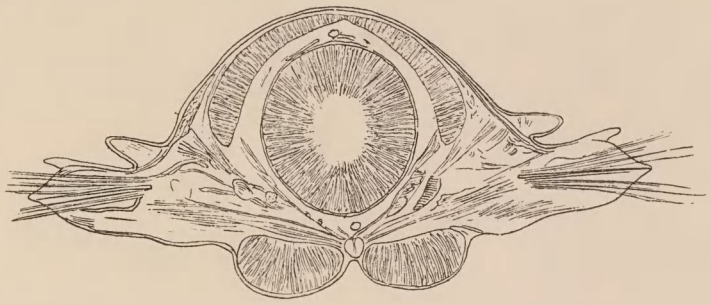

Fig. 47.—Muscles of *Castalia punctata*, O. F. M., as seen in section of the body-wall.

most massive anteriorly, gradually diminishing posteriorly, where it terminates in two long cirri. Colour of dorsum dull yellowish, crossed transversely by dark belts which become only touches posteriorly. The posterior two thirds is tinted olive from the intestine. Ventral surface dull yellow or salmon-colour, with a brown stripe in the median line, which increases in density posteriorly. The attenuated cirri are pale.

The proboscis is firm, barrel-shaped, with a broad median notch ventrally, flanked by an elevated ridge with a papillose edge (ten papillæ—Sars), and with four prominent papillæ along the dorsal arch. Foot biramous, the dorsal spine piercing the base of the dorsal cirrus, which has a ceratophore, and is of proportionally great length, diminishing, however, from before backward. Dorsal bristles slender, pale, tapering, and simple.

[1] 'Syst. Annel.,' p. 45–46.

[2] 'Loud. Mag. Nat. Hist.,' ix, p. 14.

[3] 'Annul. Dan. Consp.,' p. 23.

[4] 'Schles. Gesell.,' loc. cit.

Inferior division large, with a median, a dorsal, and a ventral papilla. The spine projects at the tip of the median. Bristles jointed, the shaft having finer markings than in *Castalia fusca*, its tip dilated, with oblique striæ, and a distinct shoulder from which the terminal process projects. The latter is longest and most slender in the middle of the foot, and terminates in a curved claw with a secondary process beneath. The ventral cirrus subulate, extending in the preparations a little beyond the ventral papilla of the setigerous process. The body-wall (fig. 47) is powerfully muscular, the dorsal longitudinal muscles being separated in the middle line, whilst the ventral form two strong curved bands in transverse section. The oblique muscles are attached to the upper edge of the nerve-area.

Synonyms.

1776. *Nereis punctata*, O. F. Müller. Zool. Dan. Prodr., No. 2633.
1780. „ *rosea*, O. Fabricius. Fauna Grönl., No. 284, p. 301.
1788. „ *punctata*, O. F. Müller. Zool. Dan., II, p. 28, Tab. lxii, f. 4 and 5.
1791. „ „ Gmelin. Linn. Syst. Nat., i, pt. 6, p. 3118.
1799. „ *rosea*, O. Fabricius. Skr. Naturh., s. 5, p. 175, Tab. iv, f. 14—16.
1806. „ *punctata*, Turton. Linn. Syst. Nat., iv, p. 89.
1825. „ *rosea*, De Blainville. Dict. Sc. Nat., xxxiv, p. 446.
1828. *Nereimyra rosea*, idem. Ibid., lvii, p. 468.
1843. *Castalia punctata*, Œrsted. Annul. Dan. Consp., p. 24, f. 15, 63—65, and 69 (excl. Fabr. and Sav. *fide* Malmgren); Reg. Mar., p. 78.
1844–5. „ „ idem. Kroyer's Nat. Tids. (Dröbak), p. 408.
„ „ „ Sars. Nyt Mag., vi, p. 209.
1848. *Halimede venusta*, H. Rathke. Beitr. Fauna Norw., p. 168, Taf. vii, f. 1—4.
1851. *Castalia punctata*, Grube. Fam. Annel., pp. 58 and 131.
1853. „ „ Sars. Nyt Mag., vii, p. 382.
1860 or 1. „ „ idem. Christ. vid. Selsk. Forh., 1861, p. 89 (sep. copy, p. 19).
„ „ „ Danielssen. Reise, 1858, p. 117.
1865. *Psamathe* „ De Quatrefages. Annel., II, pp. 102 and 664.
„ *Castalia* „ idem. Ibid., p. 106.
„ „ *rosea*, idem. Ibid., p. 107.
1867. „ *punctata*, Malmgren. Annul. Polych., p. 31.
„ *Psamathe punctata*, Parfitt. Trans. Devon. Assoc., ii, pt. i, p. 233.
„ „ *pustulata*, idem. Ibid., p. 234.
1869. *Castalia punctata*, McIntosh. Rep. Brit. Assoc. (1868), p. 339.
„ „ „ idem. Trans. R. S. Edin., xxv, pp. 411—412, pl. xvi, f. 1.
1874. „ „ idem. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
„ „ „ Malm. Op. cit. Göteb., p. 82.
1875. „ „ McIntosh. Invert. and Fishes St. Andrews, p. 121.
„ „ „ Möbius. Jahresb. Comm. deutsch., p. 170.
1879. „ „ Tauber. Annul. Danic., p. 92 (*partim*).
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 239.
1891. „ „ Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 245.
1893. „ „ Levinsen. Vidensk. Ud. "Hauchs," p. 328.

Habitat.—Dredged in deep water near the Bell Rock, off St. Andrews Bay, and on *Serpulæ* attached to *Fusus antiquus* on the same ground; procured by the fishermen's

lines (E. M.); between layers of shale near low water-mark at the East Rocks, St. Andrews (R. M.); interstices of laminarian roots in Bressay Sound, Shetland; Cumbrae (Dr. Robertson).

Extends to various parts of Norway, where it was first found by O. F. Müller on oyster shells.

Head somewhat square, pale yellowish throughout with two closely approximated dark red eyes on each side, the anterior pair obliquely elongated and wider apart, and showing a cuticular lens anteriorly. From the anterior border two slender tentacles arise, and external to each is a palpus having an enlarged basal segment with a more slender conical distal region separated by a marked shoulder. Three pairs of tentacular cirri follow, the dorsal cirrus of the third pair being the longest process in the body. These cirri are very long, slender, slightly tapered organs, and arise from a prominent ceratophore.

Body about an inch in length, most massive anteriorly, and gradually diminishing posteriorly where it terminates in two long cirri. The feet are least prominent anteriorly, and gradually increase in length as the body diminishes, though posteriorly they again become small. The ground-colour of the dorsum is dull yellowish crossed transversely by dark belts (two in each anterior segment), which do not make a solid bar except in the centre of the dorsum, the sides forming an elongated space in which the pale ground-colour of the dorsum appears. Even the dense central portion of the bar is for the most part crossed by fine pale lines. The dark pigment-belts become less and less complete towards the posterior end, where they form only transverse touches. The posterior two-thirds of the dorsum (behind the proboscis) has an olive-hue from the alimentary canal. A dark speck occurs at the base of each foot, one at the base of the cirrus, and one between the feet. These touches become more distinct posteriorly as the central pigment wanes. The dorsal blood-vessel, which alters its course at the posterior end of the proboscis, also enlivens the region. The grouping of the dark transverse belts on the massive anterior region renders it one of the darkest parts of the body. The ventral surface has a dull yellow or salmon-hue with a brown stripe, which increases in density posteriorly, in the median line. The longitudinal pigment-striæ are interrupted at the segment-junctions so that the band is elaborate. The cirri are all pale and of extreme tenuity. The proboscis in extrusion is a short barrel-shaped structure—with a broad median notch ventrally—flanked by an elevated ridge showing prominences or papillæ, and having four prominent papillæ along the dorsal arch. The whole organ is firm and resilient, and the aperture is spacious.

The intestinal canal is ciliated.

The foot (Plate LXIX, fig. 14) is distinctly biramous, the dorsal spine piercing the base of the dorsal cirrus. The latter springs from a peduncle (ceratophore) and is of proportionally great length, diminishing, however, from before backward. The dorsal bristles are slender, pale, tapering, and simple, ending in a smooth point (Plate LXXVIII, fig. 2). The inferior lobe is largely developed, and has a median, a dorsal, and a ventral papilla, so that the region appears to be trifid. The spine pierces the median papilla, and the bristles form a broad fan, the ventral, however, being shorter than those above them. The bristles are compound (Plate LXXVIII, fig. 2*a*), the shaft differing from that in

Castalia fusca in having finer transverse markings. The tip is slightly dilated and has oblique striæ with the transverse markings, and a very distinct shoulder, from which the terminal process goes. In antero-posterior view the tip is somewhat fusiform with two blunt points on each side of the origin of the terminal piece. The latter (Plate LXXVIII, fig. 2 *b*) is largest and most slender in the middle of the foot, broadest in the ventral series. The edge is finely serrated and the tip somewhat diminishes and terminates in a curved claw with a secondary process beneath. Though the serrations diminish toward the tip, yet there is no marked difference between the upper and the lower bristles as in *Castalia fusca*, Johnst. Some of the longer tips show a curve. The median bristles of the example from St. Magnus Bay have unusually long terminal processes.

The ventral cirrus arises nearer the body than the ventral papilla, and has a similar structure to the dorsal, only it is shorter. All the cirri are pale.

In life the ceratophore of the dorsal cirrus, which has the dark pigment-patch, is richly ciliated, and the cilia are continued on the skin in the immediate neighbourhood towards the intermediate dark patch. The blood-vessel internally passed up one side of the ceratophore and down the other, but did not seem to enter the cirrus proper.

Habits.—This species appears for the most part to frequent the deeper water, and the finest examples are got there. It has much of the lively habits of *Ophiodromus*, and is irritable and impetuous. When irritated, it gathers its cirri about it and swims rapidly through the water. Yet with all its beauty, it, like the gaudy *Amblyosyllis*, clings to the under surfaces of stones, and hides in crevices, so that, unless these are only its resting-places, it has little field for the display of its attractions.

Reproduction.—The fine pinkish colour of the feet is due to the presence of large ova (September), which are grouped in masses at the base and extend for some distance into the foot.

It is probably this species which Garstang[1] found breeding at Plymouth in August.

Two very distinct species have been included by Dr. G. Johnston in Britain on the one hand, and by several Continental authors on the other, under the head of *Psamathe punctata*, viz. the present form and *P. fusca*, Johnst. Neither Malmgren nor De Quatrefages recognized the distinctions. The latter indeed groups them as two species under the genus *Psamathe*, but, like Œrsted and Johnston, he has not appreciated the differences. The synonym *Castalia punctata*, Œrst., is placed under each without allusion to the fact that Œrsted shows two bristle-tufts (dorsal and ventral) in each foot, whereas De Quatrefages states as a generic character: "Pedes unirames." The bristles of the two species, besides, are quite different.

Amongst the figures of "Marine Insects" given by Baster is one[2] which probably represents this species.

This annelid appears to be both the *Nereis punctata* and *N. pustulata*[3] of Montagu, the latter being a greenish variety dredged off Torcross, Devonshire (MS. Drawings, Linn. Soc., Plate LII, fig. 3). The *N. fascicularia* of the same observer (MS. Drawings, Plate XXXVIII, fig. 2) is closely allied, if not identical.

[1] 'Journ. M. B. A.,' vol. iii, p. 225.

[2] 'Opuscula Subseciva,' Tab. iv, fig. 4. (1762.)

[3] This specific name is also given for an *Eulalia* in MS. Tab. 51, fig. 4.

H. Rathke (1843) formed a new genus and species for this form which he correctly recognized as O. F. Müller's *Nereis punctata*.

Tauber (1870) merges the *Psamathe punctata* of Johnston in this species, but they are distinct alike in minute structure, colouration, and habitat.

2. Castalia arctica, *Malmgren*, 1867. Plate LVIII, fig. 14—head; Plate LXIX, fig. 15—foot; Plate LXXVIII, figs. 3 and 3 *a*—bristles.

Specific Characters.—Head somewhat square with two tentacles anteriorly and four rather small eyes (reddish in spirit), the anterior pair wider apart. Tentacular cirri as in *Castalia fusca*. The palpi are two-jointed. Body about half an inch long, somewhat fusiform, and terminating in two long anal cirri. Proboscis with a papillose rim (ten papillæ—Théel, Levinsen, etc.), the single example from the 'Porcupine' not being definite in this point. Two prominent brownish hooked maxillæ, ventro-lateral in position. Foot biramous, two slender spines passing into the ceratophore of the dorsal cirrus, which is more or less segmented. No bristles are present in the division. Setigerous region of the inferior division diminishes towards the tip, and has a conical papilla in front of the tip of the spine. Bristles curved towards the tip of the shaft, which is dilated and with a shoulder from which the terminal process proceeds. The latter is slightly curved and diminished distally, has a serrated edge, and ends in a minute claw with a secondary process beneath. Ventral cirrus comparatively short and subulate.

Synonyms.

1790. *Nereis aphroditoides*, Fabricius. Fauna Grœnl., No. 278, p. 296.
1867. *Castalia Fabricii*, Malmgren. Annul. Polychæt., p. 32 (?).
„ „ *arctica*, idem. Ibid., p. 32.
1883. „ *aphroditoides*, Wirén. Chæt. 'Vega' Exped., p. 401.
„ „ *Fabricii*, Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 239.
1889. „ *aphroditoides*, Marenzeller. Arch. f. Naturges., 55, p. 128.

Habitat.—Dredged in 90—125 fathoms fifty miles west of Valencia on the west coast of Ireland by Dr. Gwyn Jeffreys.

Sengiarak, Greenland (O. Fabricius). Siberia and Behrings Strait (Wirén).

Head (Plate LVIII, fig. 14) somewhat square with the usual tentacles anteriorly and four rather small eyes (reddish in the preparation), the anterior pair wider apart. The tentacular cirri resemble those of *Castalia fusca*. The palpi are two-jointed.

Body appears to be about half an inch in length, is somewhat fusiform in outline, and terminates posteriorly in two long cirri. The proboscis, unfortunately, was injured in drawing, so that its subsequent examination was unsatisfactory. It had a papillose rim, but whether so many papillæ occurred as in the figure is an open question. Two brownish hooked maxillæ occur ventro-laterally and project during the extrusion of the cylindrical or barrel-shaped organ.

The foot (Plate LXIX, fig. 15) is biramous, two slender spines passing into the base

of the ceratophore of the dorsal cirrus. The ceratophore is proportionately shorter than in *Psamathe fusca*. The cirrus shows crenations towards the base and is more distinctly segmented towards the tip. The setigerous region diminishes distally, and has a conical papilla in front of the tip of the spine. The bristles form a vertical fan and have a distinct downward curve towards the tip of the shaft, which is somewhat dilated and furnished with a shoulder from which the terminal piece proceeds, the margin sloping from this upward to the pointed end of the shaft (Plate LXXVIII, fig. 3). The shaft is marked similarly to that in *C. fusca*, but the lines are much more delicate and less easily observed. The terminal blade is shortest ventrally and gradually increases in length superiorly, the blades of those on the dorsal edge, however, being shortened, though they are longer than those of the ventral edge. All are slightly curved and diminished distally, and end in a minute claw with a secondary process beneath. The serrations on the edge are finer than in *C. fusca*, yet there is a tendency to a more distinct series inferiorly, and then they gradually become finer and fade away distally. The bristle is thus intermediate in character between *C. punctata* and *C. fusca*.

The ventral cirrus is comparatively short and subulate.

In all probability a flap existed at the tip of the setigerous process, but the state of the preparation was unfavourable for determination. It may also be smaller than in allied forms.

Reproduction.—The specimen is a male with the reproductive elements well developed in June.

There are certain discrepancies between this form and the *Nereis aphroditoides* of O. Fabricius, especially in the structure of the foot, for, in addition to the single terminal papilla, Fabricius adds that there are two smaller papillæ inferiorly. The general greenish hue with red lines make the species described by Fabricius conspicuous, and it may be that further investigation will show that the British form differs from it. In the uncertainty as to the minute characters of the older form it has been deemed best to include the present species under *Castalia arctica*.

In the structure of the foot this form differs both from *Castalia Fabricii*, Malmgren, and *C. multipapillata*, Théel, for, instead of the three papillæ which characterize the tip of the setigerous region in these, the British species has only one conical papilla in front of the tip of the spine.

Malmgren observes that in *C. arctica* the dorsal division has only a single spine, and in the British species the spine is so slender in contrast with those of *C. Fabricii* that Malmgren may have overlooked the fact that in some there are two. No details of the structure of the feet are given by Malmgren, and none of the bristles or of the proboscis, so that considerable doubt must remain as to the nature of these.

Wirén amalgamates the *C. Fabricii* and *C. arctica* of Malmgren as the *C. aphroditoides* of Fabricius, the former, *C. Fabricii*, having two acicules dorsally and three or four ventrally, whereas *C. arctica* has only one dorsally and two ventrally. He considers the latter a variety of the former, but he gives no details of the structure of the foot and no figures.

Marenzeller (1898) alludes to this form from Spitzbergen as having three spines, as in *C. Fabricii*, Malmgren.

3. Castalia fusca, *Johnston*, 1836. Plate XLVI, fig. 3; Plate LVIII, figs. 15 and 16—head; Plate LXIX, fig. 16—foot; Plate LXXVIII, fig. 4—bristle.

Specific Characters.—Head small, square, with two black eyes close together on each side, the anterior elongated, placed obliquely, and with a cuticular lens. Tentacles, two, slender; palpi with a massive basal segment from which the short distal process passes off at an angle. Tentacular cirri, two pairs, filiform, slightly segmented and of great length, the dorsal being the longer. Body 1–3 inches long, scolopendriform, slightly narrowed in front, and tapered to an attenuated tail with two long, slender anal cirri. Colour pinkish or fawn, yellowish-brown, and purplish-pink, darker in the centre, with the dorsal blood-vessel which makes a double curve behind the œsophageal region. Cirri pale. Proboscis short, firm, cylindrical, the aperture surrounded by a dense fringe of filiform papillæ. Two thickened ventral edges (the "jaws" of Dr. Johnston). The body-wall (Fig. 48) is as muscular as in *C. punctata*, though, perhaps, the ventral longitudinal

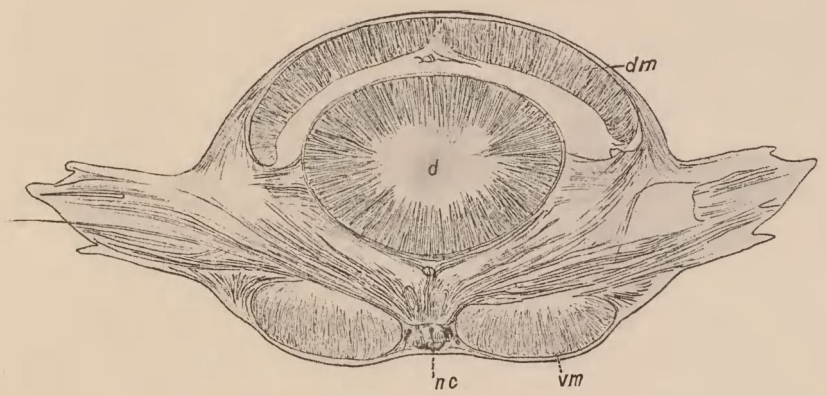

Fig. 48.—Muscles of *Castalia fusca*, Johnst., as seen in section; *n. c.* nerve-cords cut in the line of the ganglia. Other letters as before.

muscles project less inferiorly. The strong oblique bands are attached to the firm summit of the large nerve-area, which has externally hypoderm and cuticle.

Feet prominent, longer than the diameter of the body; biramous, for two small spines pass to the base of the dorsal cirrus, which is very long and slightly tapered, with a large and long ceratophore. Articulations are distinct towards the tip. The setigerous (ventral) division is massive, with a blunt papilla for the spine, another a little above it, and a third process is formed by the short ventral cirrus. Bristles leave the foot between the posterior flap and the papillæ in front, are yellowish, and boldly curved towards the tip of the shaft, which is striated longitudinally and transversely. The end of the shaft is not much dilated and is bevelled to a shoulder for the terminal blade which ends in a curved claw with a secondary process beneath. The edge of the blade has minute serrations at the base, then a series of larger curved teeth, followed by minute serrations which diminish and disappear before the tip is reached.

Synonyms.

1836. *Psamathe fusca*, Johnston. Loud. Mag. Nat. Hist., ix, p. 14, woodcut f. 1.
1840. ,, ,, idem. Ann. Nat. Hist., iv, p. 230, pl. vii, f. 4.

1851. *Psamathe fusca*, Williams. Rep. Brit. Assoc., 1851, p. 213.
„ „ „ Grube. Fam. Annel., pp. 58 and 130.
1853. *Nereis punctata* (*villosa*), Dalyell. Pow. Creat., ii, p. 158.
1862. *Psamathe cirrhata*, Keferstein. Zeitsch. f. w. Zool., Bd. XII, i, p. 107, Taf. ix, f. 32—36.
1863. „ *cirrata*, Claparède. Beobacht., p. 55, pl. xiv, f. 1—7.
1864. „ *fusca*, Grube. Insel Lussin, p. 82.
„ „ „ Kölliker. Kurz. Ber. Schott., p. 9.
1865. *Kefersteinia cirrata*, De Quatrefages. Annel., ii, p. 41.
„ „ *Claparedii*, Idem. Ibid., p. 42.
„ *Psamathe punctata* (*partim*), Johnston. Cat. Brit. Mus., pp. 182 and 342.
„ „ *fusca*, De Quatrefages. Annel., II, p. 101.
1869. „ „ McIntosh. Trans. R. S. Edin., xxv, pp. 412—413, pl. xvi, f. 2.
1874. „ „ idem. Ann. Nat. Hist., ser. 4, vol. xiv, p. 197.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 121.
1879. *Castalia cirrata*, Langerhans. Zeitsch. f. w. Zool., xxxiii, p. 306, f. 41.
„ *Psamathe* „ Marion. Ann. Sc. Nat., 6e sér., viii, art. 7, p. 21.
1885. *Hesione fusca*, Carus. Fauna Medit., p. 239.
1890. *Psamathe cirrata*, Giard. Bull. Sc. Fr. Belg., t. xxii, p. 78.
1891. „ *fusca*, Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 245.
1899. *Kefersteinia cirrata*, McIntosh. Nat. Sc. (May), p. 376.
1904. „ „ Allen. Journ. M.B.A., n.s., vol. vii, p. 220.
1906. „ „ Bohn. Ann. Sc. Nat., 9e sér., t. iii, p. 71.
„ „ „ De St. Joseph. Ann. Sc. Nat., 9e ser., t. iii, p. 228.

Habitat.—Procured under stones between tide-marks at various points around the British shores, and in Shetland in the roots of tangles in the laminarian region. It also occurs in fissures of rocks—as many as thirty or forty having thus been obtained on raising a large slab at Lochmaddy—where it is also found in the laminarian region. Plymouth (Allen).

St. Vaast, Normandy (Keferstein); Naples (Claparède). Mediterranean (Carus). Marseilles (Marion).

Head (Plate LVIII, fig. 15) small, square, entire in front, with two pairs of well-marked black eyes, the pairs on each side being close together, the anterior elongated and placed obliquely, and each furnished with a cuticular lens. Tentacles two; palpi with a massive basal segment, from which the terminal division comes off at an angle. It is directed outward, and is comparatively short. The inner tentacles are slender, cylindrical, tapered a little at the tip, and arise from the upper and inner base of the foregoing pair. Tentacular cirri two pairs, filiform, slightly jointed and of great length, the dorsal being the longer.

Body from one inch to three inches long, scolopendriform, slightly narrowed in front and tapered to a slender tail, which is terminated by two long slender cirri.

Colour generally pinkish or fawn, yellowish-brown, or purplish-pink, darker in the centre, and enlivened by the red dorsal blood-vessel, which makes a double curve behind the œsophageal region. Cirri pale. Dr. Johnston considered that the purplish hue of some specimens spreads rapidly over the body when the animal is alarmed. As this occurred

in April it is possible that it may have been connected with the development of the ova. Sir J. Dalyell, again, noted that the finest examples were scarlet, though some were yellow, but that the colour depended on the food.

The proboscis (Plate LVIII, fig. 16) is short, firm, cylindrical, the circular aperture in extrusion being surrounded by a dense fringe of filiform papillæ. It has two thickened ventral edges, which are simply the thickened parts of the organ in protrusion. The whole organ is firm, and well adapted for predatory habits. Dr. G. Johnston found that they devoured each other in confinement, and Sir J. Dalyell fed them on mussels. The latter author thought that the colour of the body was dependent on the food, but more probably it is due to the development of the reproductive elements. Intestine richly ciliated. The feet are prominent throughout, stretching, with the bristle-tufts, outwards more than the diameter of the body. Though apparently uniramous they are really biramous (Plate LXIX, fig. 16), for two small spines pass to the base of the dorsal cirrus, which is the only representative of the dorsal division. The ceratophore of the cirrus is both large and long, and the cirrus itself is very long, and is slightly tapered from the base towards the tip. Articulations are visible some distance above the base, and are very marked towards the tip. The setigerous lobe is massive, with a bluntly conical extremity, the tip being formed by a blunt papilla into which the spine goes, and another occurs a little above it; while the ventral cirrus, which is comparatively short, unjointed, and little tapered, leaves the foot internal to the bristles, which project between a posterior flap and the papillæ in front. The shafts of the bristles (Plate LXXVIII, fig. 4) are boldly curved towards the tip, are yellowish, striated longitudinally, except at the tip, where the striæ are oblique, and marked by fine transverse striæ. The end of the shaft is not much dilated and is bevelled to a shoulder, which is slightly bifid and gives attachment to the terminal blade. The upper end of the bevelled region is also bifid. The distal process is longest in the middle of the series, shorter superiorly and inferiorly, and ends in a curved claw with a secondary process beneath. The edge of the blade has minute serrations at the base, then a series of larger curved teeth, followed again by small serrations which diminish and disappear before the tip is reached. Filmy algæ grow from the tip of the shaft and the terminal blade.

Reproduction.—In May, when carrying ova, the body assumes a fine mauve or purplish-pink hue, which extends from the posterior region of the proboscis to the tail. In confinement the ova are discharged by rupture of the body, which then assumes the ordinary hue. The ova are pinkish and show a zona with markings externally. They were probably unripe. The scarlet specimens alluded to by Dalyell may have carried ova. Females with advanced ova are found at Plymouth in April (Allen).

Habits.—It swims gracefully and actively through the water with an undulating motion, its cirri streaming from the sides, but if irritated it discards these organs, and even (as in spirit) breaks into fragments and throws off its feet. According to Bohn,[1] the movements of this species are in accord with those of *Eulalia*, but its activity and irritability are quite distinctive.

This species was first found by Dr. Johnston, who afterwards confounded it with the *Castalia punctata* of Œrsted, nor did Claparède and others notice the difference between

[1] Much of the literature of the subject has escaped this author.

the latter and Dr. Johnston's species. The name (*Psamathe*) given by Dr. Johnston had already, in 1814, been used for a Crustacean by Rafinesque, and in any case lapses in favour of the earlier title of Savigny. There is no reason why the *Psamathe cirrata* of Keferstein should be separated. Fine examples under the latter title (*Kefersteinia cirrata*) were sent from Plymouth by Dr. Allen.

Dr. Williams (1851) mentions that it feeds on algæ, but this is doubtful. Dalyell found that it fed voraciously on mussels, "darting out its proboscis and absorbing a great quantity. The colour changes with the quality of its food."

Genus XLI.—Leocrates,[1] *Kinberg*, 1865.

Head with three tentacles, a pair of palpi, and a frontal tubercle; eyes four. Body comparatively short, with few segments, ending in two anal cirri. Proboscis with two maxillæ. Foot biramous; dorsal bristles capillary; inferior bristles compound (falcate).

This genus was established by Kinberg in 1865 for a species from China—near Hong Kong. The author gives the proboscis only a single "maxilla" in the median dorsal aspect, but probably the second was overlooked.

Claparède again constituted the genus *Tyrrhena*, as indicated, for the same type which Achilla Costa had discriminated under the name of *Castalia Claparedii* in the manuscript of the fourth 'Annuaire du Musée Zoologique de Naples.'

Grube[2] showed the identity of the genera established by the two preceding authors, and gave an amended description of the genus in his Philippine Annelids, with an account of a new species from Zamboanga.

1. Leocrates atlantica, *Roule*, 1896. Plate LVIII, fig. 17—head; Plate LXIX, fig. 17—foot; Plate LXXVIII, figs. 5 and 5 *a*—bristles.

Specific Characters.—Head (in spirit) more or less quadrate, longer diameter antero-posterior, and generally with a median depression and a cordate posterior border. Eyes on an elevated ridge in middle of head; anterior pair wide apart, large, rounded, and with a cuticular lens; posterior pair also rounded or oblique. Palpi thick at the base with a short terminal segment. Lateral tentacles subulate and slender; internal to palpi. Median tentacle short and subulate. Tentacular cirri eight, with massive basal segment (ceratophore) and spine. Body about one and a half inches long, massive anteriorly, though tapering a little towards the head in life and more distinctly posteriorly. Rounded or convex dorsally, iridescent and minutely ringed, flattened ventrally, and with a deep median groove. First four segments fused, but with special nerve-twigs. Proboscis with a thick, frilled, anterior edge, a blunt papilla projecting from the central fold dorsally.

[1] 'Öfvers. af K. Vet.-Akad. Förh.,' 1865, No. 4, p. 244. Claparède, in 1868, constituted the genus *Tyrrhena* for the same form, naming it after the Tyrrhene Sea opposite Tuscany. 'Annel. Neap.,' p. 227.

[2] 'Jahresb. Schles. Gesellsch.,' November 19th, 1879, s.a., p. 25; 'Anneliden fauna der Philippinen,' p. 105 (1878).

Chitinous teeth in mid-dorsal and mid-ventral lines. Feet sixteen in number, long and prominent. The dorsal lobe has—just below the ridge of the foot—the basal segment of the dorsal cirrus, the setigerous region in front being conical with a long black spine. Dorsal bristles simple, stiff, tapering to hair-like tips. Shaft marked by transverse striæ almost to the tip, which has a regular series of minute spikes. Ventral division irregularly conical with terminal papilla for spines; upper slope downward and outward, inferior (more abrupt) downward and inward. The iridescent bristles form a dense tuft; shafts with close series of longitudinal and transverse striæ, slightly dilated distally and then bevelled—from the attachment of the terminal process to the point. Terminal blades longest in upper third of tuft, shorter dorsally, shortest ventrally. Each is flattened, slightly tapered and curved distally, where it is bifid—with a secondary process. The bevelled edge of the blade is attached by a web to the shaft. Ventral cirrus long, slender, subulate, and tapering—extending a little beyond the fleshy part of the foot.

Synonyms.

1896. *Tyrrhena atlantica,* Roule. Camp. 'Caudan,' Ann. Univ. Lyon, Août-Septembre, 1895, p. 455, pls. xxi, xxiv, xxv, f. 9, 10, 24, 28 and 29.
1901. „ „ McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 227, pl. i, f. 5, 6 and 8.

Habitat.—Several specimens were dredged in the 'Porcupine' Expedition of 1870 at Station 9, on the Channel Slope, lat. 48° 6′ N., long. 9° 18′ W., in 539 fathoms, on a bottom of grey mud. Bottom-temperature 48°·0 Fahr., surface-temperature 64°·0 Fahr. Off Ushant in 400 fathoms (J. E. Allen).[1]

In the 'Caudan' from a depth of 1410 metres in the Gulf of Gascony (Roule).

Head (Plate LVIII, fig. 17) more or less quadrate, with the longer diameter antero-posterior, and generally with a median depression and a somewhat cordate posterior border, so that the eyes occur on an elevated ridge on each side. The anterior pair of eyes are wide apart, large, rounded, and with a cuticular lens in the centre, the darkest part of the pigment-ring, in spirit, being a crescent on the inner and posterior border. The posterior pair are rounded or oblique in the preparations, the latter, in all probability, being due to the presence of the pigment on the inner border. Both pairs lie in the middle of the head. From the outer and inferior angle of the head on each side the palpi project forward and downward, the segment at the tip being proportionally short, and Claparède observes that, in his species, it can be partly invaginated. The organ is small compared with that in the Syllids, is thickest at the base, and tapers towards the tip. The tentacle, arising from the head internal and superior to the former, is subulate, much more slender, and longer. In the median line between the posterior pair of eyes is a comparatively short, subulate, median tentacle, which is easily overlooked, especially in an indifferent preparation. The edge of the proboscis projects in the preparations, and in the median line dorsally is a prominent papilla, which lies under the anterior border of the snout—fitting as it were between the palpi, and Claparède states that, in his form, it is surrounded in life by a circle of cilia. In these preparations the eyes are considerably

[1] I am indebted to Dr. Allen for this and other information on this species.

larger than in examples of *L. Claparedii* from Naples, and the tentacular cirri are larger and longer.

Body about one and a half inches long, massive anteriorly, though in life it probably tapers a little towards the head, as Delle Chiaje and Claparède show in *L. Claparedii*, and more distinctly towards the tail. It is rounded or convex dorsally, iridescent and minutely ringed, somewhat flattened ventrally, and with a deep median groove. The tail terminates in a free median vent, with a long cirrus at each side. The tentacular cirri are eight in number on each side, and are long, tapering organs, springing from a massive basal segment (ceratophore), which is furnished internally with spines. The first four segments are fused, but, as Claparède showed in his species, they receive special nerve-twigs, and thus he thinks the view of De Quatrefages, that all the tentacular cirri arise from the buccal segment, untenable. The proboscis *in situ* presents a somewhat thick, frilled, anterior edge, the median papilla formerly alluded to projecting from the central fold of the dorsal arch. As Claparède pointed out in *L. Claparedii*, chitinous jaws are situated in the present species at the anterior end of the organ *in situ* in the mid-dorsal and mid-ventral lines. The dorsal tooth at the free edge has the shape of a bifid fan, whilst the ventral resembles a conical process. The massive wall of the organ is chitinous and of a brownish hue, and extends backward quite a third the length of the body, terminating at a prominent aperture (the gut) in the centre of its posterior wall. Two flattened lateral cæca, also with dark pigment, occur in this region. The inner surface of the proboscis has two thick pads behind the teeth in front, a transverse bar on each side in the middle, and the posterior half is subdivided by deep grooves. It seems to be an efficient prehensile and suctorial organ, and its great proportional size probably is in relation to its functional importance.

The bristled feet (Plate LXIX, fig. 17) are sixteen in number, long and prominent, and their resplendent tufts of bristles make them still more conspicuous. The dorsal lobe presents, just behind the ridge of the foot, the basal segment of the dorsal cirrus, while the setigerous region in front is acutely conical, the long black spine passing to the apex. Each bears a tuft of simple and somewhat stiff bristles, which taper gently to a hair-like tip. The whole bristle is marked by transverse striæ, as if camerated, till within a short distance of the tip. Moreover, the tip is furnished with a regular series of minute spikes. The latter are much more conspicuously developed in *L. Claparedii* from Naples, the spikes in some being continued far downward and forming a feature along each side of the bristle. It was the comparison between the dorsal bristles of the two forms that many years ago (long before the expedition of the 'Caudan' was thought of) led to their separation. Claparède had overlooked the presence of these spikes in his species, as also has Roule in the present form. The ventral division of the foot is irregularly conical, with a prominent papilla for the powerful black spine or two. The upper slope of the region is downward and outward, the inferior (more abrupt) is downward and inward. In shape the foot thus differs from that of *L. Claparedii*, which is longer, and the inferior setigerous region has an abrupt truncated extremity, with, superiorly, a papilla for the spine. The ceratophore of the dorsal cirrus is carried erect in the specimens from the 'Porcupine,' whereas it is horizontal in *L. Claparedii*, but this is not a point of much moment. The bristles (Plate

LXXVIII, figs. 5 and 5A) form a dense tuft. The shaft has a close series of longitudinal and transverse striæ, is slightly dilated at the distal end, and then bevelled, from the attachment of the terminal process to the point. The distal blades are longest towards the upper third of the tuft, shorter dorsally, and shortest ventrally. Each is flattened, slightly tapered, and curved distally, where it is bifid, with a secondary process beneath. Oblique striæ slope from the serrated edge of the blade downward and backward. The bevelled base of the blade is attached by a web to the shaft. These bristles, though pale, are finely iridescent, and in some are brownish in the posterior region of the body.

Comparing these bristles with those of *L. Claparedii* (Plate LXXVIII, fig. 6) the whole bristle is more slender, the tips are longer and more delicate, and the bifid tip is more minute. The boldly bifid nature of the tip in *L. Claparedii* and the more distinct secondary process are in contrast with *L. atlantica*, the second or inferior spur being curved and the secondary process adpressed. The serrations on the edge of the blade are similar. The backward tilt of the bristle is seen in both, but *L. atlantica* has also a tendency to a dorsal curve (*i. e.* a convexity toward the dorsal edge throughout). It is the same type of bristle in both, but that of the abyssal species has been modified. It is the same as that of *Dalhousia atlantica* of the 'Challenger,'[1] which agrees with this species except in the absence of maxillæ. Should these be found in fresh examples, then the specific name given in the Annelids of the 'Challenger' would stand.

The ventral cirrus is of considerable length, slender, subulate, and tapering. It extends a little beyond the fleshy part of the foot.

Claparède found the male elements in *L. Claparedii* developing in winter. None have been seen in the present species. Eisig[2] notes the occurrence of hermaphrodite glands in *Hesione sicula*, and cites the remarks of Claparède on *Leocrates* (*Tyrrhena*) to show that such a condition may also occur in that species. The subject should be re-investigated in living forms. In the same paper Eisig gives his views as to the cæca of the gut of *Leocrates* (*Tyrrhena*) having the function of a swim-bladder, but it cannot be said that either structurally or physiologically these organs lend themselves to this theory.

What relationship the foregoing form or that of Claparède has to the various species described or alluded to by De Quatrefages[3] is uncertain, for there is little that is definite or that can be relied on in his treatment of the Hesionidæ, as, indeed, Claparède long ago pointed out. In the number of the tentacular cirri *Leocrates* (*Tyrrhena*) agrees with the genus *Fallacia* of De Quatrefages, but this is all that can be said with safety.

Though the species had long been discriminated in my collection, the publication of the Annelids of the 'Caudan' by Prof. Louis Roule gives his title priority. He correctly describes the distinctions from *L. Claparedii* in regard to the tentacular cirri and teeth. His account of the dorsal bristles, however, requires further elucidation, for he states that they are of two kinds—viz. a rare form, which is simple and delicate, tapering to a curved point; the other a camerated bristle, which at the tip has a cap of granular matter giving

[1] 'Annelids of the Challenger,' p. 186, pl. xv A, figs. 5—7.

[2] 'Mitth. Zool. Stat. Neap.,' II, pp. 298—300.

[3] 'Annelés,' pp. 95—111.

it the aspect of a racquet. In the examples from the 'Porcupine' not a few of the dorsal bristles had a granular parasitic mass near the tip, as, indeed, is liable to happen in spiked bristles. That the type of bristle should be so altered (as shown in Professor Roule's right-hand figure in fig. 29, Plate XXV) is peculiar. He has likewise omitted to record the presence of the spikes. His artist has, further, taken considerable liberties in his drawing of the ventral bristles (Plate XXV, fig. 28), but perhaps the style of plate adopted is unsuitable for the illustration of structures so delicate and yet so characteristic. The distal segment of the palpus has also been overlooked in Plate XXI, fig. 10, and the sub-frontal papilla is tapered to a point, whereas that in the specimens from the 'Porcupine' is blunt.

Genus XLII.—Dalhousiella,[1] *McIntosh*, 1901.

Head devoid of a median tentacle, with a deep median furrow separating the closely approximated eyes. Tentacles about the length of the palpi. Tentacular cirri—eight pairs—from the peristomial segment backward, and furnished with spines. Tips slightly moniliform. Body typical of the Hesionidæ. Proboscis with firm muscular wall, no teeth. Foot—dorsal division represented only by two small black spines at the base of the long dorsal cirrus—ventral, with compound (falcate) bristles. Ventral cirrus long and subulate.

1. Dalhousiella Carpenteri, *McIntosh*, 1901. Plate LVIII, fig. 18—head; Plate LXXVIII, fig. 7—bristle.

Specific Characters.—Head typical; devoid of a median tentacle. Tentacles appear to be about the length of the palpi, which have a short terminal segment. A deep median furrow separates the rounded lobes on which the large and closely approximated eyes (four) are placed. Eight pairs of tentacular cirri, with spines, and slightly moniliform tips. The papilla beneath the snout is small (or little elevated). Body typical, about one and a quarter inches long (in spirit), and with seventeen bristled segments. Two short anal cirri occur beneath the vent, but the extremity seems to be injured. Proboscis with a firm wall and glistening internal surfaces. No teeth. Shape of the feet somewhat uncertain, but they are long, and appear to diminish more towards the outer edge than in *Leocrates*. Dorsal cirrus arises behind the ridge of the foot, has two small black spines, and is long, tapering, and slightly moniliform. No dorsal bristles visible. Setigerous region tapers towards the outer extremity, where a papilla occurs. Spine black and powerful. Bristles have comparatively short shafts which are minutely striated longitudinally and transversely. When seen on edge the tips of the shafts are somewhat fusiform from the dilatation below the bevelled region. In lateral view the dilatation is less pronounced, though the diameter is greater, and the striæ are oblique. The dorsal limb of the fork is the longer, but is frequently broken. Edge of the distal blade is minutely spinous, even up to the base of the fork. Ventral cirrus slender and subulate, stretching beyond the tip of the setigerous process.

[1] The genus *Dalhousia* was named in honour of the Earl of Dalhousie, late Secretary for Scotland, *vide* 'Annelids of the Challenger,' p. 186.

Synonym.

1901. *Dalhousiella Carpenteri,* McIntosh. Ann. Nat. Hist., ser. 7, vol. viii, p. 231, pl. i, f. 9 and 10.

Habitat.—Dredged in the 'Porcupine' Expedition of 1870, at Station 9, on the Channel Slope, lat. 48° 06′ N., long. 9° 18′ W., in 539 fathoms, on a bottom of grey mud. It accompanied *Leocrates atlantica*, which, like *Ophiodromus* and other Hesionidæ, has a fondness for mud—often of a most tenacious description.

Head (Plate LVIII, fig. 18) agrees with the type observed in *Dalhousia* of the 'Challenger' Expedition, and also with that in *Leocrates*, though the median tentacle is absent. The tentacles appear to be about the length of the palpi, which have a short terminal segment. A deep median furrow separates the rounded lobes on which the large and closely approximated eyes are situated. The preparation shows less disproportion than usual between the anterior and posterior eyes, but it is not good. Eight pairs of tentacular cirri, with spines, occur on the buccal and following segments, and they appear to have long and slightly moniliform tips, as in allied forms.

Body of the typical form, about one and a quarter inches long (in spirit) and with seventeen bristled segments. The posterior end appears to be injured, though two short cirri occur beneath the vent. The papilla under the snout is small or little elevated.

The proboscis has a firm wall and a glistening interior surface, but, though the parts in the mid-dorsal line are dense, no distinct teeth are present.

The shape of the feet is uncertain in the preparation, but they are long, and appear to diminish more towards the outer edge than in *Leocrates*. The dorsal cirrus arises somewhat behind the ridge of the foot, has two very small black spines at the base, and is long, tapering, and slightly moniliform. No dorsal bristles existed in the preparation.

The setigerous region tapers towards the outer extremity, where a papilla occurs. The spine is black and powerful. The bristles (Plate LXXVIII, fig. 7) have comparatively short shafts which are minutely striated longitudinally and transversely (internally) as in allied forms. When seen on edge the tips of the shafts are somewhat fusiform, from the dilatation below the bevelled region. In lateral view, though the diameter is greater, the dilatation is less pronounced and the striæ are now oblique. The terminal blade is comparatively short, has a web connecting its bevelled base with the shaft, is slightly curved, and tapers very little to the deeply forked (longitudinally split) terminal region. The dorsal limb of the fork, viz. that opposite the serrated edge, is the longer, but is frequently broken. It is proportionally longer in the upper bristles of the tuft. The edge of the blade is minutely spinous, even up to the base of the fork. The ventral cirrus is slender and subulate, stretching beyond the tip of the setigerous process. The structure of this bristle would seem to be diagnostic, for though that of *Stephania flexuosa* of Delle Chiaje,[1] as figured by Claparède,[2] is a step in its direction, yet not even uniform and continuous friction could make it resemble that of the present form, and this difference would suffice without referring to other distinctive characters of the species.

[1] 'Mem. degli Anim. s. Vert.,' II, pp. 308, 401 and 424, tav. xix, fig. 8; 'Descriz. e Not.,' III, p. 97: V, p. 103, tav. cxxix, fig. 8.

[2] 'Suppl. Annel. Neap.,' 1870, p. 118, pl. xii, fig. 1.

Genus XLIII.—Magalia, *Marion and Bobretzky*, 1875.

Cephalic lobe bearing four eyes, two palpi (jointed), and two tentacles. Buccal region with three pairs of tentacular cirri on each side. Proboscis armed with a stylet and two maxillæ. Feet uniramous.

1. Magalia perarmata, *Marion and Bobretzky*, 1875. Plate LIX, fig. 1—head, and 2—tail; Plate LXV, fig. 10—proboscis; Plate LXIX, fig. 18—foot; Plate LXXVIII, figs. 8 and 8*a*—bristles.

Specific Characters.—Head somewhat quadrangular, eyes rather large, close together on each side about the middle; anterior pair with lenses. Tentacles comparatively long, smooth, fixed over the palpi, which are bi-articulate. Buccal region under the head; six pairs of articulated tentacular cirri, the dorsal of the second pair longest. Each has a basal spine. Body 7—8 mm. in length, slightly tapered anteriorly and posteriorly; segments 31—32. Anal cirri long and articulated. Colour, yellowish with a brown touch at each dorsal cirrus, and similar touches on the head and buccal region. Dorsal surface minutely striated transversely. Proboscis with a crown of papillæ with barbed palpocils, and the adjoining surface (in extrusion) has long hair-like papillæ. A symmetrical pair of jaws, and a median tooth. Intestine sacculated. Foot uniramous, dorsal cirrus long, and with a spine in ceratophore; conical setigerous region with two spines; bristles slender, translucent, with long terminal pieces, especially superiorly, the tip minutely hooked and with a secondary process beneath. Ventral cirrus subulate.

Synonyms.

1875. *Magalia perarmata,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér., t. ii, pl. vi, f. 16 A—11 and pl. vii, f. 16.
1904. „ „ Allen. Journ. M. B. A., n.s., vol. vii, p. 220.

Habitat.—Not uncommon in dredgings from Queen's Ground, Asia Shore, and Millbay Channel, Plymouth (Allen).

Under stones and in prairies of *Posidonia*, and in the coralline region, Marseilles (Marion and Bobretzky).

Head (Plate LIX, fig. 1) somewhat quadrangular, bearing four eyes of considerable size situated near each other towards the middle of the region. The anterior pair have lenses. The tentacles are comparatively long, smooth, and are attached over the palpi which are bi-articulate. The buccal region lies entirely under the head, and the six pairs of articulated tentacular cirri are usually directed forward, the dorsal of the second pair being the longest, though it does not exceed the first dorsal cirrus. Each has a spine at its base.

Body 7—8 mm. in length (Marion and Bobretzky), slightly tapered anteriorly and more so posteriorly. Setigerous segments 31 or 32. The anal segment carries two long articulated cirri (Plate LIX, fig. 2).

Colour yellowish, with a brown touch at the base of each dorsal cirrus, and similar

touches on the head and buccal region. The dorsal surface of the segments shows under the microscope transverse striæ, somewhat irregularly arranged.

The proboscis in extrusion (Plate LXV, fig. 10, from Marion and Bobretzky) has a crown of prominent papillæ, soft and contractile, and with barbed palpocils, and the adjoining surface has long flexible hair-like papillæ. Moreover a symmetrical pair of jaws occurs a short distance within the former, and a slightly tapered tooth or stylet in the middle attached to a dark chitinous socket. The intestine is somewhat sacculated; the glandular region (urinary, Marion and Bobretzky) commences about the twenty-fifth segment.

The typical foot (Plate LXIX, fig. 18) is uniramous, having the long cirrus dorsally with a spine in the ceratophore, and a somewhat conical setigerous region with a terminal papilla, supported by two spines, and bearing a fan-like tuft of slender, translucent bristles. These have slightly curved shafts which are a little dilated, striated, and bevelled at the tip (Plate LXXVIII, figs. 8 and 8*a*), and with long, slender, terminal pieces; indeed the superior are so long and slender as to resemble those of Nereids, and the minute structure of the tip is indistinguishable. In the shorter forms the tip is hooked and a secondary process appears to be present beneath, whilst the ventral cirrus is subulate, and the edge of the blade is minutely serrated.

Marion and Bobretzky state that the cirri of the segments adjoining the tip of the tail have no spines in the ceratophores.

Reproduction.—Marion and Bobretzky found ripe males and females at Marseilles in December and January.

Habits.—It can swim rapidly after the manner of a *Syllis*, though the body is much shorter, and the long yellowish cirri make it very conspicuous (Marion and Bobretzky).

Family IX.—Syllidæ (*Autor.*).

The Syllidæ are characterized by a thread-like body, definitely segmented, and often with articulated tentacles and cirri, the former and some of the latter being occasionally very long. The head is rounded or quadrangular, has three tentacles—a median and two lateral—and usually four eyes. Palpi, in various degrees of development and separation, are generally present. Buccal segment with two tentacular cirri, rarely with bristles. The alimentary apparatus consists of a mouth opening into a pharyngeal cavity, through which the protrusible proboscis (pharynx, Schlundröhre), which has a chitinous wall, can be exserted. This organ *in situ* often shows a sinuous outline, has anteriorly a series of soft papillæ at its margin, and a little behind a hard prominent tooth, or two maxillæ (Grube). It terminates posteriorly in the proventriculus, a region often more or less barrel-shaped and marked by rows of dots from glands. The proventriculus is followed by a short portion—frequently tapering posteriorly—which ends in a dilated region, often with two lateral cæca,[1] and which is marked from the intestine behind by a

[1] Said by Benham (after Meyer?) to be used for storing water.

constriction. Body terminated posteriorly by two cirri, sometimes with an intermediate papilla. The minute feet have dorsal and ventral cirri, or the latter are absent, are uniramous, and bear falcate bristles with a terminal process, which is either simple or bifid. Swimming dorsal bristles also occur in the sexual forms.

Grube describes the stolones as having few segments, two or three tentacles, two palpi, with tentacular appendages and tentacular cirri; two eyes, generally large. Feet with two fascicles of bristles; bristles in some compound, in others simple and long. Cirri present or absent. Proboscis and proventriculus absent.

The chief features of the body-wall (Fig. 49) in such species as *Syllis armillaris* is the proportionally large size of the dorsal longitudinal muscles, which form in transverse section a massive arch resting, as it were, upon the broad base formed by the incurvation of the lower edge. A slight median raphe carries the mesentery from the gut. Externally are the circular fibres, the very thin hypoderm, and lastly the thick cuticle. The arrangement of the fibres of these and the ventral muscles in transverse section corresponds with that of other families, such as the Nephthydidæ. The ventral muscles approach each other very closely in the median line, a condition, however, which

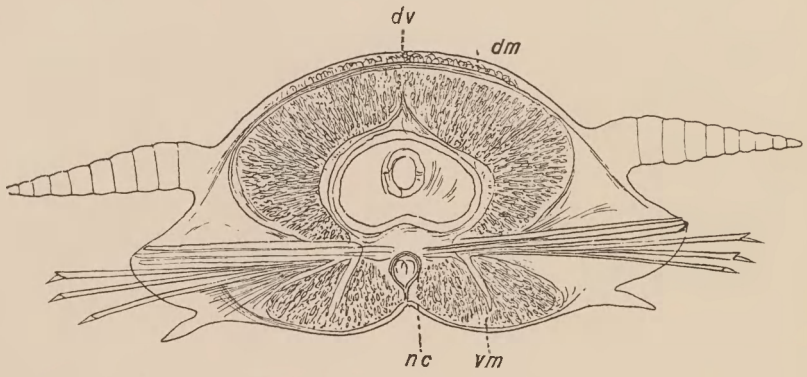

Fig. 49.—Muscles of the body-wall of *Syllis armillaris* (Müller) Œrst., as seen in section.

does not appear to be general in the group, so that the nerve-cords are pushed upward, only a pedicle, apparently of basement-tissue, connecting them with the external hypoderm. The oblique muscles pass below the cord to be attached to the raphe in the intervals.[1] Another feature of interest is the presence of a strong muscular slip—from the fan-like muscles of the spines—which goes straight downward at intervals through the ventral longitudinal muscles to the basement-membrane. As slips from the bases of the spines pass dorsally along the inferior border of the dorsal longitudinal muscles, and on the other hand, ventrally along the outer border of the ventral muscles, the movements of the spines and of the foot with its bristles are well provided for.

Though De Quatrefages did not observe blood-vessels in the Syllidæ, Ehlers, Claparède, De St. Joseph, Viguier, and Albert found them, the latter describing dorsal and ventral vessels, a branch to the dissepiment, and a cæcum in the middle of the genital gland. Malaquin showed that the dorsal and the ventral vessels communicated in the cephalic region by a double loop. Such is, briefly, the condition in the Syllides and

1. Claparède (1868) mentions that the Syllids have a large tubular fibre on the dorsal surface of the nerve-chain. This has not yet been observed in the British forms.

Eusyllides, the dorsal trunk anteriorly in the ganglionic region splitting into two, which pass anteriorly downward to form the ventral. In each segment, posteriorly, a vascular trunk unites the dorsal with the ventral; and, in the genital segments, a vascular cæcum leaves the ventral vessel a little behind the dissepiment and goes to the genital gland.

Malaquin describes lymphatic glands along the ventral vessel in certain forms, and amœbicyte-glands in *Syllis hamata*. The blood is colourless, and the movement is from behind forward in the dorsal vessel; from before backward in the ventral.

Some forms are epigamous, others schizogamous or viviparous, and the remarkable condition of several has long given examples of the alternation of generations of various authors. The sexual distinctions between male and female buds, and between these and the nurse-stocks are characteristic. Alternation of generations in Annelids was first suggested by De Quatrefages (1843) for the condition in *Syllis monilaris*, Savigny, and it was further exemplified by Krohn (1852) in *Syllis prolifera*. Alex. Agassiz, again, in his account of *Autolytus cornutus*, accurately distinguished the several generations, though he considered the parent-stock to be constantly devoid of sexual elements. It has since been shown[1] that sexual products (chiefly female) appear in segments 11—13 of the stock from which the stolon separates, and the same occurs in *Proceræa ornata* and *Myrianida*. Calvin Mensch, therefore, considers it more a case of sexual dimorphism, and not a sexual alternating with an asexual generation. Epitokous conditions occur in *Autolytus longeferiens* and in other Syllids. Moreover, some carry eggs in a brood-pouch, whilst others bear them in sacs or in pairs along the body. In no group of animals, indeed, are the complexities of reproduction more pronounced.

Segmental organs.—R. Horst[2] describes a Syllis-bud with extrusible segmental organs. It has large eyes, like an Alciopid, articulated dorsal cirri, and a brown spot at the base of the foot dorsally, and the terminal pieces of the bristles are bifid. At the ventral base of each foot, except the first, a large dark-brown sac is extruded. No sexual products occurred in the body-cavity. He alludes to the observation of Ehlers[3] that in several species of *Glycera*, bladder-like bodies (branchiæ) capable of extrusion were found.

Goodrich[4] observes that in young Syllidæ the genital funnel can scarcely be said to exist, being represented only by a few crowded cells in the cœlomic epithelium on the anterior face of the septum just above the opening of the small segmental funnel. In budding forms, such as *Autolytus*, *Myrianida*, and *Haplosyllis*, the genital funnel advances little on the foregoing in the regions from which genital products are not extruded. In those shedding the sexual products a large trumpet-shaped genital funnel is formed, as in the Phyllodocidæ, on the anterior end of the segmental organ, the dilated canal of which transmits the products. Fage[5] gives similar observations, the minute nephrostome being replaced at maturity by a large genital funnel; and points out that in the males of certain forms a peculiar transformation of the segmental organ occurs at maturity, a change which he associates with the formation of spermatophores, a kind of sexual dimorphism

[1] *E.g.* Mensch, 'Americ. Nat.,' vol. xxxiv, p. 165 (1900).

[2] 'Notes Leyden Mus.,' vol. xi, p. 11, pl. i and pl. ii, fig. 1 (1889).

[3] 'Die Borstenw.,' pp. 659 and 676.

[4] *Op. cit.*, p. 728.

[5] *Op. cit.*, p. 312, fig. 25, and pl. vi, figs. 9—12.

thus being present, as in certain Spionidæ. As no solenocytes are present the nephridial functions are performed by the special cells of the organ. This author agrees with Pruvot in thinking that the segmental organs have a mechanical function (by resistance) during locomotion, but this appears to require further elucidation.

Though a conspicuous feature in the family no case of branching or lateral budding occurs amongst the British Syllidæ. Langerhans describes an example of *Syllis variegata* with two heads, whilst *Syllis ramosa* of the 'Challenger' has a furor for budding at all points. Neither has the *Syllis vivipara* of Krohn[1] from Nice, as recently and carefully described and figured by Goodrich[2] at Naples, been hitherto captured in our waters. The Neapolitan form has the head of a *Syllis*, with moderately long tentacles and cirri, which are all articulated, the proboscis has apparently about ten papillæ and a single tooth towards the front in extrusion, and simple tips to the terminal pieces of the compound bristles. Mesnil[3] is inclined to consider all such cases (which are not to be confounded with parasitic forms in the body-cavity of Syllids) as associated with parthenogenesis.

Novel instances of collateral budding have been lately described by H. Parlin Johnson[4] in *Trypanosyllis ingens* and in *T. gemmipara*, the former from Pacific Grove, California, between tide-marks, and the latter from Puget Sound. In the last-mentioned the buds, about fifty in number, arise in front of the last twenty-four segments of the diminished caudal region of the annelid. They form a tuft like a series of fronds of a minute fern, have no swimming-bristles, only a median strand for an alimentary canal, two large nerve-cords, two large eyes, dorsal and ventral cirri, spines, and bristles. Both species approach generally the *Syllis gigantea* of the 'Challenger,'[5] though no buds were present in the latter. Mr. Cyril Crossland, who has done such able work on the Annelids, tells me that he procured a Syllid with a rosette of buds at the posterior end, at Wasin, British East Africa, living in a red sponge common in ten fathoms in that locality. The annelids are bright orange, with four brown eyes. The dorsal cirri are annulated, very long, and of a still deeper hue. The tentacles and ventral cirri are shorter, but also annulated. The rosette of young is of the same colour as the parent, but each is shorter and broader, and no cirri are visible under a lens. Their tails keep waving in the water, the attachment being only by the head. Mr. Crossland's forms were collected before the publication of the American author was issued, but his species is still undescribed.

Forms commensalistic in sponges like the foregoing and *Syllis ramosa* of the 'Challenger' lead the way to what appears to be a parasitic *Autolytus*, found by Mr. Crossland, also at Wasin, East Africa. "This annelid was attached by the extruded proboscis to a specimen of a yellow Nemertean, another to a Polynoid, seven examples to *Nicidon gracilis*, n.s., and a single specimen to another *Nicidon* of the same species. The Syllids cannot be pulled off their prey without rupture except in the case of the soft Nemertean. In the polychæt hosts the point of attachment is always near the parapodia.

[1] 'Arch. f. Naturges.,' Bd. xxxv, p. 197 (1869).

[2] 'Journ. Linn. Soc.,' vol. xxviii, p. 105, pl. xiii (1900).

[3] 'Compt. Rend. Soc. Biol.,' Paris, vol. liii, p. 270 (1901).

[4] 'Biol. Bullet.,' vol. ii, No. 6 (1900), and 'American Naturalist,' vol. xxxvi, No. 424 (April, 1902).

[5] 'Annel. 'Challenger,' p. 193.

The proboscis seems incapable of retraction, and the parasites do not move after removal from the host. The Syllid is colourless, except the posterior part of the gut, which is grey, has four very minute eyes, very long tentacles, and uniramous feet."

Syllids have, moreover, long been celebrated for their phosphorescence. Thus Viviani[1] (1805) mentions and figures no less than three, viz. *Nereis cirrhigera* (*Odontosyllis fulgurans* ?), *Nereis mucronata*, and *Nereis radiata*. The British forms are as conspicuous in this respect as the foreign, one of the commonest (*Eusyllis tubifex*, Gosse) causing striking manifestations of the phenomenon from its vast abundance on the blades of tangles covered by *Obelia*.

In this country the pelagic types chiefly belong to the genus *Autolytus*, but in foreign waters certain of the Syllids proper likewise appear to have a pelagic stage. Thus when Mr. Crossland was in the Pearl Fisheries' steamer in Mersa Harbour, Durur, he observed numerous "small Heterosyllids circling round on the surface after the manner of Heteronereids. They were rapidly discharging genital products, the water in the jar in which they were placed becoming milky in a minute or two. They were readily killed by adding a drop of spirit to the water, and under this treatment showed a brilliant green phosphorescence. The dorsum was marked with alternate oblique and transverse bands composed of minute dots. The dorsal cirri were slender and the ventral cirrus absent. Long swimming-bristles occurred superiorly, and the terminal pieces of the compound bristles were simple."

Andrews[2] also observed the adults of *Autolytus prolifer* swimming at the surface of the sea in the evening.

The relationships of the remarkable pelagic types found by Greef[3] off the Canaries, such as *Pontodora* and *Pelagobia*, cannot be accurately determined, though he was inclined to link them to the Syllidæ. In general form and in the structure of the alimentary canal, nervous system, and bristles, they certainly appear to approach that family and the Hesionidæ.

The Syllids abound between tide-marks, under stones, amongst zoophytes, algæ, shells, and sponges. In the laminarian region they frequent oyster-banks, mussel-beds, or occur in great numbers amongst zoophytes on the blades of the tangles.

They are especially common in the Mediterranean and at Madeira (Langerhans), yet the colder British area is not far behind the more genial southern waters in the variety of the species which frequent it. Thus Langerhans thought the waters of Madeira surpassingly rich with forty species, yet our own waters hold nearly the same number, and, whilst a few may prove to be varieties of one form, others not included may be discovered by future investigators.

They range to a considerable depth (600 to 1380 fathoms).

Little was done by the early naturalists to assign a definite place to the Syllidæ. Savigny made them the twelfth genus of his Nereids, and his description is fairly accurate for the period.

Grube, in his 'Familien der Anneliden' (1851), gave order to the group, but he

[1] 'Phosphorescentia Maris,' Genuæ, 1805, p. 11, tab. iii, figs. 1—6.

[2] 'Journ. Morph.,' 1892, p. 186.

[3] 'Zeitsch. f. w. Zool.,' Bd. xxxii, pp. 245 and 247, taf. xiv (1879).

separated the sexual forms of *Autolytus* in a distinct family, the Amytidea. The Syllids followed the Glyceridæ as the eighth family of Annelids.

Dr. Thomas Williams (1851) was not able to demonstrate the segmental organs in the genus *Syllis* "by any manœuvre." He thought they resembled those of *Psamathe* (*Castalia*).

In his "Glanures," Claparède (1861), after careful study at Port-Vendres, gave a more or less complete classification of the Syllidæ up to date. He took the frontal lobes (palpi), the armature of the pharynx, the different kinds of cirri, and various external features—for instance, the presence or absence of ventral cirri—as a basis, and he produced a useful classification for the period. He made thirteen genera.

Ehlers,[1] after an extended historical account of the family, gives a classification, the main divisions of which rest on the presence or absence of palpi, the subdivisions having as their basis the presence or absence of bristles on the first segment. Under those with palpi, the number of tentacular cirri, the armature of the proboscis, the nature of the palpi, and the presence or absence of ventral cirri, are used to differentiate the genera. In those devoid of palpi, the main groups rest on the nature of the cirri, which may occur on all the segments, on certain segments, or be absent.

In an appendix[2] to this part he gives an elaborate series of references as well as descriptions of new and other genera arranged under the various heads. While this able author has greatly increased our knowledge of the group, he shows, perhaps, a tendency to increase unnecessarily the number of the genera.

The terminology of Kinberg[3] (1865) was as follows:—Median tentacle = his *tentaculum;* lateral tentacles = his antennæ (antennæ interiores and antennæ exteriores); *palpi;* posterior part of cephalic lobe (Grube) = his segmentum buccale; buccal segment (Grube) = his segmentum primum corporis. Kinberg relied for discrimination on what he termed "maxillæ," the papillæ of the proboscis, the palpi, the condition of the tentacles and cirri, the eyes, and the bristles.

De Quatrefages (1865), who placed the Syllidæ between the Nereids and Hesionidæ, describes salivary glands at the posterior part of the proboscis (*trompe*) in the form of small granular masses, or occasionally simple cæca. He probably refers to the gastric cæca, as he mentions that the intestine follows. As a rule blood-vessels, he says, are absent. Only in *Grubea* did he find a dorsal vessel. This author classified them according to the mobility or immobility of the feet, the presence of cirri (dorsal and ventral), the armature of the "gizzard," the structure of the head and its appendages, and the number of "antennæ" and tentacles. He, however, included members of the Staurocephalidæ, such as *Prionognathus*, Hesionidæ, like *Kefersteinia* (*Castalia*), and gave generic distinction to sexual forms like *Ioida*.

Claparède[4] thought the posterior region of the intestine in this group had a urinary function. In *Trypanosyllis cœliaca* he found lateral diverticula of the intestine, and he

[1] Borstenw.,' I (1864).
[2] *Ibid.*, pp. 255—256.
[3] 'Öfvers. af k. Vet.-Akad. Förh.,' No. 2; p. 248 (1865).
[4] 'Annel. Neap.,' 1868.

notes that it would be interesting to see if *T. Khronii* has similar cæca. His fine figures and good descriptions did much for this group.

Eisig[1] considered the T-shaped glands or cæca of the alimentary canal of this group and the cæca of the Hesionidæ to be swim-bladders.

Langerhans[2] follows Ehlers, Malmgren, and others, in grouping the Syllidæ. He makes three great divisions according to the condition of the palpi. Thus the Syllidæ proper have these separate; the Exogoneæ have them fused, but prominent; whilst the Autolyteæ have them fused and grooved ventrally. These groups are subdivided by the condition of the pharynx, the nature and number of the tentacles and tentacular cirri, the condition of the head, and the first segment. He makes twenty-six genera of those from Madeira, and points out that *Syllides* = *Pionosyllis*, and *Pterosyllis* = *Amblyosyllis*, and that of forty-eight different genera by various authors only eleven stand. This author did much to place the classification of the group on a more rational footing.

Langerhans (1881) found a canal in the tooth of the proboscis in several genera, and in *Syllis aurantiaca*, Grube, he met with a pair of glandular sacs on the dorsum of the proboscis. He gives interesting notes on the budding of the Syllids.

Haswell[3] (1885) found that *Syllis corruscans* had ova of a dull colour anteriorly, whilst posteriorly an orange-coloured region bore sperms (with testicles, Malaquin). The passage from the one to the other occurred abruptly at the 100th segment. At the same epoch he observed a pair of large eyes on the first segment of the male region, and the part was by-and-by detached as a pelagic male.

De St. Joseph[4] found *Labrostratus parasiticus* and a Lumbriconereid parasitic in the cœlom of various Syllids, viz. *Eusyllis moniliconis*, *Syllis prolifera*, *Pionosyllis lamelligera*, and *Grubea clavata*. In this case the parasitism may be transitory, for others occur on sea-weed (*Rytiphlœa*).

Malaquin,[5] in one of the most complete treatises on the structure, development, and classification of the group, describes the Syllidæ as a Family of Errant Annelids (Polychæta), his diagnosis being: Cephalic segment provided with five appendages—viz. two palpi, two lateral antennæ and one median, and two pairs of eyes. The peristomial (post-cephalic) segment has in general two pairs of tentacular cirri; sometimes only a single pair. The succeeding segments have feet formed only of the setigerous lobe of the ventral division, accompanied by a dorsal and a ventral cirrus. The dorsal division of the foot appears at the epoch of sexual maturity. Pygidium with two cirri. Bristles variable—simple or compound. The most general is the compound heterogomph with bidentate tip. Proboscis protrusible—of two regions, the anterior (pharynx) chitinous, cylindrical; the second, the muscular proventriculus and ventriculus, being a secondary development of the pharynx of the larva. Reproduction distinguished by the appearance of secondary sexual characters; the individual is transformed (epigamy), or gives rise to a bud (schizogamy).

[1] 'Mitth. Zool. Stat. Neap.,' t. ii, p. 255.

[2] 'Zeitsch. f. w. Zool.,' Bd. xxxii (1879).

[3] 'Proc. Linn. Soc. N.S.W.,' iv (1885), p. 733.

[4] 'Ann. Sc. Nat.,' 7e sér., v, p. 221 (1888), and Gravier, 'Bull. Mus. Hist. Nat., Paris,' vi, p. 417 (1900).

[5] 'Recherches sur les Syllidiens,' Lille, 1893, pp. 477, and 14 plates (4to).

He makes four great tribes:

Syllidæ with ventral cirrus	Palps present	fused	throughout	Exogonés.
			at the base only	Eusyllidés.
		separate.		Syllidés.
	Palps absent			Autolytés.

He gives an elaborate list of the genera under each tribe, with careful references, and a few remarks.

This author [1] maintains that the cephalic lobe in the Syllidæ and other forms is homologous with the ordinary segments of the annelid; thus the lateral tentacles correspond to the ventral division; the median to the dorsal cirri; the palps to the ventral cirri, and the tentacular cirri (antérieures, latérales, postérieures) to the dorsal division. This is contrary to the views of his countryman, Pruvot, who holds that the cephalic region consists of three segments with three corresponding nerve-centres: (1) The stomatogastric with its appendages the palps; (2) the tentacular segment (segment antennaire antérieur) with the lateral tentacles; (3) the posterior tentacular, with the median tentacle (composed of two fused). Of the two views Malaquin's has most in its favour.

Malaquin [2] (1893) found the pharyngeal wall to have *in Syllis*:

(1) A thick layer of chitine.
(2) An epithelium secreting the foregoing.
(3) A thin layer of circular muscles.
(4) A thick longitudinal muscular coat.
(5) A layer of peritoneal endothelium.

The proboscis has protractor and retractor muscles.

In the case of the proventriculus, he describes from without inwards:

(1) The peritoneal endothelium.
(2) Thin external circular muscular coat.
(3) Complex radiating muscles separated by transverse diaphragms.
(4) Internal circular muscular coat.
(5) Columnar epithelium of the digestive tube.
(6) The cuticle.

The ventricule (stomach) follows, and often presents T-shaped lateral cæca, which have the same ciliated epithelium as the ventricule. Malaquin thinks they are filled with water pumped in by the proventriculus. In those without these organs, the author considers that the anterior part of the intestine performs their function. He divides the intestine into the glandular secreting anterior, and the rectal or urinary posterior.

He uses the terms "schizogamy" and "epigamy" to distinguish the reproductive processes in the Syllidæ.

The former ("schizogamy") is applied to cases in which a non-sexual nurse-stock gives off sexual buds. In the latter ("epigamy") the individual is entirely sexual. Epigamy (Malaquin) is accompanied by the enlargement of the eyes and the elongation

[1] 'Recherches sur les Syllidiens,' Lille, 1893, p. 437.
[2] *Op. cit.*, p. 194.

of the antennæ, the development of swimming-bristles, the development of the genital glands in the median and posterior regions of the body, and changes in the segmental organs. They are parallel to the changes seen in *Nereis*.

In a subsequent paper[1] he demonstrates that epigamy occurs in the family just mentioned (Nereidæ), in the Syllids, particularly in *Exogone* and *Eusyllis*, and in the Hesionidæ, *e.g.*, *Kefersteinia cirrata*. Further, that schizogamy is present in the Syllids and occasionally in the Capitellidæ, and in this a part of the individual only acquires sexual characters and is separated. In the Syllids schizogamy has various forms, viz.: (1) Acephalous, ex. *Syllis* (*Haplosyllis*) *hamata*, Clap.; (2) *Tetraglene*, ex. *Trypanosyllis*; (3) *Chætosyllis*, ex. *Syllis prolifera*, Krohn; (4) *Syllis amica*, De Quatrefages; (5) *Ioida*, ex. *Syllis* (*Typosyllis*) *hyalina*, Gr. In *Autolytus* the form assumed is that of *Sacconereis* for the female, and *Polybostrichus* for the male.

He points out that at the period of maturity the eyes of the Syllids having direct reproduction enlarge, and become lateral in position, or move to the ventral surface. In the pelagic sexual forms the great development of the eyes is a necessary accompaniment. An additional pair of pigment-specks is occasionally seen in front of these two pairs, but they are not true eyes.

He shows that in the group of the Syllidés (Malaquin) as contrasted with the Autolyti, the sexual forms resemble each other, even to the distribution of the male and female sexual glands. Again, they differ from the Autolyti in the variation in different types. That variation exists not only in distinct genera, but in closely allied species in the same genera.

Malaquin describes the small segmental organs as having the ciliated funnel projecting anteriorly from the septum, and with a long, narrow canal, which opens on the ventral surface by an extremely minute pore.

He gives an account of several larval stages of *Syllis hyalina* frequenting Polyzoa, and indicates how the development runs parallel with that of *Eusyllis*, only the formation of the proboscis is more rapid. His earliest stage had two setigerous segments, and the larval pharynx was comparatively long. The intestine opened by an anus. The larva with five bristled segments had the proventriculus behind the pharynx, and the rounded palps projecting from the sides of the head. When the larva has seven or eight setigerous segments the structure is much the same as in the adult.

In *Syllis*, *Grubea*, and *Exogone* the ciliated apparatus of the larva disappears and the phenomena are abridged.

Eisig's[2] opinion that the lateral cæca of the alimentary canal in the Syllids performs the function of swim-bladders does not meet with much support, especially as such a provision is not distinctive of highly pelagic types—types in which, for instance, swimming-bristles are developed on specially modified feet. The bodies of these animals are so plastic at the reproductive season that the modifications of an organ designed to aid in distributing the sexual elements could not fail to have attracted notice, and to have more or less differentiated pelagic from non-pelagic types in this alone.

The Syllidæ form one of the families under the group *Syllidiformia vera* of Levinsen (1883), and are placed between the Hesionidæ and Nerillidæ, a position to which no great

[1] 'Zool. Anzeiger,' No. 514 (October 5th, 1896).

[2] 'Mitth. Zool. Stat. Neap.,' ii, p. 255 (1881).

objection can be taken. Benham, again, makes the family the first of thirteen under his sub-order Nereidiformia, and thus links them to such divergent forms as the Aphroditidæ, Tomopteridæ, Nephthydidæ, Amphinomidæ, Glyceridæ, Sphærodoridæ, Ariciidæ, and Typhloscolecidæ. It is true that Levinsen, under the second group of his Syllidiforma, viz. the *S. spionina*, associates the Spionidæ, Chætopteridæ, Cirratulidæ, Ariciidæ, Chloræmidæ (?), and Ophelidæ (?), but this is all that can be said in its favour—after substituting Nereidiformia for Syllidiformia.

Pruvot distinguished two forms only in the Syllides, viz. *Pseudocephale* (Chætosyllis, Tetraglena, S. amica) and *Eucephale* (Ioida).

In the *Pseudocephale* the oculiferous lobes are separated from the cerebral ganglia. In the *Eucephale* the lobes are fused and contain the cerebral ganglia.

In Benham's[1] classification this is the first family of the sub-order Nereidiformia of the Branch Phanerocephala, though upon what principal is uncertain. It is followed by such as the Hesionidæ, Aphroditidæ, Phyllodocidæ, Tomopteridæ, and Nephthydidæ, a classification which appears to be at variance with natural affinities and with structure, as, indeed, Miss Florence Buchanan has ably pointed out. It has been considered better to follow the arrangement given by Malmgren and others than to adopt this classification, which, however, in its primary branches, viz. Phanerocephala and Cryptocephala, certainly gives expression to actual facts.

Calvin Mensch[2] finds that in certain parent-stocks of *Autolytus ornatus*, Verrill, after the separation of buds at the fourteenth segment, sexual elements appear in the eleventh, twelfth, and thirteenth segments, and he suggests the possibility of the parent-stock developing into a sexual form subsequently, though he has not observed the changes in the eyes, bristles, and other parts—probably because the examples were too young. This may be a case similar to Haswell's.

Häcker[3] (1896) figures a metatrochophore of *Syllis* with two eyes, three separate tufts of cilia on the sides, and a paratroch. Gland-cells occur on the ventral aspect, and the alimentary canal is simple and cylindrical. He gives a later stage, in which only a protrotroch and a paratroch remain, whilst the long space between them has fifteen segments, the head is more elongated (conical), and the eyes are at the posterior border. A large black pigment-speck is present. Each segment has a pair of hook-like bristles.

In a note, in 1902, on the British Syllidæ,[4] the increase in the number of genera and species was alluded to.

Perhaps the most natural grouping of the Syllidæ is that of those authors who arrange them primarily into (1) those with palpi fused but prominent (Exogonea), (2) those with palpi separate (Syllidea proper, Langerhans), and (3) those with the palpi fused (Autolytea). These groups are readily subdivided by the condition of the pharynx, the nature and number of the tentacles and tentacular cirri, the condition of the head and first segment, and especially the structure of the feet and bristles. Moreover, a fourth group, the Eusyllidea (Malaquin), in which the palpi are fused at the base only, may be

[1] 'Camb. Nat. Hist.,' vol. ii, p. 306 (1896).

[2] 'Zool. Anzeiger,' June 15th, 1896.

[3] "Pelagische Polychätenlarven," 'Zeitsch. f. w. Zool.,' Bd. lxii, p. 82, Taf. iii, figs. 6 and 7.

[4] McIntosh, 'Ann. Nat. Hist.,' ser. 7, vol. ix, p. 296.

interpolated between the Exogonea and Syllidea. *Nerilla* may be left at present in an uncertain position.

Syllids especially abound in the Mediterranean and at Madeira (Langerhans), and they range from tide-marks to 1380 fathoms (Ehlers, *Syllis abyssicola*).

Genus XLIV.—Nerilla, *O. Schmidt*, 1848 (provisionally).

This form (figs. 50, 51, and 52), as Malaquin truly states, is at present in an uncertain position, though most authors place it in relation with the Syllidæ. De Quatrefages gave it a new title, viz. *Dujardinia*, and inserted it between *Microsyllis*,

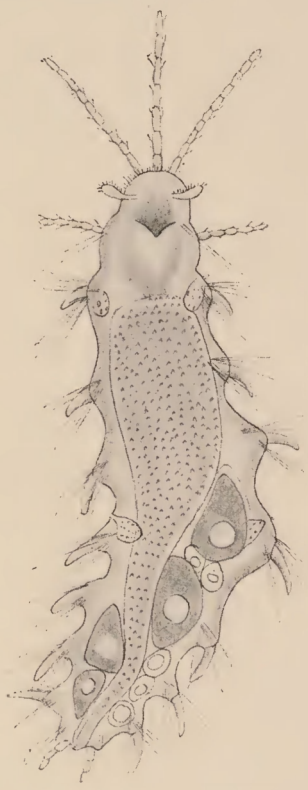

Fig. 50.—*Nerilla antennata*, Schm. (after Claparède), from the ventral aspect. (Enlarged.)

Schmardia, and the Amytidea. A brief notice of it is, perhaps, necessary, as it has been found in the British area. Its structure and reproduction need careful re-examination. It has been thought unnecessary to constitute a family for it, as some have done, in the present condition of information on the subject. No example has been seen by the author.

1. Nerilla antennata, *O. Schmidt*, 1848.

Synonyms.

1848. *Nerilla antennata*, O. Schmidt. Reise nach der Färör, Neue Beitrag., Nat. Würmer, p. 38, Taf. III, f. 8 and 8 *a*, *fide aut.*

1851. „ „ Grube. Fam. Annel., p. 62.

1854. *Nerilla antennata*, Leuckart. Archiv Naturges., 1854, p. 327.
1863. „ „ Claparède. Beobacht., p. 48, Taf. xii, f. 16—20.
1865. *Dujardinia* „ De Quatrefages. Annel., II, p. 69.
1877. *Nerilla* „ Barrois. Compt. Rend. Ac. Sc., t. lxxxv, p. 288.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 250.
1884. „ „ Webster and Benedict. Rep. U. S. Comm. Fish for 1881, p. 711, pl. ii and iii, f. 17—23.
1893. „ „ Flor. Buchanan. Rep. Brit. Assoc., 1892, p. 358.

Habitat.—Plymouth (Miss F. Buchanan).

Faröe Islands (O. Schmidt). St. Vaast-la-Hougue, and other shores of France (Claparède and Barrois). Amongst corallines at Chausey (De Quatrefages).

Head (fig. 51) rounded, bearing three rather long, articulated tentacles, a median and two lateral. The palpi (?) are small, clavate, and lateral in position. Eyes four, brown, the anterior pair wider apart than the posterior; all are provided with lenses.

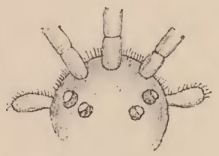

Fig. 51.—Head of *Nerilla antennata*. Enlarged. After Claparède.

Body (fig. 50) about 1 mm. long, and of nine segments, the first bearing a pair of articulated cirri shorter than the tentacles. The mouth is large and somewhat triangular, and it is followed by a muscular pharynx and a stomach. No constrictions appear on

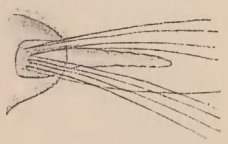

Fig. 52.—Foot of *Nerilla antennata*. Enlarged. After Claparède.

the intestine, which in the middle region is glandular. Numerous tufts of vibratile cilia occur on the body, and one on each side behind the foot. Segmental organs are present. The body terminates in two cirri posteriorly.

Foot (fig. 52) with only a lateral cirrus and simple capillary bristles. A glandular organ occurs in most of the segments of the body after the first, with a ciliated opening between the feet. The gland has refracting corpuscles (Claparède).

Reproduction.—Ova large, developed in the lateral region so as to affect the outline of the body. In the males the sperms float freely in the body-cavity.

Claparède thought that this form lay between the errant and the sedentary annelids. The free condition of the alimentary canal in the body-cavity, and the absence of dissepiments and compound bristles are interesting. Barrois (1877) found both males and females and observed the development.

Levinsen (1883) makes a new family for this genus, viz. Nerillidæ. Until further investigation is made, however, it is, perhaps, well to leave the genus as an appendix to the Syllidæ.

Group I.—EXOGONEA.

Small syllids, with ventral cirri; palpi fused throughout. Segments few and variable. Appendages short. Proboscis straight. Bristles with simple tips to terminal pieces. Reproduction generally direct; rarely by stolons (Malaquin).

Genus XLV.—Exogone, *Mag. Œrsted*, 1845.

Head composed of two distinct segments; palpi prominent, fused; three clavate tentacles fixed to the middle of the head; eyes four; one pair of tentacular cirri (short); ciliated pits at the posterior part of the cephalic segments. Body small, linear, of a fixed number of segments. Proboscis short, with a single tooth anteriorly; lateral cæca of the stomach small. Two clavate or filiform anal cirri. Feet small, papilliform; dorsal and ventral cirri sub-equal, clavate, or conical. A single fascicle of falcate bristles in the female; in the male, all the segments (the first eight excepted) with falcate and long capillary bristles. Reproduction direct. Ova borne on the dorsum or on the ventral surface, with embryos and larvæ in the latter case attached near the segmental orifice.

This group received a notable contribution from the late distinguished anatomist of Würzburg, viz. Professor Kolliker,[1] who, in 1845, appended to a paper, by his friend H. Koch, in the 'Nouveaux Mém. de la Soc. helvét.,' viii, an account of three forms from Naples, viz. *Exogone Œrstedi*, *Exogone cirrata*, and *Cystonereis Edwardsi*. The first has two pairs of tentacles, eggs in sacs at the sides, and long swimming-bristles. The second has the palpi apparently fused at the base, two pairs of tentacles, and also eggs in sacs at the sides. The third has four pairs of tentacles, no visible palpi, and the eggs are borne ventro-laterally. None of these correspond with Professor Graham Kerr's form from the Clyde with eight ovigerous sacs.

Considerable confusion has occurred in this group from the imperfect descriptions of authors. Thus the *Exogone Kefersteinii* of Claparède[2] appears to be *Exogone gemmifera*, whilst Ehlers, misled by the supposed absence of the ventral cirri, constituted a new genus, *Exotokas*, for the inclusion of both as separate species. Claparède's genus, *Pœdophylax*[3] is in the same position as the *Exotokas* of Ehlers, both referring to *Exogone*. The examples of the genus have hitherto been so rarely procured in this country that much yet remains to be done both in synonymy and investigation of structure.

The genus seems to be cosmopolitan in its distribution, ranging from the Antarctic seas northward, a form very similar to *Grubea pusilla*, and bearing ova on the dorsum, for instance, occurring at Kerguelen, and entangled amongst the bristles of *Lœtmonice producta*, just as an Irish member of the group was found on *Aphrodita aculeata*. It is probable that considerable additions will yet be made to the group in British waters, especially on the southern and western coasts.

[1] 'Nachwort zu dem vorhergehenden aufsatze,' op. cit., p. 13.

[2] 'Beobach. ueb. Anat. u. Entwickl.,' p. 42, Taf. xii, f. 3—6.

[3] 'Annel. Nap.,' p. 210.

De Quatrefages (1865) instituted the genus *Brania* for the *Exogone pusilla* of Dujardin,[1] which he distinguished from Œrsted's species.

1. Exogone naidina, *Mag. Œrsted*, 1845.

Specific Characters.—Head bluntly conical, the fused palpi being only marked by a notch dorsally, but clearly seen inferiorly. Eyes four, connate, the anterior the larger, and furnished with cuticular lenses. Median and lateral tentacles short and clavate. Body linear, slightly tapered anteriorly, and more so posteriorly, 2—3 mm. long, and with 19—35 segments; pellucid, yellowish from the intestine; terminating posteriorly in two short, clavate cirri. Proboscis with a median tooth, proventriculus whitish and granular. Foot with the setigerous region obliquely truncated, and bearing falcate bristles with short terminal pieces furnished with a simple hook; capillary swimming-bristles in male. Dorsal cirri slightly tapered; longest in the anterior third; ventral cirrus shorter. Both were stated by M. Œrsted to be subclavate. Ova borne on the ventral surface.

Synonyms.

1845. *Exogone naidina,* M. Œrsted. Arch. f. Nat., xi, p. 20, Taf. 2, f. 1—14.
1851. „ „ Grube. Fam. Annel., p. 62.
1855. *Syllis longiseta,* Gosse. Ann. Nat. Hist., 2nd ser., xvi, p. 32, pl. iv, f. 14—21.
1865. *Exogone naidina,* De Quatrefages. Annel., ii, p. 33.
1874. „ „ Malm. Op. cit. Göteb, p. 82.
1879. „ „ Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 563.
„ „ „ Tauber. Annul. Danic., 95.
1883. „ „ Levinsen. Vidensk. Meddel. Foren. Kjöbenh., p. 244.
1885. „ „ Carus. Fauna Medit., p. 232.
1890. „ „ Giard. Bull. Sc. Fr. Belg., t. xxii, p. 78.
1893. „ „ Levinsen. Vidensk. Ud. 'Hauchs,' p. 330.

Habitat.—Weymouth (P. H. Gosse (?)).

This species has been entered on the responsibility of various authors who have considered Gosse's *Syllis longiseta* as identical with it. So far as can be made out this conclusion seems to be reasonable both as regards description and figures, but no opportunity should be lost of re-examining this interesting form.

Magnus Œrsted first described this small Syllid from Lille Belt near Strüb, and his account agrees generally with that of Gosse. He shows the eggs on the ventral surface, and gives an interesting description of the development of the young from the egg up to the fourteenth day, when it is furnished with a median and two lateral tentacles, four separate small eyes, four bristled segments, and two anal cirri.

The *Syllis longiseta* of Gosse[2] from Weymouth, for which De Quatrefages[3] constituted the genus *Gossia*, is a bud with long swimming-bristles and a head like *Exogone* if the drawing and description can be relied on. The head shows three short clavate tentacles, and the tips of the bristles are simple. De Quatrefages repeats his reference to Gosse's species by

[1] 'Ann. Sc. Nat.,' 3e sér., t. xv, p. 298, pl. v, fig. 9 and 10.
[2] 'Ann. Nat. Hist.,' ser. 2, vol. xvi, p. 32, pl. iv, figs. 14—21 (1855).
[3] 'Annel.,' II, p. 49.

making a second new genus (*Syllia*) for it.[1] The example from Weymouth secreted a tube fixed to the glass, and was procured amongst sea-weeds. It may be a male bud of *Exogone gemmifera*.

2. Exogone gemmifera, *Pagenstecher*, 1863. Plate LIX, figs. 5 and 6.

Specific Characters.—Head with fused palpi forming an even rim. Tentacles clavate. Eyes four, with lenses, connate on each side, the anterior the larger. Body about 3 mm. long, with 30—32 segments, yellowish or pinkish, bearing embryos along the dorsal or the ventral surface. Tail terminating in two slender cirri.

Synonyms.

1863. *Exogone gemmifera*, Pagenstecher. Zeitsch. f. w. Zool., Bd. xii, p. 267, Taf. xxv and Taf. xxvi, f. 1, 2, 6, 7, 8.
1874. „ *naidina*, McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 198.
1875. „ „ idem. Invert. and Fishes St. Andrews, p. 121.
1884. „ *gemmifera*, Viguier. Arch. Zool. Expér., II, p. 69, pls. iii and iv, f. 21—37.
1890. „ „ Giard. Bull. Sc. Fr. Belg., t. xxii, p. 78.

Habitat.—Under a stone near low water-mark, East Rocks, St. Andrews (E. M.), 1864. Lochmaddy, North Uist, between tide-marks.

Between tide-marks at Cette, Coast of France (Pagenstecher); Bay of Algiers (Viguier).[2]

The *Head* has anteriorly a rounded border of the fused palps with a slight median notch. On the ventral surface a median groove indicates the palps more clearly. The cephalic region proper bears two brownish-red eyes on each side, the anterior the larger, and all furnished with lenses. A median and lateral tentacles are situated in front of the eyes. They are short, enlarged at the base, and the lateral are rather blunt distally, whilst the median is the longer. The tips of these have palpocils. The cephalic segment is closely united with the buccal, but, as Viguier points out, they are distinguished by a line behind the eyes.

Body translucent, rather less than one eighth of an inch in length, slender, very slightly tapered anteriorly, but more distinctly so posteriorly, where it terminates in two slender cirri on each side of the anus, and Pagenstecher found refractive corpuscles near the bases of these cirri. The first segment has only a small cirrus and is separated by an undulating line from the buccal (Claparède and Viguier). A minute ciliated groove (sense organ?) occurs immediately in front of the cirrus (Viguier). The second bristled segment is peculiar in having no dorsal cirrus.

The proboscis has a single tooth anteriorly (Plate LIX, fig. 6), and Viguier indicates a break in the pigment about its middle. The proventriculus is situated opposite the

[1] Annel., II, p. 80.

[2] It is interesting to find that this observer obtained his specimens by following a very old plan at St. Andrews—viz. by removing portions of rocks, stones, or calcareous algæ at low water and placing them in vessels of sea-water, when the minute annelids by-and-by leave the shelter of zoophytes, sea-weeds, or crevices, and appear at the water-line of the vessel.

seventh segment (fourth bristled) and is whitish, with transverse rows of glands to the number of about a dozen (Viguier). It has a rhomboidal outline or resembles a square with the angles rounded. The stomach behind has two lateral cæca (the salivary glands of Pagenstecher). On each side of the commencement of the proboscis is a brownish organ placed opposite the first setigerous foot.

The intestine is of a yellowish or brownish hue, and has a moniliform outline, and oily granular matter in its glandular walls.

The typical foot has a short and somewhat conical dorsal cirrus, and a ventral cirrus, with the intermediate setigerous region. The latter, in the males and certain females, has a tuft of long swimming-bristles between the dorsal cirrus and the setigerous region. The superior ventral bristle is the strongest, with a curved shaft and a short terminal piece. The next has a longer tapering terminal piece, then follow two with bifid terminal pieces like those of *Autolytus* (though Viguier's figure is peculiar), and, lastly, a simple curved bristle. The curvature of these inferior bristles resembles that of a gun-stock.

The nine pairs of larvæ in the example from St. Andrews are flask-shaped, and with a reddish-pink granular mass of yolk at the enlarged central portion, and have two processes (caudal cirri) posteriorly at the attached end, and three at the anterior or free end, viz. the median and lateral tentacles. They corresponded, therefore, with the stage shown in Viguier's Plate IV, fig. 29, the French author having, under favourable opportunities, given an excellent original account of the escape of the ova, their attachment to the region of the segmental aperture a little in front of the ventral cirrus, and their subsequent development.

In a female, procured between tide-marks at Lochmaddy, about a quarter of an inch in length, pale—almost translucent—marked down the centre by a moniliform yellow band from the intestine, twenty-one pairs of flask-shaped, rose-pink embryos with a red spot in the centre occurred on the ventral surface. The head and nine segments only were devoid of them in front, whilst posteriorly the embryos nearly reached the tip, which may, however, have been broken.

Viguier found the male with short swimming-bristles, and the perivisceral cavity from the ninth or tenth normal segment to the posterior end—with the exception of the tip of the tail—filled with sperms, the sexual region thus occupying about twenty segments. The short swimming-bristles begin somewhat behind the first sexual segment. The sperm-sacs (his seminal vesicles) appear to be fusiform and to stretch across each segment to open at the ventral pore on each side, a little behind the ventral cirrus, at which point also a group of four bacillary corpuscles is found.

In the female, Viguier found some with and some without the swimming-bristles, which, as in the male, commenced at the first sexual segment, or a little behind it, and continued to the ante-penultimate segment. The ova are developed under the intestine in pairs in the cœlomic space of each segment, which they by-and-by fill. They have externally the vitelline membrane and are extremely mobile, in short, almost amœboid in their nature, for when ripe they pass outwards, apparently by the segmental aperture. All the ova are about the same stage in development, and appear to be fertilised after their escape and attachment. Viguier figures the two-, four-, eight-celled, and the morula stages, and also what he regards as invagination at a later stage, the aperture (mouth)

being on the ventral surface, but it afterwards shifts forward to the anterior end. Then the median tentacle appears, afterwards the two lateral and the caudal cirri on each side of the point of attachment. This is the stage subsequent to that which the sole example from St. Andrews had reached (Plate LIX, fig. 5). In front, that is at the distal or free end of the larva, are the three tentacles, the fused palps forming a ventral projection, the pharyngeal region and the proventriculus follow, then a reddish-brown vitelline mass with oleaginous globules, behind which is the intestine and the anus. The whole is enveloped by the vitelline membrane which, he (Viguier) holds, becomes transformed into the cuticle of the larva, as Stossich found in *Serpula*. The chief features observable before the larva leaves its parent are the appearance of eyes with lenses, tentacular cirri, the more definite outlining of the pharynx (proboscis) with its tooth, and outlining of the proventriculus, as well as the intestine, together with the occurrence of four bristled feet with dorsal and ventral cirri, the dorsal, however, being absent on the second bristled segment, as in the adult.

Habits.—This form dwells between tide-marks, and seems to differ considerably from the pelagic types. It is sluggish—rolling in the vessel, and appears to be unable to use bristles or feet actively when carrying the embryos. On immersion in spirit the embryos on its ventral surface were thrown off.

Exogone gemmifera, from Cette, was first described by Alex. Pagenstecher, in 1863, the year before the example from St. Andrews was found. His specimen was 3 mm. long, had thirty-two segments, and bore what he thought were buds from the ninth to the twenty-second bristled segment on the dorsum. Moreover, the dorsal and ventral surfaces of the buds corresponded with those of the parent. They presented head, mouth, "upper lip," four brownish-red eyes, and four bristled feet, and were attached by a posterior pedicle. The cæcal digestive canal was brownish-red, and the proboscis had a tooth anteriorly. He notes sac-like segmental organs between the seventeenth and twenty-ninth segments, and also the early eggs with the tentacles indicated in the embryo. His supposition that the embryos were buds has been fully dealt with by Viguier.

The larval forms found on this species are very similar to those on *Syllides pulliger*, Krohn.

Claparède ("Glanures," 1864) points out that Pagenstecher was wrong, but that in all probability the larvæ in this (which he calls a *Sylline*, Grube) arose from eggs, as in *Exogone* and *Syllides*—attached to dorsal cirri (Krohn)—alternately with blanks. Claparède notes that it is a fact that in this and other forms long and short cirri occur alternately. The young are detached from *Syllides pulliger* when they have six segments, the third segment, however, being devoid of the dorsal cirrus.

Giard (1890) thinks that this species is identical with *E. Kefersteinii*, Claparède, and probably also with the *Pædophylax claviger* of the same author.

Malaquin mentions that the young on being set free have the larval pharynx and the proventriculus (the so-called dipharyngeal condition), and when they have four setigerous segments the characters are nearly those of the adult.

Malaquin found in September several mature male buds of thirteen segments of *Exogone gemmifera*, with swimming-bristles and heads recently formed, with two large

anterior eyes on the ventral surface, and a smaller dorsal pair. No proboscis existed, only the alimentary canal. He decided these to be buds after the type of *Tetraglene*. Langerhans previously had found a similar condition.

So long a period has elapsed since the examples (which unfortunately have been lost) occurred at St. Andrews and Lochmaddy that considerable doubt exists on some points,[1] but they appear to pertain to this species.

Exogone gemmifera ?, var. Scharffi.

Head a smoothly rounded lobe divided by a constriction. Behind the latter on each side is a pair of connate eyes with lenses, the anterior pair being large, the posterior minute. Body 3—4 mm. in length, and composed of about thirty-six segments. It terminates posteriorly in a slightly enlarged blunt process with two cirri. Proboscis a short, narrow, straight tube. Proventriculus also short. The feet have lost the dorsal cirri. Setigerous region conical, bearing a series of translucent bristles with the end of the shaft dilated and notched like the cannon-bone of a sheep. The upper bristles have a long tapering terminal piece, like that of *Phyllodoce*, whilst the inferior have a short terminal piece with a claw at the tip.

Habitat.—Amongst the bristles and hairs near the tail of *Aphrodita aculeata* procured at Long. 55, R. I. Academy's Expedition, 1886.

Head forms a smoothly rounded lobe with a constriction marking off an anterior from a posterior region. Just behind this constriction at each side is a pair of connate eyes, each with a clear lens-like body, the anterior large, the posterior minute. The example had no tentacles or tentacular cirri, but the margin of the snout may have had sensitive papillæ.

Body about 3 or 4 mm. long, elongated, composed of about thirty-six segments, the first following the region on which the eyes are placed. Each segment consists of a setigerous lobe and a short dorsal cirrus.

The proboscis appears to be short, as the proventriculus commences at the fourth bristled segment and ends behind the fifth. The intestine then passes backward to the anus. Stretching from the mouth, which lies a little in front of the eyes, is a clear, straight, narrow tube, which may represent the proboscis thus curiously reduced.

The posterior end terminates in a slightly swollen blunt process with two cirri.

The foot has no dorsal cirrus in the preparation, but it may have been lost. The setigerous region is conical, and bears a series of translucent bristles with the distal end of the shaft curved and slightly dilated, the end being notched like that of a sheep's cannon-bone. The upper bristles have a long tapering terminal piece like that of a minute *Phyllodoce*. The inferior bristles have a short terminal piece with a claw at the tip, but the whole structure is so minute that whether it is simple or bifid could not be determined. Apparently it is simple. In lateral view the bevelled region of the dilated end of the shaft is truly Syllidean, and when seen on end the blunt point formed in those devoid of terminal pieces is also characteristic.

[1] *e. g.*, the dorsal or ventral attachment of the embryos.

Whether this minute species lives amongst the bristles of *Aphrodita* or was only entangled therein in the dredge is unknown.

This species somewhat resembles Claparède's[1] *Exogone Kefersteinii* from St. Vaast-la-Hougue, and may be a young form of this or an allied species such as *Exogone gemmifera*, yet the structure of the bristles, the form of the cephalic segment, and other details differ.

The specimen has been lost or mislaid since the description was drawn up, so that drawings could not be made.

Genus XLVI.—Xenosyllis, *Marion and Bobretzky*, 1875.[2]

So far as can be observed in the single example the following characters appear to coincide with this genus, the type of which is the *Syllis scabra* of Ehlers.[3] Head with comparatively large palpi fused at the base. Tentacles three, thick, short, and moniliform, as also are the tentacular cirri. Body[4] somewhat short and broad, with rather long setigerous processes to the feet, short, moniliform dorsal cirri, and a broadly lobate ventral cirrus. Bristles strong, terminal piece simple.

1. Xenosyllis (?) Kinbergi,[5] n.s. Plate LIX, fig. 7; Plate LXX, fig. 2—foot; Plate LXXVIII, fig. 10—bristle.

Specific Characters.—Head with two comparatively large palpi, fused at the base, visible ventrally, and prominent laterally. Median and lateral tentacles short, moniliform. Tentacular cirri two on each side, moniliform. Body 10 mm. long, having about fifty bristled segments, about equally narrowed anteriorly and posteriorly. Posterior end imperfect. Foot: dorsal cirrus short, stout, slightly tapered towards the tip; nine to ten segments in the anterior third. Setigerous region comparatively long. Bristles strong, terminal piece with a simple hook—longer in the posterior region of the body. Ventral cirrus bluntly rounded at the tip, and in shape broadly lobate. Tip of the spines bent.

Habitat.—Berehaven, Ireland, Royal Irish Academy's Expedition, 1885, along with *Syllis cornuta*, H. Rathke.

Head with comparatively large palpi fused at the base. The median and lateral tentacles are short, but distinctly moniliform, the former being the longer. Two small eyes occur on each side posteriorly, arranged in the usual trapezoid, the anterior pair

[1] 'Beobach.,' p. 42, Taf. xii, figs. 3—6.

[2] 'Ann. Sc. Nat.,' 6e sér., ii, p. 26.

[3] 'Borstenw.,' i, p. 244, pl. xi, figs. 1—3 (1864).

[4] No indication of a scabrous condition was seen.

[5] Named after the distinguished Swedish zoologist, Professor Kinberg, who has done so much valuable work in the Annelids.

being the wider apart. In addition, a small pigment-speck is situated internal to the base of the anterior tentacles.

Body 10 mm. long, about equally narrowed anteriorly and posteriorly, and composed of about fifty bristled segments, but the condition of the posterior end is doubtful. It terminated in two rounded lobes, but as the last foot and bristle-bundle projected from the outer side of each lobe, the condition is unusual and probably indicates injury.

In the foot (Plate LXX, fig. 2) the dorsal cirrus is short and stout, slightly tapered towards the tip, and composed of nine to twelve segments at the anterior third, but the number apparently diminishes posteriorly. The setigerous region is comparatively long throughout the greater part of the body, and viewed from above is nearly cylindrical, or with a forward curve, and in some slightly narrowed at the base. In lateral view a slight hollow occurs below the spine superiorly, and then the margin slopes inward. The region is thus bifid at the tip. Each bears a projecting tuft of somewhat strong bristles of the ordinary type (Plate LXXVIII, fig. 10), the bevelled end of the shaft being smooth, and the comparatively short terminal piece having a simple hook distally, the figure representing one of those with shorter tips from the middle of the body.

The anterior feet have bristles with more slender shafts and longer terminal pieces, the posterior stouter shafts and shorter terminal pieces. The tip of the spines in some is bent and projects slightly beyond the surface. The ventral cirrus is bluntly rounded at the tip and in shape broadly lobate.

This form is distinguished by the comparative shortness of the body, the short but distinctly moniliform dorsal cirri, by the lobate form of the ventral cirri, and the simply hooked terminal pieces of the bristles. It has certain resemblances in the shortness and marked moniliform condition of the cirri to the *Syllis scabra* of Ehlers.[1]

Genus XLVII.—Sphærosyllis, *Claparède*, 1863.

Cephalic and peristomial segments coalescent. Palpi small, continuous with the head, fused dorsally. Tentacles (three), tentacular cirri (two), and dorsal cirri short, enlarged at the base. Eyes usually four. Body comparatively short, beset with papillæ. First segment with a single tentacular cirrus on each side[2], and bristles. Pharynx with a single tooth; proventriculus short. Ventral cirri short and filiform. No alternation of generations (Claparède). Ova borne on the ventral surface.

1. Sphærosyllis hystrix, *Claparède*, 1863. Plate LIX, figs. 3, 4, 8; Plate LXX, fig. 1—foot; Plate LXXVIII, figs. 11–13—bristles.

Specific Characters.—Head with the palpi tapering in front. Eyes four, red, the anterior pair having lenses. A median and two lateral tentacles much enlarged at the

[1] 'Borstenw.,' i, p. 244, pl. xi, figs. 1—3.

[2] Claparède considers the pair on the united cephalic and peristomial segment tentacular cirri, whereas Ehlers gives five tentacles to the head.

base and tapering gradually towards the tip. A tentacular cirrus on each side. Body rather less than a quarter of an inch in length, tapered anteriorly. Segments thirty-two. About ten segments in front free from eggs, then a double series of pale rose-pink eggs follows. Proboscis has lateral glands and a tooth in front. Proventriculus with twelve rows of points (De St. Joseph). Foot has a small superior cirrus much enlarged (almost globular) at the base and marked by minute and scattered tubercles. Setigerous region with a few long papillæ, two of which near the apex appear to be regular—viz. one pointing forward and the other backward. The falciform bristles bear a somewhat elongated terminal piece ending in a simple claw. A single simple bristle slightly curved toward the tip occurs amongst them, and from the ninth segment to the tail a tuft of long swimming-bristles. From the fifth segment there is a capsule with rhabdites in each foot ventrally.

Synonyms.

1863.	*Sphærosyllis hystrix*,	Claparède.	Beobach, p. 45, Taf. xiii, f. 36 and 37.
1864.	,,	,,	idem. Glanures, p. 86, pl. vi, f. 1.
1865.	,,	,,	De Quatrefages. Annel., ii, pp. 52 and 646.
1869.	,,	,,	McIntosh. Trans. R. S. Edin., t. xxv, p. 416, pl. xv, f. 10; pl. xvi, f. 9.
1874.	,,	,,	Marenzeller. Sitzb. Wien., p. 25 (Adriat. Annel.).
1875.	,,	,,	Marion and Bobretzky. Annél. Marseil., p. 44; Ann. Sc. Nat., 6e ser., t. ii, p. 44.
1879.	,,	,,	Langerhans. Zeitsch. f. w. Zool., t. xxxii, p. 567.
,,	,,	,,	Tauber. Annul. Danic., p. 95.
1884.	,,	,,	Viguier. Arch. Zool. Expér., 2e ser., t. ii, p. 98.
1885.	,,	,,	Carus. Fauna Medit., p. 233.
1887.	,,	,,	De St. Joseph. Ann. Sc. Nat., 7e sér., t. i, p. 204, pl. x, f. 79, 80.

Habitat.—Under a stone, near low water, Lochmaddy, August, 1865. In the tow-net, off County Down, Ireland, August, 1902 (Professor G. S. Brady).

Dinard, France (De St. Joseph), Madeira (Langerhans), Mediterranean, Atlantic, and North Sea.

Head (Plate LIX, figs. 4 *a* and 8) with the palpi fused, except at the tip; two lateral tentacles, much enlarged at the base and tapering gradually towards the tip. Their surface is somewhat rough. A median tentacle, rather larger, but of similar shape, arises just in front of the eyes (fig. 4 *a*). Eyes four, red, the anterior pair furnished with lenses. In an example from the Minch there were six eyes—two larger posteriorly, quite separated from each other, and two small round ones in front. De St. Joseph found the head (peau) covered with papillæ and incrusted with muddy particles.

Body pale, nearly translucent, marked by a central moniliform yellow band, rather less than a quarter of an inch long, and tapered anteriorly to the small snout. Segments 19—32 (30—38, De St. Joseph). The tail has two swollen cirri.

Proboscis with a tooth and with a series of papillæ. The proventriculus is typical of the family.

De St. Joseph observes that the proboscis has lateral glands and a tooth in front. The proventriculus has twelve rows of points. In the lateral pouches of the ventricle is active ciliary circulation.

In the foot (Plate LXX, fig. 1) the superior cirrus is small, much enlarged at the base—especially anteriorly, and the posterior cirri longest. It is marked by minute and scattered tubercles. The setigerous region presents long fleshy papillæ, two of which, near the apex, appeared to be regular in position—viz. one pointing forward and the other backward. Each bears a number of jointed bristles (Plate LXXVIII, figs. 11 *a* and 11 *b*), and the somewhat elongated terminal piece with a simple claw at the tip and serrated along the anterior edge. In addition is a single simple bristle (figs. 12 and 13) slightly curved towards the tip, and apparently dorsal in position. Then a tuft of long simple bristles (swimming), stretching far beyond the body from the ninth segment to the tail. In an example from the Minch no elongated swimming-bristles are present, and the terminal pieces of the jointed bristles are somewhat longer. The ventral cirrus is slender and short.

De St. Joseph describes a rounded gland containing rods at the base of each foot from the fifth to the last segment but one.

Reproduction.—Professor G. S. Brady, who has for many years sent interesting specimens, procured several pelagic examples in the tow-net off the coast of Co. Down. All the females (Plate LXVI, fig. 3) carried eggs, but no example out of eight or ten had swimming-bristles. On the other hand, the only two males bore swimming-bristles (Plate LIX, fig. 4), and were distinguished in other respects from the females by the smaller number of segments, which, moreover, were more deeply cut, so that the aspect was moniliform. The long bristles commenced on the eleventh bristled foot and continued to the posterior end, which, however, was incomplete. These pelagic forms had the eyes considerably larger than the littoral.

The females of these pelagic Syllids have a series of ova projecting freely from the dorsum in some cases, and in others from the ventral surface, and apparently fixed to dorsal or ventral cirri or between the feet, or to the feet by a tough thread.

In an example of medium length they formed four irregular rows, occupying more than the median third of the dorsum, about five bristled segments at each end being free. By transmitted light the ova had a reddish speck (oleaginous?), and readily became detached during the manipulations.

In a small female considerable elongation of the bristles was present, but no capillary swimming-bristles could be distinguished.

Habits.—So far as observed, these Syllideans frequent the under-surfaces of stones near low-water mark, especially in their earlier stages, but when carrying ova in the one case, or ripe sperms in the other, they appear to become pelagic. The great proportional size of the ova would seem adverse to pelagic activity, but their specific gravity is probably such as to aid the annelids in this nomad life, a supposition the more likely as the majority of the females obtained had no swimming-bristles.

De St. Joseph found a male, 4 mm. in length, of thirty-eight segments, with natatory bristles and sperms from the eleventh to the thirty-fourth segment. In a female, 2·40 mm. long, of thirty segments without natatory bristles, the eggs were attached from the eighth to the twenty-second under the ventral cirri by a membrane. Each of the fifteen ovigerous segments had two eggs containing an embryo with a head, three tentacles, and two eyes, three segments furnished with a dorsal and ventral cirrus, a group of bristles with terminal pieces having a simple tip, and a single long simple bristle. The body of the embryo is terminated by an anal segment with two long cirri which are not dilated at the base like the other appendages. Internally is a rudiment of a proventriculus without a proboscis, and a mass of vitellus. They were ready to hatch.

In another incomplete female without natatory bristles there were twelve older embryos (placed two and two behind the twelfth segment) with seven segments.

Claparède (1863) pointed out that the fused palpi with the median groove approached *Sylline*, whilst the enlarged basal region of the cirri and their papillæ reminded him of the condition in *Sphærodorum* (*Ephesia*) and the *Siphonostomum villosum* of Rathke. He observed cells with rhabdites in the feet, as in *Sphærodorum*.

Viguier[1] describes a bud (of fourteen segments) of this species having two large ventral eyes and two smaller dorsal, and with swimming-bristles from the first post-cephalic segment backward. Malaquin thinks that the sexual elements had probably been shed.

Sphærosyllis ovigera, Langerhans[2] (from Madeira), is entered in the fauna of Plymouth, and Dr. Allen kindly forwarded a preparation (slide) of it. The eyes (Plate LVIII, fig. 19) in this example are more closely arranged on each side, and no ova are visible. So far as could be observed the structure of the foot, the presence of the single slightly curved and pointed bristle, and the structure of the compound bristles all agree with *S. hystrix*. The skin has numerous papillæ, to which and to the dorsum sand-grains and mud adhere. The perusal of the description and figures of Langerhans does not conduce to greater certainty, for almost all would apply to *S. hystrix*, unless the figure of the compound bristle is held to be accurate—viz. with a spine on the convex border of the enlarged terminal region of the shaft. Dr. Allen's example does not show any process of this kind.

Genus XLVIII.—Microsyllis, *Claparède*, 1863.

The pre-oral and peristomial lobes not separated; only two tentacles. Palpi small. Tentacular and dorsal cirri very small. First segment with only one tentacular cirrus on each side. Body typical in shape, with 17—30 segments. Proboscis as in *Syllis*, with a tooth in front and a proventriculus. Foot with a small dorsal cirrus; short setigerous region; bristles with simple tips. No ventral cirrus.

[1] *Fide* Malaquin, 'Arch. Zool. Expér.,' 2e sér., iv, p. 733 (1885).

[2] 'Zeitsch. f. w. Zool.,' Bd. xxxii, p. 547, taf. xxxii, fig. 23 (1879).

1. Microsyllis Marenzelleri, n.s. Plate LIX, fig. 9; Plate LXX, fig. 3—foot.

Specific Characters.—Head smoothly rounded, with a slight lateral notch, behind which is a short lanceolate tentacle and near it a lens—indicating at least one eye on each side. Body about 3 mm. long, slender, and tapered towards the posterior end. Segments about thirty. Proventriculus stretches over three segments. Foot has a small dorsal cirrus. Setigerous lobe bluntly conical. Upper bristles have a slender tapering terminal piece considerably shorter than in *Exogone*. The others have a short terminal piece with a simple hook at the tip.

Habitat.—Procured by the dredge in four to five fathoms in the Sound of Harris, August, 1872.

Head smoothly rounded and having a very slight lateral notch to indicate subdivision. Just behind the notch is a short lanceolate tentacle on each side. Near this is a lens, showing that in life at least two eyes are present.

Body about 3 mm. long, slender, somewhat tapered towards the posterior end, and marked laterally by the feet. The tail was injured. The bristled segments appear to be upwards of twenty-eight. The proboscis seems to be indicated by a pale region commencing behind a line between the tentacles and extending to the proventriculus. The proventriculus is considerably larger than in the *Exogone* from Ireland, and stretches over three segments. From this the canal passes backward to the tail. A more opaque central region in front is probably the tooth in the proboscis.

The foot (Plate LXX, fig. 3) has a small conical dorsal cirrus. The setigerous lobe is bluntly conical. The upper bristles have a slender tapering terminal piece, considerably shorter than in the Irish *Exogone* (p. 154). The others have a short terminal piece after the fashion of *Syllis*, with a simple hook at the tip. The end of the shaft of these bristles is dilated, shouldered, and bevelled.

The condition of the single example is such that only an imperfect account of it is possible.

This genus is closely allied to Claparède's *Pædophylax*,[1] in which a small dorsal and a ventral cirrus are present.

Group II.—EUSYLLIDEA, *Malaquin.*

Syllidæ provided with ventral cirri; palpi fused at the base only. Tentacles and cirri filiform or cylindrical, presenting superficial constrictions, but not distinctly articulated. Reproduction direct (epigamy).

Malaquin separates the genera by the structure of the proboscis. Proventriculus normal, ventricule (stomach) little developed. The epithelial coat is very fine and

[1] 'Annel. Nap.,' p. 210.

surrounded by a layer of circular and radiating fibres with nuclei. The radiating muscles are less developed than in *Syllis*, but penetrate the epithelial coat. Externally are longitudinal fibres and the endothelial epithelium (Malaquin).[1]

Genus XLIX.—Pionosyllis, *Malmgrem*, 1867.

Tentacles, and tentacular and dorsal cirri, articulated, as in *Syllis*. Proboscis armed with a single tooth anteriorly and with ten soft papillæ. Compound bristles subfalcate, terminal piece long and bidentate. Median and posterior segments with long swimming-bristles besides the falcate (Malmgren). *Pionosyllis* is distinguished by the presence of the single tooth from *Syllides*, which has an unarmed proboscis; from *Eusyllis* by the elongated nature of the terminal pieces of the bristles, though they are bifid in both; and from *Syllis* by the bifid terminal pieces to the bristles throughout.

1. Pionosyllis prolifera, *Krohn*, 1852. Plate XLVI, fig. 1; Plate LIX, fig. 10—head, etc.; Plate LXX, figs. 4–6—feet; Plate LXXVIII, figs. 14–14 *c*, 15, and 16—bristles.

Specific Characters.—Head hexangular or sub-rectangular with four distinct reddish eyes obliquely arranged on each side, the anterior pair wider apart and with or without lenses. Palpi large and long. Median tentacle has 25—30 articulations, lateral 16—18. Tentacular cirri long and moniliform. Body three-quarters of an inch or more in length, of a dull straw colour, regularly banded with brown in front. On each side of the segment-junctions a lateral brown bar with a speck in front, whilst in the middle line a shorter bar occurs at a greater distance from the segment-junction and nearly in a line with the speck. Tail with two moniliform caudal cirri. Foot with a long and tapering dorsal cirrus of about 27 or 28 articulations. Setigerous lobe bluntly conical with two terminal papillæ. Spines with a peculiar and short point. Bristles of moderate size, translucent, with the convexity of the enlargement at the distal end of the shaft, spinous. Terminal piece rather long, with a nearly straight spinous edge and a minutely bidentate apex. Ventral cirrus fusiform, lanceolate, and does not reach the tip of the setigerous lobe.

Synonyms.

1852. *Syllis prolifera*, Krohn. Arch. f. Naturg., Bd. xviii, p. 66, Taf. iii, f. 1.
1860. „ *variegata*, Grube. Ibid., Bd. xxvi, p. 85, pl. iii, f. 6.
1863. „ *lussinensis*, idem. Ibid., Bd. xxix, p. 46, Taf. iv, f. 9.
1864. „ *fiumensis*, Ehlers. Borstenw., I, p. 224, Taf. ix, f. 1—9.
„ „ *Armandi*, Claparède. Glanures, p. 70, pl. v, f. 1.
„ „ *hexagonifera*, idem. Ibid., p. 73, pl. v, f. 2.
1869. *Pionosyllis Malmgreni*, McIntosh. Trans. R. S. Edin., vol. xxv, p. 414, Tab. xvi, f. 10, var.
1874. *Syllis lussinensis*, Marenzeller. Sitzb. k. Akad Wien, Bd. lxix, sep. abd., p. 30, Taf. iii, f. 1.
1875. „ *variegata*, idem. Ibid., Taf. lxxii, p. 147, pl. ii, fig. 2.

[1] 'Recher. Syllid.,' p. 239.

1879. *Typosyllis* (*Syllis*) *prolifera*, Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 530, Taf. xxxi, f. 3.
1885. *Syllis prolifera*, Carus. Fauna Medit., II, p. 226.
1886. „ (*Typosyllis*) *prolifera*, De St. Joseph. Ann. Sc. Nat., 7e sér., tom. i, p. 147, pl. vii, f. 9—13.
1900. „ *variegata*, Gravier. Nouv. Arch. Mus., 4e sér., Taf. ii, p. 158, pl. ix, f. 8.
1903. „ *prolifera*, McIntosh. Mar. Invert. S. Africa, vol. iii, p. 35.
1904. *Typosyllis prolifera*, Allen. Journ. M. B. A., N. S., vol. vii, p. 219.
1905. *Syllis* „ (= *lussinensis*, *fiumensis*, and *Armandi*, Clap.), Graeffe. Arbeit. Zool. Stat. Triest, xv, p. 323.
1906. „ (*Typosyllis*) *prolifera*, De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 179.

Habitat.—Abundant in fissures and cracks of the rocks to the north of the harbour, St. Peter Port, Guernsey; between tide-marks at Luccomb Chine, Isle of Wight, and in the same region at Herm; between tide-marks, Outer Hebrides; seven to eight fathoms in the West Voe of Burra, Scalloway.

Adriatic, Mediterranean, shores of France, Madeira, whilst Malmgren procured his species from Spitzbergen; South Africa. The range thus is wide.

Head (Plate LIX, fig. 10) of the typical shape, with long palpi. Median tentacle has twenty-five to thirty articulations; lateral somewhat shorter.

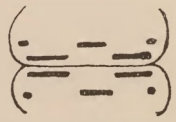

Fig. 53.—Plan of dorsal markings of *Pionosyllis prolifera*.

Body of a dull straw-colour, banded with brown in front. On each side of the segment-junction is a short, brown bar (fig. 53), in each lateral region with a speck or brown touch in front; whilst, in the median line, a shorter bar occurs at a greater distance from the segment-junction. Occasionally the general hue of the anterior region is greenish-olive. It is rather pale posteriorly. The markings thus approach those observed in other forms, such as the *Pionosyllis lamelligera* of De St. Joseph, a species, however, in which the tentacles and cirri are not articulated. In some from Shetland the body is roseate anteriorly, with a black speck (which remains for some time in spirit) at the base of each dorsal cirrus.

The foot (Plate LXX, figs. 4—6) has a long and distinctly articulated cirrus which tapers distally and has about twenty-seven articulations. The setigerous lobe is bluntly conical with a receding slope ventrally. The spines, which have a peculiar and short point, pierce the lobe at the upper angle. The bristles (Plate LXXVIII, figs. 14 and 15) are translucent and of moderate or small size, and have the convexity of the enlarged region at the end of the shaft denticulated. The terminal piece is rather long, has a nearly straight spinous edge, and is minutely bidentate at the tip.

The ventral lobe is somewhat lanceolate, diminishing at base and tip. It does not extend so far as the end of the setigerous region.

Reproduction.—Several examples had buds, and in one this was of larger diameter than the nurse-stock, and of a fine salmon-tint, apparently from the ova. It was about a third the length of the adult, and often contorted itself in opposition to it. It had four

reddish eyes, and its foot is shown in Plate LXX, fig. 5. Moreover, in a female bud with swimming-bristles, from the West Voe of Burra, Shetland, the falcate bristles had stouter shafts and shorter terminal pieces (Plate LXXVIII, fig. 14 *b*). Some of the female buds in Shetland were of a pale lilac hue.

At first sight amongst the rocks this widely distributed species somewhat resembles *S. armillaris*. It is easily discriminated by the longer dorsal cirrus, the structure of the bristles, and the longer ventral cirrus. It is a characteristic species of the southern shores of Britain, and if it is right to make *Pionosyllis Malmgreni* a variety of the same form, then it is sparingly represented on the west so far north as the Outer Hebrides, and it may occur so far as Shetland.

A form which was found between tide-marks in Herm differs from the ordinary examples in the shortness of the dorsal cirri, which have only ten articulations (Plate LXX, fig. 6). Moreover, in certain varieties, as in one from Luccomb Chine, a calcareous region, the bifid tip of the bristle is less evident (Plate LXXVIII, fig. 16).

Krohn (1852) first discriminated this species when describing its budding and that of *Autolytus prolifer*, and it is quite recognizable from his account. He also alludes in a footnote to an allied form which he termed *Syllis fissipara*.

Grube (1863) described the same species from Neresine in the Adriatic as *Syllis lussinensis*, giving characteristic figures of the anterior segments and bristles.

The *Syllis fiumensis* of Ehlers (1864), though he describes and figures the terminal region of the bristles as simple, appears to be this species. He gives a detailed account of the alimentary canal with good figures, and also describes the segmental organs and the budding.

The same year (1864) Claparède described and figured his *Syllis Armandi* as common at Port-Vendres, giving an account of the general structure and reproduction. His figure of the bristle is indifferent.

Marenzeller (1874) found this species plentiful in the Bay of Muggia. It was of a brownish-violet colour, with bands anteriorly and a speck at the base of the dorsal cirrus. The intestine shone through the tissues as a brownish-green streak, and the posterior end of the body was yellowish-green. Anteriorly the dorsal cirri are alternately long and short. His figures of the tips of the bristles are good. A bud arose from the forty-eighth segment, with capillary swimming-bristles. He recognized its relationship with Krohn's *S. prolifera*.

Langerhans (1879) mentions and figures a simple bristle with a bifid tip which he found from the twentieth to the thirtieth segment. He also observes that the budding takes place in the following segments, viz. 31, 33, 35, 36, 37, 41, 44, and that the ova are greenish. *Vorticellæ* are frequently parasitic on it.

De St. Joseph (1888) observed that in the stoloniferous examples violet ova or sperms occurred in two or three segments in front of the bud according as that was male or female. He mentions a male bud as rose-orange, and points out that the *Chætosyllis* of Malmgren [1] is a closely allied bud. He also describes one which had a regenerated head.

The variety described as *Pionosyllis Malmgreni*, from Lochmaddy, shows no bars in

[1] 'Annul. Polych.,' p. 162, Tab. ix, fig. 51.

front, and the terminal piece of the bristles is rather broad. The rapid widening below the tip is noteworthy (Plate LXXVIII, fig. 14 *c*). One example has a developing bud, about the fortieth segment, with two widely-separated dorsal eyes, and the foot has a tuft of swimming-bristles which do not yet extend beyond the jointed forms.

This species approaches Malmgren's *P. compacta*, from which, however, it is easily differentiated by the shorter terminal piece of the compound bristles, the longer and more distinctly moniliform cirri (Malmgren's form having these organs indistinctly articulated), the absence of the elongated simple bristles in the non-budding animal, and the greater length of the palpi.

The *Syllis* (*Typosyllis*) *variegata* of Grube seems to be this form.

Gravier (1900) describes the pharynx as reddish ochre, and as armed with a large tooth in front. The *Syllis* (*Typosyllis*) *exilis*, *S. Bouveri*, and *S. compacta* of this author seem to be closely allied forms, probably also falling under Malmgren's genus *Pionosyllis*.

De St. Joseph (1906) describes examples from St. Raphael with longer appendages than the British. Thus he gives the tentacles thirty-six, and the tentacular cirri no less than ninety articulations. The dorsal cirri, again, show fifty segments. He also mentions the violet eggs in the stolon.

2. Pionosyllis (?) divaricata, *Keferstein*, 1862. Plate LIX, fig. 12—head; Plate LXX, fig. 7—foot; Plate LXXVIII, figs. 17 *a* and 17 *b*—bristles.

Specific Characters.—Head resembling that of *Syllis*, with two large, simple palpi; eyes four, red, in pairs close together on each side, the anterior considerably the larger, besides an additional eye-speck at the base of each lateral tentacle (Keferstein) but not visible in the spirit preparations, a long median tentacle just in front of the eyes, and two on the anterior border of the snout. Body about one inch long, with a considerable number of segments (45—55), tapering a little anteriorly and still more so posteriorly. Dull brownish, paler in the first fourth, and from this a dull, yellow, median stripe proceeds to the tail, with brownish spurs at each side crossing the dorsum at the segment-junctions. Under surface pale brownish. Proboscis is a short cylinder with a smooth, distal edge and a brown interior with a prominent dorsal tooth. The foot has a long, filiform, dorsal cirrus, often coiled like a screw. The dorsal division has a single, stout spine which appears only before the swimming-bristles at maturity. The ventral division has a very long, setigerous region slightly bevelled and bifid at the tip, with several spines, and a series of slender bristles having a short dilatation at the tip of the shaft which has a few serrations on the convex edge. The terminal blade is flattened, narrow, diminishing little towards the tip, which is rather abruptly hooked, and has a slender secondary process beneath. Ventral cirrus somewhat lanceolate, curved, and though carried far outward does not reach the tip of the setigerous lobe.

Synonyms.

1844–5. *Syllis* (*Syllides*) *longocirrata*, Œrsted. Kroyer's Nat. Tids., p. 408 (?).
1862. „ *divaricata*, Keferstein. Zeitsch. f. w. Zool., Bd. xii, p. 111, Taf. ix, f. 45—47.

1863. *Syllis normannica,* Claparède. Beobach. u. Anat., p. 40, Taf. xiii, f. 24.
1879. *Pionosyllis divaricata,* Langerhans. Zeitsch. f. w. Zool., Bd. xxxiii, p. 545.
1886. „ *longocirrata,* De St. Joseph. Ann. Sc. Nat., 7e ser., t. 1, p. 160, pl. viii, f. 21—29.

Habitat.—Under a stone in a rock-pool at Herm, and under stones between tide-marks at St. Peter Port, Guernsey.

St. Vaast-la-Hougue (Keferstein); Madeira, at some depth (Langerhans); Rochardien, France (De St. Joseph).

Head (Plate LIX, fig. 12) like that of *Syllis*, with two large palpi, which thus conspicuously differ from those of *Castalia fusca*; eyes red, and the pairs of each side are close together, besides a small pair at the base of the lateral tentacles. A median tentacle of considerable length occurs just in front of the eyes, and there are two on the anterior border of the snout.

Body about an inch in length, and it has a considerable number of segments. It tapers a little anteriorly and still more so posteriorly. It is of a dull brownish or pale fawn hue, somewhat paler in the centre, which has a few dark brown specks. The first fourth of the body is paler than the succeeding (probably from the pharynx), and is of a pale brownish hue. From this a dull, brownish-yellow, median stripe proceeds to the tail, having on each side a brownish stripe which, by sending a spur outwards at every segment-junction, cuts the brown of the dorsum into segments. The bases of the feet are occasionally paler than the inner region. The under surface is pale brownish.

The proboscis is extruded as a short, firm process with a smooth distal edge, and a brown interior with a prominent dorsal tooth, which, according to De St. Joseph, has a poison-canal at its base, the issue of the organ being preceded by a ring of ten papillæ, each being continued posteriorly (behind the ring) by an elongated cæcal process, the function of which is unknown.

The foot (Plate LXX, fig. 7) has a long pale dorsal cirrus—longer than that of *Castalia*, indeed it resembles a mobile hair which is now gently extended, and again drawn in numerous screw-coils close to the body of the worm. The dorsal division of the foot is represented in the mature female by a single stout spine which scarcely projects beyond the integument, such probably being the precursor of the swimming-bristles, yet its occurrence at first caused the specific separation of the example. The inferior lobe is of moderate length in the ripe form, longer in the others, and slightly bevelled at the tip. It has several spines and a series of slender bristles (Plate LXXVIII, figs. 17 *a* and 17 *b*), which have a short dilatation at the tip with a few serrations on the convex edge. The terminal blade is flattened, narrow, diminishing very little towards the tip, which is rather abruptly hooked and has a slender secondary process beneath. The terminal pieces of these bristles diminish in length from the upper to the lower border of the fan projecting from the foot. The ventral cirrus is somewhat lanceolate, curved, carried far outward, and does not reach the tip of the fleshy setigerous lobe. The foot in the immature form is apparently considerably longer than in the mature, the ova, in the example under examination, distending the base.

Reproduction.—De St. Joseph observes that this species produces directly without alternation of generations. In the ripe forms the segmental organs from the eighteenth

to about the thirty-sixth segment show marked ciliation internally, with a violet colour in the wall of the internal trumpet (pavillon), and orange at the external aperture at the base of the feet. At the same time a clear spine and a group of swimming-bristles develop beneath the dorsal cirrus.

Advanced ova occurred in a female from Herm in July, and indeed, the example appeared to be almost ripe.

Habits.—The species is somewhat smaller than *Castalia fusca* and is at once distinguished by its brown colour. It is active and lively, wriggles through the water with the usual vigour of a *Hesione*, and is irritable and fragile. Those obtained broke into fragments.

So far as can be determined this species is that originally described by Keferstein from St. Vaast-la-Hougue, and subsequently by Claparède as *Syllis normannica*, and though it is true Langerhans states that it has a simple tip to the terminal piece of its bristles, it is more likely that this feature—often so indistinct—was misinterpreted than that two forms so nearly identical exist on the shores of the Channel. The additional distinction given by De St. Joseph, viz. the structure of the first segments, would not seem to invalidate the foregoing conclusion.

The occurrence of a spine for the support of the swimming-bristles, and the structure of the distal piece of the compound bristles, give the form an intermediate character—approaching the Syllids most closely, but also leaning to the Hesionidæ. It may be placed provisionally in this group.

De St. Joseph (1886) found *Trichodina Auerbachii* attached to the tentacles and feet.

3. Pionosyllis (Syllis) hyalina, *Grube*, 1863. Plate LI, fig. 2; Plate LXX, fig. 24—foot; Plate LXXVIII, figs. 9 and 9 *a*—bristles.

Specific Characters.—Head subpentagonal; eyes four, dark-reddish, arranged in a trapezoid, anterior pair larger and wider apart and in some with lenses, posterior close together, occasionally with a small additional pigment-speck in front on each side. Palpi large, somewhat triangular. Median tentacle rather longer than the lateral, and all distinctly articulated (about twenty segments). Buccal segment slightly narrower than the succeeding. Tentacular cirri about the length of the dorsal cirri, a little longer than the breadth of the segment. Body about 18 mm. long (Grube), 90—127 segments, hyaline, showing the gut. Cutis dense and iridescent, occasionally with a pinkish-yellow colour. Two long anal cirri, thicker than the dorsal cirri, and much longer, with a median papilla. Feet with moniliform dorsal cirri, the articulations ranging from twelve to sixteen, but some are alternately shorter; about half the breadth of the body-segment. Setigerous lobe forming a short bilobed cone—the spines piercing its apex, which is superior—leaving the longer curve inferiorly. About ten falcigerous bristles in the setigerous region, the terminal piece elongate and slightly curved. The jointed bristles occur beneath the spines, and have shafts with a marked distal curve and a bevelled dilatation, the convex edge of which has traces of serrations. The terminal piece is somewhat

long, and bifid at the tip, the edge below being boldly spinous. The ventral cirrus is somewhat lanceolate and scarcely reaches the tip of the setigerous process.

In the posterior segments the bristles are more slender, with short terminal pieces (about as broad as long—Grube).

Synonyms.

1843. *Syllis tigrina,* Rathke. Nova Acta Leop.-Carol., xx, p. 165 (?).
1852. „ *fissipara,* Krohn. Arch. f. Naturg., Bd. xviii, p. 68.
1863. „ *hyalina,* Grube. Ibid., xxix, p. 45, Taf. iv, f. 8.
1864. „ *pellucida,* Ehlers. Borstenw., I, p. 239, Taf. x, f. 6—11.
„ „ *simillima,* Claparède. Glanures, p. 77, pl. v, f. 4.
1867. „ *borealis,* Malmgren. Annul. Polych., p. 42, pl. vi, f. 42 (?).
1868. „ *simillima,* Claparède. Annel. Nap., p. 199, pl. xii, f. 5.
1874. „ *macrocola,* Marenzeller. Sitzb. k. Akad. Wien, Bd. lxix, 1 Abth., sep. abd., p. 37, Taf. iii, f. 3.
1875. „ *hyalina,* idem. Ibid., Bd. lxxi, p. 22 (sep. abd.).
1879. *Typosyllis* (*Syllis*) *hyalina,* Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 535.
1905. *Syllis hyalina* (= *fissipara,* Krohn, etc.), Graeffe. Arbeit. Zool. Stat. Triest, XV, p. 323.

Habitat.—Millbay Channel, Plymouth Sound (Dr. Allen).

Lussin Grande, Neresino, Crivizza, in the Adriatic (Grube). Quarnero, Adriatic (Ehlers). Common in 20—30 fathoms off Madeira and also between tide-marks (Langerhans). Adriatic (Marenzeller).

Head with the structure of *Syllis*; two long palpi; eyes comparatively small; anterior pair the wider apart.

Body of about 100 segments, the anterior end being slightly tapered, and gradually increasing to a little behind the anterior third, this region being of a yellowish brown colour, and each segment being banded with brown, which anteriorly is in the form of a double band—a longer at the segment-junction, and a shorter immediately in front. The succeeding region is uniformly thicker, and has a pinkish or salmon colour, a darker stripe marking the segment-junctions. Pharynx (proboscis) long, with a large dorsal tooth and twelve soft papillæ in front. The proventriculus has thirty or more rows of dots and is reddish.

In this species the dorsal longitudinal muscles have a different character from those of *Syllis armillaris*, which form a continuous and massive band on each side. In *S. hyalina* they are considerably thinner, and are cut into a larger upper band and a smaller inferior division on each side (Fig. 54), the former stretching to a point a little above the origin of the dorsal cirrus, and the latter terminating at the base of the spine. The ventral longitudinal muscles are also somewhat thin, and show a marked differentiation on each side of the muscular slip from the base of the spine.

The foot (Plate LXX, fig. 24) has a dorsal cirrus of 22—23 articulations; setigerous region forms a short cone, with the edge below the apex split, the longer margin being inferior. Ventral cirrus lanceolate, and does not reach the tip of the setigerous region. Bristles (Plate LXXVIII, fig. 9) translucent, with curved shafts, dilated and bevelled ends, which show traces of serrations on the convex border. The

terminal pieces are rather long and boldly bifid at the tip, the edge below being spinous. As usual, the spinous edge with the hooks at the tip is directed upward.

The observation of Langerhans that in the caudal segments a simple bristle occurs dorsally and ventrally, in addition to the ordinary jointed ones, is correct. A stout, translucent, simple bristle (Plate LXXVIII, fig. 9*a*) tapered distally, occupies the dorsal margin, and apparently another ventrally. Toward the tip of the tail the ventral bristles and their terminal pieces are longer and more slender. The foot in this region has a single, powerful, translucent spine, the sharp point of which projects beyond the tissues.

Reproduction.—Ehlers states that in July at Zurkowa the eggs were bluish-violet. Marenzeller describes the eggs as deep rose-red, and as filling eighteen segments behind the fifty-second.

In the structure of the bristles this form leans to *Pionosyllis*, and it may in the meantime be placed in that group.

Grube considered that this species approached *S. moniliformis*, and he states that the

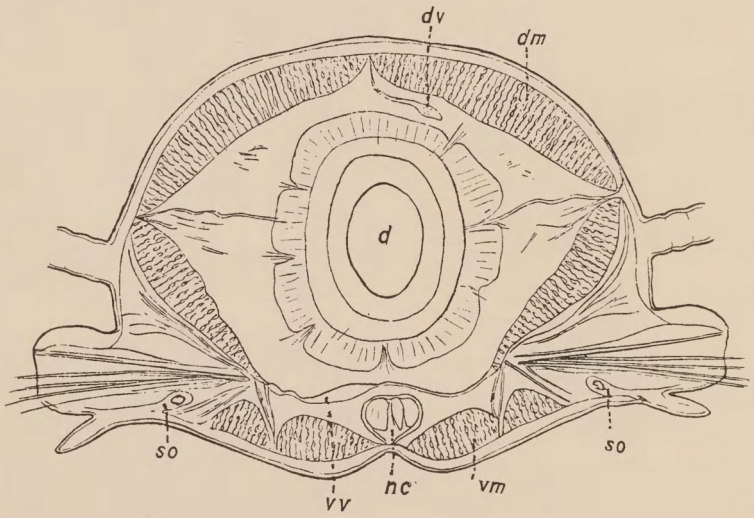

FIG. 54.—Transverse section of the body-wall of *Pionosyllis* (*Trypanosyllis*) *hyalina*, Grube; *d. m.* dorsal longitudinal muscle; *d. v.*, dorsal vessel; *v. v.*, ventral vessel; *s. o.*, segmental organ. Other letters as before. After Malaquin.

proboscis (Rüssel) reached the tenth segment (in spirit), whilst the stomach extended between this and the nineteenth foot.

Claparède, in 1864, describes the same species (as *S. simillima*) from Port-Vendres, and states that the eggs are bluish. He gives an amended figure in his later work on Neapolitan Annelids (1868), showing ciliated grooves on each side of the head posteriorly, and he points out that the tips of the spines are truncated, and the tips of the bristles bidentate.

Ehlers described, also from the Adriatic, this form under the name of *Syllis pellucida*, though he pointed out its near approach to Grube's *Syllis hyalina*. The differences in the shape of the ventral cirrus and in the length of the proventriculus are not material, and Grube had overlooked the details of the armature of the proboscis.

There is doubt concerning the *Syllis borealis* of Malmgren (1867), for while there is

a general resemblance in outline of the body and processes, he figures the bristles with simple tips. Unless the artist overlooked the bifid nature of these organs, Malmgren's form may be different.

This form was described by Marenzeller (1874) as a new species from the Adriatic, where Grube originally found it. His example had somewhat shorter cirri. He gives the foot two spines and five or six bristles. The tail has a rudimentary cirrus between the anal cirri. He saw only eleven of the anterior flat papillæ in the proboscis, and the dorsal tooth. The cæca of the gut are not mentioned. He compares it with *Syllis hyalina*, Grube, and *S. pellucida*, Ehlers, but, on insufficient grounds, thought it different. He figures a bristle with a short tip, but shows no serrations on the convex margin of the dilated end of the shaft; indeed they are not readily seen.

Langerhans (1879) cleared up the synonymy of this species. He also found it budding in November, the female stolon having violet ova, and the swimming-bristles developing. In a male the sperms were roseate, and it had small (developing) swimming-bristles. He gives a figure of two free female buds with ova, and in both a median and two lateral tentacles are present. The frontal incurvation is small. He is not, however, quite sure of their relationship, and they differ from the *Tetraglene*-buds of De St. Joseph.

Genus L.—TRYPANOSYLLIS, *Claparède*, 1864.

Head with palpi well-developed as in *Syllis*. Eyes four, large; tentacles large, long, and distinctly articulated. Body proportionately large, with large dorsal cirri, alternately long and short. Anal cirri two, with a median process. Ventral cirri lanceolate (pinniform). Proboscis with an anterior row (in extrusion) of twelve flat papillæ, and behind a hook-like series of horny teeth. A single dorsal tooth. Foot truncate, bilobed; bristles with rather large terminal pieces which are boldly bifid. Reproduction by stolons.

This genus was established by Claparède (1864) for a species (identical with that previously described by Grube as *Syllis zebra*) which he found at Port-Vendres.

1. TRYPANOSYLLIS ZEBRA, *Grube*, 1860. Plate L, figs. 9 and 10—head and tail; Plate LI, fig. 1; Plate LXX, fig. 8—foot; Plate LXXVIII, fig. 18—bristle.

Specific Characters.—Head rounded trapezoidal, slightly narrower posteriorly where a forward incurvation and a median hollow occurs. Eyes four, somewhat large, placed anteriorly at the angles of a trapezium; the anterior slightly larger and wider apart than the posterior. The median tentacle has about thirty articulations; lateral a little shorter. Palpi of moderate size, diverging anteriorly. Upper tentacular cirri very long with about forty articulations. Body comparatively large, attaining a length of 5 cm., and about 1—2 mm. in breadth (De St. Joseph). Segments 190—215; slightly tapered anteriorly and

more distinctly so posteriorly, where it ends in two caudal cirri with numerous articulations. The dorsum is somewhat rounded anteriorly, the ventral surface flattened. Anteriorly the dorsum is beautifully banded with madder-brown or violet-brown bars—two in each segment, the longer touching the bases of the opposite cirri, which are pale, and the shorter following closely behind. Both bands can be traced to the posterior third, becoming considerably paler, however, behind the middle, the shorter bar then disappearing, and by-and-by the longer also fades, leaving the tip of the tail pale yellowish—from the intestine. The ventral surface is dull yellow. Dorsal cirri characteristically large, and all are distinctly articulated and alternately long and short, the latter having about twenty articulations, the former about double the number. They are occasionally coloured violet by the corpuscles (De St. Joseph). Setigerous region blunt and bilobed with two flat, conical papillæ below the spines. Bristles translucent, with traces of serrations on the convex margin of the distal end of the shaft; terminal pieces rather shorter and broader than in *Pionosyllis*, boldly bifid at the tip and spinous on the edge. Ventral cirrus ovato-lanceolate; extends a little beyond the setigerous region.

Synonyms.

1860. *Syllis zebra*, Grube. Arch. f. Naturges., Bd. xxvi, p. 86, Taf. iii, f. 7.
1861. „ „ idem. Ausflug Triest, p. 143, Taf. iii, f. 7.
1864. *Trypanosyllis Krohnii*, Claparède. Glanures, p. 38, pl. vii, f. 2.
1865. *Syllis zebra*, De Quatrefages. Annel., II, p. 28.
1874. „ „ Marenzeller. Sitzb. k. Akad. Wiss. Wien, Bd. lxix, p. 40, Taf. v, f. 1.
1875. „ *Krohnii*, Marion and Bobretzky. Ann. Sc. Nat., 6e sér., tom. ii, p. 35.
1879. „ *zebra*, Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 556, Taf. xxxii, f. 17.
1885. „ „ Carus. Fauna Medit., II, p. 230.
1886. „ *Krohnii*, De St. Joseph. Ann. Sc. Nat., 7e sér., tom. i, p. 180, pl. ix, f. 51—56.
1904. „ „ Allen. Journ. Mar. Biol. Assoc., N.S., vol. vii, p. 220.

Habitat.—Between tide-marks, Herm, 1868. Common in dredgings from Millbay Channel and Asia shore, as well as from Yealm, Plymouth (Dr. Allen).

Cherso (Grube). Port Vendres (Claparède). Bay of Muggia in the Adriatic (Marenzeller). Marseilles (Marion and Bobretzky). Madeira (Langerhans). Common in dredgings 10—15 metres, at St. Dinard, France (De St. Joseph).

Head (Plate L, fig. 9) rounded trapezoidal, slightly narrower posteriorly where a forward incurvation at the median depression occurs. Eyes four, black, rounded or ovoid, rather large, placed anteriorly, the posterior pair slightly the smaller. Median tentacle arising between the anterior eyes, broad at the base and tapering distally, with about thirty articulations. Lateral tentacles somewhat shorter. Palpi of average size. Upper of the first pair of tentacular cirri very long (forty articulations).

Body comparatively long (50 to 76 mm.), large, rounded dorsally and flattened ventrally; segments 190; slightly tapered anteriorly, more distinctly so posteriorly where it ends in two caudal cirri with numerous articulations (Plate L, fig. 10). The dorsal cirri are large, and alternately long and short, the former having about forty articulations, the latter about half the number.

In front it is ornamented by violet transverse bands which occur on each side of the

segment-junctions, and the dorsal cirri are violet from corpuscles. An alternation of longer and shorter cirri is noted by De St. Joseph, and they are present anteriorly in the example figured.

The proboscis occupies the area from the sixth to the eighteenth segment, and the proventriculus the following eighteen (De St. Joseph).[1] The stomach has no lateral cæca. Anteriorly the proboscis has ten soft papillæ, and ten hook-like horny denticulations, accompanied by a single large conical tooth on the dorsal arch.

The foot (Plate LXX, fig. 8) anteriorly has dorsally the long and large cirrus alternately with a shorter one after the first few segments, the longer cirri having about forty and the shorter about twenty articulations. As transparent objects the cirri show a median groove towards the base.

The setigerous region forms a blunt or truncated bilobed process only slightly rounded at the inferior angle. Dorsally the upper angle is pierced by two of the three spines, and below them are two flat, conical papillæ, the bristles closely following—to the number of a dozen or thereabout—in the groove beneath. They extend to the margin beyond the rounded ventral angle. Each (Plate LXXVIII, fig. 18) has a translucent shaft with the usual dorsal convexity, a few longitudinal striæ in the middle, and a more distinct series of slightly oblique striations in the enlarged distal region which has traces of serrations on its convex margin. The terminal piece is rather shorter and broader than in *Pionosyllis*, with a few oblique striations on the blade, boldly bifid at the tip and spinous along the free (upper) edge.

The ventral cirrus is ovato-lanceolate, and extends a little beyond the setigerous region.

The feet in front of the tail become much less, but they preserve a similar shape. The bristles are more slender, and the ventral cirrus is somewhat longer and more tapered at the tip. The simple bifid bristle mentioned by De St. Joseph as occurring in this region has not been seen.

In a form procured in August at Herm the eyes were larger, and the pigment-bars occurred—the one in the middle of the segment and the other at the segment-junction. The dorsal cirrus was somewhat shorter than in the type.

The foot presents a long and often gracefully coiled dorsal cirrus of about twenty segments, best marked towards the tip. The conical setigerous region has an irregular outline at the tip. Superiorly the sharp tips of the two spines project, then a prominent papilla appears, below which is the fascicle of bristles in their furrow; the translucent shafts have the usual curvature towards the tip, which is dilated and bevelled to an acute point. Oblique striæ occur in this region of the bristle, and its front edge shows a trace of serrations. The terminal piece agrees with the type.

This beautiful species was first found by Grube (1860), and his description and figures are good.

Claparède (1864) described it as a new species, and instituted for it the genus *Trypanosyllis*. This acute and enthusiastic zoologist first found the species budding, the nurse-stock having seventy-two segments and the stolon twenty-two. He gives a

[1] This has not been verified.

diagnostic coloured figure of the head and anterior region, and shows the true structure of the pharynx in extrusion, with its anterior circle of rounded papillæ and its posterior of chitinous, hook-like processes. He describes the feet as cylindrical and trilabiate, but his figures of these and of the bristles need improvement. He pointed out the cæca of the intestine, which he thought comparable with those of Aphroditaceans, but it disappeared in the stolons. Its blood was of a fine pale rose colour.

Marenzeller (1864) states that the number of the papillæ of the proboscis is twelve, and he thinks that it differs from the *Trypanosyllis Krohni* of Claparède—amongst other reasons because that form has only ten teeth (papillæ).

Langerhans (1879) mentions an additional pair of eye-specks on the ventral surface, and a median process between the anal cirri. He also describes and figures the intestinal cæca anteriorly. In the last six to twelve segments is a simple bristle.

Marion and Bobretzky (1875) found at Marseilles, in February, buds of a yellowish and rose colour, 20 mm. long. Their dorsal cirri were more cylindrical and shorter than that of the nurse-stock. Two large eyes occurred on the head with two lateral antennæ and two minute palps. Swimming-bristles were present. The nurse-stock regenerated its posterior segments. These buds have the form of *Tetraglene*.

De St. Joseph (1886) gives a careful account of this species, mentioning that in the terminal segments are simple birostrate bristles. He describes ten soft papillæ at the end of the proboscis, followed by ten corneous ones, and a single large conical tooth. The intestine has for some distance lateral cæca. He adds further information as to its reproduction by budding either by male or female stolons which have the form of *Tetraglene*, Grube, and shows that such are not to be confounded with *Chætosyllis*, Mgrn., as Langerhans does, since they differ in the configuration of the head, which is devoid of tentacles. Besides this type of head in the stolons of the Syllideans, there are (1) the form seen in *Syllis amica*, De Quatref.; (2) the form of *Ioida*, Johnston; (3) the form of *Chætosyllis*, Mgrn.; (4) the form of *Sacconereis*; and (5) the form of *Polybostrichus*. The male buds of *Trypanosyllis zebra* are reddish-brown, the dorsal cirri brownish-violet, with 14—16 articulations, and with two kinds of bristles, viz. compound as in the nurse-stock, and from the third segment a superior fascicle of swimming-bristles. Moreover the feet are long. The head shows a deep median cleft and carries on each side a pair of very large eyes, the inferior (ventral) being usually the larger, and having in addition only the dorsal and ventral cirri of an ordinary segment. It thus corresponds with Grube's *Tetraglene*. The body is filled with sperms. The female stolon has also four large eyes, but the head is less deeply incised in front. The dorsal cirri are nearly of equal size and have sixteen articulations. The feet are much shorter than in the male, and the entire body is distended with eggs, the intestine, as in the male, being rudimentary. It also has dorsal swimming-bristles from the third segment. After the separation of the buds from the nurse-stock, regeneration of the posterior segments occurs in the latter with the development of caudal cirri.

The *Syllis maculosa* of M. Edwards[1] does not appear to diverge much from this species, though the author observes that the tentacular cirri are absent, and shows the

[1] 'Règne Anim. Illust.,' pl. xv, fig. 1.

distal piece of the bristle simple. A re-investigation may clear up doubts, especially as to the fusion of the palpi at the base.

The *Trypanosyllis Richardi* of Gravier[1] (1900) from the Red Sea comes very near this form, the chief distinction being the greater length of the dorsal cirri. The variation in this respect may be greater than is at present supposed.

The small size of the head of the bud in *Trypanosyllis* and its absence in *Syllis spongicola* inclines Calvin Mensch[2] to Huxley's view that the stolon amongst Syllids is not so distinctly individualized as would appear from the earlier observations of Alex. Agassiz on *Autolytus cornutus*.

Genus LI.—Eusyllis, *Malmgren*, 1867.

Head with a ciliated collar; palpi soldered at the base; general structure as in *Syllis*. Proboscis in extrusion armed with a single conical tooth, with a double row of papillæ (circa ten) incomplete on the dorsal margin. Compound bristles falcate; terminal pieces short and bifid. Dorsal cirri short and indistinctly articulated. Ventral cirrus broadly lanceolate. Median and posterior segments with or without long capillary (swimming) bristles. Two anal cirri.

Reproduction.—Epigamy occurs in this genus (Malaquin), and the genital glands are developed immediately behind the proventriculus, viz. from the twelfth to the fifteenth segment. The development of the swimming-bristles takes place as in schizogamy.

1. Eusyllis tubifex, *Gosse* (1855). Plate LIX, figs. 11 and 13—head; Plate LXX, fig. 9—foot; Plate LXXIX, fig. 1—bristle.

Specific Characters.—Head somewhat ovoid, with a pair of comparatively small red eyes on each side, the anterior and larger being the wider apart. Palpi of considerable length, ovoid, soldered at the base, richly ciliated internally, and with palpocils in front. Median tentacle longer than the lateral. The base of these organs is comparatively smooth, whilst the distal region is moniliform. Body of about fifty-six segments, and five eighths of an inch in length. Pale and translucent anteriorly, the proboscis having a bluish-white iridescence and a brown speck or two. Proventriculus is opaque-white, and dotted.[3] Behind the latter is a pale region of the body, then the intestine gives it a pale-brown hue, which increases in depth towards the tail which has its tip pale. A series of white grains is grouped on the dorsum from the proventriculus backward. The tail has a median lanceolate process and two long moniliform cirri with palpocils. Cirri of the first four segments longest and most distinctly moniliform, the latter character diminishing posteriorly. Proboscis has a denticulated edge and a single large pyramidal tooth. Foot

[1] 'Nouv. Arch. Mus.,' 4e ser., t. ii, p. 168, pl. ix, figs. 12 and 13.

[2] 'Amer. Naturalist,' vol. xxxiv, p. 165 (1900).

[3] Haswell, Eisig, and De St. Joseph demur to these being termed glands.

has dorsally the tapering cirrus, the distal crenations being better marked in the anterior than in the posterior feet. Setigerous region conical, with a fan-shaped series of bristles, the curves of which increase from the dorsal to the ventral edge. The terminal piece is comparatively short and bifid, the hooks being directed upward. A well-developed tuft of cilia occurs between the dorsal cirrus and the setigerous lobe. Ventral cirrus is ovate, with a bluntly conical tip which does not reach the end of the setigerous region.

Synonyms.

1855. *Syllis tubifex,* Gosse. Ann. Nat. Hist., ser. 2, vol. xvi, p. 31.
1865. „ „ De Quatrefages. Annel., II, p. 24.
1869. *Eusyllis* „ McIntosh. Trans. R. S. Edin., xxv, p. 414, pl. xv, f. 21.
1874. „ „ idem. Ann. Nat. Hist., ser. 4, vol. xiv, p. 198.
1875. „ „ McIntosh. Invert. and Fishes St. Andrews, p. 121.
1891. „ „ Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 244.
1901. „ „ Whiteaves. Rep. Geol. Surv. Canada, No. 722, p. 81.

Habitat.—In vast numbers in membranous tubes on the blades of *Laminaria saccharina* tossed on shore by storms. It is thus common both in the laminarian region and in deep water amongst algæ and zoophytes. When the *débris* is placed in sea-water the annelids congregate at the water-line of the vessel. Stomach of the haddock, St. Andrews (E. M.).

Le Havre Bank, Nova Scotia ('Challenger'). Madeira (Langerhans). Canada (W.C.M.).

Head (Plate LIX, fig. 13) somewhat ovoid, with a pair of comparatively small red eyes on each side in the usual oblique position, the anterior being slightly larger and wider apart than the posterior. Palpi of considerable length, ovoid, joined at the base in front of the snout, and richly ciliated internally, besides having in front some motionless microscopic palpocils. The pair in outline resemble the sole of a ruminant's foot. They are capable of various movements of extension and contraction. The median tentacle is longer than the two lateral. One palpocil in each segment of the tentacle is generally prominent, though sometimes there are two. The three tentacles are often gracefully coiled, and when the animals are vigorous the base is comparatively smooth, while crenations and a moniliform condition occur distally.

Body of about fifty-six segments, and about five eighths of an inch in length. It is pale and translucent anteriorly, the pharynx having a bluish-white iridescence and a brown speck or two. The proventriculus is opaque-whitish and dotted. Behind the latter is a pale portion, then the intestinal region is pale brownish, increasing in depth towards the tail, which, however, occasionally has its tip pale. A series of opaque-white grains is grouped on the dorsum from the proventriculus to the tip of the tail. A faint, reddish streak occurs just behind the former. All the cirri are pale. The body is little tapered anteriorly, but diminishes rapidly posteriorly where it terminates in two long moniliform cirri with palpocils. A short and somewhat lanceolate process marks the end of the body between the cirri. The cirri of the first four segments are longest and most distinctly moniliform. The sixth is shorter and is generally carried horizontally outward, and the rest are about the same length, but with less evident crenations towards the tail, where they become a little longer and more slender. All have palpocils—most developed towards the tip. The

ceratophore, or basal process, is ciliated, and the large and powerful cilia extend to the setigerous region.

The proboscis (Plate LIX, fig. 11), which extends to the sixth segment, has a denticulated edge, though more than a third of the circumference is only minutely crenated; and it is furnished with a small pyramidal tooth situated on the smoother part of the edge. The sides of the organ are thrown into prominent wrinkles. Several elongated papillæ occur in front of the anterior edge of the proboscis—some directed forward, others backward (the soft ring under compression). The proventriculus is studded with minutely granular dots, and stretches to the thirteenth segment. This organ would seem to act as a compressor, for its two halves occasionally move against each other. The glandular intestine is rendered moniliform by the septa, and terminates posteriorly in a ciliated rectum. Occasionally ciliary action is observed just behind the proventriculus and apparently extending into the lateral cæca as well as along the gut.

The foot (Plate LXX, fig. 9) presents dorsally the tapering cirrus which has more distinct crenations anteriorly than posteriorly. After an interval is the somewhat conical setigerous region, with the tips of the spines pointing at the upper angle. The bristles (Plate LXXIX, fig. 1) form a fan-shaped series, with the convexity of the curve directed dorsally, and the curvature increasing from the dorsal to the ventral edge of the series. The bevelled distal end of the shaft is minutely spinous. The terminal piece is comparatively short and bifid, with the hooks directed upward so that they would be useful to the annelid in clinging to its tube or other surface. There is little difference between the anterior and the posterior bristles. The ventral edge of the fan of bristles has more slender bristles, but the terminal pieces are longer than the superior. The ventral cirrus is ovate with a bluntly-conical tip which does not extend so far outward as the setigerous region. In the posterior feet this lobe is smaller and more pointed. A well-developed tuft of long cilia occurs between the dorsal cirrus and the setigerous lobe, and another on the dorsal edge of the latter.

Reproduction.—This species perhaps sometimes develops directly, since comparatively large ova occur in the ordinary forms, yet in these, between the dorsal cirrus and the setigerous lobe of the foot, indications of a spine are observed, though none of the natatory bristles are developed.

Ovigerous buds with long natatory bristles supported by a spine also occur, and the ordinary bristles are somewhat longer both in shaft and terminal piece. Such buds are found on the blades of the tangles in April.

Habits.—They rapidly secrete a translucent tube in confinement, and thus protect themselves. If incautiously interfered with their bodies are ruptured, and the anterior end wriggles out of the tube.

On being irritated with the forceps, the annelid emits a fine green light from the ventral surface of each foot and as if from many minute pores at the area. It flashes along both sides posterior to the point of irritation, and fades, a faint trace remaining for a few seconds. On severe irritation it remains luminous behind the injured point for nearly half a minute, and the surface of granular light on each segment is larger than usual, and in a few instances is connected across the ventral surface by a few granular phosphorescent points. For some time it was sufficient to shake the vessel to cause a

repetition of the brilliant green flashes. Even when undisturbed a point of green light appeared here and there. After immersion in spirit a moniliform band of green phosphorescence occurred on each side and continued for some time, the tail being brightest. For five minutes the body was faintly luminous, and yet herniæ of the tissues had occurred at the injured points.

This species was first clearly described by Mr. Gosse (1855), who found it not uncommon in his jars containing Hydroids, from Ilfracombe. It is probably, however, the *Nereis cirrhigera* of Viviani.[1]

The *Eusyllis phosphorea* of Verrill[2] comes very near this species.

De St. Joseph thinks that all the representatives of *Eusyllis* reproduce without alternation of generations. He does not think that the *Syllis tubifex* of Gosse—which is a stolon of a *Eusyllis*—is to be confounded with my *Eusyllis tubifex*—which apparently he had not found at Dinard.

2. Eusyllis blomstrandi, *Malmgren*, 1867.

Specific Characters.—Head subrectangular with the angles rounded. Eyes four, forming a rectangle (with occasionally two oculiform points in front). Palpi somewhat ovate. Median tentacle longer than the lateral, and the dorsal of the first pair of tentacular cirri exceeding the length of the tentacle. All are indistinctly articulated, and the tips of these and of the first dorsal cirri are coloured brownish. Malmgren states that the long tentacular cirri are twice or thrice the diameter of the body. Body five eighths of an inch long, of an orange colour and having the typical shape. The dorsal cirri become shorter than the breadth of the body after the fourth. Two caudal cirri occur at the tapered posterior extremity. Proboscis with a single tooth at the tip in extrusion, and a series of papillæ behind it. Proventriculus with fifty-five rows of points, and the lateral pouches of the ventricle are small. Foot has dorsally the somewhat short, unjointed cirrus, then a bluntly-conical setigerous region. Bristles have slightly curved shafts with serrations on the bevelled region at the tip, and on the convex edge of the dilatation. Terminal piece of moderate length and nearly equally bifid at the tip. Ventral cirrus is somewhat ovate, and does not quite reach the tip of the setigerous region.

Synonyms.

1867.	*Eusyllis Blomstrandi,*	Malmgren.	Annul. Polych., p. 40, Tab. vi, f. 43.
1869.	„	„	McIntosh. Trans. R. S. Edin., vol. xxv, p. 415.
1885.	„	„	Carus. Fauna Medit., p. 229.
1887.	„	„	De St. Joseph. Ann. Sc. Nat., 7^{e} sér., p. 171, pl. viii, f. 39.
1892.	„	„	Marenzeller. Polychæt. Ostspitzberg, p. 411, Taf. 19, f. 3.

Habitat.—Dredged in the Minch, August, 1865. Plymouth? (Allen).

Mediterranean (Carus), Madeira (Langerhans), Dinard, France (De St. Joseph), Spitzbergen (Marenzeller).

[1] 'Phosphorescentia Maris,' p. 9, Tab. iii, figs. 1 and 2 (1805).

[2] 'Trans. Conn. Acad.,' iii, p. 39, pl. vii, fig. 2.

Head sub-rectangular, with the angles rounded. Eyes four, forming a rectangle, and according to De St. Joseph, with a pair of oculiform touches in front. Palpi somewhat ovate. Median tentacle longer than the lateral, indistinctly articulated. Tentacular cirri of similar shape, the dorsal of the first pair exceeding the length of the tentacle. At the base of the head is a patch of cilia on each side. The tips of the tentacles, the tentacula, and the first dorsal cirri, are coloured brown (De St. Joseph).

Body of an orange hue, about five eighths of an inch long, but incomplete in the examples, and having the typical shape. The dorsal cirri become shorter than the breadth of the body after the fourth. Two caudal cirri at the tapering posterior end. Proboscis with a single tooth at the tip in extrusion, and a series of papillæ behind it. The proventriculus has fifty-five rows of points, and the lateral pouches of the ventricle are small.

The foot has dorsally the short cirrus, then a bluntly-conical, setigerous region, with the tips of the spines [1] pointing to the upper angle. The bristles (Plate LXXIX, fig. 2) have slightly curved shafts, with traces of serrations on the bevelled region at the tip and the convex edge of the dilatation. The terminal piece is of moderate length and nearly equally bifid at the tip. Slight variations in the length of the terminal piece occur in different specimens from the Minch. The ventral lobe is somewhat ovate and does not quite reach the tip of the setigerous region.

De St. Joseph [2] (1887) found an abnormal example with three proventriculi. The median was normal in position, whilst the two lateral were posterior to the former and in the situation of the lateral cæca, which in this case were minute. If no misinterpretation occurred the condition is remarkable.

An elaborate account of this form is given by Marenzeller (1894) from examples procured in the Ostspitzbergen Expedition of Kükenthal and Walther in 1889. He figures in some of these the enlarged distal end of the shaft spinous along the bevelled edge, and in others hispid with small spikes over the dilated region.

A fragmentary specimen from the South-West of Ireland (Royal Irish Academy's Expedition, 1885) appears to correspond with the foregoing species. The dilated and bevelled ends of the shafts of the bristles, however, show the minute spines less distinctly either from their removal by friction or otherwise. This also is a female laden with ova, and swimming-bristles are developing below the dorsal cirrus.

Eusyllis monilicornis of Malmgren is a very closely allied form, and further examination may explain certain points of divergence, as, for instance, in the description of De St. Joseph, for it differs from the type in Malmgren's paper.

Malaquin, though he did not ascertain the precise details of the early history of the eggs and larvæ of *Eusyllis monilicornis*, found young forms abundant on the tufts of Polyzoa (*Membranipora*), showing no movements, devoid of cilia, and enveloped in a vitelline membrane. Each presents two eyes, and a larval pharynx abutting on a vitelline mass differentating into an intestine. These are of interest in relation to

[1] De St. Joseph gives these a curved tip (as in *Sylline*), but such was not seen in the foregoing examples.

[2] De St. Joseph, op. cit., p. 172, pl. viii, fig. 39.

Eusyllis Blomstrandi from the close connection of the forms. As development proceeds, the tentacle and additional pair of eyes posteriorly, the appearance of the adult pharynx behind the larval and the gradual recrudescence of the latter and the completion of the former, the growth of the proventriculus behind and in rear of it, the lateral cæca and the intestine with its anus, the growth of the palpi subsequent to the tentacles, as lateral buds,[1] the fusion of the base as they increase in size and pass to the front with their rich coating of cilia and palpocils, and the completion of the alimentary canal, are all figured and described by the author. There is much in common with the growth of *Autolytus*, but the cephalic band of cilia does not appear till there are seven or eight bristled segments, at which time the dorsal ciliated bands also occur posteriorly.

The author points out that he thus differs from Viguier, who described the development of the proboscis as from behind forward, and who considered the larval pharynx as the proventriculus.

Genus LII.—Odontosyllis, *Claparède*, 1863.

Palpi short or moderately elongated, more or less separate, or fused at the base. Tentacles (three) and dorsal cirri filamentous, short. They become longer in the mature (sexual) state. Nuchal organ has a central pit (Malaquin), and an occipital gibbosity occurs. Tentacular cirri two pairs. Ventral cirrus present. Proboscis with a series of pointed cuticular horny papillæ, the points curved backward.[2] Ventricle (stomach) short and devoid of T-shaped cæca. Bristles with terminal piece simple or bifid (Claparède[3]).

1. Odontosyllis fulgurans, *Aud.* and *Ed.*, 1833. Plate XLIX, fig. 5; Plate LIX, figs. 15 and 15 *a* and *b*—head and tail; Plate LXX, fig. 11—foot; Plate LXXIX, fig. 4—bristle.

Specific Characters.—Head rounded, a Y-shaped groove dividing it into three regions. Eyes four, large, the anterior with lenses, occasionally nearly forming a square. Palpi moderately elongated. Median tentacle, which arises in front of the eyes, longer than the two lateral. Body fully an inch in length with 60 to 100 segments, slightly tapered anteriorly and more distinctly so posteriorly. A prominent papilla in the mid-dorsal line occurs behind the head, giving gibbosity to the region. Tail with two median cirri and a slight median process between them. Of an orange hue, or pale yellow in front and reddish over the intestinal region behind. Whitish grains on the dorsum. Proboscis short, with seven denticulations. Proventriculus long (extending to the sixteenth segment). Foot distinctly bifid at the tip. Dorsal cirrus of moderate length, unjointed. The dorsal edge of the setigerous lobe passes with a slight curvature to the spine, a deep groove splitting the foot beneath. The dilated distal region of the shafts of the larger

[1] Malaquin compares these with the condition in *Nerilla*, Schmidt, op. cit., p. 412.

[2] Ehlers observes that the opening of the œsophagus has two transverse thickenings like teeth.

[3] Claparède mentions a bifid bristle (like that of *Syllis gracilis*) in a large specimen from St. Vaast.

bristles is smooth. The terminal process is comparatively short, ends in a strong hook, and after an interval has a smaller process about the middle of the curve. Ventral cirrus ovate, its bluntly-conical tip being less prominent than the setigerous region.

Synonyms.

1756. *Noctiluca marina,* Adler. Amœnitates Acad., p. 202 (with fig. in text).
1761. *Nereis noctiluca,* Linnæus. Fauna Suecica, II Edit., pp. 509 and 2098.
1767. „ „ idem. Syst. Nat., ed. 12, i, pt. 2, p. 1085.
1787. „ „ Pennant. Brit. Zool., IV, p. 46; and edit. 1812, IV, p. 93.
1791. „ „ Gmelin. Linn. Syst. Nat., ed. 13, i, pt. vi, p. 3115.
1806. „ „ Turton. Linn. Syst. Nat., IV, p. 86.
1807. „ „ idem. Brit. Fauna, p. 134.
1817. „ „ Stewart. Elem., I, p. 390.
1833. *Syllis fulgurans,* Audouin and Edwards. Ann. Sc. Nat., t. xxix, p. 229.
1834. *Nereis noctiluca,* idem. Annél., p. 209.
„ *Syllis fulgurans,* idem. Ibid., p. 207.
1851. „ „ Grube. Fam. Annel., p. 62.
1853. *Nereis noctiluca,* Dalyell. Pow. Creat., ii, p. 161.
1864. *Odontosyllis fulgurans,* Claparède. Glanures, etc., p. 95, pl. viii, f. 1.
1865. „ „ De Quatrefages. Annel., ii, pp. 24 and 648.
1874. „ *virescens,* Marenzeller. Adriat. Annel., April, 1874, p. 41, Taf. iv, f. 2.
1875. „ *fulgurans,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér., t. ii, p. 40, pl. iv, f. 11, 11a.
1879. „ „ Langerhans. Zeitsch. f. w. Zool., xxxii, p. 554.
„ „ „ Webster. Annel. Virg. Coast, Trans. Alb. Instit., ix, p. 220 (sep. copy, 20).
„ „ „ idem. 32nd Rep. N. Y. Mus. Nat. Hist., p. 109.
1885. „ „ Carus. Fauna Medit., p. 231.
1887. „ „ De St. Joseph. Ann. Sc. Nat., 7e sér., t. i, p. 175.
1890. „ „ Giard. Bull. Sc. Fr. Belg., t. xxii, p. 79.
„ „ „ Malaquin. Annél. Boulon, p. 36.
1904. „ „ Allen. Journ. M. B. A., n.s., vol. vii, p. 219.

Habitat.—Under an Ascidian fixed to a littoral stone between tide-marks, Herm. It was observed in the dusk, when tearing off the Ascidian, by its bright green phosphorescence. Dredged by Dr. Gwyn Jeffreys in St. Magnus Bay, Shetland, in 100 fathoms in 1867. Dredged at Plymouth (Dr. Allen).

Mediterranean (including the Adriatic) and the Atlantic. Amidst tubes of *Dasychone*, Marseilles (Marion and Bobretzky). Common at Dinard (De St. Joseph). Virginian Coast, dredged in 6—12 fathoms on shells and stones; pelagic male on surface, New Jersey (Webster).

The specimen is unfortunately imperfect, so that only a brief account can be given. In the general outline of the fragment the body resembles *Autolytus*, the dorsal cirri being smooth, and they are slightly longer than in *A. prolifer*, from which they differ also in the absence of the distinct basal joint (ceratophore). The basal region is somewhat constricted, and it dilates a little beyond this and again slightly tapers towards the tip.

Moreover, on its convex edge it presents several wart-like papillæ, but whether these are due to imperfect preservation is uncertain.

Head (Plate LIX, fig. 15) rounded, provided with two moderately elongated palpi, which in the Zetlandic specimen seemed to be short, and three tentacles, the median, which arises in front of the eyes, being the longest. Eyes four, large, purplish, the anterior with lenses. In the Zetlandic example from deep water they nearly formed a square. A **Y**-shaped groove divides the head into three regions.

Body fully an inch in length with upwards of sixty segments, slightly tapered anteriorly and more so posteriorly. A prominent papilla behind the head in the mid-dorsal line. Of an orange hue throughout. De St. Joseph gives it 100 segments and states that it is pale yellow in front and behind, reddish over the intestinal region, and with whitish grains arranged along the dorsum.

Proboscis with seven denticulations; proventriculus long (to the sixteenth segment).

Posteriorly the body terminates in two caudal cirri with a slight median process between them (Plate LIX, fig. 15 *a*). When the tail is injured the two cirri in front of the truncated extremity bend backward and become somewhat longer than the others (Plate LIX, fig. 15 *b*).

The feet are more prominent than in *Autolytus* and are distinctly bifid at the tip (Plate LXX, fig. 11). The dorsal edge [1] passes outward with a slight curvature to the two spines which just pierce the upper and outer angle, a deep groove occurring beneath so as to split the tip vertically. The greater part of this lobe is occupied by the strong, translucent bristles which have a slight curvature below the dilatation at the tip of the shaft (Plate LXXIX, fig. 4), which is bevelled as in allied forms, and ends in a point. The edge appears to be almost smooth. The terminal process is articulated as in *Autolytus*, and shows a strong hook, and after a distinct interval, so as to be about the middle of the curve, a smaller process. The bristles are proportionally larger than in *Autolytus*, and their structure is diagnostic.

The inferior lobe of the foot is more or less ovate, its bluntly-conical tip being less prominent than the upper lobe.

Claparède found this species at Port-Vendres, Pyrénées Orientales, and describes the beautiful emerald lustre of its phosphorescence in daylight. A band of green shone along each side of the body, and by-and-by broke up into points grouped at the bases of the feet.

Marenzeller's *O. virescens* from the Adriatic, as De St. Joseph states, approaches this species very closely, indeed, the structure of the head, the foot, pharynx, and other parts, is almost identical, but he did not observe the second tooth on the terminal piece of the bristles or notice the phosphorescence.

De St. Joseph points out that the pharynx (proboscis) has ten teeth and ninety rows of points in the proventriculus, and that the terminal pieces of the bristles are bifid, and arranged as his excellent figure shows. He observed a transparent gland in the feet of the middle region of the body, the function of which is undetermined. He found that it developed directly, and that the eggs were violet. Moreover, after a precursor of a

[1] In one preparation what seemed to be a band of cilia coursed along the upper border of the foot.

small, curved, dorsal bristle on the twenty-seventh, the long natatory bristles extended from the twenty-eighth to the fifty-second segment. In another example the sexual elements and the capillary bristles occurred from the twenty-fifth to the fortieth segment. He found gregarines in the intestine of one; whilst in another the head was regenerated, but without proboscis or proventriculus. Its phosphorescence is so bright as to show the parts under the microscope.

The specimen from deep water in St. Magnus Bay showed the structure of the bristles very clearly, and the terminal hook of the distal piece was perhaps a little less curved than in the form from the Channel Islands.

It would be difficult to frame a theory explanatory of the phosphorescence of this annelid under a littoral ascidian in the Channel Islands, and at the depth of 100 fathoms in the Zetlandic seas, just as it was long ago pointed out how uncertain the theory is which endows, on the one hand, phosphorescent animals with the faculty of alluring others which fall a prey to them, and, on the other, of attracting the attention of some to their own destruction.

This species has been a favourite subject of study with observers from De la Voie (1666) onwards, the memoirs of Vianelli, Claparède, and Panceri on its phosphorescence being especially noteworthy. The last-named author locates the luminosity in certain glands at the base of and in the dorsal cirri, but other tissues may not be excluded under the influence of the nervous system. The figures of this author are of much interest. Viviani probably refers to this form under his *Nereis radiata*.[1] Adler, again (1756), gives his *Noctiluca marina* a round head, two eyes, two tentacles (figure shows three), and a body of twenty segments. It is two lines long, and is found amongst the marine algæ.

The *Nereis noctiluca* of O. F. Müller[2] (1806) is apparently a female bud of a form approaching this and resembling the coloured figure of a male *Autolytus*. In the figure of the segments the foot is inverted. He adds "Corpus totum purpurascens."

It is possible that the *Syllis fulgurans* of Audouin and Edwards, which was sent to them by Dugès from the shores of the Mediterranean, is this species.

A very closely allied form is the *Odontosyllis dugesiana* of Claparède,[3] who described it as having nine teeth in its proboscis, but Langerhans[4] has given it only six (as in *O. fulgurans*), and the compound bristles are similar.

Claparède[5] shows a young *Odontosyllis* of three bristled segments and three eyes on each side. The bristles are very long and have tapering terminal pieces.

Webster found a large adult male with swimming-bristles commencing on the twenty-first segment and extending over forty-two, in Great Egg Harbour, New Jersey.

Malaquin[6] describes a young *Odontosyllis* in the dipharyngeal stage with five bristled segments and lateral ciliated pits.

[1] 'Phosphor. Maris,' p. 11, Tab. iii, figs. 5 and 6.
[2] 'Zool. Dan.,' iv, p. 31, Tab. cxlviii, figs. 1—3.
[3] 'Glanures,' p. 97, pl. viii, fig. 2.
[4] 'Zeitsch. f. w. Zool.,' Bd. xxxii, p. 554, Taf. xxxii, f. 15.
[5] 'Beobacht.,' p. 81, Taf. xii, fig. 15, 1863.
[6] Op. cit., p. 429, pl. xiv, fig. 29.

2. Odontosyllis ctenostoma, *Claparède*, 1868. Plate LXX, fig. 12—foot; Plate LXXIX, figs. 5 and 6—spine and bristle.

Specific Characters.—Head rounded, with short palpi in front, and ventrally projecting separately in the preparations. Eyes four, large, the anterior with lenses and distinctly separated from each other, nearly forming a square. Median tentacle slightly longer than the lateral. None of the appendages articulated. Body like that of *O. fulgurans*, and about an inch in length. The segments are banded transversely with greyish granulations which also occur on the gibbosity, and the general colour is green, like that of *Bryopsis*, amongst which it occurs (Marion and Bobretzky). Six teeth occur in the proboscis anteriorly. The proventriculus commences at the eighth bristled segment. The foot forms a short cone slightly bifid at the tip. Dorsally is the moderately long cirrus, which is slightly tapered toward the tip. The setigerous region has two pale spines with a beak and crown (spike) at the tip. The paler bristles issue between the blunt papillæ at the tip, are curved distally, dilated at the end of the shaft, and the convex edge and tip are finely serrated. Terminal piece short, with a simple boldly-curved hook at the tip. The front edge is concave and finely spinous. In Claparède's figure of the compound bristle a tooth occurs on the anterior margin of the terminal piece near its base, as in *Odontosyllis fulgurans*. Langerhans, however, shows none, and points out that the proboscis (his pharynx) is longer than in the latter species. Ventral cirrus short and broadly lanceolate, the tip falling short of that of the setigerous region.

Synonyms.

1868.	*Odontosyllis ctenostoma,*	Claparède.	Annel. Nap., p. 202, pl. xii, f. 4.
1874.	„ *virescens,*	Marenzeller.	Sitzb. k. Akad Wiss. Wien, Bd. lxix, p. 41, Taf. iv, f. 2.
1875.	„ „	Marion and Bobretzky.	Ann. Sc. Nat., 6e ser., tom. ii, p. 42, pl. iv, f. 12.
1879.	„ „	Langerhans.	Zeitsch. f. w. Zool., Bd. xxxii, p. 555, Taf. xxxii, f. 16.
1885.	„ „	Carus.	Fauna Medit., ii, p. 230.
1904.	„ „	Allen.	Journ. M. B. A., n.s., vol. vii, p. 219.
1905.	„ „	Graeffe.	Arbeit. Zool. Stat. Triest, xv, p. 323.
1906.	„ „	De St. Joseph.	Ann. Sc. Nat., 9e sér., t. iii, p. 185.

Habitat.—Plymouth, between tide-marks, under stones, and amongst sea-weeds and sponges (Allen).

Naples. Marseilles (De St. Joseph, Marion and Bebretzky). Adriatic (Marenzeller). Common at Cannes.

Head, like that of *O. fulgurans*, rounded in front, and with four distinct, brownish eyes nearly in a square, the anterior pair having lenses. They are distinctly separated from each other, yet Claparède states that they are almost coalescent. The palpi form short projections—best seen from the ventral surface. Tentacles and tentacular cirri similar to those of the species mentioned.

Body like that of *O. fulgurans*, and ranging from 18 mm. to 25 mm. or even to 1 cm.

(Claparède), slightly diminished anteriorly, and more distinctly tapering posteriorly. It is bright green at Dinard, with a transverse band of greyish granulation in each segment (De St. Joseph). Yellowish-green (Marenzeller). Body terminated by two cirri. Marenzeller and Marion and Bobretzky observe that the armed region of the proboscis is found in the fifth setigerous segment, and it has six teeth under a glandular mass of the fibrous region of the organ. The proventiculus occurs in the eighth setigerous segment, and it is twice as long as the former.

The foot (Plate LXX, fig. 12) is comparatively short and bluntly bifid at the tip, the bristles issuing between the papillæ. Two pale spines pierce the tip superiorly and their ends are peculiarly bent so as to form a short, blunt beak anteriorly, whilst a kind of heel projects posteriorly in some, as apparently first indicated by Marenzeller. The tip is indeed somewhat T-shaped, especially in the posterior segments (Plate LXXIX, fig. 5). The bristles are translucent, with the shafts slightly curved, dilated, and bevelled at the tip, which is finely spinous. The terminal piece (Plate LXXIX, fig. 6) is short, with a bold and sharp hook at the tip, and a concave, spinous edge in front.

The ventral cirrus is broadly lanceolate, and does not reach the tip of the setigerous region.

Reproduction.—An example captured on April 23rd at Plymouth is laden with nearly ripe sperm-cells. The segmental organs are green (Fage[1]).

The habits of this form would seem to resemble those of *O. fulgurans*, and Marion and Bobretzky found it brilliantly phosphorescent.

3. Odontosyllis gibba, *Claparède*, 1863, var. Robertianæ. Plate XLIX, figs. 3 and 4; Plate LIX, fig. 14 and 14*a*—head; Plate LXX, fig. 13—foot; Plate LXXIX, fig. 7—bristle.

Specific Characters.—Head small, rounded or bluntly conical, with two reddish eyes, confluent or separated, on each side, the anterior the wider apart. Two short anterior tentacles and a median with a dark tip in front of the eyes. Tentacular cirri dark. Body about half an inch long, most distinctly tapered posteriorly. Segments 43—48. Of a pale brown or fawn colour, with a whitish stripe interrupted by three or four brownish touches along the dorsum, and a transverse white belt extending to the bases of the feet on the seventh segment. Ventral surface of a pale brown hue with dark touches in front. Gibbous segment succeeding the head is somewhat semicircular, and bears two clavate cirri each with a white ring on the dilated region. Terminal segment has two short and somewhat clavate cirri with a white touch at the tip. Foot uniramous in so far as there is only one spine. Dorsal region elevated, giving rise to a clavate cirrus, dilated towards the tip, which has a white ring, and with a slender terminal process. The cirrus is simply clavate or fusiform in other examples. Setigerous region separated by a sulcus, its dorsal margin convex, and terminating externally in two conical papillæ. Bristles long, slender, and translucent, dilated distally, and with a shoulder and a bevelled edge. Terminal process short, very slightly diminished at the tip, which has a simple hook.

[1] 'Ann. Sc. Nat.,' 9e sér., iii, p. 316.

Synonyms.

1863. *Odontosyllis gibba,* Claparède. Beobacht., p. 47, Taf. xii, f. 7, 8.
„ *Syllis brevicornis,* Grube. Arch. f. Naturges., Bd. xxix, p. 44, Taf. iv, f. 7.
1872. *Umbellisyllis fasciata,* M. Sars and G. O. Sars. Remark. Forms Norweg. Coast, p. 41, pl. iv, f. 12—18.
1875. *Odontosyllis brevicornis,* Marenzeller. Sitz. Akad. Wiss. Wien, Bd. lxxii, p. 32, Taf. iv, f. 1.
„ „ *gibba,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér., t. ii, p. 38, pl. iii, f. 10 and 10 B, pl. iv, f. 10 A and 10 C.
1885. „ „ Carus. Fauna Medit., II, p. 230.
1904. „ „ Allen. Journ. M. B. A., N.S., vol. vii, p. 220.
1905. „ „ Graeffe. Arbeit. Zool. Stat. Triest, xv, p. 323.
1906. „ „ De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 185.

Habitat.—Dredged on dead shells in 15 fathoms off St. Peter's Port, Guernsey, July, 1868. It also occurs at Kingstown Harbour where it was procured by Professor Haddon. Dredged at Plymouth (Dr. Allen); St. Andrews Bay.

Shores of France—Normandy and Marseilles (deeper coralline region). Adriatic (Grube and Marenzeller).

Head (Plate L, fig. 5, and Plate LIX, figs. 14 and 14 *a*) small, rounded, or bluntly-conical, with two reddish eyes on each side, the anterior pair the wider apart. Two short anterior tentacles, and a median in front of the eyes with a dark tip. The tentacular cirri have a darker colour than the general fawn of the region. The flap-like process at the posterior part of the head moves to and fro in life.

Body fully half an inch long, most distinctly tapered posteriorly, somewhat rounded dorsally and flattened ventrally; segments 43—48. Of a pale brown or fawn colour with a whitish stripe interrupted by three or four brownish touches along the dorsum, and a transverse white belt on the seventh segment extending to the bases of the feet. The gibbous segment succeeding the head is somewhat semicircular or half shield-shaped and bears two clavate cirri with a white ring on the dilated region. This prominent shield-shaped region overlaps the head and is very conspicuous from its lighter hue. The four succeeding segments are somewhat smaller than those which follow, and each has a whitish median patch in continuation of the dorsal belt, and the last (fifth) of these has, in addition, three white dots before and behind its white touch. The sixth segment has a whitish patch at the bases of the feet and two brown dots in the centre, and it commences the somewhat larger region of the body. The rest of the segments are nearly alike except that they diminish in size towards the tail. The terminal segment has two short and somewhat clavate cirri with a white touch at the tip. Under surface with some dark touches in front.

The southern examples, as described by Marion and Bobretzky, have each segment ornamented by a double transverse line of violet which reaches the base of the dorsal cirri. A similar line occurs at the segment-junctions. An irregular touch of yellowish orange is distributed irregularly on the lateral regions. Chalky touches occur on the palpi, the median tentacle, and here and there on the dorsal surface posteriorly. Many of the dorsal cirri have touches of violet towards their extremities; others again have this replaced by the chalky (white) pigment.

In the example from Plymouth the colouration consists of numerous isolated brownish specks (Plate XLIX, fig. 4) which here and there form a band.

A figure of the proboscis is given by Marion and Bobretzky, showing a series of denticulate papillæ anteriorly.

The foot (Plate LXX, fig. 13) is uniramous in so far as there is only one spine. The dorsal moiety of the foot, however, may be held to be represented by the elevated region at each side from which the dorsal cirrus springs. The cirrus is clavate—somewhat like that of *Lepidonotus*—with a dilated region towards the tip, followed by a slender terminal process. The anterior cirri have the largest dilatations, the posterior being more slender, though still rendered characteristic by the white ring towards the tip. The setigerous region is separated from the foregoing by a marked sulcus, the dorsal margin of the lobe being convex, and it terminates externally in two short conical papillæ, while beneath the lobe is a larger conical process, which may represent the ventral cirrus, unless that is altogether absent. It does not extend quite so far outward as the upper papillæ. The bristles (Plate LXXIX, fig. 7) have a long, slender, translucent shaft, curved towards the dilated distal end where it has a shoulder and a bevelled edge. From the shoulder passes off the terminal blade, which is short, very slightly diminished at the tip, and ends in a simple hook, a feature not clearly indicated by Marion and Bobretzky. The bristles form a diminishing series from above downward both as regards the length of the shaft and the terminal pieces. The ventral cirrus forms an elongated conical process.

This species is *Hesione*-like in its active movements and irritability. When at rest the anterior six segments of the body are elevated. Marion and Bobretzky's examples swam freely to and fro like Nereids. It differs from the form described by Claparède and Marion and Bobretzky in the arrangement of the eyes, the anterior and posterior pairs of which are more widely separated; and still more in the shape of the dorsal cirri, which instead of forming fusiform or gently clavate organs are somewhat cylindrical with a rather sudden bulbous dilatation distally, from which a slender filiform tip projects. On the whole, however, in the present state of our knowledge it will suffice to indicate the variety, especially as the bristles do not appear to differ materially in structure.

A similar form (young?) comes from the tow-net in St. Andrews Bay, 1894. The setigerous process of the foot seems to differ slightly in its relation to the ventral cirrus, but this may be due to youth.

Claparède and Grube described and figured this form within the same year, and it appears to be extensively distributed.

Malaquin[1] (1893) observes that the protoplasmic "setting" of the muscular fibres of the proventriculus has totally disappeared, only the longitudinal fibrils of the column being present. Each column has transverse striation as in *Syllis hyalina*.

So far as can be made out the *Umbellisyllis fasciata* of M. Sars[2] appears to be this species, though the large size (24 mm.) gives a margin for variation, and the presence of an additional minute pigment-speck in front of the anterior pair is novel. Whatever may be the condition as regards specific identity, the Norwegian form is an *Odontosyllis* from deep water—viz., 100 to 300 fathoms.

[1] Op. cit., p. 231.

[2] 'On some Remarkable Forms of Animal Life, etc.,' 1872, p. 41, pl. iv, figs. 12—18.

Genus LIII.—Sylline, *Grube*, 1860.

Head as in *Autolytus*, but the palpi, though coalesced at the base, are separated distally. Tentacles and tentacular and dorsal cirri not articulated. Body as in *Autolytus*. Feet with a smooth, tapering dorsal cirrus; setigerous region rather short, and having beneath it a broadly lanceolate ventral cirrus. Spines with a hammer-like tip; bristles with a short terminal piece ending in a single boldly-curved hook.

1. Sylline rubropunctata, *Grube*, 1860. Plate XLVIII, fig. 5; Plate LXX, fig. 26—foot; Plate LXXIX, fig. 26—bristle.

Specific Characters.—Head as in the type, only the short palpi are clearly separated by a median fissure. Eyes two on each side, the anterior being the larger and wider apart; both with lenses—indeed, the anterior show two. Median and lateral tentacles long. Tentacular cirri as in *Proceræa* (Marion and Bobretzky). Body about 20 mm. in length, and with 120 or more setigerous segments. Dorsally the translucent body is marked by a series of orange touches—two or four in number—longitudinally arranged, the buccal segment, however, having only the two outer. Minute, clear corpuscles occur in the skin, forming a transverse line in the segment (Marion and Bobretzky).[1]

Foot rather prominent, with a considerable dorsal cirrus tapered distally Cirri of the first fourteen feet alternately longer and shorter. The setigerous region is short, with the long slope inward ventrally. Two spines pierce the upper angle of the region, their tips having a shoe-like modification, or shaped like a hammer. The bristles are slightly yellowish, curved distally, and bear a short, simply-hooked terminal piece. The enlarged end of the shaft is spinous on the convexity and sides of the peak.

Synonyms.

1860. *Sylline rubropunctata,* Grube. Arch. f. Naturges., Bd. xxvi, p. 87, Taf. iii, f. 8.
1861. „ „ idem. Ausflug Triest, p. 144, Taf. iii, f. 8.
1875. *Autolytus* (*Proceræa*) *ornatus,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér., tom. ii, p. 44, pl. v, f. 14.
1879. *Proceræa rubropunctata,* Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 579, Taf. xxxii, f. 30.
1890. *Autolytus rubropunctatus,* Malaquin. Annél. Boulonn., Rev. Biol. Nord Fr., t. iii, p. 179.
1904. „ „ Allen. Journ. M. B. A., n.s., vol. vii, p. 220.

Habitat.—Dredged on Queen's Ground, Plymouth (Allen).

Porto ré in the Adriatic (Grube); Marseilles, from the deeper waters inhabited by *Gorgonia* (Marion and Bobretzky); Madeira (Langerhans).

Head ovoid, with a median, longitudinal sulcus; the fused palpi are separated in front by a median fissure. Eyes black, two on each side, the anterior the larger and wider apart.

[1] Viguier questions if a dorsal cirrus is present on the second bristled segment, but it seems to occur in the British specimen.

Both have lenses, the specimen, moreover, showing in the anterior eyes a larger lens and a smaller in front of it. The median and lateral tentacles are long, the former being frequently carried backward. All have palpocils and "corpuscles brillants" (Marion and Bobretzky). Tentacular cirri two pairs, the dorsal in each being as long as the median tentacle.

Body about 20 mm. in length, a little tapered anteriorly, more distinctly tapered posteriorly, and ending in two caudal cirri. The pale body is marked by two touches of orange on the first segment, by four on the succeeding, and has a series of minute corpuscles often arranged as a transverse band anteriorly. The first dorsal cirrus is as long as the median tentacle.

Foot (Plate LXX, fig. 26) well marked, with a smooth dorsal cirrus about equal to the diameter of the body, and the comparatively prominent setigerous region has the form of a truncated cone, with two or three spines piercing the upper angle, each of these having a modification of the tip, as in every case this is bent as well as blunt. The bristles are slightly yellowish, and form a considerable group below the spines. The shaft has a ventral curve distally (Plate LXXIX, fig. 26), is enlarged and bevelled, with distinct spines along the convex (upper) border and peak, and a short terminal piece with a single bold terminal hook. The concavity below the hook is crescentic, and an abrupt edge bounds it inferiorly. The type of bristle thus differs essentially from that characteristic of *Autolytus*, since that is bifid. Moreover, the ventral cirrus is free distally, forming a broadly lanceolate process.

Grube (1860), who did so much patient and excellent work in the group, first described this form as a *Sylline*, as its frontal lobes (palpi) had coalesced, its cirri were not articulated, and the ventral were altogether absent. His description, both in regard to structure and colouration, is easily recognized, though the ventral cirrus is not absent.

Marion and Bobretzky fifteen years later (1875) published an account of the same annelid under the title of *Autolytus* (*Proceræa*) *ornatus*, as a new species. They gave a good figure, but did not add much to Grube's original description.

Langerhans (1879) found large examples of the same form at Madeira, and describes the four dorsal touches as red, the lenses of the eyes as somewhat cylindrical, the pharynx (proboscis) with thirty teeth, and the proventriculus with thirty rows of points. He shows two kinds of terminal pieces to the bristles, viz. bifid and slender simple. So far as can be ascertained, the former would appear to refer to the bristles seen on edge. Females carried white and reddish eggs.

Malaquin (1890) regards this species as synonymous with the *Autolytus* (*Proceræa*) *ornatus*, De St. Joseph,[1] a view adopted here.

Group III.—SYLLIDEA (PROPER).

Syllidæ provided with ventral cirri. Palpi free throughout their entire length. Tentacles and cirri moniliform, as if of independent articulations. Reproduction by

[1] 'Ann. Sc. Nat.,' 1885, p. 220, pl. x, figs. 98–99.

stolons (schizogamy). Malaquin divides them into two primary groups according to the presence or absence of a branchial appendage, and he separates the genera by the armature of the proboscis. Ventricule (stomach) well-developed, with lateral T-shaped pouches.

Apparently only one genus of this group occurs in Britain.

Genus LIV.—Syllis, *Savigny*, 1820.

Head with three tentacles; two pairs of tentacular cirri—all moniliform. Palpi separate throughout. Body more or less elongate, with distinct segments. Opening of the pharynx (proboscis) only with papillæ; armature a single anterior tooth dorsally. Proventriculus short, two T-shaped glands behind. Feet with moniliform dorsal and filiform or pinniform ventral cirri. Falcate bristles with a short terminal piece ending in a single hook, or with simple bristles partially, rarely throughout. Tail with two elongated cirri.

Reproduction normal, or by alternation of generations. Sexual individuals furnished only with two tentacles and devoid of tentacular cirri. Sexes similar.

1. Syllis armillaris (Müller), *Œrsted*, 1842–3. Plate LX, fig. 1—head, fig. 2, *Ioida*—head; Plate LXX, fig. 14—foot; Plate LXXIX, figs. 8, 8 *a*, 9, and 9 *a*—bristles.

Specific Characters.—Head rounded, about as long as broad, four reddish eyes obliquely placed, the anterior pair being the wider apart. Palpi ovate. Median and lateral tentacles moniliform. Body two or three inches long, slightly diminished in front and tapering to a lanceolate point posteriorly between the caudal cirri. Straw-yellow, streaked transversely by two lateral bars and a central bar of greyish brown in each segment, so that anteriorly there are three rows of dark touches. Proboscis with a single conical tooth, and ten papillæ on its margin.[1] The foot has dorsally a moniliform cirrus of 10—12 segments, barely equalling the diameter of the body, and carried alternately horizontal and erect. Setigerous region bluntly conical—bearing spines and a group of strong bristles, which in the anterior segments have a short spinous terminal piece with a simple hook at the tip, which points upward in the normal position of the foot. Ventral cirrus lanceolate.

Synonyms.

1776. *Nereis armillaris*, O. F. Müller. Zool. Dan. Prodr., p. 217.
1780. „ „ O. Fabricius. Fauna Grœnl., p. 294.
1791. „ „ Gmelin. Linn. Syst. Nat., i, pt. vi, p. 3115.
1800. *Die geperlte Nereide*, O. F. Müller. Naturges. einiger Wurm-Arten, p. 150, Tab. ix, f. 1—5.
1806. *Nereis armillaris*, Turton. Linn. Syst. Nat., iv, p. 86.
1820. *Lycastis armillaris*, Savigny. Syst. Annel., p. 45, pl. iv, f. 3.
1824. *Nereis armillaris*, Bruguière. Tabl. Encycl. Méth., Vers, I, p. 134, Tab. lv, f. 13—17.
1825. „ „ De Blainville. Dict. Sc. Nat., xxxiv, p. 436, pl. xiv, f. 2.
1828. *Nereisyllis monilaris* (and *ornata*), idem. Ibid., p. 473, t. lvii.

[1] *Vide* body-wall in Fig. 50, p. 139.

1830. *Nereis armillaris,* Bosc. Vers, ed. 2, i, p. 168.
1834. *Syllis* „ Audouin and Edwards. Annél., p. 205, pl. iv *b*, f. 1—5.
1840. *Ioida macrophthalma,* Johnston. Ann. Nat. Hist., iv, p. 231, pl. vii, f. 5, and p. 343.
1842–3. „ „ Œrsted. Kröyer's Nat. Tids., p. 118.
„ *Syllis armillaris,* idem. Ibid., p. 117.
1843. „ „ idem. Annul. Dan. Consp., p. 24, figs. 27, 90, 94, 102.
„ „ „ idem. Grönl. Annul. Dorsib., p. 181.
1844. „ „ Johnston. Ann. Nat. Hist., xiii, p. 438.
„ „ „ Thompson. Rep. Brit. Assoc., 1843, p. 273.
1844–5. „ „ Œrsted. Kröyer's Nat. Tids., p. 408.
1845. „ „ Johnston. Ann. Nat. Hist., xv, p. 145, pl. ix, f. 1, 2.
1851. „ „ Grube. Fam. Annel., pp. 61 and 132.
„ „ „ Sars. Nyt Mag., vi, p. 209.
1865. „ *amica,* De Quatrefages. Annel., ii, pp. 20 and 87.
„ „ *danica,* idem. Ibid., p. 21.
„ „ *armillaris,* Johnston. Cat. Brit. Mus., p. 191, pl. xiv *a*, f. 1, 2.
„ *Ioida macrophthalma,* idem. Ibid., p. 197, pl. xiv *a*, f. 5.
1867. *Syllis armillaris,* Malmgren. Annul. Polych., p. 42, Tab. vii, f. 46.
„ „ „ Parfitt. Trans. Devon. Assoc., ii, pt. i, p. 236.
1869. „ „ McIntosh. Trans. R. S. Edin., xxv, p. 414.
1874. „ „ idem. Ann. Nat. Hist., ser. 4, vol. xiv, p. 198.
„ *Ioida macrophthalma,* idem. Ibid., p. 198.
„ *Syllis armillaris,* Malm. Op. cit. Göteb., p. 82.
1875. „ „ McIntosh. Invert. and Fishes St. Andrews, p. 121.
„ *Ioida macrophthalma,* idem. Ibid., p. 122.
„ *Syllis armillaris,* Möbius. Jahresb. Comm. Deutsch., p. 169.
1879. „ „ Tauber. Annul. Danic., p. 94.
„ „ „ Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 535.
1883. „ „ Levinsen. Vidensk. Meddel. Foren Kjöbenh., p. 245.
1886. „ „ Harvey Gibson. Proc. Lit. Phil. Soc. Liverp., vol. xi, p. 153.
1890. *Ioida macrophthalma,* Giard. Bull. Sc. Fr. Belg., t. xxii, p. 79.
„ *Syllis armillaris,* Malaquin. Annél. Boulon., p. 35.
1891. „ „ Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 245.
1893. „ „ Levinsen. Vidensk. Ud. "Hauchs," p. 330.

Habitat.—A comparatively common species, under stones near low water-mark, St. Andrews, and ranging to the coralline ground; in the interstices of *Filigrana implexa* from the Bell Rock; under roots of Laminaria in rock pools beyond Maiden Rock; amongst *débris* from deep sea fishing; dredged in the laminarian region; under stones between tide-marks, Lochmaddy, North Uist, and in muddy fissures of rocks, near low water-mark in tracks.

Faroë (Willemoes-Suhm); shores of Norway and Sweden; Greenland (Œrsted), and Behrings Sea (Marenzeller).

Head (Plate LX, fig. 1) rounded, about as long as broad, with the reddish eyes obliquely placed on each side, the anterior and larger pair being the wider apart. Palpi somewhat ovate. Median and lateral tentacles moniliform, the former the longer.

Body two or three inches long and of sixty to seventy segments, slightly diminished in

front, tapering to a lanceolate point posteriorly, and furnished with two cirri. It is straw-yellow or slightly skin-coloured, streaked transversely by two lateral bars and a central bar of greyish-brown in every segment, the effect being that anteriorly three rows of dark touches are visible.

The proboscis has a single conical tooth anteriorly, and about ten papillæ on its margin.

The foot (Plate LXX, fig. 14) has dorsally a moniliform cirrus of ten to twelve segments tapering towards the tip, barely equalling the diameter of the body, and alternately carried horizontal and erect. Beneath is a short, bluntly-conical, setigerous region bearing a series of stout spines, a point piercing the surface at the upper angle, and a group of strong bristles (Plate LXXIX, figs. 8 and 8 *a*) with the shafts curved towards the tip, which is bevelled, and bears a terminal piece of considerable length in the anterior segments, a simple hook at the tip, and an edge covered with spikes (though these are often worn). In the posterior segments the terminal piece is shorter; indeed, in the anterior feet the upper bristles in each foot have longer terminal pieces than the lower. The hooks of the bristles point upward. Ventrally is a lanceolate lamella (cirrus).

In some a tuft of extremely fine, translucent bristles, above the jointed forms, indicates the formation of the sexual stage.

Habits.—It is a hard, stiff form, and comparatively sluggish, hiding under *débris* in a vessel, or crawling slowly over the bottom.

H. Rathke's *Syllis tigrina*[1] comes very near this form, and as subsequent authors have not identified it, in all probability it refers to a variety of *S. armillaris*.

The sexual form of this species is the *Ioida macrophthalma* of Dr. Johnston (1840) and subsequent authors. The following example appears to pertain to the same form as Dr. Johnston's, but there are certain discrepancies, so that further investigation is necessary.

Habitat.—On a laminarian blade covered with *Obelia* from the West Sands, St. Andrews, after a storm, October 25th, 1864.

Head (Plate LX, fig. 2) small, with a slender median and two lateral tentacles, and two large dark eyes.

Body about three quarters of an inch long, with the segments and feet well marked.

The foot in the first six segments presents no capillary bristles. Dorsally is the moniliform cirrus of twelve or thirteen segments, tapering to the tip, then a considerable interval, with the tip of a spine projecting from its surface. The conical setigerous region has a group of jointed bristles, with simple hooked tips (hook directed upward) as in *S. armillaris*, these tips being longer in the anterior bristles than in the median (Plate LXXIX, fig. 9 *a*). A ventral lobe occurs beneath of an elongate conical form, thus differing from the lobe in *Syllis armillaris*.

This apparently is the form described by Dr. Johnston, but there is doubt, since the long swimming-bristles are stated to be inferior and the jointed superior. This is probably due to a misprint.

[1] 'Beitr. Fauna Norweg.,' p. 165, Taf. vii, f. 9—13 (1843).

The feet (Plate LXX, fig. 15) bearing the long swimming-bristles (Plate LXXIX, fig. 9) have the region between the cirrus and the setigerous lobe more prominent, and the strong translucent and long bristles piercing a central eminence supported by a spine of a more slender type than those of the inferior lobe. These long bristles are beautifully iridescent. The conical setigerous lobe follows, its strong spine piercing the tip above the bristles, which have the hooks of the terminal piece directed upward (as usual). The ventral lobe agrees with that in front.

This is probably the *Nereis scolopendroides* of Montagu (MS. Drawings, Linn. Soc., Plate XXXVIII, fig. 1, 1808).

De Quatrefages treated this form as pertaining to a special genus.

An *Ioida* (Plate LIX, figs. 16 and 16 *a*) procured at Plymouth by Dr. Allen in September, appears to differs from any procured in the north, and probably pertains to a southern species.

The head is deeply bilobed and furnished with two very large, somewhat ovoid eyes on each side. The foot shows a crenate dorsal cirrus of considerable length. Swimming-bristles occur dorsally. The setigerous region bears a series of bristles, but as the specimen was lost, their structure is unknown. The tail has no median process. The softness of the crenated cirri would suggest a connection with *Pionosyllis prolifera* or a nearly related form.

The genus *Chætosyllis* of Malmgren (1867) refers to a nearly allied, though probably different, sexual form distinguished by the great length of the tip of the falcate bristles.

The *Tetraglene rosea* of Grube,[1] from the Adriatic, is apparently the Ioida-stage of a *Syllis*, having a moderately long slender tip to the compound bristles. Small simple bristles occur in the dorsal division, and long swimming-bristles of the typical form are found in the ventral division of the foot.

2. Syllis cucullata, n.s. Plate LX, fig. 3—head; Plate LXX, fig. 17—foot; Plate LXXIX, fig. 11—bristle.

Specific Characters.—A somewhat massive species, with four rather large eyes nearly in a square. Palpi of considerable size. Tentacles and tentacular cirri of moderate length and crenated—especially towards the tip. Foot with a bluntly-conical setigerous region and two hooked spines. Bristles rather stout, translucent, dilated and bluntly bevelled at the end of the shaft, and furnished with spines. Terminal piece short, simply and boldly hooked.

Habitat.—Under stones between tide-marks, Luccomb Chine, Isle of Wight.

Head (Plate LX, fig. 3) rounded, with two considerable palpi in front. Eyes moderately large, the anterior pair only very slightly the wider apart, so that they nearly form a square. Tentacles and tentacular cirri of moderate length—slightly moniliform.

Body comparatively firm and broad, little tapered anteriorly, but diminishing to a slender tail posteriorly. Proboscis exserted.

[1] 'Arch. f. Naturges.,' Bd. xxix, p. 42, Taf. iv, fig. 6 (1863).

The foot (Plate LXX, fig. 17) has the dorsal cirrus crenate rather than moniliform, and tapered. It arises from the dorsum without a distinct basal region. The setigerous lobe is bluntly conical, with the trend of the distal margin downward and slightly inward, and having the usual furrow for the bristles. The two spines reach the surface at the outer and upper angle and have distinctly hooked tips which point upward. The bristles (Plate LXXIX, fig. 11) have strong translucent shafts with dilated and bluntly-bevelled ends without evident serrations, though two spikes occur at the point. The terminal piece is short, ending in a simple hook, occasionally with a minute spike on the edge. The ventral lobe is broadly ovate and does not quite extend to the tip of the setigerous region.

3. Syllis Krohnii, *Ehlers*, 1864. Plate XLIX, fig. 6; Plate LXXIX, fig. 12—bristle.

Specific Characters.—Head notched in front, somewhat narrowed behind, and with two prominent, tapering, ciliated palpi. Eyes four, reddish, placed obliquely in pairs, the anterior being the wider apart. Median tentacle shorter than the lateral. It arises between the eyes, and is speckled with white dots. The dorsal tentacular cirri are longer than the lateral. All are slightly annulated and have white specks and whitish tips. Body about an inch and a half long, little diminished in front, but tapering posteriorly to a slender tail, with a median papilla and two lateral cirri. Dorsum pale anteriorly, with about a dozen madder-brown belts, the anterior being double. Ventral surface pale anteriorly, pale orange behind, and translucent towards the tail, which has two long cirri. Dorsal cirri alternately large and small. Proboscis with a denticulated edge and a prominent tooth. The setigerous region has a series of translucent bristles with a trace of serrations on the convex edge of the distal enlargement of the shaft. Terminal piece of moderate length with a simple hook at the tip and a finely spinous edge—the spine next the tip being so prominent as to give a pseudo-bifid appearance to the tip. Ventral cirrus of an elongated conical form.

Synonyms.

1864. *Syllis Krohnii,* Ehlers. Borstenw., I, p. 234, Taf. x, f. 1—4.
1865. „ „ De Quatrefages. Annelés, ii, p. 31.
1869. „ „ McIntosh. Trans. R. S. Edin., vol. xxv, p. 415, pl. xvi, f. 14.
1881. *Typosyllis Krohnii,* Langerhans. Can. Annel., Nov. Act. Leop.-Car. Deutsch. Akad., xlii, p. 102 (?).
1885. *Syllis* „ Carus. Fauna Medit., p. 225.
1906. *Syllis* (*Typosyllis*) *Krohnii,* De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 180.

Habitat.—In a tube of sand under a stone in a rock-pool near low water at Paible, North Uist. It may have crept accidentally into the tube, for it generally prefers to hide itself under *débris* in a vessel. Between tide-marks, Herm. Benham[1] states that it is abundant under stones, and forms tubes, but gives no locality. It is not common in the author's experience.

[1] 'Camb. Nat. Hist.,' ii, p. 307.

Adriatic (Ehlers); Mediterranean; Canaries (Langerhans); shores of France (De St. Joseph).

Head somewhat narrowed behind, notched in front and with two prominent tapering palpi, which are ciliated. Eyes four, reddish, placed obliquely in pairs, the anterior pair being the wider apart. The moniliform median tentacle is less elongated than the lateral cirri, and projects upward from its attachment between the eyes. It is speckled with opaque white dots. The lateral tentacles are shorter, but of similar shape to the median. The buccal segment has two cirri, the dorsal being longer than the lateral tentacles. All these organs are slightly annulated, and have white specks and whitish tips.

Body about an inch and a half long when extended, linear, very little tapered in front, but diminishing posteriorly to a slender tail which has a median papilla and two cirri. Dorsum pale anteriorly, marked transversely by more than a dozen madder-brown bands, the anterior being double. The rest of the dorsum is opaque yellowish white (from the viscera), paler at the sides and posteriorly. The under surface is pale anteriorly, pale orange throughout the greater part of its length, and translucent towards the tail.

The proboscis has its anterior edge denticulated, and stretches from the second to the sixth segment. Opposite the fourth segment of the body the organ has a prominent tooth. The proventriculus extends from the sixth to the tenth segment. The region of the canal behind shows the lateral cæca, which, springing about the twelfth, pass forward to the ninth, and backward to the thirteenth. The gut is ciliated internally and of a brownish colour.

The segments throughout are distinctly marked, each furnished with a large dorsal cirrus alternately with a smaller one. The former are a third larger, more opaque, speckled with distinct white dots, and instead of passing transversely outward as the others do, they are borne upward in a graceful manner, the tips usually curved inward or coiled in various ways. The other cirri are smaller, paler, also speckled with white dots, and longer than the diameter of the body. Both are somewhat tapered towards the tips, and at the base of the anterior cirri is a brown speck. The tail terminates in two long cirri.

The setigerous region of the foot bears a series of translucent bristles (Plate LXXIX, fig. 12), the shaft of which is slightly curved distally and the tip dilated and bevelled, a trace of serrations occurring on the convex edge. The terminal piece is of moderate length with a simple hook at the tip, and the edge of the process is finely spinous, the first spine being so prominent as to give a pseudo-bifid aspect to the tip.

The specimens were unfortunately so softened by decay after death that the outlines of the foot could not be safely drawn. The ventral cirrus forms an elongated cone.

In Ehlers' figure the alternate cirri are club-shaped, a feature not observed in the healthy specimen from North Uist; whilst, again, the cirri of the third and fourth segments were nearly equal, whereas Ehlers shows a clavate pair. All the cirri are much more distinctly articulated than in the British example.

Reproduction.—A large example, procured in August under a stone between tide-marks at Herm, had a bud at its posterior end. It agreed with the coloured figure for the most part, every alternate dorsal cirrus being long and generally carried with a coiled tip. Behind the madder-brown bars in front is a pale yellowish part and then a

region of considerable extent marked by brownish pinnæ from the intestine, and speckled with white.

The bud had a salmon-tint and was full of ova, and next day it became detached. It is wider than its nurse-stock, has a small head with four large red eyes, only two of which, however, are visible from the dorsum, though seen when the head is viewed obliquely. They subserve ventral vision. The cirri of the bud are nearly equal.

Habits.—The species is hardy. The specimen captured in August at Paible was carried to Lochmaddy, and after a few days across the Minch to Dunvegan, and thence to Murthly, where it was figured by my sister. It lived for five months in confinement fifty miles from the sea, in a tumbler of sea-water, the only change being an increase in translucency and a diminution in the size of the cirri. The sea-water was rarely changed.

When placed in a flat vessel it generally makes for the side, where it remains quiescent. It sometimes coils both larger and smaller cirri upward in repose, but generally the smaller remain extended transversely. It is fond of twisting itself and turning over and over, and occasionally coils itself into a ball, ventral surface outwards. The movements of the cirri are many and graceful, and render the species one of the most beautiful of the British Syllids.

4. Syllis macroceras, *Grube*, 1857. Plate LXX, fig. 18—foot; Plate LXXIX, fig. 13 and 13 *a*—bristles.

Specific Characters.—Head about as long as broad, with two long palpi.[1] Eyes four, dark red, arranged nearly in a rectangle, though the anterior pair are wider apart. Median tentacle longer than the lateral, but shorter than the third from the front. These processes are not articulated. Body about half an inch in length, and with 100 segments. Colour dull orange, paler in front and at the tail which has a pair of cirri. Foot with a long, tapering, smooth dorsal cirrus; the setigerous region is conical, but the inferior slope trends away more rapidly than the superior. Spines with a blunt, curved tip. Bristles translucent, little modified in each group, with a short terminal piece which shows a well-marked hook at the tip and no trace of spines. The dilated distal region of the shaft is short and has indications of serrations on the bevelled edge. Ventral cirrus large, broadly ovate, and does not reach the tip of the setigerous region.

Synonyms.

1857. *Syllis macroceras,* Grube. Annul. Œrsted (Nat. Foren. Vidensk. Meddel.), iii, p. 28.
1865. „ „ De Quatrefages. Annelés, II, p. 28.
1869. „ *macrocera,* McIntosh. Trans. R. S. Edin., xxv, p. 416, pl. xv, f. 12.

Habitat.—Procured under a stone near low water-mark, Lochmaddy, North Uist; in the Gouliot Caves, Sark, under stones; and in the tidal region at Whitecliff Bay, Isle of Wight.

A widely distributed form—ranging to St. Croix, Christiansted (Grube).

Head about as long as broad, with two long palpi in front. Median tentacle longer than the two lateral, but shorter than the third from the front. These organs are not

[1] Grube states that they are connate to the middle, but they were not so in these examples.

articulated. Eyes four, dark red, arranged nearly in a rectangle, though the anterior pair are wider apart.

Body about half an inch in length, of a dull orange-yellow colour, paler in front and at the tail, which has a pair of cirri. The segments are about 100.

Foot (Plate LXX, fig. 18) with a long, tapering, smooth, dorsal cirrus. The setigerous region is conical, the inferior slope trending away more rapidly than the superior. The spines, which pierce the upper angle, often have a blunt curved tip. The translucent bristles (Plate LXXIX, figs. 13 and 13 *a*) have a very short terminal piece with a well-marked hook at the apex, whilst the abbreviated edge shows no traces of spikes. These terminal pieces do not vary to the same degree as, for instance, in *Syllis armillaris*. The dilated distal region of the shaft is short with indications of serrations on the bevelled edge. The ventral cirrus is large, broadly ovate, and does not reach the tip of the setigerous region.

The long simple (swimming-) bristles are developed in the posterior region of one from Lochmaddy, indicating the formation of a bud with the reproductive elements.

In transverse section the ventral longitudinal muscles are separated by the nerve-cords, which are comparatively large and have the basement-tissue, hypoderm, and cuticle externally.

This form seems to agree with Grube's description in regard to the arrangement of the eyes and the form of the head, but the palpi were not connate. The author points out the shortness of the terminal pieces of the bristles, which he describes as almost equilateral, and the absence of articulations in the cirri, thus differing from all except *Syllis longocirratus*, in which, however, the tip is dilated. His example came from St. Croix, Christiansted.

5. Syllis Cunninghami,[1] n. s. Plate LXX, fig. 19 and 19 *a*—foot; Plate LXXXIV, fig. 6—bristle.

Specific Characters.—Head apparently typical, though eyes not seen. Tentacles and cirri articulated. Body normal. Attached posteriorly was a male bud considerably larger in diameter than the parent-stock. Foot anteriorly has a somewhat stout tapered cirrus of about seventeen segments. Setigerous region rather narrow and elongate when seen from above; obliquely conical in lateral view. Next the spines are two bristles larger than the others and apparently devoid of terminal pieces. The smaller bristles beneath are of average size, and have short terminal pieces—spinous on the edge and with a simple hook at the end. The ventral cirrus is narrow and elongate, but does not reach the tip of the setigerous region.

Habitat.—In the tracks of *Spio* in fissures of the hard rocks between tide-marks. Cobo Bay, Guernsey, 1868.

Head apparently typical, but the eyes had disappeared before it was critically examined. The tentacles and tentacular cirri are of average length and articulated.

Body about three quarters of an inch in length and normal. The posterior region

[1] Named in honour of my late valued and eloquent colleague, Principal John Cunningham, of St. Mary's College, St. Andrews.

was occupied by an opaque bud distended with male elements, and much more bulky than the caudal region of the adult in front.

The foot (Plate LXX, fig. 19) anteriorly shows a somewhat stout tapered cirrus of about seventeen segments. The setigerous region is rather narrow and elongate when seen from above, obliquely conical in lateral view. The two spines, which have a blunt tip, pierce the upper angle. Next these are two bristles much longer than the others, and apparently devoid of terminal pieces. The group of smaller bristles of the average size beneath show short tips with a simple hook and a spinous edge (Plate LXXXIV, fig. 6). The ventral cirrus is narrow and elongate, but does not reach the tip of the setigerous region.

The bud was nearly ready for separation. The foot (Plate LXX, fig. 19 *a*) has a dorsal cirrus of about thirteen articulations with a tuft of slender, tapering, swimming-bristles beneath. The setigerous region has a similar outline to that of the nurse-stock, the spines end in a probe-tip; the two upper bristles are larger and devoid of terminal pieces, and the inferior bristles correspond with those in the adult. The ventral cirrus is also similar.

This species presents an intermediate condition to that of *Syllis gracilis* and *Syllis spongicola*, in which a further differentiation of the tip of the shaft of the enlarged bristles occurs. Subsequent investigation may show a closer relationship with either of these than at present can be made out. The occurrence of these enlarged bristles anteriorly is noteworthy.

6. SYLLIS BREVICIRRATA, N. S. Plate LXX, fig. 20—foot; Plate LXXIX, figs. 14 and 14 *a*—bristles.

Specific Characters.—Head resembling that of *Syllis gracilis*. Foot with a short dorsal cirrus of about nine segments. Setigerous region bluntly conical, the tips of the spines slightly dilated and bevelled. Bristles stout, terminal pieces comparatively short, with a spinous edge and a simple hook at the tip. Ventral cirrus tongue-shaped, scarcely projecting so far as the tip of the setigerous region.

Habitat.—Between tide-marks, Herm, August, 1868.

Head apparently similar to that of *Syllis gracilis*.

Body about three eighths of an inch in length, tapered to a delicate tail furnished with two caudal cirri posteriorly, but only slightly diminished towards the head. The colour has disappeared.

The foot (Plate LXX, fig. 20) has a short and rather thick dorsal cirrus of about nine segments. The setigerous region is bluntly conical with the tips of the spines, which are slightly dilated and bevelled, projecting at the upper angle. The bristles (Plate LXXIX, figs. 14 and 14 *a*) are somewhat stout, with curved shafts and dilated and bevelled tips. The terminal pieces are comparatively short and have a simple hook at the tip with a spinous edge below. The tongue-shaped ventral cirrus scarcely projects so far as the tip of the setigerous lobe, and thus is shorter than in *S. gracilis*.

Posteriorly the same type of bristle is found in the feet, but further examination may show that certain sexual forms of *S. gracilis*, to which this form is evidently allied, may vary in this respect.

The relationships of this *Syllis* appear to be with such forms as *Trypanosyllis zebra* and perhaps *S. gracilis*.

7. Syllis spongicola, *Grube*, 1855. Plate LI, fig. 4; Plate LXX, fig. 21—foot of bud; Plate LXXIX, fig. 15—bristle.

Specific Characters.—Head comparatively small, with two long and large palpi tapered distally. Eyes four, small, the anterior the larger, accompanied or not by two pigment-dots anteriorly. Tentacles and tentacular cirri of moderate length, articulated. Body of about 76—100 segments, pale orange, translucent yellowish or sand-coloured, translucent bluish towards tip of tail, and from an inch to an inch and a half or more in length. Anal cirri short. Proboscis with ten soft papillæ and a tooth. Proventriculus about the tenth segment, and occupying seven segments. Foot with a dorsal cirrus of 25—30 segments. Bristles simple, of a peculiar hamate character, shaped somewhat like an abbreviated bill-hook. Ventral cirri leaf-shaped, not reaching the tip of the setigerous region.

Synonyms.

1829. *Nereis teticola*, Delle Chiaje. Mem., pp. 175, 195, Tav. lxvi, f. v (*?*).
1841. „ „ idem. Descrizione, v, p. 103.
1851. *Syllis tethycola*, Grube. Fam. Annel., p. 62.
1855. „ *spongicola*, Grube. Arch. f. Naturg., p. 104, pl. iv, f. 4.
1864. „ „ idem. Insel. Lussin, p. 84.
1865. „ *spongicula*, De Quatrefages. Annel., II, p. 88.
1868. „ *hamata*, Claparède. Annel. Nap., p. 195, pl. xv, f. 2.
1870. „ *oligochæta*, Bobretzky. Annel. de la Mer Noire, f. 51 and 52 (*fide aut.*).
1875. „ *spongicola*, Marion and Bobretzky. Ann. Sc. Nat. 6e sér., t. ii, p. 24.
1878. „ *violacea-flava*, Grube. Ann. Semp., p. 115.
„ „ *hamata*, Langerhans. Zeitsch. f. w. Zool., xxxiv, p. 128.
1879. „ *spongicola*, Marion. Ann. Sc. Nat., 6e sér., t. viii, art. 7, p. 19, f. 4—4 *e*.
1881. *Haplosyllis hamata*, Langerhans. Nov. Act. Leop.-Carol. Akad., p. 102.
„ „ *aurantiaca*, Eisig. Mitt. Zool. Stat. Neap., II, p. 270.
1885. *Syllis hamata*, Carus. Fauna Medit., p. 225.
„ „ *spongicola*, idem. Ibid., p. 228.
1886. *Haplosyllis spongicola*, Albert. Mitt. Zool. Stat. Neap., Bd. vii, pp. 1—20, pl. i, f. 1—17.
„ „ (*Syllis*) *hamata*, Langerhans. Zeitsch. f. w. Zool., xxxii, p. 527, Taf. 31, f. 1 *a* and 1 *b*.
1887. *Syllis* (*Haplosyllis*) „ De St. Joseph. Ann. Sc. Nat., 7e sér., i, p. 142, pl. vii, f. 5—8.
1893. *Haplosyllis hamata*, Marenzeller. Zool. Ergebn., II, p. 7.
1895. „ „ De St. Joseph. Ann. Sc. Nat., 7e sér., tom. xx, p. 185.
1900. *Syllis* (*Haplosyllis*) *djiboutiensis*, Gravier. Nouv. Arch. Mus., 4e ser. ii, p. 147, pl. ix, f. 3 (?).
1905. „ *spongicola*, Willey. Rep. Pearl Fish. Ceylon, IV, p. 269.
„ „ „ Graeffe. Arbeit. Zool. Stat. Triest, xv, p. 323.
1906. „ (*Haplosyllis*) *hamata*, De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 178.

Habitat.—Procured at Jersey by Mr. Hornel. Millbay Channel, Plymouth Sound (Dr. Allen).

It was first found by Professor Grube at Triest; whilst Claparède got it at Naples; Bobretzky in the Black Sea; the same author and Marion at Marseilles. Shores of France (Baron de St. Joseph). Ceylon (Willey). Canaries; Madeira—between tide-marks amongst algæ—rarely (Langerhans).

Head comparatively small, of greater transverse than antero-posterior diameter, and with four eyes, the anterior and larger being the wider apart. An additional pigment-dot occasionally occurs anteriorly. The median tentacle is as long, if not longer, than the longest cirrus and moniliform like all the cirri. The lateral are shorter. Palpi rather large, often tapered anteriorly. Tentacular cirri considerably shorter than the median tentacle, the upper longer than the lateral tentacles, the ventral shorter.

Body of the typical form, segments 76—90, considerably tapered posteriorly, and ending in two cirri with a median papilla. The general hue is translucent yellowish with a brownish tinge from the intestine posteriorly, the tail, however, being translucent bluish.[1] The proboscis occupies the first eleven segments, the proventriculus commencing in the twelfth, and extending for seven segments behind it.

The first foot has the bifid strong hooks with occasionally a simple one (Claparède). The typical foot presents the comparatively short tapering cirrus. Beneath is the short obliquely-conical setigerous region with the spines passing to the upper angle. The bristles are simple, of a peculiarly hamate character (Plate LXXIX, fig. 15)—somewhat like a bill-hook, often bifid at the tip, the distal spikes apparently being longer in those uninjured by wear. The spines generally present a curved tip. The ventral cirrus is rather slender and conical, and its tip does not reach the extremity of the setigerous region.

In a pelagic female bud the foot (Plate LXX, fig. 21) has the simple bristles in the setigerous region somewhat longer, whilst a long tuft of swimming-bristles occurs beneath the dorsal cirrus. A spine, moreover, supports the base of these.

In a new Syllid recently described by Gravier[2] from Madagascar the bristles somewhat resemble the foregoing, each being simple, and terminating in an enlargement obliquely bevelled, as if the distal piece had been lost.

Body.—Marion and Bobretzky note that the colour is variable, the young being very transparent, whilst the adults are of a fine orange, sometimes opaque.

Reproduction.—De St. Joseph[3] found that at the reproductive period the eggs fill segments 28—81, and that natatory bristles appear, whilst the segmental organs are indicated by two black points. The latter organs open on the one hand into the body-cavity, and on the other at the base of the feet, the apertures in each case being ciliated. The ova give the specimens a violet hue. He quotes Albert as having seen a bud without a head, detached, which swam away. Malaquin[4] refers to the same quotation, and calls the bud acephalous, and he has followed its further history.

[1] Claparède states that its pigment is continuous.

[2] 'Compt. Rend. 6e Congrès internat. Zool., Berne,' 1904, p. 372, fig. 5.

[3] 'Ann. Sc. Nat.,' 7e sér., p. 143.

[4] Op. cit., 1893, p. 333.

After swimming about it settles on a stone or on the bottom, and gradually the anterior end develops a head, first after the *Tetraglene* type, then that of *Chætosyllis*, thereafter a median and two lateral tentacles appear as in *Syllis amica*. The *Ioida* stage follows, with moniliform tentacles and cirri.[1] Moreover, he found that the head, if removed, could be reproduced. The bud swims actively about and by-and-by discharges the sexual elements. The long natatory bristles are moved by muscles—as in *Autolytus*. Malaquin found only male buds in what he calls *Syllis spongicola*, and large female buds in *S. hamata*. Langerhans describes the sperms as reddish, and the eggs as violet. Lo Bianco[2] states that Neapolitan specimens are ripe in September. In the sexual forms a pair of pigment-spots occurs on each segment, and Malaquin considers that they are veritable eyes, with refringent granules and rods, vitreous bodies and pigment.

This is one of the many species science owes to the laborious Grube of Breslau, who in 1855 described it from an orange-coloured sponge, at Triest. He recognized most of its important features.

The *Nereis teticola* of Della Chiaje (1829) is either this or an allied species somewhat approaching *Syllis armillaris*, he says, in general outline.

Claparède (1868), in the specific description of this form (his *S. hamata*), observes that the dorsal cirri are slender and short, not attaining the diameter of the body. The form of the hooks he associated with its habits in tubes amongst *Balani*. He was uncertain whether it bored such tunnels or took advantage of those of *Polydora* and other forms. He thought it different from Grube's *S. spongicola*, though the grounds for his opinion do not now seem to be sufficient. He mentions glands with transparent processes (boyaux) near the bases of the dorsal cirri.

The *Syllis setubalensis* of the 'Challenger'[3] is probably only a variety of this species.

A variety (*tentaculata*) was found by Marion (1879) at Marseilles, having rather long tentacles. He gives a good figure of the extended proboscis with ten soft papillæ and the median tooth, which seems to be large.

Verrill figures a *Syllis spongiphila* in the collections of the 'Albatross,' which seems to approach this species, but no description has yet been studied.

Langerhans (1879) considers this a representative of one of the oldest and simplest forms amongst the Syllidæ.

Marion and Bobretzky pointed out[4] the identity of *Syllis hamata*, Claparède, with Grube's species. They mention that the young are transparent (translucent?), whereas the adults are opaque orange.

Albert (1886) has given a detailed account of the budding of this form at Naples, the stolons occurring posteriorly from the thirtieth to the sixty-third segment, the bud being broader than the nurse-stock, furnished with a pigment speck (ocular?) at the base of the dorsal cirrus, and containing either ova of a violet hue or sperms. The bud is thrown off without a head but with long swimming-bristles. The author notes the degeneration of the muscular walls of the body, the shrinking of the alimentary canal,

[1] All these are but stages of one process.

[2] 'Mitt. Zool. Stat. Neap.,' xiii, p. 486.

[3] 'Annel "Challenger,"' p. 195, pl. xxx, figs. 5 and 6; pl. xxxiii, fig. 6; and pl. xv *a*, figs. 16, 17.

[4] Op. cit.

the differences in section of the ordinary and the swimming-bristles, and the structure of the pigment-spots and glands in the sexual bud.

In 1893 De St. Joseph observed that he had found specimens of thirty-eight and forty-six segments, with orange segmental organs, and filled with rose-coloured sperms, and acephalous buds of twenty-eight and seventeen segments loaded with sperms and having swimming-bristles. A spot of violet pigment occurred at the base of some of the dorsal cirri. He did not consider the *Syllis hamata* of Claparède identical with *Syllis spongicola*, Grube.

The structure of the proventriculus of this species is described by Malaquin[1] as similar to that of *Syllis hyalina*, Grube, which is intermediate between the Autolyti and the Eusyllides. The intimate structure of the muscular columns is, however, more complex, for four or five transverse striations are present.

The same author[2] describes and figures the ovaries of this species—in the lateral regions of the body—as having a large cæcal blood-vessel in their midst. Each is surrounded by a follicular membrane.

In Gravier's *S. djiboutiensis*, which resembles this form in general aspect, the dorsal cirrus is shorter, and the ventral still more so, whilst the bifid tip to the distal end of the bristle is noteworthy.

8. Syllis cornuta, *H. Rathke*, 1843. Plate LXX, figs. 22–22 *b*—feet; Plate LXXIX, figs. 16–16 *b*—bristles.

Specific Characters.—Head transversely ovoid, with four eyes in a semicircle. Palpi elongate ovoid, soldered at the base. Median and lateral tentacles and the tentacular cirri long and moniliform. Dorsal cirri in the middle of the body have 17—20 or more articulations. Body moderately elongated. Foot with a dorsal cirrus gently tapering from a point a little above the base to the tip. Setigerous region conical, bearing one or more very large spines, and a series of falciform bristles, the bevelled ends of the shafts being smooth. The upper bristles have very long narrow terminal processes, which are slightly bent, like a curved bistoury, in lateral view, and minutely bifid at the extremity. The lower bristles have shorter hooked tips spinous along the edge, the last spine being the secondary process beneath the hook. The ventral cirrus is sausage-shaped with a tapering tip extending as far outward as the setigerous region.

Synonyms.

1843.	*Syllis cornuta,*	H. Rathke.	Beiträge z. Fauna Norw., p. 164, Taf. vii, f. 12.
1851.	„	„	Grube. Fam. Annel., pp. 61 and 132.
1865.	„	„	Johnston. Cat. Brit. Mus., pp. 192 and 342.
„	„	„	De Quatrefages. Annel., II, p. 23.
1867.	„	„	Malmgren. Annul. Polych., p. 43, Taf. viii, f. 45.
1869.	„	„	McIntosh. Trans. R. S. Edin., xxv, p. 415, pl. xvi, f. 15.
1874.	„	„	Malm. Op. cit. Göteb., p. 82.

[1] 'Mitt. Zool. Stat. Neap.,' pp. 228 and 229.

[2] Op. cit., 1893, p. 377.

1875. *Ehlersia sexoculata,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér. t. ii, p. 20.
1879. „ „ Marion. Ibid., t. viii, p. 18, pl. xv, f. 3.
„ *Syllis cornuta,* Tauber. Annul. Danic., p. 94.
1885. *Ehlersia cornuta,* Langerhans. Zeitsch. f. w. Zool., Bd. xl, p. 247.
„ „ „ Carus. Fauna Medit., p. 228.
1890. „ *sexoculata,* Giard. Bull. Sc. Fr. Belg., t. xxii, p. 78.
1902. „ *cornuta,* McIntosh. Ann. Nat. Hist., ser. 7, vol. ix, pp. 297 and 298.
1903. „ „ idem. Mar. Invert. S. Africa, vol. iii, p. 37.
1904. „ (*Ehlersia*) *cornuta,* Allen. Journ. M. B. A., N.S., vol. vii, p. 219.
„ „ *cornuta,* Soulier. Trans. Inst. Zool., Univ. Montpellier, 2e sér., Mem. 14, p. 39.
1906. *Ehlersia sexoculata,* De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 181.

Habitat.—Dredged off the Hebrides by Dr. Gwyn Jeffreys in June and July, 1866, and in 100 fathoms, St. Magnus Bay, Shetland, in the same months in 1867; deep-sea fishing off St. Andrews (E. and R. M.); off Bundoran, Donegal, and Berehaven, Ireland (R. I. A. Exped.). By 'Porcupine,' 1869, 20—25 fathoms, No. 18.

Mediterranean, shores of France. Finmark and Norway. South Africa. Spitzbergen. Madeira.

Head transversely ovoid with the four eyes in a large semicircle, or as Rathke puts it in a single series. Palpi long, soldered at the base. Median and lateral tentacles long and monilified. Tentacular cirri likewise long.

Body about an inch long and having about 100 segments. The colour is yellowish-white.

The foot (Plate LXX, figs. 22, 22 *a*, and 22 *b*) in the anterior region bears dorsally a longer cirrus than posteriorly, the former having about seventeen articulations, the latter about twelve. In both the organ is tapered. The setigerous lobe is a truncated cone, bifid at the tip, with the spines (one is large) piercing the upper angle. Of these about four are present in front and two posteriorly. The bristles (Plate LXXIX, figs. 16, 16 *a*, and 16 *b*) are characteristic. Whilst the shafts correspond with the type the tips of the dorsal series quite differ, being elongate, tapered, slightly curved, and ending in a minutely bifid tip. There are three or four of these in each foot. The edge is minutely spinous. In the posterior feet these processes are shorter and stouter. The other bristles have a short terminal piece, minutely bidentate, and with a spinous edge (Plate LXXIX, figs. 16 *a* and 16 *b*). Slight differences exist between those procured in Donegal Bay (fig. 16 *b*) and those from Shetland (fig. 16), the bifid condition of the bristles in the latter being most distinctly marked, as it also is in the posterior bristles of the southern forms.

The inferior lobe is sausage-shaped anteriorly, and has a downward curve, its convexity being dorsal. The tip extends as far outward as the fleshy part of the setigerous region. In the posterior feet the lobe is more pointed.

The characteristically large spines of this species are a feature of moment, especially towards the posterior region, where one is so prominent. In certain varieties the elongation of the ventral cirrus is noteworthy.

It is doubtful whether the form mentioned by Dr. Johnston was this species. In Dr.

Malmgren's figure[1] the dorsal cirrus is furnished with double the number of segments, and the bristles are not characterized by the minutely bidentate apex; moreover, only a profile or linear view of the elongated kind is given. It is not always easy to make out the bidentate condition of the bristles, and there can be little doubt that the structure of the bristles, especially in the earlier papers, was imperfectly known. Indeed, it requires special care to observe that the bifid condition is simply due to the well-developed nature of the last spine of the row along the edge of the terminal blade. The condition is less distinct, for instance, than that shown in the figure of Marenzeller.

The Norwegian examples collected by Canon Norman are smaller than those procured by the 'Porcupine,' and the characters of the bristles more minute.

This species has certain relationships with *Syllis prolifera*, Krohn (*S. lussinensis*, Grube, and *S. Armandi*, Claparède). The presence of the simple bristle in the anterior (twenty-one) segments of Krohn's species, however, differentiates it, but further investigation may clear up doubts.

There seems to be variety as to the number of segments in the dorsal cirri.

De Quatrefages (1865) constituted a genus *Ehlersia* for the *Syllis sexoculata* of Ehlers from Martinsica, which has six eyes, three tentacles, and four tentacular cirri, with long articulated dorsal cirri, and which may fairly be included under Rathke's species.

Giard (1890) is of opinion that the *Typosyllis alternosetosa* of De St. Joseph is a variety of this form.

De St. Joseph (1906) is inclined to consider the *Syllis sexoculata* of Ehlers as this form, and there is much to be said in favour of such a view.

8 *a*. Syllis cornuta (?) var. Collingsii.[2]

Habitat.—Caught in the surface tow-net off the Island of Sark, July, 1869, by Mrs. Collings, of Sark.

Head with the general aspect of *Syllis cornuta*; eyes comparatively small, arranged in a semicircle, that is, the anterior and larger pair lying obliquely to the exterior of the posterior. In an example two small posterior eyes were present on one side. The tentacles and tentacular cirri are moniliform, but shorter than in *S. armillaris*.

Body little tapered anteriorly, more so posteriorly, where it terminates in two short cirri, which are larger than those adjacent, and of nine or ten segments. The longest dorsal cirri are in front.

The foot (Plate LXX, fig. 16) presents dorsally a moniliform tapering cirrus, which according to its position has its segments ranging from ten to twenty. The setigerous lobe forms an elongated cone with a bevelled tip, the two spines passing to the upper border. The bristles (Plate LXXIX, fig. 10) have slender shafts, curved, dilated, and bevelled at the tip, while the terminal piece is comparatively long and has a minutely bifid tip and the edge finely spinous. The ventral cirrus is lanceolate and elongate, with a slight swelling above its base.

[1] 'Annul. Polych.,' p. 43, Taf. viii, fig. 45 *c*.

[2] Named after Mrs. Collings, of Sark, the kind friend of every zoologist landing on the island.

The somewhat long terminal process of the bristles and the presence of a minutely bifid tip in this form, which may be a young example, would show its relationship with *Syllis cornuta*, H. R., but the upper bristles did not attain the length of the ordinary examples of that species, a feature, however, which may be due to age. Moreover, the prominent spines of the typical species were not seen. It has been thought desirable, however, for the present to regard it as a variety of *Syllis cornuta*.

9. Syllis gracilis, *Grube*, 1840. Plate LI, fig. 3; Plate LXX, figs. 25 and 25 *a*—foot; Plate LXXIX, figs. 17–17 *c*—bristles.

Specific Characters.—Head broader than long, with four small black eyes, the anterior pair the larger and wider apart. Palpi slightly tapered and transversely striated. Median tentacle has about eighteen segments, the lateral twelve, and the tentacular cirri eighteen. Body of numerous segments (eighty or more) and of a brownish hue, paler anteriorly, the intestine giving a dark brownish colour to the central region from the proventriculus backward. The buds are purplish. The anterior cirri have from twenty to twenty-five segments, but they soon diminish to fifteen or sixteen.

Two anal cirri of moderate length (thirteen segments) with a distinct median papilla ventrally. The anterior border of the proventriculus is at the twelfth segment, and it reaches to the seventeenth. The foot in the anterior third has a dorsal cirrus of sixteen segments, tapering towards the tip. Setigerous region forms a short cone. The enlarged distal ends of the shafts of the bristles are smooth. The distal piece is long, spinous on the edge, terminating in a well-marked hook with a minute tooth beneath. The distal pieces diminish in length from above downward. The ventral cirrus is long and lanceolate, projecting considerably beyond the tip of the setigerous region. The middle region of the body has two greatly-developed bifid bristles, the strongest of which has no intermediate teeth in the fork, whilst the other may have an intermediate spike or two. In the posterior third a tendency to the growth of a separate spur at the tip appears in one of these. In the posterior fourth a single strong bristle occurs, the end of the shaft being bevelled, and a stout terminal piece appended, its tip usually being indistinct. It is flanked on each side by a bristle of the type seen in front, viz., with a long terminal piece and a bifid tip. The stout bristles gradually disappear so that in the last twelve segments or thereabout only the falciform bristles remain.

Synonyms.

1840. *Syllis gracilis*, Grube. Akt. Echin., etc., p. 77.
1841. „ „ Delle Chiaje. Descriz., iii, p. 95; v, p. 101.
1851. „ „ Grube. Fam. Annel., pp. 61 and 132.
1864. „ „ Claparède. Glanures, p. 77, pl. v, f. 3.
1865. „ „ De Quatrefages. Annel., II, pp. 24 and 644.
1868. „ „ Claparède. Annel. Nap., p. 193, pl. xv, f. 3.
1875. „ „ Marion and Bobretzky. Ann. Sc. Nat., 6^{e} sér., t. ii, p. 23.
1879. „ „ Webster. Trans. Albany Inst., ix, p. 17, f. 6.

1879. *Syllis gracilis,* Webster. 32nd Rep. N. Y. Mus. Nat. Hist., p. 109.
1881. „ „ Langerhans. Canar. Annel., Nov. Acta Leop.-Car., p. 105.
1885. „ „ Carus. Fauna Medit., p. 228.
1887. „ „ De St. Joseph. Ann. Sc. Nat. 7e sér. i, p. 158.
1890. „ „ Malaquin. Annél. Boulonn, p. 35.
1895. „ „ De St. Joseph. Ann. Sc. Nat., 7e sér., xx, p. 190, pl. xi, f. 4—7.
1900. „ „ Gravier. Nouv. Arch. Mus., 4e sér., ii, p. 150, pl. ix, f. 4—6.
1901. „ „ Mesnil. Comp. Rend. de Soc. Biol., t. liii, p. 268.
1904. „ „ Soulier. Trav. Inst. Zool. Mont., 2e sér., Mem. 14, p. 31.
„ „ (*Ehlersia*) *gracilis,* Allen. Journ. M. B. A., n.s., vol. vii, p. 219.
1905. „ *gracilis,* Willey. Rept. Ceylon Pearl F., iv, p. 269.
1906. „ „ De St. Joseph. Ann. Sc. Nat. 9e sér. t. iii, p. 182.

Habitat.—Under stones in the Gouliot caves, Sark, July, 1868. Common elsewhere in the Channel Islands. Deep-sea fishing, St. Andrews (E. M.). Millbay Channel, Plymouth Sound (Allen).

Marseilles (Marion and Bobretzky). Port-Vendres (Claparède). Shores of France (De St. Joseph). Naples (Claparède). Canaries (Langerhans). Black Sea (Czerniavsky). Red Sea (Gravier). On oysters at low water on the Virginian coast (Webster). Ceylon (Willey).

Head broader than long, with four small black eyes, the anterior pair the wider apart. The palpi are slightly tapered and transversely striated, as Claparède states, and this is probably due to muscular bands. The median tentacle has about eighteen segments, the lateral twelve, the tentacular cirri about eighteen, and the dorsal cirri of the anterior region twenty to twenty-five, those of the posterior about nine (Claparède gives twelve to fifteen).

Body has 150 segments, twenty-eight belonging to a sexual stolon of nearly a millemetre in diameter (Claparède). The colour is brownish, whereas that of the bud is purplish. The brownish hue is due to the presence of fine, interrupted striæ on the dorsum, best marked in the anterior twenty-five segments. De St. Joseph gives the proventriculus seventy-four rows of points.

The foot (Plate LXX, fig. 25) anteriorly has a moderately elongated dorsal cirrus, tapering towards the extremity, moniliform throughout and consisting of about sixteen segments. The setigerous region forms a short cone, the spines passing to a papilla at the upper angle. The bristles are stout, translucent, curved below the dilated end of the shaft, which is bevelled to an acute point but not spinous (Plate LXXIX, fig. 17). The distal piece is long, spinous on the edge, and ends in a well-marked hook with a minute tooth beneath, as in *Pionosyllis*. The terminal piece diminishes in length from above (fig. 17) downward (figs. 17*a*, 17*a*[1]). The ventral cirrus is long and lanceolate, projecting considerably beyond the tip of the setigerous region.

The posterior feet differ from the foregoing in the shorter and thicker dorsal cirrus, which has only about nine segments, in the shorter cone of the setigerous region which superiorly has three strong spines which do not pierce the surface superiorly, and two strong bristles (Plate LXXIX, figs. 17 *b*, 17 *c*) with a slightly bifid tip, which may be a modification of the dilated end of the shaft in the ordinary form. Their great strength points to a special function—possibly amongst the *Balani* so common in the Gouliot caves.

The ventral lobe is also shorter and distinctly tongue-shaped, being narrower at the base and tip than in the centre.

The middle region of the body is characterized by the great development of the strong bifid bristles,[1] two of which are present in each foot (Plate LXX, fig. 25 *a*), the jointed bristles having disappeared. The strongest of these have no intermediate teeth in the fork, others present a single oblique spike, while a few have more than one point. Many have no distinct points though the fork is slightly rough. These two strong bristles continue to the posterior third, where a tendency to the development of a separate spur-like process, instead of a limb of the fork, occurs. This is generally better marked in one than in the other (of the two in each foot).

In the posterior feet (about the posterior fourth) a single strong bristle occurs in the centre, the end of its shaft is bevelled, and a stout terminal piece is appended, the tip of which is generally indistinct. It is flanked on each side by nine bristles of the type of those in front, viz., with a long terminal piece bifid at the tip. The stout bristles of the feet behind the foregoing segments gradually disappear, the first and then the second, until only jointed bristles remain, one of which, however, is stouter than the others, and has a shorter terminal piece. Finally in the last twelve or more segments only the slender bristles with the elongated and bifid terminal pieces are found.

In an example from Plymouth eight segments, and the cirri of the tail, were in process of reproduction.

Claparède (1864)[2] describes the spines as having a button-like tip as in *S. Armandi*. He found a papilla between the caudal cirri, as in certain other species, and mentioned that the blood, usually colourless in Syllids, is in this species of a beautiful rose colour.

This author[3] mentions that the term *Syllis gracilis* was first used by Delle Chiaje, but as the species is indeterminable Grube's name stands. The same term was adopted by Schmarda for a species from the Cape after Grube had employed it. He drew special attention to the glands with coiled contents near the dorsal cirri, and to the coiled structures in the latter.

Langerhans (1879) adds an interesting note on the arrangement of the bristles (simple, mixed, and compound) in the various segments of this species, but it is not constant in the several examples. He thought the stolons had the form of *Ioida*.

De St. Joseph (1886) found his example at Dinard in the midst of *Cynthia glomerata*. He describes the proboscis as elongated, stretching from the second to the eleventh segment, the conical tooth in front with a poison canal. The proventriculus extends from the twelfth to the fifteenth segment. He criticises Czerniavsky, who made four species out of it in the 'Fauna of the Black Sea' (Mare Ponticum). In his later note (1895) he adds further information. He observes that the first twenty-seven segments have bristles with a long bidentate terminal piece, whereas from the twenty-eighth to the forty-fourth segment these are replaced by two stout bristles with a forked point (ypsiloïde), with

[1] Claparède states that the ypsiloid bristles commence from the nineteenth to the twenty-sixth segment. 'Annel. Nap.,' p. 194.

[2] This author thinks the species approaches *Syllis oblonga*, Keferstein, and *S. tigrina*, Rathke, though they differ in palpi and bristles. 'Beobach.,' pp. 52 and 82.

[3] 'Annel. Nap.,' p. 193, etc.

three minute points between. In segments 45—53 stout bristles with a simple terminal piece are present. In segments 54—62 are bristles like those in front (with long slender terminal pieces), besides two simple bristles, the one with an entire point, the other with a bidentate tip.

In large examples (5 cm. long and 125 segments) from Villerville there were in front twenty-seven segments with long bidentate tips to the bristles; the next fifty-six segments with two ypsiloïde bristles; the twenty-five following with one ypsiloïde bristle, and one bristle with a short unidentate tip; and the last sixteen with a long bidentate tip to the bristles, as in the anterior segments. He also met with an example in which regeneration had taken place, but to a less degree than in Mesnil's example.

He dredged[1] an epitokous female of 32 segments, somewhat resembling his *Syllis alternosetosa*, at Cannes. It had a rounded head, with four enormous eyes, and three slightly articulated tentacles. The first segment bears a dorsal cirrus of ten articulations, a ypsiloïde bristle, a bidentate one, and a ventral cirrus. The bristles vary posteriorly, and swimming-bristles with hooked points were present from the second to the thirtieth segment. A median papilla occurred between the anal cirri.

Mesnil[2] relates a case of regeneration of the head with four eyes furnished with lenses, and the anterior region with complete pharynx, proventriculus, and other organs. The posterior part of the new region, that is, where it joined the old, presented very indistinct segmentation. He notes that about the seventh regenerated segment anteriorly a simple bristle, curved and bifid at the extremity, occurred, whereas he had not found such in the ordinary or unregenerated example.

Gravier (1901) pointed out the presence of a third kind of bristle, viz., one with a spike on the dilated end of its stout shaft, and a short distal piece. Such may indicate a stage in the modification of the stronger forms devoid of the terminal piece. This author also describes and figures a female stolon of thirty-five segments and 10 mm. in length. In this the usual conditions are found. The long natatory bristles are tapered towards the extremity and hooked. The stout ventral bristles show a tooth between the bifid ends and minute spikes in the hollow.

A female bud, with four enormous eyes, and greyish eggs in the body-cavity, has more recently (1906) been mentioned by De St. Joseph.

10. Syllis Buskii,[3] n. s. Plate LXX, fig. 23—foot; Plate LXXIX, figs. 18 and 18 *a*—bristles.

Specific Characters.—Head apparently typical and with large palpi. Eyes had disappeared in the preparation. Tentacles and cirri articulated and of considerable length. Body of comparatively large size, $1\frac{1}{2}$ in. long, the general aspect being that of *Syllis armillaris*. Foot presenting dorsally a comparatively long articulated cirrus of 24—28

[1] 'Ann. Sc. Nat.,' 9e sér., t. iii, p. 183 (1906).

[2] 'Compt. rend. Soc. Biol.,' t. liii, p. 269 (1901).

[3] Named after Professor G. Busk, who encouraged others, and also did much able work in the Polyzoa and other groups.

or more segments. Setigerous region conical. Bristles strong, translucent, with indications of serrations on the distal dilatation of the shaft. Terminal piece of moderate length, with a simple hook at the end, and just below it the spinous edge ends in a somewhat stronger spike, so that a pseudo-bifid aspect is produced. Ventral cirrus elongate ovate or broadly lanceolate, and does not reach the tip of the setigerous region.

Habitat.—Under stones between tide-marks, at Guernsey and Herm.

Head apparently typical, with large frontal palpi, but the eyes had disappeared before a critical examination was made.

Body of comparatively large size and $1\frac{1}{2}$ in. in length, the general aspect being that of *Syllis armillaris*. The tail in all is incomplete.

The foot (Plate LXX, fig. 23) presents dorsally a comparatively long articulated cirrus, having twenty-four to twenty-eight or more segments. The setigerous region is conical, with the spines piercing the upper angle. The bristles (Plate LXXIX, figs. 18, 18 *a*) are strong, translucent, and with the usual curve towards the dilated end of the shaft. The convexity of the dilatation has indications of serrations. The terminal piece is of moderate length with a hook at the tip, and just below it another minute tooth at the end of the spinous edge. The latter tooth is easily overlooked.

The ventral lobe is elongate-ovate or broadly lanceolate, and does not reach the tip of the setigerous region. It is somewhat diminished posteriorly.

Posteriorly the body has many large ova, and a developing tuft of simple swimming-bristles appears between the cirrus and the setigerous region. A bud was thus forming. In this region the cirrus is shorter, about a dozen articulations only being present.

This species somewhat approaches *Typanosyllis zebra*, but is readily distinguished from it by the colouration, and the structure of the foot and bristles, the terminal pieces being shorter and broader proportionately, and the secondary process beneath the terminal hook is closer to the latter and more minute.

11. Syllis abyssicola, *Ehlers*, 1875. Fig. 55.

Specific Characters.—Head somewhat triangular, bluntly pointed anteriorly, with elongate-ovoid palps. Lateral tentacles of fourteen segments; median of seventeen segments. No eyes. Body deep yellow: first segment very short, with a pair of cirri on each side, the dorsal with thirteen segments. Proboscis has ten papillæ, and a single tooth behind them. Foot has dorsally a cirrus of nine to eleven segments; setigerous region cylindrical; two or three of the upper bristles have long tapering tips with a simple hook. The lower bristles have much shorter tips. Ventral cirrus is somewhat cylindrical and pointed.

Synonyms.

1875. *Syllis abyssicola*, Ehlers. Zeitsch. f. w. Zool., Bd. xxv, p. 45, Taf. ii, f. 18—20.
1879. *Ehlersia* „ Langerhans. Ibid., Bd. xxxii, p. 237.

Habitat.—Dredged at Station 30, 56° 24′ N., 11° 37′ W., in the 'Porcupine' Expedition of 1869, at a depth of 1380 fathoms amongst dark-coloured mud. Langerhans says 1483 fathoms.

Head (fig. 55) somewhat triangular, bluntly pointed anteriorly, with distinct, elongate, ovoid palpi (in spirit). Paired tentacles of fourteen segments: median of seventeen segments. No eyes, a rare condition in the Syllids.

Body incomplete posteriorly, 5·5 mm. long and 0·5 mm. in breadth; segments thirty, and of a deep yellow colour. First segment very short, apparently overlapped by the head, bearing on each side a pair of cirri, the dorsal having thirteen segments and being somewhat longer than the ventral.

The proboscis has ten soft papillæ, and behind them a single tooth. It extends to the ninth segment, the proventriculus being in the next seven segments.

The foot has dorsally a cirrus of nine to eleven segments, thus being comparatively short, a cylindrical setigerous region bearing bristles, two or three of which dorsally have very long tapering tips with a slight hook, and a group with much shorter tips, also simply hooked ventrally. The ventral cirrus is simple and more or less cylindrical and pointed at the tip (Ehlers).

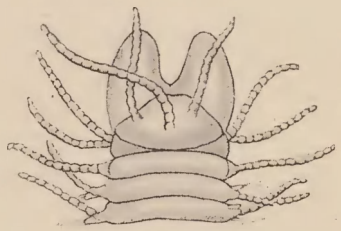

Fig. 55.—Head of *Syllis abyssicola*, Ehlers. (After Ehlers.)

Ehlers considers that in the absence of the eyes this species approaches *Syllis variegata*, Grube.[1]

12. Syllis brevicollis, *Ehlers*, 1875.

Specific Characters.—Head resembling that of *Syllis armillaris*, but the median tentacle is longer. The lateral tentacles have fifteen segments. Body normal. First segment with two tentacular cirri, the dorsal very long. Proboscis with a single tooth, and reaching to the thirteenth segment. Foot has a long dorsal cirrus of forty to fifty segments. Setigerous lobe short and blunt; bristles have a somewhat long terminal piece with a simple hook. Ventral cirrus short and clavate, a little longer than the setigerous lobe.

Synonyms.

1875. *Syllis brevicollis*, Ehlers. Zeitsch. f. w. Zool., Bd. xxv, p. 44, Taf. ii, f. 16 and 17.
1879. *Typosyllis* (*Syllis*) *brevicollis*, Langerhans. Ibid., Bd. xxxii, p. 533.

Habitat.—Dredged on the 15th July in the 'Porcupine' Expedition of 1869 at Station 47, 59° 14′ N., 7° 18′ W., in 650 fathoms (Langerhans says 1380 fathoms), on Holtenia ground with mud and Globigernia-ooze, mingled with sand.

[1] "Beschrieb. neuer oder wenig gekaunter Annel.," 'Arch. f. Naturges.,' Jahrg. 26 (1860), p. 85, Taf. iii, fig. 6.

Head somewhat like that of *S. armillaris*, except that the median tentacle is longer (forty-four segments) and the palpi seem to be closer. The paired tentacles have fifteen segments.

The incomplete body has sixty-four segments and is 18 mm. long, the breadth being 1·5 mm. The colour of the dorsum (in the spirit-preparation) is brownish-yellow. The first segment bears two tentacular cirri, the dorsal very long. The proboscis (pharynx) has a single tooth and reaches to the thirteenth segment.

The foot has a long dorsal cirrus of forty or fifty segments. The setigerous region is short and blunt—carrying bristles with a somewhat long terminal piece and a simple hook at the tip, and thus resembling those of *S. armillaris*. The ventral cirrus is short and clavate, a little longer than the setigerous region (Ehlers).

How far the cirri vary in length is still an open question, so that the species may yet be linked on to others.

Group IV.—AUTOLYTEA.

Syllideans deprived of ventral cirri. Palpi little developed, soldered on the ventral surface of the cephalic lobes. Cirri not articulated. Reproduction generally by stolons (schizogamy), rarely direct (epigamy, Malaquin).

Genus LV.—Autolytus, *Grube*, 1851.

Animal surculare.—Head rounded in front; palpi obsolete (coalescent), but separated by a line ventrally. Proboscis sinuous, with a crown of teeth. Stomach little developed. Tentacles three, smooth, and little tapered. Two tentacular cirri on each side of the buccal segment. Dorsal cirri of the first two segments considerably longer than the others. Ventral cirri absent. Falcate bristles with short bifid tips, the lower point or hook being the larger. The sexual generation budded from the foregoing shows dissimilar males and females (*Polybostrichus* and *Sacconereis*), but both always have a median tentacle, and the paired tentacles are often present.

In a transverse section of a female (Fig. 56) the muscular system is as powerfully developed as in *Syllis*, the dorsal longitudinal muscles widening from the median raphe to the inferior border. The ventral longitudinal muscles are curved, and separated by the large nerve-cords. The large ova lie in the cavities of the feet and in the peri-visceral space around the gut, which in the example had thick glandular walls.

The type of circulation in this group is simple, a dorsal and a ventral vessel united only in the anterior region, as seen in *Autolytus* and *Myrianida*, are present. The nurse-stock in the latter has a dorsal vessel fixed to the wall of the body by the mesentery, and in a fold of the intestine, though quite free from it (the intestine). The ventral vessel is intimately united with the intestine. In the anterior region the vessels are independent of the proboscis dorsally and ventrally. The dorsal vessel is only contractile anteriorly (Malaquin).

Grube, in his ' Familien der Anneliden ' (1851), made a new Family, the Amytidea, to include *Polybostrichus longisetosus* of Œrsted, *Nereis prismatica* of O. F. Müller, *Nereis bifrons* of O. F. Müller, *Photocharis cirrigera* of Ehrenberg, *Nereis corniculata* of O. F. Müller, and *Nereis clavicornis* of Sars—all sexual forms connected with *Autolytus prolifer* and its immediate allies.

Malaquin (1893) takes *Autolytus Edwardsi*, De St. Joseph, as the type of reproduction in the group, and describes various phases in separate individuals. In the first instance an adult develops genital glands in the posterior segments, this region subsequently separating by fission and having an independent existence for a time. A segment in front of the genital region, between the fortieth and forty-fifth segment, is thickened and becomes the formative segment—the head of the bud being developed from it and subsequent additional segments in the bud. In some cases a number of segments in front of the head of the bud bear genital glands. After the separation of the bud the nurse-stock develops new segments.

In the second case the stolons of twenty to twenty-two segments have in front of them

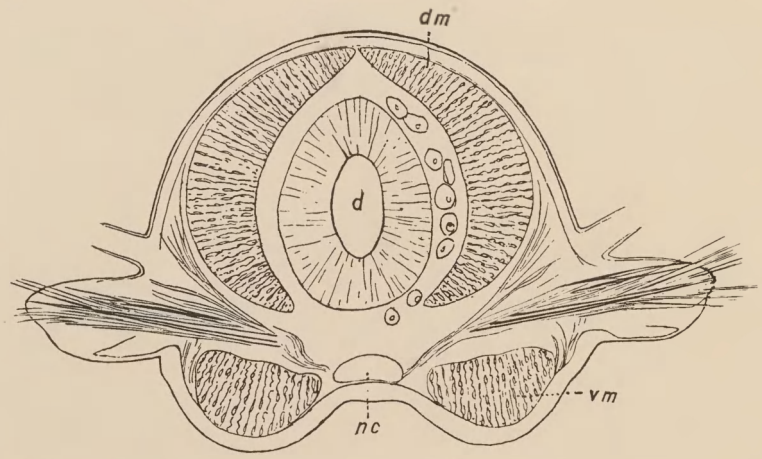

Fig. 56.—Transverse section of *Autolytus prolifer* to show the arrangement of the muscles. Letters as before.

a certain number of segments in process of development. The bud separates as usual, regeneration of the posterior segments of the nurse-stock ensuing.

In the third case the genital segments posteriorly are separated as a bud with head and appendages. A formative zone in front of the bud actively develops segments which have genital products in front of them and the bud and its genital organs behind.

In the fourth case several buds, generally males, are attached to the posterior end of the nurse-stock, the last separating as a bud as in the case of *Myrianida*. It is an example of rapid stolonization.

The fifth case resembles the first and second. In a nurse-stock of forty segments the last fifteen, viz., from the twenty-fifth to the fortieth, are observed to have ovaries, a bud of four segments with cirri and small bristles, a formative zone, and a pygidium, the head being at the forty-first setigerous segment of the stock.

In the sixth case the condition is the same as in the first, only the head of the bud is between the twenty-fifth and thirtieth segments.

In the seventh case a nurse-stock of twenty-eight segments bears a chain of stolons from one to seven in number. Malaquin is of opinion that where the chain of buds is smaller than the nurse-stock it is a case of budding, whereas when the stolon is larger or as large as the nurse-stock it is a case of fission.

Langerhans makes this his third tribe, and divides it into seven sub-sections, viz., *Eurysyllis*, Ehlers; *Anoplosyllis*, Claparède; *Heterosyllis*, Claparède; *Autolytus*, Grube; *Proceræa*, Ehlers; *Myrianida*, Aud. and Edwards; and *Virchowia*, Langerhans.

The British forms fall under only three of these, viz., *Autolytus*, *Proceræa*, and *Myrianida*; and if, as appears to be right, the first two ought to be conjoined, then only two genera are represented in our fauna.

Langerhans distinguishes *Proceræa* from *Autolytus* by the presence of elongated cirri on the first, second, and third segments of the body, the latter (*Autolytus*) only having these on the first and second. Moreover, he points out that the pharynx has twenty teeth (papillæ)—ten larger and ten smaller.

De St. Joseph included *Proceræa* and *Stephanosyllis* under *Autolytus*, and his description of the genus corresponded for the most part with that now given. He also noted that one group, Autolytides, Malaquin, has an unarmed proboscis.[1]

As Calvin Mensch[2] points out, only one bud is borne at a time in this genus and in *Autolytus cornutus* of Agassiz, who demonstrated the relationship of Œrsted's *Polybostrichus* (1843) and J. Müller's *Sacconereis* (1853).

1. Autolytus pictus, *Ehlers*, 1864. Plate XLVII, fig. 1—male bud; Plate XLIX, fig. 8—nurse-stock; Plate LXXI, fig. 2—foot; Plate LXXIX, fig. 21—bristle.

Specific Characters.—Head somewhat small, rounded in front, long diameter antero-posterior. Eyes four, the anterior pair the wider apart, in some connate, and both have lenses. Two lateral and a longer and thicker median tentacle, all of a madder-brown hue. The tentacular cirri are less elongated but of the same colour. Body about one inch long, and of about 100 segments; slightly narrowed anteriorly and more distinctly so posteriorly, where it terminates in two short, flattened, and curved cirri about twice the length of the last segment. Dorsum marked by a pale central band with numerous and regular transverse spurs, which cut the brown (sepia) pigment into oblong spaces. Beneath and external to the latter is a pale lateral belt into which the transverse spurs run. Just above the feet a dark brown belt passes from end to end, intersected here and there, opposite the pale transverse spurs, by narrow pale lines. First twelve or thirteen segments are darker and have the ground colour paler than the rest. Ventral surface pale or flesh-coloured. Foot carries a short dorsal cirrus (except anteriorly) which shows slight crenations when coiled. Setigerous process short and truncated, with comparatively short bristles, the shaft of which is stout, enlarged distally, bevelled at the edges, and spinous. Terminal piece short and broad, with a bifid tip, the lower hook being the larger.

[1] 'Ann. Sc. Nat.,' 7e sér., I, 1887.

[2] "On the Life-History of *Autolytus cornutus* and Alternation of Generations in Annelids," 'Americ. Nat.,' vol. xxxiv, p. 165 (1900).

Synonyms.

1864. *Stephanosyllis scapularis*, Claparède. Glanures, p. 107, pl. vii, f. 5.
„ *Proceræa picta*, Ehlers. Borstenw., I, p. 256.
1865. *Myranida* „ De Quatrefages. Annel., II, p. 63.
1868. *Proceræa* „ Claparède. Annel Nap., p. 219.
1869. *Autolytus pictus*, McIntosh. Trans. R. S. Edin., t. xxv, p. 415, pl. xv, f. 11.
1874. *Autolytus* (*Proceræa*) *pictus*, McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 198.
1875. „ „ „ idem. Invert. and Fishes St. Andrews, p. 121.
1879. *Proceræa picta*, Langerhans. Zeitsch. f. w. Zool., Bd. xxxii, p. 577, pl. xxxii, f. 28.
1885. „ „ Carus. Fauna Medit., p. 235.
1887. *Autolytus* (*Proceræa*) *pictus*, De St. Joseph. Ann. Sc. Nat., 7e sér., t. i, p. 222, pl. xi, f. 100—105.
1890. „ „ „ Malaquin. Annél. Boulonn., p. 39.
1904. „ „ „ Allen. Journ. M. B. A., N.S., vol. vii, p. 220.
1906. „ „ „ De St. Joseph. Ann. Sc. Nat. 9e sér., t. iii, p. 186.

Habitat.—Under stones in rock-pools and near low water, St. Andrews; under a stone in a rock-pool at Paible, North Uist; on a zoophyte off Sark (Mrs. Collings); Plymouth (Allen). It is probably very widely distributed in Britain, and is not uncommon at St. Andrews, where it was first found by my sister, who made the coloured drawings.

Abroad it occurs in the Mediterranean (Carus) and the White Sea; the Adriatic (Ehlers); Cannes (De St. Joseph); Madeira (Langerhans).

Head somewhat small, rounded in front, the longer diameter being antero-posterior. Eyes two on each side, the anterior pair the wider apart, but sometimes they are connate, both the anterior and posterior being furnished with lenses, the former, like the eye, being the larger, and De St. Joseph states that they lie in front, while the lenses of the posterior are behind. Two lateral and a longer and thicker median tentacle, all of a deep madder-brown colour, the median being darkest, though its ceratophore is paler. Their surface is supplied with numerous palpocils. The ocular region is richly ciliated, and the dark portion (probably De St. Joseph's fused epaulettes), at the sides of the succeeding ring, is also ciliated. A dark patch of deep brown is placed behind the median tentacle, and from the latter two diverging pale lines proceed backward. The tentacular cirri are less elongated than the tentacles, but have the same madder-brown colour.

Body about an inch in length, and with upwards of 100 segments, slightly narrowed anteriorly, and more distinctly so posteriorly, where it terminates in two short, flattened, and curved cirri—about twice the length of the last segment. The dorsum is prettily marked by a pale central band with numerous and regular transverse spurs which cut the sepia-brown pigment into oblong spaces. The spaces, however, are not solidly pigmented, but are striated by fine pale lines and grains (under a lens). By transmitted light some of the dark pigment appeared of a fine purplish hue. On each side below (and external to) these striated oblongs is a pale lateral band, into which the transverse spurs run. Just above the feet a dark brown belt passes from end to end, intersected here and there—opposite the pale transverse spurs—by narrow pale lines. The first twelve or thirteen segments are darker and the ground-colour is paler than in the rest. The lateral pale line within the feet is also less distinct in this region, but behind it becomes boldly marked though

less white. The ventral surface is pale or flesh-coloured. The tints are retained for a long time (eight months) in spirit.

The proventriculus, according to De St. Joseph, has from forty-eight to sixty rows of brown points, and occurs in segments 10 and 11. The proboscis, he states, is furnished with ten large teeth, alternating with ten smaller. He also found in the sub-cuticular tissue greyish plates with two refringent hemispherical concretions.

The foot (Plate LXXI, fig. 2) carries the dorsal cirrus, which in the fourth segment exceeds in length the tentacles and tentacular cirri. They are short posteriorly. All have palpocils, and show slight folds and crenations when coiled. As in *Amblyosyllis* they are stretched out on irritation. When falling through the water the long coiled processes in front bear the weight on touching the bottom. The setigerous process is somewhat short and truncated at the tip, though it varies in outline according to the development of the reproductive elements. It has several spines, which point above the bristles. The latter (Plate LXXIX, fig. 21) are comparatively short, with a stout, slightly curved shaft, the distal end of which is enlarged, and both sides of the bevelled region have minute spines, largest at the apex. The distal piece is short and rather broad, and the tip is bifid, the lower hook being the larger. Towards the tail only a single conspicuous spine occurs in each bristle-bundle, and finally a larger and a smaller spine alone exist. The terminal processes of the bristles vary much in length, being very short in the anterior region, then lengthening, and again becoming short as the bristles diminish in size towards the tail. The ventral cirrus seems to be fused with the setigerous lobe.

In the thirty-fourth segment De St. Joseph met with a single dorsal bristle, "à article en alêne," as figured by Langerhans, who found it on the fourth foot.

He also found individuals bearing eggs, as Ehlers and Claparède did, but he thinks Claparède was hasty in concluding them to be *Autolyti* without alternation of generations. He observed eggs in the thirteenth segment and in the fifteenth segment (with a developing head of a bud). The buds have from forty-five to fifty-eight segments. In the males (*Polybostrichus*) the first region has six segments, the second thirty-one segments, and the third twenty-two segments. The first region has two spines in each foot; in the second the compound bristles are accompanied by a strong spine, except the two first segments, which have two, and the natatory bristles are accompanied by two hooked bristles; in the third region there is only one spine.

No proboscis or proventriculus occurs in the buds, and the intestine is rudimentary.

Malaquin observes that the first three setigerous segments (devoid of swimming-bristles) carry the male elements. The rest have no genital glands, but have long feet and swimming-bristles. The latter have specially-developed muscles—two superior and two inferior—for moving them.

Reproduction.—The male buds (Plate XLVII, fig. 3) of this form are procured in May, and are composed of three regions. The head and two achætous segments and all their appendages are pale. Of the great bifid palps the large inner division is ciliated and tapered, the outer slender and non-ciliated. Two minute rudiments occur in the central region behind these. The median tentacle is long. The eyes are large, and appear to lie on the ventral rather than on the dorsal surface, and are bright red. The anterior pair are the wider apart, much (more than twice) larger than the posterior, and nearly circular,

while the posterior are also nearly circular. The buccal segment bears two pairs of tentacular cirri, the dorsal being the longer. The succeeding achætous segment bears three long tentacles—a median and two lateral. The long anterior cirri are often coiled like conical screws.

The body reaches only about half the length of the nurse-stock, and its colouration differs. After the first two brown squares a considerable and wider portion of the dorsum has a central dark brown streak interrupted by pale bands at the usual intervals, and with the lateral region of the feet of a granular brown. Behind this the body tapers towards the tail and has the ordinary markings. The tail has two short cirri.

Each of the feet of the middle region of the body bears a long tuft of simple bristles, and the divisions of the feet are split deeply towards the centre of the body, the inner portion being coloured, so as to add to the breadth of the central belt of brown.

Habits.—The species lives well in captivity, and, like many others, constructs a tough and translucent tube or case on the side of the vessel at the water-line. Some lived for nine months at Murthly, which is about fifty miles from the sea.

2. Autolytus aurantiaca, *Claparède*, 1868. Plate LXXI, fig. 3—foot; Plate LXXIX, figs. 22, 22 *a*—bristles.

Specific Characters.—Head small, rounded in front with a long median and two lateral tentacles. Eyes four, black; anterior pair the wider apart, whilst those on each side are close together. Body about $\frac{3}{4}$ inch long, tapered towards both extremities, of an orange colour somewhat clouded in the middle from the intestine and its contents. Foot forms a short blunt process, devoid of a distinct ventral cirrus. Dorsally is the short tapered cirrus, then the massive setigerous region with bristles resembling *A. pictus*, and bifid at the tip of the short terminal piece.

Synonyms.

1868. *Proceræa aurantiaca,* Claparède. Annel. Nap., p. 219, pl. xv, f. 1.
1874. „ *luxurians,* Marenzeller. Sitz. Akad. Wiss. Wien, p. 50, Taf. vi, f. 1, and Taf. vii, f. 1.
1875. *Autolytus* (*Proceræa*) *aurantiacus,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér., t. ii, p. 44.
1879. „ „ „ Langerhans. Zeitsch. f. w. Zool., xxxii, p. 578.
1885. „ „ „ Carus. Fauna Medit., p. 236.

Habitat.—In a tube under a stone in a rock-pool at Paible, North Uist. It may have been an accidental visitor to the tube.

Madeira, amongst littoral plants, as well as in 20 fathoms (Langerhans). Shores of France (Marion and Bobretzky). Mediterranean (Claparède). Adriatic (Marenzeller).

Head small, rounded in front, with a long median and two lateral pale tentacles. Eyes four, black, and about equal in size, the two anterior being wide apart, while those on each side are close together.

Body about $\frac{3}{4}$ inch long, and with 70—100 segments (Marenzeller), tapered towards both extremities; of an orange colour, somewhat clouded in the middle from the intestine

and its contents. Langerhans describes it as diffused red, darkest at the tips of the tentacles and cirri. From the tenth foot backward each has a small red speck (Langerhans). Small specimens are pale, and Marenzeller states that twenty denticulations occur at the opening of the proboscis into the gut.

The feet (Plate LXXI, fig. 3) form short, blunt processes without a distinct ventral lamella (cirrus). Dorsally is the pale tapered cirrus, which is comparatively short. The massive setigerous region bears a group of strong, slightly curved bristles (Plate LXXIX, figs. 22 and 22 *a*) resembling those of *Autolytus pictus*, the bevelled portion beyond the dilated distal end of the shaft being spinous. The distal piece is short and bifid. On immersion in spirit the pale cirri assumed a greenish hue.

Further investigation may show that this form is a well-marked variety of *Autolytus pictus*, but the opportunities for critical comparison have been so few that it has been deemed best to leave the subject as it stands.

Claparède points out the muscularity of the tentacles and tentacular cirri in this group (*e. g.*, *Autolytus aurantiaca*) and the presence of cilia on their surface.

3. Autolytus prolifer, *O. F. Müller*, 1788. Plate XLVIII, fig. 6 (*An. surculare*; Plate LX, fig. 4—early larva, and figs. 5 and 5 *a*—anterior and posterior ends of free bud; Plate LXXI, fig. 4—foot of bud; Plate LXXIX, figs. 23 and 23 *a*—bristles. Plate L, fig. 11—pelagic male (*Polybostrichus*). Plate XLIX, fig. 7—pelagic female (?), tinted like *A. pictus*, with ventral egg-sac.

Specific Characters.—Head smoothly rounded in front; eyes placed close together on each side, but obliquely, so that the anterior are the wider apart. A long tapering median cirrus and two lateral cirri. Two tentacular cirri on each side. All these processes are smooth. Body about half an inch long, slightly and rather abruptly tapered anteriorly, more distinctly tapered posteriorly, where it ends in two slender cirri. Colour pale yellowish, somewhat darker in the middle from the intestine, and with numerous small whitish specks over the latter. Ten papillæ in pharynx (Langerhans). Foot with a comparatively short dorsal cirrus with a distinctly marked cirrophore. The setigerous region is bluntly conical, with short bristles abruptly dilated at the tip of the shaft, minutely spinose, and having a short bifid terminal piece, the second of the two hooks being the larger. A single simple bristle is generally present in each foot, the tip being bent and acutely pointed, as in *Autolytus fallax*, Malmgren.

Synonyms.

Animal Surculare.

1788. *Nereis prolifera*, O. F. Müller. Zool. Danic., II, p. 15, Tab. lii, f. 5—9.
1791. „ „ Gmelin. Linn. Syst. Nat., ed. 13, i, pt. 6, p. 3120.
1806. „ „ Turton. Linn. Syst. Nat., iv, p. 90.
1824. „ „ Bruguière. Tabl. Encycl. Méth., Vers, I, p. 134, Tab. lvi, f. 12—15.
1825. „ „ De Blainville. Dict. Sc. Nat., xxxiv, p. 440.
1828. *Nereisyllis prolifera*, idem. Ibid., lvii, p. 473.
1830. *Nereis prolifera*, Bosc. Vers, ed. 2, I, p. 174.

1834. *Nereis prolifera,* Audouin and Edwards. Annél., p. 209.
„ „ „ idem. Ann. Sc. Nat., xxix, p. 231.
1845. *Syllis* „ Johnston. Ann. Nat. Hist., xv, p. 146, pl. ix, f. 3, 4.
1847. „ „ Frey and Leuckart. Beitr., p. 92, etc.
1850. *Autolytus prolifer,* Grube. Arch. f. Naturg., p. 310.
„ „ Krohn. Ibid., xviii, 1, p. 66.
1851. „ *prolifera,* Grube. Fam. Annel., p. 62.
1855. „ „ idem. Arch. f. Naturges, Bd. xxi, p. 105.
1865. *Syllis* „ Carrington. Annel. Southport, p. 8.
„ „ „ Johnston. Cat. Brit. Mus., p. 192, pl. xv *a*, f. 3, 4.
„ *Autolytus prolifer,* De Quatrefages. Annel., II, pp. 45, 63, and 87.
„ „ *Agassizii,* idem. Ibid., p. 44.
„ *prolifer,* A. Agassiz. Journ. Bost. Soc. Nat. Hist., vii, p. 392.
1866. „ „ Greef. Archiv f. Naturges., Bd. xxxii, p. 363.
1867. „ „ Malmgren. Annul. Polych., p. 32.
„ „ *fallax* (*?*), idem. Ibid., p. 33, Tab. vi, f. 41.
1868. „ *prolifer,* idem. Ann. Nat. Hist., 4th ser., vol. i, pp. 173 and 183 (translated).
„ „ *hesperidum,* Claparède. Annel. Nap., p. 216, pl. xiv, f. 1.
1869. „ „ Langerhans. Zeitsch. f. w. Zool., t. xxxii, p. 575.
1874. „ *prolifer,* McIntosh. Ann. Nat. Hist., ser. 4, vol. xiv, p. 198.
„ „ „ Malm. Op. cit. Göteb., p. 82.
1875. „ „ McIntosh. Invert. and Fishes St. Andrews, p. 121.
1879. „ *hesperidum,* Tauber. Annul. Danic., p. 95.
1883. „ *prolifer,* Levinsen. Vidensk. Meddel. Foren. Kjöbenh, p. 246.
1885. „ „ Carus. Fauna Medit., p. 235.
1886. „ „ Viguier. Arch. Zool. Expér., 2e ser., iv, p. 429, pl. xxvi, f. 13—15, and pl. xxvii, f. 1.
1887. „ „ De St. Joseph. Ann. Sc. Nat., 7e sér., i, p. 238, pl. xii, f. 118.
1890. „ „ Malaquin. Annél. Boulonn., p. 41.
1891. „ „ Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 245.
1892. „ „ (eyes), Andrews. Journ. Morph., p. 186.
1903. „ „ McIntosh. Mar. Invert. S. Africa, vol. iii, p. 35.
1906. „ „ De St. Joseph. Ann. Sc. Nat., 9e sér., t. iii, p. 186.

♂ *Bud.*

1788. *Nereis corniculata,* O. F. Müller. Zool. Danic., II, p. 15, Tab. lii, f. 1—4. ♂.
1806. „ „ Turton. Linn. Syst. Nat., iv, p. 87.
1824. „ „ Bruguière. Tabl. Encycl. Méth., Vers, I, p. 134, Tab. lvi, f. 8—11.
1825. „ „ De Blainville. Dict. Sc. Nat., xxxiv, p. 438.
1842–3. *Polybostrichus longisetosa,* Œrsted. Kroyer's Nat. Tids., p. 119.
1851. *Diplocera corniculata,* Grube. Fam. Annel., p. 64.
„ *Polybostrichus,* etc., idem. Ibid., pp. 63 and 64.
1855. *Sacconereis helgolandica* ♂, Max Müller. Arch. f. Anat., p. 13, Taf. iii, f. 9—13.
„ *Crithidia thalassina,* Gosse. Ann. Nat. Hist., 2nd ser., xv, p. 308.
1862. *Polybostrichus Mülleri,* Keferstein. Zeitsch. f. w. Zool., Bd. xii, p. 113, pl. xi, f. 1—6.
1865. „ *longisitis,* De Quatrefages. Annel., II, p. 72.
„ *Crithidia thalassina,* idem. Ibid., II, p. 81.
„ *Diploceræa corniculata,* idem. Ibid., p. 76.

1891. *Autolytus Alexandri,* Hornel. Trans. Liverp. Biol. Soc., vol. v, p. 245 (?).
1893. „ *prolifer,* Levinsen. Vidensk. Ud. "Hauchs," p. 330.

♀ *Bud.*

1778. *Scolopendrina marina,* Slabber. Natuur. Verlus., pp. 51 and 83, Taf. x, f. 3—5.
1855. *Sacconereis helgolandica* ♀, Max Müller. Arch. f. Anat., p. 14, Taf. ii, f. 4.
1865. „ „ De Quatrefages. Annel., II, p. 74.
1875. „ „ Möbius. Jahresb. Comm. deutsch., p. 170.

Habitat.—On shells and other *débris* procured by the deep-sea lines of the fishermen, St. Andrews; on stones near low water-mark (whence they are best procured by immersion in sea-water, as they by-and-by crawl from the stones and growths thereon to the margin of the water); it occurs also in tough translucent tubes under stones (gneiss) between tide-marks in Bressay Sound, Shetland, where buds were found in July, 1871. It may be a question whether it has not tubes at St. Andrews likewise, for it was generally collected at the margin of a vessel into which stones from low water-mark had been placed. Nurse-stock and buds were likewise found amongst tangle-roots in 8 fathoms in the same region (Bressay Sound).

Mediterranean. Atlantic. English Channel. North Sea. South Africa. Shores of France.

Head smoothly rounded in front; eyes placed closely together on each side, but obliquely, so that the anterior are the wider apart, and they have a small lens. A long tapering median tentacle, and two lateral. Two tentacular cirri occur on each side. All these processes are more or less smooth.

Body about half an inch in length, of a pale yellowish hue—somewhat darker in the middle from the intestine, and with numerous small whitish specks over that. It is slender, elongated, with numerous distinct segments, slightly and rather abruptly tapered anteriorly; more distinctly so posteriorly, where it ends in two slender cirri. The cirri of the foot behind the tentacular cirri are considerably longer than the tentacular cirri.

The proboscis in transverse section presents a radiate arrangement of fibres from the firm inner lining to the outer coat.

The foot (Plate LXXI, fig. 4) forms a bluntly-conical or rounded process with a groove at the spine. The dorsal cirrus is comparatively short, the basal region or cirrophore being of some size, and distinctly differentiated from the distal region. The bristles (Plate LXXIX, figs. 23 and 23 *a*) are somewhat short, curved backward towards the abrupt dilatation at the tip, and have a short terminal piece with two hooks, the second being the larger. The dilated part of the shaft has minute spikes. A single simple bristle is generally present in each foot, the tip being bent and diminished to a fine point after the manner of *Autolytus fallax*, Malmgren.[1]

So far as present observations go, this form would seem to frequent the lower margin of the tidal rocks, and probably also the laminarian region beyond, and from this to deep water, so that the area for the production of buds is extensive. These buds (♂ and ♀), from their pelagic habits, scatter the reproductive elements very widely, and, as they occur

[1] 'Annul. Polychæta,' p. 153, pl. vii, fig. 41.

throughout the year continuously, Nature has therefore provided for any losses the species may encounter in its varied life-history.

The buds (♂ and ♀) are found in the pelagic condition all along the shores of Britain, from Shetland to the Channel Islands. Well-developed forms are met with every month, and the younger examples, as might be expected, are equally distributed over the year.

Habits.—The female buds with the ventral sac (Plate XLIX, fig. 7) are truly pelagic, and are frequently caught in the large mid-water net. So far as the records and specimens of those captured by the tow-nets (and those chiefly the bottom tow-nets) go, the majority occur in February, though a considerable proportion are found in March and April. An occasional form appears every month from June till November. The greatest number, however, are procured in the months first mentioned. From the nature of their origin there is little difference in size between those obtained in February and those in October and November, and the continuance of schizogamy throughout this extended period is noteworthy.[1]

In glancing at a series captured in the tow-net near the bottom, for example, on April 20th, the diversity in size of the ovigerous females is interesting, for they range from 2·5 mm. to about 14 mm. The small forms carry a small mass of ova, the larger a great mass, and there is a marked difference in the size of the ova in these respectively. Thus, on the date mentioned, those of the small mass attached to the small example measured ·07 mm., whilst those of the larger were ·15 mm. The respective larvæ probably show the same disparity, and those from the larger eggs thus might be supposed to enter life with a better chance of survival. That, however, does not necessarily follow, for the smaller may be more inconspicuous.

After the escape of the larvæ the body of the female is diaphanous, and the ovigerous membrane forms soft wrinkled folds at each side. It is probably a cuticular structure, augmented by a secretion of the dermal cells, as in the instance of the tube, and in communication with the body-cavity of the annelid. They probably break up and disappear soon afterwards. The fine elastic ovigerous membrane keeps the eggs *in situ* during the active pelagic life of the animal.

The head of *Sacconereis* (the female bud) is rounded in front, comparatively small, and with a pair of large connate eyes, situated at the outer and posterior border of the head. The upper part of the pigment looks dorsally and externally, the lower commands the ventral surface as a large dark brown eye on each side, and more conspicuous than the dorsal pair. Each is provided with a lens. A long median tentacle occurs behind the eyes, and two tentacular cirri.

Eleven bristled segments follow (in one in March only three, and yet the form carried eggs), and they have a dorsal cirrus and a setigerous region; then about thirty segments bearing the long dorsal swimming-bristles succeed. Each of these has a deeply-cut foot, which increases in size from the first for some distance backward, and has dorsally the cirrus (Plate LXXI, fig. 4), which is of moderate length, and smooth.

[1] It is interesting that Greef, also in December, found a translucent pelagic *Sacconereis* off the Canaries, and he followed the development of the larvæ to the appearance of the first pair of bristled feet ('Zeitsch. f. w. Zool.,' Bd. xxxii, p. 251, Taf. xiv, f. 31—36).

Beneath is a bluntly-conical region, which is stiffened by a group of spines, several of which are curved at the tip and spread out for supporting a web, it may be that enclosing the ova. From this region the dense and long tuft of swimming-bristles projects. These (Plate LXXIX, fig. 23 *a*) are translucent flattened bristles, which increase in diameter towards the broad terminal part, which then diminishes a little, and ends in a curved tip.

These spines and bristles are moved by considerable strands of muscular fibres, a conspicuous series being dorsal and another ventral. The inferior division of the foot consists only of a setigerous region, which is bifid at the tip and bears a series of the characteristic jointed bristles, the shafts of which are slightly curved towards the end, which is bevelled to a point and serrated on each side. The terminal piece is short and bifid as in the nurse-stock. Posteriorly a considerable portion of the tapering caudal region is devoid of the long swimming-bristles. In addition to the long swimming-bristles is the group of ordinary bristles with abruptly-dilated ends to the shaft and a short bifid terminal piece. In many is also a single modified bristle in each tuft, having a somewhat dilated end to the shaft and a lateral spike or process.

The region bearing the ova is reddish and green, the former colour being chiefly at the segment-junctions. The region behind the sac is greenish, then pale posteriorly. The colours are similar but paler ventrally. The egg-sac, from a central constriction, has the shape of an hour-glass. The region behind the long bristles varies in the number of its segments—from ten to twelve or upwards (in the ovigerous examples), the tip being furnished with a pair of short symmetrical styles or cirri. Other specimens in the same month (March) show a larger number of segments anteriorly and posteriorly to the ovigerous region and the long bristles.

The stages reached by the embryos in the sac of the pelagic *Sacconereis* are indicated in the following notes at different dates:

April 19th, 1887.—Embryos in sac developed, and they swim in the water; some have three segments, other examples have four, besides head and tail (Plate LX, fig. 4), with palpocils. Eyes four. Head of adult pinkish, and the eyes dark brown. Two appear to be dorsal, but the pigment is closely connected with the ventral. The ventral position of these eyes would certainly enable the animal to look downward. The eyes, indeed, form a large double mass, the anterior looking upward and outward, the other pair commanding the ventral surface. The tentacles are long and smooth.

April 26th, 1887.—The young *Autolyti* have only two pairs of bristle-bundles, but the feet extend further outwards and are more distinct. They have a more elongated and pointed dorsal region, and a shorter and thicker ventral. The number of segments is the same. A process appears on the head—probably a tentacle.

April 27th, 1887.—Numerous females in the bottom trawl-like tow-net. Some are dull yellowish or paler, others greenish. The ova thus differ in tint.

May 9th, 1887.—The young have increased in size. The head has lost its palpocils. The four eyes are still nearly in a transverse line, the two median being dorsal; the two lateral are at the sides. The buccal segment has a large pharyngeal cavity. The next two segments have rudimentary feet with bristle-bundles, the tips being bifid as in *Autolytus*. The penultimate and the terminal segments have no bristles. The animal is

evidently feeding, and the alimentary canal is distended. May 11th, 1887.—The young are now pale greenish, with eyes of a lustrous silvery blue.

The male buds (*Polybostrichus*, Plate L, fig. 11) occur from February onward to November, and probably throughout the entire year, and are discriminated by their shorter bodies and structural differences.

Head comparatively small, with two circular dark brown eyes (in spirit), reddish or blackish in life, which have a lens and which look laterally as well as dorsally, a long median tentacle arising behind them, and a large and long pair of cirri laterally (post cephalic). From the front of the head project the bifid palpi, which are undivided and massive at the base. The outer division is short, the inner long, tapering, and often thrown into graceful coils. These processes appear to develop considerably after the separation of the bud from the nurse-stock—just as the body increases in length and bulk. A smaller and more slender cirrus is ventral to the great tentacular cirrus, and a still smaller to the outer side of the eye.

On the ventral aspect of the head a large pair of eyes occupies each lateral region, and each also shows a cuticular thickening or lens. These eyes chiefly look downward, though in a lateral view of the head a considerable portion of the pigment of both dorsal and ventral pairs is visible.

Body increasing in length, and probably in the number of its segments, with age; slightly narrowed in front and tapering to a slender tail. A median furrow runs along the dorsal surface, while ventrally the nerve-cord and the adjoining ventral longitudinal muscles form three central stripes. Behind the head are fourteen narrow segments provided with slender dorsal cirri, which are largest in front, and the ordinary bristles with bifid terminal pieces.

In the next region the feet project more, so that the body is broader, and the dorsum of each has a tuft of the long swimming-bristles. These are longest in the anterior twelve or fourteen segments and diminish gradually in the succeeding. The feet so provided were twenty-eight in number in a fine example fully half an inch in length. In these the dorsal cirrus is shorter than in the anterior region. Each foot has also beneath the former a group of the ordinary bristles with the bifid terminal pieces. About thirty diminishing segments with short dorsal cirri, and the ordinary bristles with the bifid terminal piece, occur posteriorly, the last having two larger cirri, though they are not conspicuous. The peculiarly broad and flattened body of this form, and its long bristles, fit it, like the young *Nerine*, for example, for its pelagic life. The specimen from which the foregoing description was drawn up was captured on February 1st. Most of those procured in the subsequent months were smaller.

The stolons have neither proboscis nor proventriculus. They swim gracefully and vigorously, the sheen of the long lustrous bristles with their ever-changing hues being very beautiful.

De St. Joseph gives an account of the changes in the muscular system in the second region of this form (male).

Martin Slabber (1778) describes and figures under the name of *Scolopendrina marina* (Zeedurzendbeen) a female bud of this form, with swimming-bristles, in which the larvæ

in the ventral sac are advanced and some have escaped into the surrounding water. They appear to have four or five post-cephalic segments. On the whole the figures are good.

O. F. Müller mentioned the male bud and the nurse-stock as separate species, but he correctly figures them, and assigns them different habitats, the former being pelagic with long bristles, the latter as only rarely occurring in the gulfs of Norway. He describes the nurse-stock and its female buds as mother and fœtuses, and he recognized the ova in the buds.

From this period onward the gradual unfolding of the life-history of *Autolytus* is one of the most interesting chapters in zoology—associated as it is with one of the very prominent examples of the so-called "alternation of generations." The nurse-stock and its divergent sexual buds were each regarded as separate species by the earlier observers, such as O. F. Müller, Œrsted, and Max Müller. It was not till Leuckart and Frey, and, more definitely, Krohn, had shown the relationships of *Sacconereis* and *Autolytus*, and De Quatrefages and he had studied the conditions in *Syllis prolifera*, that the true nature of the processes were elucidated. Further advances were made by Alexander Agassiz, Keferstein, Greef, Ehlers, Malaquin, and others. Thus the male and female buds, formerly known as *Polybostrichus* and *Sacconereis*, were linked to the nurse-stock *Autolytus*, and the structure and physiology of the parts elucidated.

The genus *Sacconereis* was established by Johannes Müller,[1] and his son Max Müller (1855) gave good descriptions and figures of both male and female of *Sacconereis helgolandica*, the female carrying the ova in the sac and with swimming-bristles from the fourth foot backward. He shows that the sperms are found in the first three bristled segments of the male, and gives figures of four stages in the development of the young. The forms were at that time considered as independent.

Alex. Agassiz[2] gives a careful account of the life-history of a species he terms *Autolytus cornutus*, which does not seem to differ in any essential respect from *Autolytus prolifer* (and in this Greef and others coincide) except in the structure of the compound bristles, which he figures as having a simple "sickle-shaped" tip, a feature at variance with the usual structure of *Autolytus*, and which may have arisen from misinterpretation. He furnishes an excellent description, with figures of the nurse-stock, male and female buds, and for the first time the development of the eggs (borne on the ventral surface in a sac), and young issuing from these up to the stage of the nurse-stock, thus illustrating the alternation of generations in the species.

The *Polybostrichus Mülleri* of Keferstein[3] (1863) seems to be a male form with much longer tentacles than usual, but it may be only a variety. The body is in two parts, the anterior having 19—22 segments, the posterior with long swimming-bristles.

Claparède[4] describes and figures a new species under the name of *Autolytus roseus*, which bears a very close resemblance to a female *Autolytus prolifer* bearing the sac with

[1] "Ueber den allgemeinen Plan in der Entwickelung der Echinodermen," 'Phys. Abh. Akad. Wiss. Berlin,' 1852, p. 52 (1853).

[2] 'Journ. Bost. Soc. Nat. Hist.,' vol. vii, p. 392.

[3] 'Zeitsch. f. w. Zool.,' xii, p. 113, pl. xi, f. 1—6.

[4] 'Glanures,' p. 106, pl. vii, fig. 4 (1864).

eggs. As he figures the bristle with a simple hook to the terminal piece it is possible that a misinterpretation has occurred.

Malaquin (1893) states that the formation of the sac is always subsequent to the separation of the stolon, but apparently he has not seen it. The first and second setigerous segments carry the eggs, and they have no swimming-bristles. The rest of the segments, with the exception of a few of the last, are provided with these bristles.

He gives a careful account[1] of the development of *Autolytus* from $\frac{2}{10}$ mm. onward. The youngest stage is devoid of bristles, shows a head with four eyes, the anterior with lenses, and palpocils, a tail, and two constrictions, with cilia on the elevated regions between. The pharynx is indicated. In the next stage, also achætous, the body is longer, shows constrictions, the cephalic and post-cephalic segments have cilia, the pharynx abuts on an intestine, but the latter is devoid of an anus. Rudiments of the lateral tentacles appear, and the proctodeum is formed.

In the next stage the larval *Autolytus* is larger, the head is separated from the peristomial segment, and bristles appear in the first segment, the lateral tentacles are longer, and the median appears as a bud. Ciliated dorsal bands occur on the head and body.

The pharyngeal apparatus is only completed when the young form has from twenty-two to twenty-five segments. It feeds by thrusting out its proboscis and engulfing prey. At the sides of the larval pharynx are glands. Moreover, Malaquin points out that at the stage of eight or ten segments the larva presents two pharyngeal bulbs, the posterior becoming the proventriculus. By-and-by the transformation, by disappearance of the anterior enlargement, takes place, and the pharynx acquires the sinuous adult characters, when there are about twenty-two segments with bristles.

The *Autolytus fallax* of Malmgren (1867) does not seem to differ in any important point from this species.

In connection with this group is a bud which may be termed *Autolytus A.*

Habitat.—Clinging to an osculum of *Halichondria panicea* under a stone in a pool at the East Rocks, St. Andrews, November 5th, 1863.

Head rounded, small, with two large round black eyes. A comparatively short median and two lateral tentacles.

Body about half an inch long, not much diminished anteriorly, but tapered posteriorly, and the segments are distinctly marked.

The foot (Plate LXX, fig. 10) has dorsally a comparatively short and unjointed cirrus, the basal region (ceratophore) apparently not being differentiated. It is tapered to a blunt tip. The space between the cirrus and the setigerous region of the foot is short, and is supported by some slender spines which separate from those passing to the setigerous lobe. A tuft of very slender translucent bristles projects from this region about as far as the tip of the setigerous lobe. These may be developing swimming-bristles. The setigerous lobe is ovate, and has a series of slender spines in its centre. A careful search furnished one or two bristles (Plate LXXIX, fig. 3) of the form shown.

This differs from Johnston's *Ioida macrophthalma* in the structure of the foot, since the cirrus is obscurely moniliform and twice the length of the foot, whilst there are two

[1] Op. cit., pp. 392—404.

bundles of bristles—the superior capillary, the inferior articulated. Unfortunately the bristles are imperfect, only a shaft (Plate LXXIX, fig. 3) having been obtained. The peculiar nature of the dilatation, together with the shape of the foot, would seem to point to its connection with *Autolytus* rather than either *Eusyllis* or other form.

Autolytus? Female Bud.

A form captured by the tow-net in the Firth of Clyde differs from the ordinary female *Autolytus* carrying ova in several particulars, and I am indebted to Professor Graham Kerr, of Glasgow, for bringing it under my notice just as this part is passing through the press. The sole example (Fig. 57) is stained and mounted on a slide, so that only an imperfect description can at present be given. It appears to be fully a quarter of an inch in length, and is readily discriminated by the absence of the single ventral egg-capsule, the ova being borne in eight conspicuous globular or pear-shaped sacs.

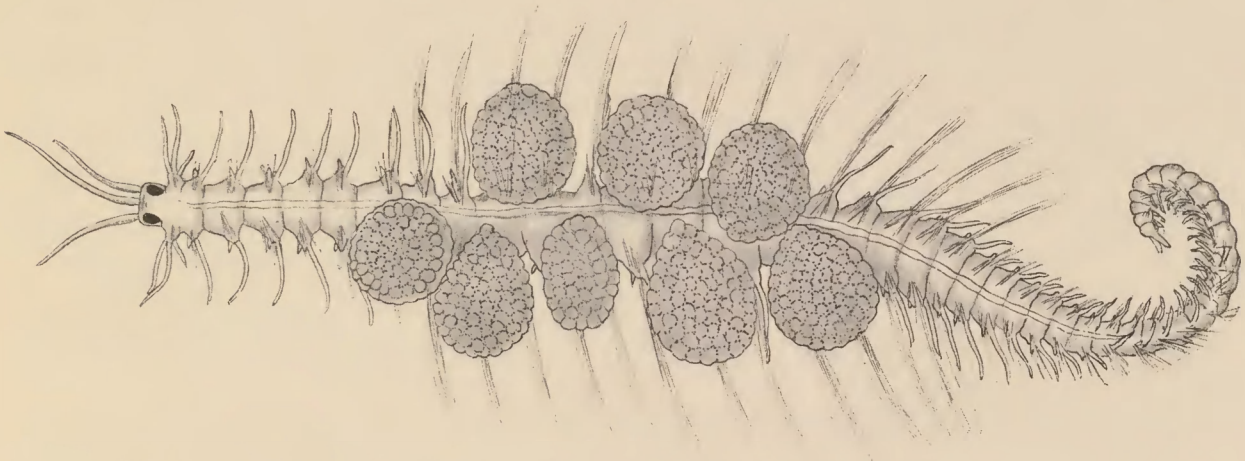

Fig. 57.—*Autolytus* (female bud) with pyriform lateral sacs containing ova.

The head resembles that of an *Autolytus*-bud, with a long median and two somewhat shorter lateral tentacles, a large rounded dorsal and a larger ovoid ventral eye occur on each side. Each appears to be furnished with a lens. Then follows the buccal segment with two tentacular cirri on each side, the base of the ceratophore being opaque, but apparently without differentiation into a rudimentary ovigerous sac, yet the preparation left uncertainty on this point. The second segment bears a group of typical compound bristles, though the minute bifid terminal pieces are absent, and behind the foot a rounded swelling resembling an egg. A similar condition exists in the third, fourth, and fifth feet, only these have longer dorsal cirri in the preparation. The sixth has the same arrangement on one side, but on the other an egg lies in front of the foot in the cœlom. The seventh has similar bristles, but on one side a large ovisac. The eighth foot has a lanceolate flap and a tuft of long tapering swimming-bristles, and the setigerous region with the compound bristles is larger and truncated distally. Altogether about fourteen segments (*i.e.*, to the twenty-first) bear the long swimming-bristles, whilst the caudal region has about twenty-six segments, the body

gradually tapering and terminating in two short and slightly clavate caudal cirri. The great pear-shaped egg-sacs are arranged alternately, so as to give room for the distal globular region of each, and appear to occupy about ten segments. The dorsal cirri are longest in the ovigerous region, and diminish to short processes posteriorly. The alimentary canal is rudimentary, but is open in front.

The relationships of this form have not yet been ascertained, though it is clearly a female bud of an *Autolytus* having this characteristic method of carrying the comparatively large circular granular ova. Whether it has any connection with such forms as *Proceræa*, Ehlers, which is here included under *Autolytus*, remains to be seen.

Professor Graham Kerr [1] noticed that this form quite differed from the ordinary female bud of *Autolytus prolifer*.

The structure of the head, the arrangement and nature of the ovisacs, and other features, distinguish it at once from Kölliker's three forms, viz., *Exogone Œrstedii*, *Exogone cirrata*, and *Cystonereis Edwardsii*,[2] all of which bear ova in sacs.

Genus LVI.—Amblyosyllis, *Grube*, 1857.

Head short. Eyes, four pairs on each side, confluent. Tentacles and cirri long and slender. Palpi small, appearing as two bosses on the ventral surface. Two nuchal flaps.

Pharynx long, sinuous, armed with a point (trépan, Malaquin) and a circle of papillæ. Pharyngeal glands posteriorly, ventricule small, and with two minute cæca.

Body of few segments; cirri thread-like, not articulated (Langerhans). Ventral cirrus lanceolate. Falcate bristles bidentate. Penultimate segment provided with two pairs of cirri (Malaquin).

Grube's genus *Amblyosyllis* (1857) has priority.

Claparède [3] again established the genus *Pterosyllis* for this species, but the characters had probably been known previously in this country. He describes the proboscis as furnished with bifid cuticular papillæ in *P. formosa*, which seems to be very closely allied to *P. spectabilis*. His *Pterosyllis dorsigera* [4] may have some connection with a female of the same species, though the moniliform condition of the cirri is noteworthy. Subsequently Ach. Costa,[5] without having seen Claparède's accounts, described probably the same form under the name of *Nicotia lineolata*. The publication of the 'Catalogue of the British Museum' [6] added another generic name for the same type, viz. *Gattiola*.

Malaquin notes that the nuchal flaps (ailerons occipitaux) receive two large nerves from the occipital lobes of the cephalic ganglia. Lang considers them organs of smell, but Malaquin doubts this interpretation.

[1] 'Trans. Nat. Hist. Soc. Glasgow,' N.S., vol. viii, p. 4 (1905–6).
[2] 'Nouv. Mém. de la Soc. Helvétique,' Bd. vii, p. 14, Taf. iii.
[3] 'Beobach u. Anat.,' etc., p. 46 (1863), and 'Glanures,' p. 100 (1864).
[4] 'Glanures,' p. 100, pl. vi, fig. 1.
[5] 'Ann. del Mus.,' p. 160, 1864.
[6] 'Cat. Brit. Mus.,' p. 195.

1. Amblyosyllis lineata, *Grube*, 1864. Plate XLVIII, fig. 4; Plate LXXI, fig. 1—foot; Plate LXXIX, fig. 20—bristle.

Specific Characters.—Head small, transversely ovoid, with a median and two lateral tentacles of considerable length (indistinctly articulated, De St. Joseph). Palpi small, appearing as two bosses on the ventral surface. Eyes four, red, the anterior slightly the wider, and the pairs on each side almost connate. Behind the eyes are the ciliated nuchal wings, which have a sepia-brown tint with a pale border. Body about half an inch in length; segments sixteen, tapered in front and again posteriorly to a less degree, and ending in a bluntly-conical segment bearing two long cirri. General colour purplish brown, with definite yellowish patches. Feet thirteen pairs. Dorsally is the long slightly crenate cirrus. Near the base is a tuft of slender hair-like (swimming) bristles in certain females. Setigerous lobe stout with a conical papilla above the spine. Bristles a dense group, each bristle dilated and bevelled at the tip. Terminal piece longest in the superior bristles, tapering to a hook distally, and on the edge beneath is a secondary process, so that it is bifid. Ventral cirrus of a curved lanceolate form, and it scarcely reaches the tip of the setigerous region.

Synonyms.

1863. *Pterosyllis formosa,* Claparède. Beobacht., p. 46, pl. xiii, f. 31—34.
1864. „ „ Ehlers. Borstenw., p. 222.
„ *Nicotia lineolata,* A. Costa. Ann. del Mus. Zoologico, p. 160, Taf. iii.
„ *Amblyosyllis lineata,* Grube (?). Insel Lussin, p. 84.
1865. *Gattiola spectabilis,* Johnston. Cat. Brit. Mus., p. 195, pl. xvi A, f. 1—7, and p. 342.
„ *Pterosyllis formosa,* De Quatrefages. Annel., II, p. 17.
1867. *Gattiola spectabilis,* Parfitt. Trans. Devon. Assoc., ii, pt. 1, p. 236.
1874. „ *plectoryncha,* Marenzeller. Op. cit., p. 47, pl. v, f. 3.
„ *Stephanosyllis ornata,* Verrill. Proc. Americ. Assoc. Sc., 1873, p. 378, pl. iv, f. 1.
1875. *Pterosyllis lineolata,* Marion and Bobretzky. Ann. Sc. Nat., 6e sér, t. ii, p. 43, pl. iv, f. 13, and pl. v, f. 13.
1879. *Amblyosyllis madeirensis,* Langerhans. Zeitschr. f. w. Zool., t. xxxii, p. 561, pl. xxxii, f. 19.
1885. „ *lineolata,* Carus. Fauna Medit., p. 231.
1887. *Pterosyllis (Gattiola) spectabilis,* De St. Joseph. Ann. Sc. Nat., 7e sér, i, p. 187, pl. ix, f. 64—67.
1904. *Amblosyllis spectabilis,* Allen. Journ. M. B. A., n.s., vol. vii, p. 220.
1905. „ *lineata,* Graeffe. Arbeit. Zool. Stat. Triest, xv, p. 324.

Habitat.—Under stones near low water-mark, in the creek to the south of the harbour (behind the first small promontory) at Lochmaddy, North Uist, and again near the foot of the Lee hills, under a stone, near low water-mark. Off Fermain Bay, Guernsey, in 10 fathoms; and under stones in tidal pools, Herm. Off Plymouth, where it occurs in considerable numbers in sponges (Miss Florence Buchanan, Garstang, and Allen).

Naples; Marseilles (Marion and Bobretzky). Eastern shores of America (Verrill) ?.

Head small, transversely ovoid, with three long tentacles—a median and two lateral—all of considerable length (forty to fifty articulations, De St. Joseph). The palpi are

small and form two bosses on the ventral aspect of the snout. Eyes four, red, situated obliquely on each side, the anterior pair slightly wider than the posterior, and the pairs on each side connate, or almost so. Some specimens have a black point in the centre of each. Behind the eyes are the cephalic wings, which have a sepia-brown colour with a pale border. Tentacular cirri two pairs (one long and the other short).

The cirri on the head and first segment are sometimes pinkish from the presence of transverse reddish bars, and De St. Joseph found palpocils on all.

Body about half an inch or more in length (13 mm., De St. Joseph), segments sixteen to thirty (Marion and Bobretzky), deeply indented at the sutures, but not narrowed in front. It is tapered anteriorly, and again posteriorly, but to a less degree, and ends in a somewhat shield-shaped or bluntly-conical segment bearing two long cirri. The body is slightly rounded dorsally, flattened ventrally, and with a median ventral groove in the preparations. The general colour is purplish brown, with peculiar and definite yellowish patches. A dark brown bar, with an angle directed backward and thinned off at either end, crosses the segment in a line with the origin of the lateral cirri. Behind is a narrow, pale band with a somewhat cordate mark in the centre, succeeded by a broad brown band which runs into the dark belt first mentioned, and has on each side a pale and somewhat triangular patch which diminishes anteriorly as the brown of the general surface slopes to meet the first dark belt. Considerable variation in the arrangement of the pigment-bands occurs—De St. Joseph, for instance, describing only narrow, straight transverse bars. The last segment is dark brown. The penultimate segment is compressed and has no setigerous process, only two elongated cirri on each side, the longer inferior.

When the male is fully distended with ripe sperm the body recalls the condition in the Queen termite.

De St. Joseph states that the proboscis has six large teeth, each subdivided into three divisions (tricuspid). The proventriculus has eighteen rows of points, and instead of the two horny pieces of other Syllids has two horny valves.

Feet (Plate LXXI, fig. 1) thirteen or more pairs, increasing in size from the front nearly to the posterior end. They vary much in appearance, according to the condition of the reproductive elements, as likewise does the body. Dorsally is the long cirrus which arises from the posterior part of the lobe. It is slightly crenate when living, and has minute grains or specks of white pigment. Near the base of the dorsal cirrus in certain female examples is a small tuft of slender hair-like simple bristles, which readily become curved (from lack of stiffness). These probably represent the pelagic bristles of other forms. They were not present in a male distended with nearly ripe sperms.

The setigerous lobe is stout, with a bevelled tip, and superiorly is a conical papilla above the exit of the spine, which is supported by four or five others. The bristles (Plate LXXIX, fig. 20) form a dense group, the longer occurring superiorly, the shorter inferiorly, so that the outline of the brush slopes from above downward and inward, as indicated in Plate LXXI, fig. 1, where the foot is observed from above; the translucent and slightly curved shaft of the bristle is dilated at the tip which is bevelled to a point. The terminal blade is longest superiorly, shortest inferiorly, and tapers to a hook at the tip, while on the edge beneath is another process, less distinct, for instance, than in

Pionosyllis, so that the blade is bifid. The edge is probably minutely serrated, but this could not be satisfactorily determined.

The ventral cirrus arises from the posterior edge of the foot, is of a curved, lanceolate form, and scarcely reaches the tip of the fleshy part of the setigerous region. The occurrence of the ventral cirrus distinguishes this genus from both *Autolytus* and *Myrianida*, and is another instance of the plastic nature of the appendages in the Annelids.

Reproduction.—The period of reproductive activity is, in all probability, in July. A ripe male was found at Herm in August, and an advanced female, in the same month, at Lochmaddy, North Uist. The changes in the form of the body and bases of the feet at maturity are marked. In one the seventh segment was more dilated than the rest, but this may have been accidental. The ova are of an orange or brownish hue.

De St. Joseph [1] describes the eggs as green or brown, while the sperms are white. The natatory bristles commenced on the seventh segment. The eight segments filled with the sexual elements are largely dilated, and their colouration is reduced to a simple brown band. The eyes are largely increased in size, and cover almost the entire head. After the development of the natatory bristles the animal swims with great activity. The reproduction is direct, without alternation of generations.

Malaquin [2] observed a young *Amblyosyllis* of eight bristled segments. Its proboscis is long and coiled, but the larval pharynx is still visible anteriorly. The proventriculus is present though small. The occipital wings and minute palpi are present. The stage appears to agree with that of an *Autolytus* of twenty-two segments.

Habits.—It is a most interesting and beautiful annelid in confinement. In repose the cirri are gracefully coiled on the dorsum, but on touching the animal with a needle they are stretched out, the opposite of what occurred in Mr. Hancock's specimen, though it agrees in part with Mr. Dyster's experience as mentioned by Dr. Johnston. When moving about a large trough (of a dissecting-lens) it occasionally coiled up the long cirri, and swam through the water with a rapid wriggling motion like *Evarne* or *Harmothoë*. In its native sites it cannot have much scope for locomotion, and this may explain its habit of remaining quiescent for a long time in a glass vessel, its cirri being closely coiled.

Specimens very readily fracture themselves in confinement, as, for instance, in a bottle amongst other marine animals, or when put in spirit. Yet they may be kept alive for a considerable time. Thus one obtained near the foot of the Lee hills at Lochmaddy was carried in a small bottle (ʒij) therefrom to the summit of the mountain and across to the shore on the southern side, where the sea-water was renewed. Moreover, ten or twelve days thereafter it was transported to Murthly in Perthshire, where the coloured figure was made and where it lived for six weeks.

In a specimen from Herm the bases of the cirri were covered with minute whitish parasites, probably the forms alluded to by De St. Joseph,[3] viz. Infusorians. He mentions *Trichodina Auerbachii*, Cohn, *Licrophora Auerbachii*, Claparède, and an Acineta (*Ophryo-*

[1] Op. cit., p. 189 (1886).
[2] Op. cit., p. 423, pl. xiv, f. 30.
[3] 'Ann. Sc. Nat.,' 7e sér., I, p. 190 (1886).

dendron annulatorum) on the tentacles and cirri. He also found a number of Cercariæ and Distomes in the intestine.

What the *Amblyosyllis rhombeata* (1857) of Grube may be is doubtful ('Annul.,' Œrst., 1857, p. 29). It has fourteen sub-rhomboid segments, and came from St. Croix. De Quatrefages thinks it is near *Ioida*, but this can hardly be. Grube's *A. lineata*,[1] which is roseate and has sixteen segments, from Lussin Picolo, is nearer the British species, and may, indeed, be that form.

Malmgren[2] describes the falcate bristles of his *Gattiola finmarchica* as simple, yet in other respects the form does not appear to differ from the British. It is possible that the minute secondary process may have been overlooked.

De St. Joseph in 1886 points out that without any anatomical differences four species of this form have been made.

It is doubtful if the species described by Marenzeller (1874), viz., *P. plectorhyncha*, differs in any essential degree from the present form. A further examination of *P. lineata* is also necessary.

A similar species (*I. cincinnata*, Verrill, 1879) occurs on the American shores; indeed, it is probable that the same form is found there. The *Stephanosyllis picta*[3] and *ornata*[4] of Verrill do not appear to differ materially from the British annelid. Two names are thus given to the same species, and two figures (Pl. II, fig. 1, and Pl. IV, fig. 1) seem to refer to the same form.

Malaquin[5] points out the structure of the proventriculus of this annelid, the muscular columns having the form of a pyramid, which in transverse section presents two fissures. They also show from fifteen to twenty striations.

Genus LVII.—Myrianida, *Audouin and Milne Edwards* (1845).

Head devoid of palpi, three tentacles—a median and two lateral. A pair of tentacular cirri. The foregoing and the cirri thick and clavate, or almost foliaceous. No ventral cirrus. Reproduction by schizogamy.

The genus was established by Milne Edwards, who termed the phenomena of its reproduction, multiplication by buds. Ehlers placed it near *Autolytus* and *Proceræa*. The second example was procured by Claparède at Naples, and the author considered that it was not mature, being only 3·5 mm.[6] in length, whereas the former specimen (Milne Edwards') was 64 mm. He termed it *M. maculata*. Viguier found the female form (*Sacconereis*) of *M. fasciata*. De St. Joseph observed two examples of *M. maculata*. Giard showed that *M. fasciata*, M. Edwards, agreed with *M. pinnigera*, Montagu. Malaquin again seems inclined to ignore Giard's diagnosis.

[1] 'Archiv f. Naturges.,' 1863, p. 48, Taf. v, fig. 1.
[2] 'Annul. Polych.,' p. 38, Tab. vi, fig. 36 (1867).
[3] 'Americ. Journ. Sc.,' iii, vol. vii, p. 132 (1874), pl. v.
[4] 'Proc. Americ. Assoc. Sc.,' 1873, p. 378.
[5] Op. cit., p. 230.
[6] This is probably a misprint for 35 mm.

1. Myrianida pinnigera, *Montagu*, 1808. Plate LXXI, figs. 5 and 6—feet; Plate LXXIX, figs. 24 and 24 *a*—bristles.

Specific Characters.—Head comparatively small, bluntly conical or irregularly rounded. Eyes large, the two anterior being wide apart, while the pairs on each side are close together. Palpi apparently fused, forming two rounded bosses with a median fissure in front. Median tentacle long and somewhat clavate, lateral shorter and dilated at the tip. First pair of tentacular cirri curved and short; second clavate and rather longer. Body (of nurse-stock and buds) about 1½ in. long, the two sections being nearly equal. Nurse-stock dull whitish and brilliantly marked by thirteen rich orange spots, two irregular longitudinal patches in front, followed by a pair, and then nine well-defined spots, having a deep orange marginal belt and a paler orange centre. Two orange dots occur on the last segment of the nurse-stock. Behind the tentacular cirri are two or three cirri of similar form, though with a tendency to flattening, but becoming ringed in spirit, and thus differentiated from the succeeding. Foot with the dorsal cirrus in the form of a flattened oar, which is translucent, with a faint milky opacity, and of a tissue more lax than the ceratophore. Setigerous lobe has superiorly a prominent papilla above the spines, whilst the outline of the ventral border is nearly semi-circular. Bristles rather feeble, elongated, the distal end of the shaft dilated, and the bevelled region spinous distally. Terminal piece short and diminished towards the bifid tip.

Synonyms.

1808. *Nereis pinnigera,* Montagu. Trans. Linn. Soc., ix, p. 111, Tab. 6, f. 3 (nurse-stock and bud).
1812. „ „ Pennant. Brit. Zool., iv, p. 95.
1815. „ *maculosa,* Montagu. Trans. Linn. Soc., xi, p. 21, pl. iii, f. 4 (♀ bud).
1845. *Myrianida fasciata,* M. Edwards. Ann. Sc. Nat., 3e sér., t. iii, p. 170, pl. xi, f. 65—68.
1851. *Nereis pinnigera,* Grube. Fam. Annel., p. 63.
1864. „ „ Kölliker. Kurz. Ber. Schotl., p. 9.
1865. *Nereis pinnigera,* Johnston. Cat. Brit. Mus., p. 281.
„ „ *maculosa,* idem. Ibid, pp. 198, 280 (bud).
„ *Myrianida fasciata,* De Quatrefages. Annel., II, p. 63.
„ „ *pinnigera,* Johnston. Cat. Brit. Mus., p. 196.
1867. „ „ Parfitt. Trans. Devon. Assoc., ii, pt. i, p. 236.
„ *Amytidea maculosa,* idem. Ibid., p. 29.
1869. *Myrianida fasciata,* Langerhans. Zeitsch. f. w. Zool., xxxii, p. 581.
1885. „ „ et *maculata,* Carus. Fauna Medit., p. 237.
1886. „ „ Viguier. Arch. Zool. Expér., 2e sér., iv, p. 432, pl. xxvii, f. 21 and 22.
„ „ „ Harvey Gibson. Proc. Lit. Phil. Soc. Liverp., vol. xi, p. 154.
1890. „ *pinnigera,* Giard. Bull. Sc. Fr. Belg., t. xxii, p. 79.
1893. „ *fasciata,* Malaquin. Recherch. Syllidiens, *ubique* in text and figs.
1895. „ *maculata,* De St. Joseph. Ann. Sc. Nat., 7e sér., tom. xx, p. 195.
1904. „ *pinnigera,* Allen. Journ. M. B. A., n.s., vol. vii, p. 220.

Habitat.—Dredged in 10 fathoms at the northern end of Bressay Sound, amongst horse-mussels, July, 1871; and, again, in the Sound of Harris, in 3 to 4 fathoms, in

August, 1872, amongst the roots of tangles (nurse-stock with female buds). Amongst ascidians and sponges, Plymouth (Allen).

Shores of France (Audouin and Edwards). Madeira (Langerhans).

Head comparatively small, bluntly conical or irregularly rounded, the transverse exceeding the antero-posterior diameter in spirit-preparations, whilst the posterior border is rounded and the anterior truncate. The eyes are large, the two anterior being the wider apart and with lenses, though the pairs on each side are close together. The palpi appear to be fused, forming two rounded bosses with a median furrow in front. The median tentacle is long and somewhat clavate, the lateral on each side shorter, more cylindrical, and somewhat dilated at the tip. A short, curved pair of tentacular cirri follow, then another clavate pair, rather longer than the first. All have vibratile cilia. De St. Joseph describes the median and lateral tentacles in his *M. maculata* as foliaceous like the cirri in the nurse-stock of sixty segments. There would thus seem to be variation in this respect.

Body (in nurse-stock and buds from Bressay Sound) about 1½ in. long,[1] the two sections being about equal in length. The dull whitish nurse-stock in front is brilliantly marked by thirteen rich orange spots, two irregular patches in front, the first commencing behind the eyes, and median in position, with the posterior end somewhat bifid, and the second occasionally is also chiefly longitudinal, followed by a pair (the third), and then by nine well-defined spots having a deep orange marginal belt and a paler orange centre. Two orange dots occur on the last segment of the nurse-stock. The posterior region or section is formed of buds, the largest (and oldest) being posterior. Eight or nine had distinct eyes, in the rest these were obscure.

Behind the long clavate cirrus mentioned in connection with the head are two or three shorter cirri of similar form, the last, however, having a tendency to flattening. All the foregoing cirri and tentacles are more or less ringed in spirit, thus being at once differentiated from the succeeding cirri, which assume the form of flattened oars, and continue of this shape to the posterior end. In those in process of regeneration the organs are narrower and more pointed. The cirri throughout are translucent, with a faint, milky opacity. The buds have minute cirri of the same form as the nurse-stock. The terminal (and oldest) bud had two longer caudal cirri. On the dorsum of the buds the orange specks are chiefly arranged in pairs.

Claparède (1868) describes the proboscis as similar to that in *Proceræa aurantiaca*, the anterior edge without papillæ or denticles, and the proventriculus with about thirty-four rows of points.

De St. Joseph describes the nurse-stock as having in his example sixty-six segments. Then followed a bud of ten segments, and behind it fifteen others. The first had a rudiment of a head without eyes, with two rudimentary palps. It had three segments. The second and third were similar, but with four segments. The fourth agreed with the foregoing, but had eight segments. The fifth had four minute eyes and twelve segments, and a simple pigment-touch. The sixth and seventh were similar, and the palps were

[1] Malaquin gives 32 mm. for nurse-stock and 38 mm. for stolons in one, sixty-six segments (twenty-nine stolons).

differentiated; they had twenty segments. The eighth and ninth corresponded, and the bifurcation of the palps had commenced. In the eleventh and twelfth the bifurcation of the palps was marked, and the tentacles were present. They had twenty-three segments. From the sixth to the twelfth bud there were four reddish-orange touches. In the thirteenth and fourteenth the palps were completely bifurcate, the tentacles well developed, and the eyes large. The fifteenth and last ripe stolon became detached under observation.

Foot.—In the nurse-stock (Plate LXXI, fig. 5) dorsally is a long ceratophore rounded at the end. It bears the large flattened cirrus, the tissue of which is much more lax than that of the basal process, and has pigment and glands. The cirrus forms a long flattened blade, somewhat pointed at the tip, and having a central nerve of considerable size, which gives off branches on its way to the tip. The inferior lobe has superiorly a prominent papilla above the tips of the spines, which form a group. The outline of the ventral border is nearly a semicircle, the swollen process inferiorly having pigment and glandular tissue. The ventral bristles (Plate LXXIX, fig. 24) are rather feeble, with elongated, slightly curved shafts dilated at the tip, the edges of the bevelled region distally being minutely spinous, whilst the terminal piece is short and diminished towards the bifid tip. As usual the points of the hooks are directed dorsally.

In the bud a distinct papilla occurs between the ceratophore of the dorsal cirrus and the base of the ventral lobe (Plate LXXI, fig. 6), from which a long tuft of swimming-bristles (Plate LXXIX, fig. 24 *a*) projects.

Reproduction.—The specimen procured on August 8th, in the Sound of Harris, carried female buds, all with ova except the minute ones next the nurse-stock. The latter had fully sixty segments, and there were ten buds. On the other hand, that procured in Bressay Sound, Shetland, in July, carried male buds.

In life the species is one of the most beautiful and graceful in the family. Its brilliant orange spots, the translucency of its tissues, and its active movements as it trails the long series of finely-coloured buds behind it, make it as striking as it is interesting.

Montagu's *Nereis pinnigera* (1808) is a nurse-stock with a developing bud posteriorly. He thought that at the posterior end it (the nurse-stock) "suddenly decreases and becomes very small, as if that part had been newly formed; a circumstance of no unreasonable conjecture, as it is well known that many of the Mollusca tribe are capable of reproduction." The *Nereis maculosa* of the same author appears to be a pelagic female bud of this species,[1] with swimming-bristles. Dr. Johnston made a separate family for it (Amytiaceæ). In his manuscript volume of drawings (1808) in the Linnæan Society, Montagu shows in Plate XVIII, fig. 2, under the name of *Nereis doridea*, a female bud, and in fig. 4 the species itself (nurse-stock) with buds.

The *Myrianida longissima* of Audouin and Edwards[2] is probably the same form.

De St. Joseph describes the proventriculus in *M. maculata*, Claparède, as barrel-shaped, with thirty-two rows of "oleaginous" dots, and occupying segments 13, 14,

[1] 'Trans. Linn. Soc.,' xi, p. 21, Tab. iii, fig. 4, and also MS. vol. Drawings in the Linn. Soc., Plate XXXV, fig. 4.

[2] 'Ann. Sc. Nat.,' t. xxix, p. 240.

and 15. The proboscis is 4 mm. long, and has fifty to sixty pointed papillæ at the edge. There are no lateral pouches or stomach. Little difference exists between this and the foregoing species.

Malaquin [1] considers from his observations on three examples that the budding occurs after the sixty-sixth segment of the nurse-stock. The segment concerned is the penultimate one, and he terms it "*Zoonite formateur*." The pygidium of the nurse-stock, therefore, he found at the extremity of the twenty-ninth bud. With this segment (*zoonite formateur*) the new buds are connected. On the other hand, he has observed *zoonites formateurs* at a distance from the pygidium and independent of it. This author has studied the growth of the buds, the early segments of which present no appendages; then minute processes appear in the succeeding segments, in the first or youngest bud on the pygidium (Malaquin). In the next series of segments forming a bud, these appendages are better developed, and so until in the third bud (*e. g.*) bristles occur, and the alimentary canal of the nurse-stock goes through each to the terminal bud. Each stolon possesses a *zoonite formateur* in front of the pygidium, the former having no appendages, the latter having them. Malaquin thinks the formative segment in the buds gives rise to additional segments in front. The anterior segment, on the other hand, is thickened dorsally and gives rise to head and post-cephalic segment. The author minutely describes each successive bud, and the appearance of the various appendages in it, including the eyes for dorsal and ventral vision, and the swimming-bristles. The terminal stolons—male or female—thus developed show great activity, and by-and-by break from the nurse-stock and swim freely away. The male bud (*Polybostrichus*) had thirty segments besides head, peristomium, pygidium, and the formative ring in front of it. Their sexual elements were ripe. The first four segments have no swimming-bristles, and contain the genital glands (four pairs). They have spots of brilliant orange-red pigment. The head bears dorsally a long median and two shorter lateral tentacles, and beneath are the split palpi, or, as he terms them, the anterior lateral antenna and the palpus. The peristomial segment has a long dorsal and a shorter ventral tentacular cirrus.

The female bud (*Sacconereis*) has about thirty-five segments, and twenty-three bear swimming-bristles. The head carries a median and two lateral foliate tentacles. The post-cephalic (peristomial) has a single tentacular cirrus. The eyes are, as in the male, a larger anterior and a smaller posterior. The ovigerous sac occupies the fifteen or sixteen median segments, and has a median constriction. It is proportionally smaller than in *Autolytus*, and has exactly forty-three large orange eggs (Malaquin). The sac is a transparent secretion of the mucous glands of the ventral division of the foot. The colouration is similar to that of the male. The natatory bristles begin on the first foot, though occasionally they vary. These stolons, ♂ and ♀, are devoid of a proboscis and proventriculus.

[1] 'Recherches sur les Syllidians,' pp. 287—305.

ERRATA ET CORRIGENDA.

PAGE

2. Explanation of Fig. 43, for nephridispore read nephridiopore. *for* nephridispore *read* nephridiopore.
6. „ *for* below *read* above.
8, line 14 from bottom, for Plate LXXVII *read* Plate LXXVI.
17, „ 15, Plate fig. 6 *read* fig. 3.
17, „ 16, *for* Pl II *read* Plate LXXVI.
20, „ 22, „ „ „
21, „ 18, „ „ „
22, „ 24, *delete* the *before* priority.
23, „ 4 from bottom, *for* Pl. LXXVII *read* Pl. LXXVI.
24, „ 21 from bottom, 1867, *for* Annel. *read* Annul.
26, „ 6, *for* dilation *read* dilatation.
29, „ 12 from bottom, *for* Plate LXXVII *read* Plate LXXVI.
30, „ 7, 1867, *for* Annel. *read* Annul.
31, lines 21 and 24, *for* Plate LXXVII *read* Plate LXXVI.
49, line 6 from bottom, *for* Annel. *read* Annul.
61, Synonyms, line 4, 1868, *for* Neap. *read* Nap.
62, line 22, *for* bacilliporous *read* bacilliparous.
75, „ 10 from bottom, *for* rev. *read* etc., and *for* Mgrm. *read* Mgrn.
99. Explanation of Fig. 43, for *spetzbergensis* read *spetsbergensis.*
104. Head-line and line 15 from bottom, *ditto.*
104, line 18, *for* Mgm. *read* Mgrn.
105. Head-line, for *spetzbergensis* read *spetsbergensis.*
108, „ 7, *for* preparation *read* preparations.
111, „ 13, *for* umbricate *read* imbricate.
114, „ 11 from bottom, *for* organs *read* organ.
130. Foot-note 1, *for* Annel. Neap. *read* Annél. Nap.
135. „ 2, „ „ „ „
142. „ 4, „ „ „ „
143, line 23, for *moniliconis* read *monilicornis.*
144, „ 19, *for* chitine *read* chitin.
154, „ 18, *for* Long. 55 *read* Log 55.
161, „ 3, *for* epithelium *read* coat.
170, „ 11, *insert* a comma *after* bilobed.
178, „ 4, *delete* and in rear of.
197, and in succeeding entries under Synonyms, *for* Annel. Nap. *read* Annél. Nap.
214, line 18, *insert* a comma *after* front.
228, „ 11 from bottom, *insert* apparently *before* devoid.
228, „ 7 „ *delete* the comma *after* reproduction.
232. Foot-note, *for* Syllidians *read* Syllidiens.

PLATE XLIII.

Fig.

1. *Nephthys cæca*, O. Fabr., from the dorsum. About natural size. The example is a little more deeply coloured than usual.
2. *N. cæca*, var. *ciliata* (epitokous form ?), the *N. longisetosa* of Johnston, from the dorsum. Slightly enlarged.
3. *Nephthys Hombergii*, Lamk., from the dorsum. The filament at the tip of the tail is unusually long. Slightly enlarged.
4. *Anaitis rosea*, McIntosh. St. Andrews. From a drawing by Eliza Lorimer. It is incomplete posteriorly. Enlarged.
5. *Eulalia bilineata*, Johnst., var., from the tidal region, St. Andrews, July 1st, 1904. Enlarged.
6. *Eulalia nebulosa*, Mont. Drawing of a specimen from Plymouth by Mrs. Sexton. × 2.
7. *Eulalia viridis*, O. F. Müll., var. = *E. aurea*, Gravier, from Plymouth. From a drawing by Mrs. Sexton. × 3.
8. *Eulalia* ? brick red, Dr. Allen, Plymouth (six specimens found July 26th, 1904). Enlarged.
9. *Eumida sanguinea*, Œrst. The body shows various constrictions and dilatations. Enlarged.
10. *Eumida sanguinea*. A few segments, behind the middle, of a variety from Plymouth having a dull orange hue. Enlarged.

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PLATE XLIV.

Fig.

1. *Eulalia viridis*, O. F. Müll., from the East Rocks, St. Andrews. Enlarged.
2. Gelatinous cocoon with ova of the foregoing (?) appended to a fragment of *Fucus serratus* by a cord of mucus, from St. Andrews (in March). Enlarged.
3. *Eulalia tripunctata*, McIntosh, from St. Andrews. Considerably enlarged.
4. *Eumida sanguinea*, Œrst., with white bar at collar and white touches, from Plymouth; drawn by Mrs. Sexton. Enlarged.
5. *Eulalia viridis*, O. F. Müll., var. *ornata*, De St. Joseph, from Plymouth; drawn by Mrs. Sexton. Enlarged.
6. *Phyllodoce Paretti*, De Blainv. Head and anterior segments, from the dorsum. From Plymouth. Enlarged.

6*a*. Middle segments of the foregoing, viewed laterally.

6*b*. Middle segments from the dorsum.

6*c*. Tail of the foregoing, recently reproduced.


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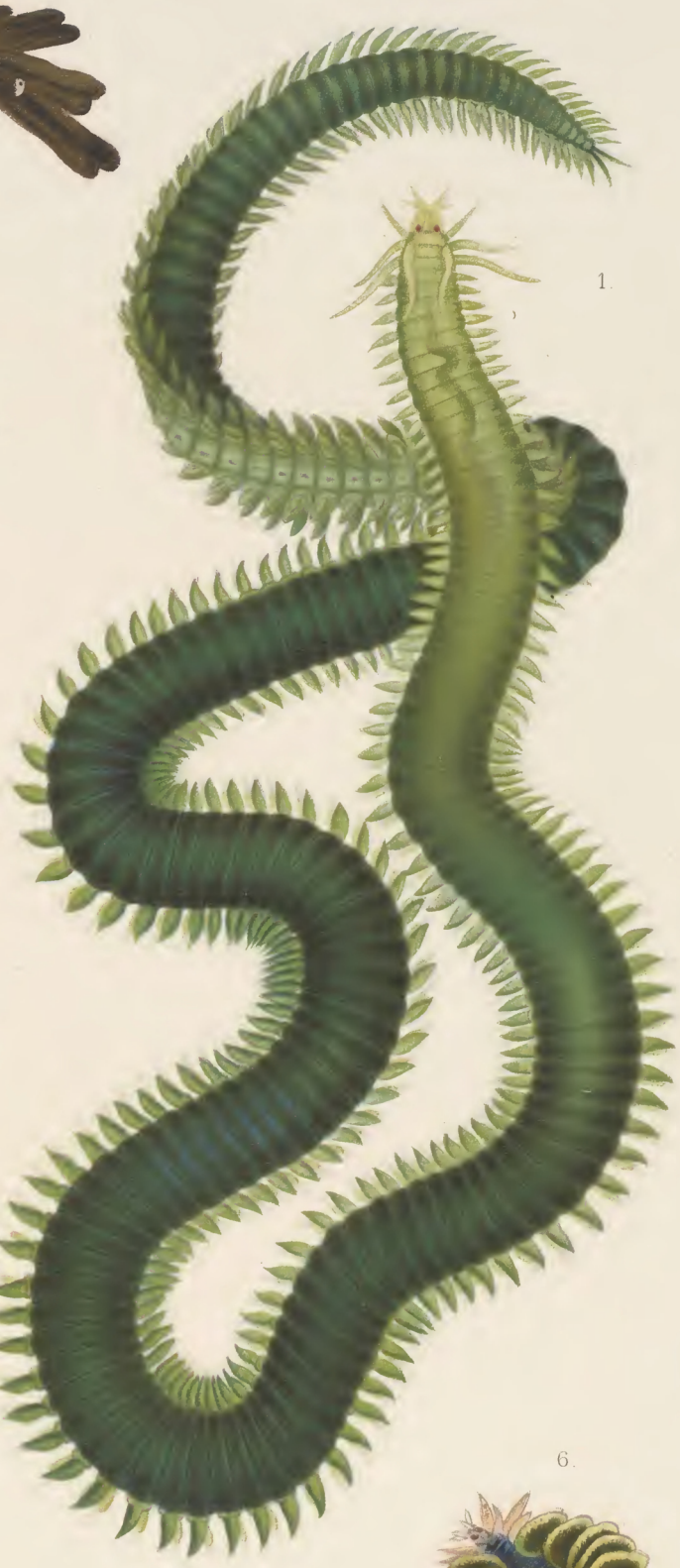
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6c.


6b.

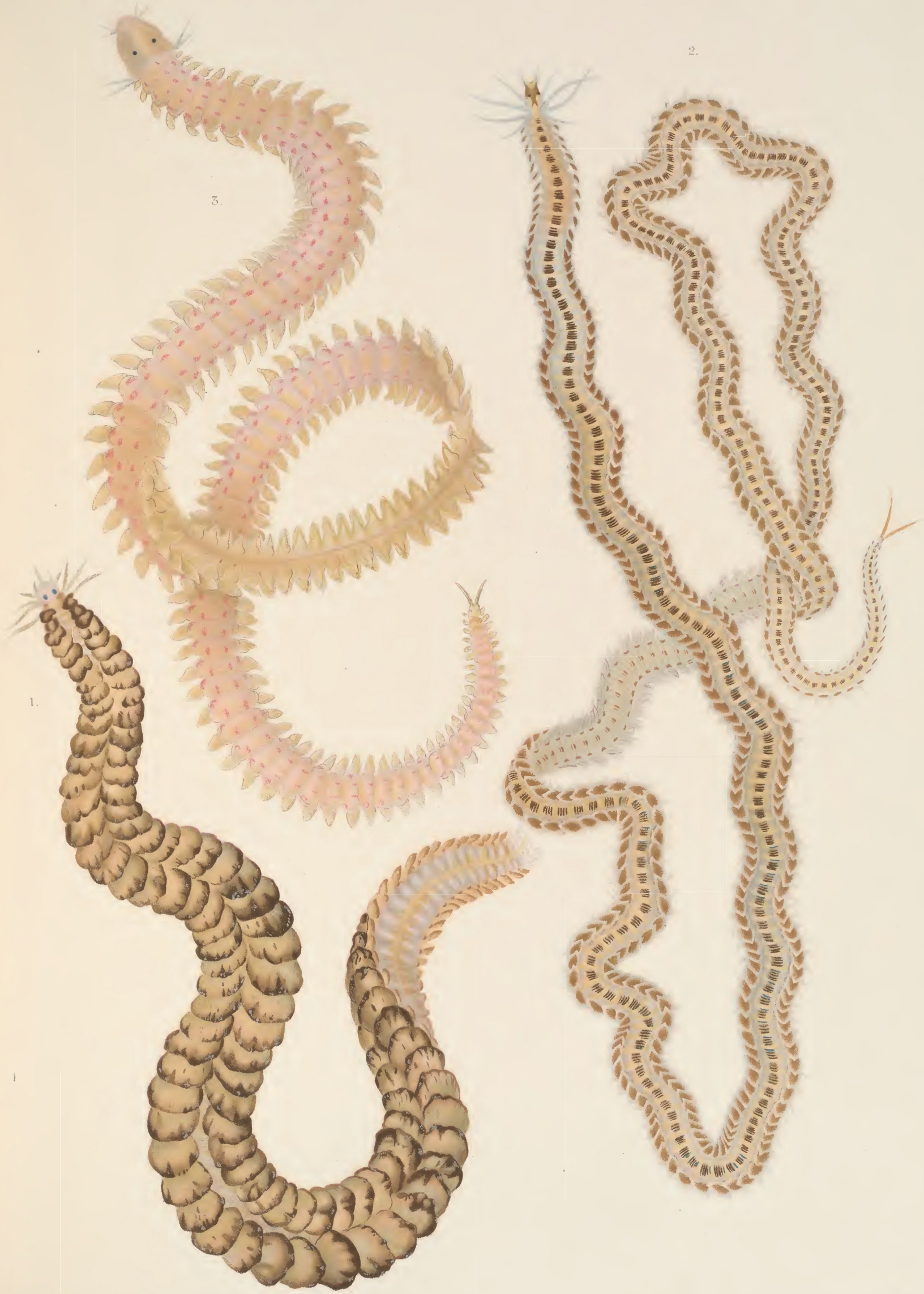
Figs. 1, 2 & 3. R.M.
4, 5. Mus. S. Cætera A.H.W.

Lith. Werner & Winter, Frankfort a/M.

PLATE XLV.

Fig.

1. *Notophyllum foliosum*, Sars, showing the dorsum, and, posteriorly, the ventral aspect of the tail (which is incomplete), from St. Andrews. Enlarged.
2. *Phyllodoce maculata*, Linn., in full activity, from St. Andrews. Enlarged.
3. *Eteone picta*, De Quatref., from St. Andrews. Enlarged. The red tints are less bright than originally.



R.M. ad nat. fecit.

Lith. Werner & Winter, Frankfurt

PLATE XLVI.

Fig.

1. *Pionosyllis prolifera*, Krohn (?), from St. Andrews. Enlarged.[1]
2. *Castalia punctata*, O. F. Müll., from the deeper water off St. Andrews Bay. Enlarged.
3. *Castalia fusca*, Johnst., from the tidal water, St. Andrews. The tail is incomplete and the bristles are absent from a few feet on the left anteriorly. Enlarged.

[1] There is doubt in connection with this figure, the preparation of which has been lost. The dorsal cirri showed no articulations in life.

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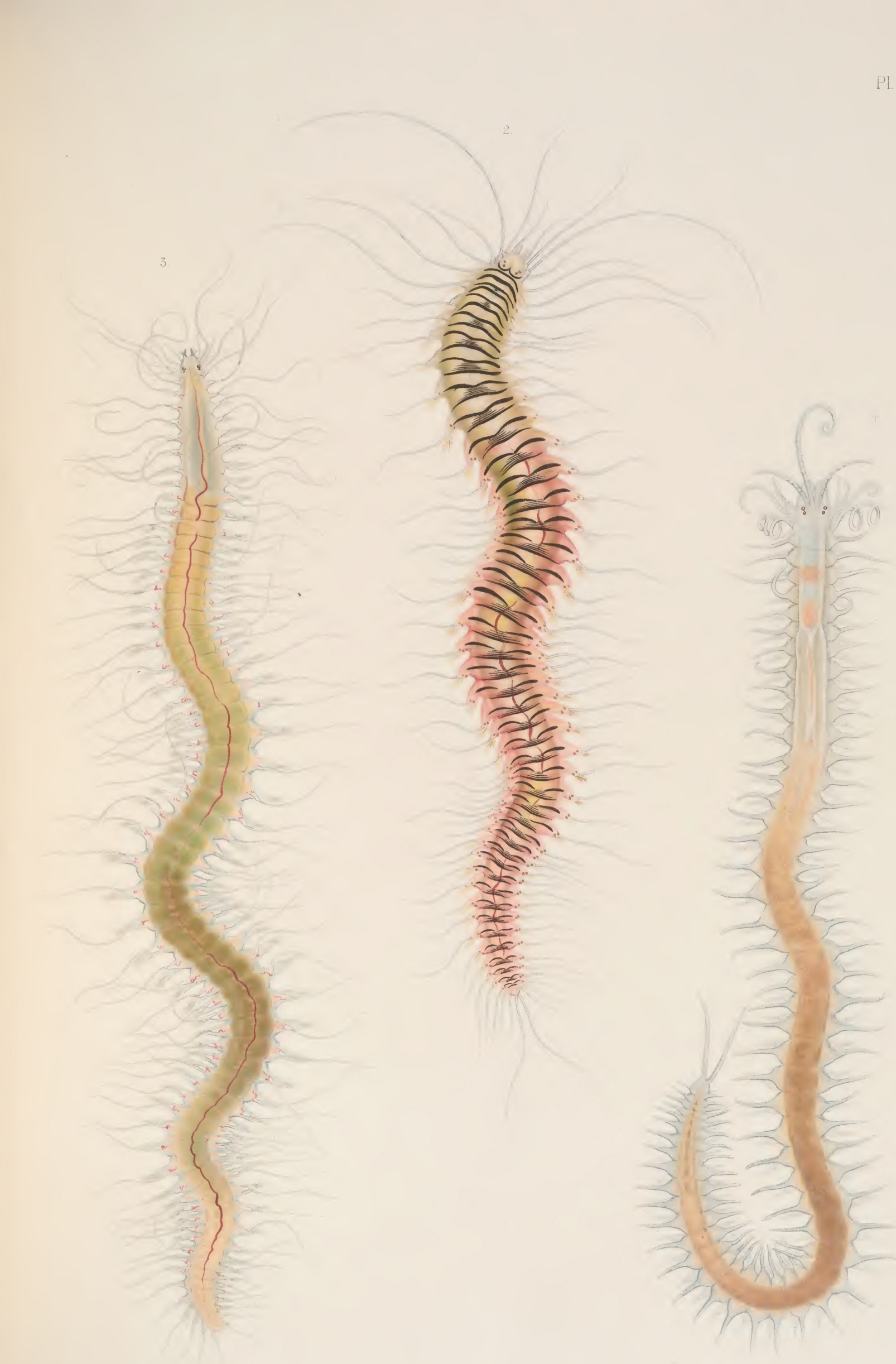

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PLATE XLVII.

Fig.

1. *Autolytus pictus*, Ehlers, male bud (*Polybostrichus*), from St. Andrews. The bifid palpi have the limbs approximated, so that the separation is scarcely visible. Enlarged.
2. *Phyllodoce lamelligera*, Linn., from a specimen at St. Andrews. × about 2. The majority are considerably darker.
3. *Phyllodoce maculata*, Linn., portion of the dorsum of an example of a deep greenish hue, in March, from St. Andrews. Enlarged.
4. *Phyllodoce rubiginosa*, De St. Joseph, from the dorsum, from Plymouth. A few of the dorsal cirri behind the head have been injured. Enlarged.
5. Middle segments of the above, from Plymouth. Enlarged.

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Fig.1 R.M. Fig.2 R.M.& A.H.W.
Cætera A.H.W.

PLATE XLVIII.

Fig.

1. *Eumida sanguinea*, Œrst., from St. Andrews. Enlarged.
2. Variety of the foregoing, with a white touch behind the head, and with transverse white bars, from Plymouth. Enlarged.
3. *Eteone spetsbergensis* (?), from the mouth of the Bay of St. Andrews. Enlarged.
4. *Amblyosyllis lineata*, Grube, from Lochmaddy, North Uist. Lived at Murthly for a month or two. Enlarged.
5. *Sylline rubropunctata*, Grube, from a Plymouth example. Enlarged.
6. *Autolytus prolifer*, O. F. Müll., *animal surculare*. Enlarged.

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Fig. 4. R. M. del.
Cætera A.H.W.

Lith Werner & Winter, Frankfort °/M

PLATE XLIX.

Fig.

1. *Phyllodoce lamelligera*, Linn., a variety, from Plymouth Sound, September 30th, 1905.
2. Dorsal aspect of a few segments from the middle of the foregoing. Enlarged.
3. *Odontosyllis gibba*, Clap., dorsal view of an example from Plymouth.
4. Middle segments of the foregoing, from the dorsum. Enlarged.
5. *Odontosyllis fulgurans*, Aud. & Ed., from Plymouth. The tail is incomplete. Enlarged.
6. *Syllis Krohnii*, Ehlers, from the tidal rocks, Lochmaddy, North Uist. It lived for months at Murthly. Enlarged.
7. *Autolytus*, deeply tinted like *pictus*, but probably *prolifer*, pelagic female, with eggs in ventral sac. Enlarged.
8. Nurse-stock of *Autolytus pictus*, Ehlers, from the West Rocks, St. Andrews. Enlarged.


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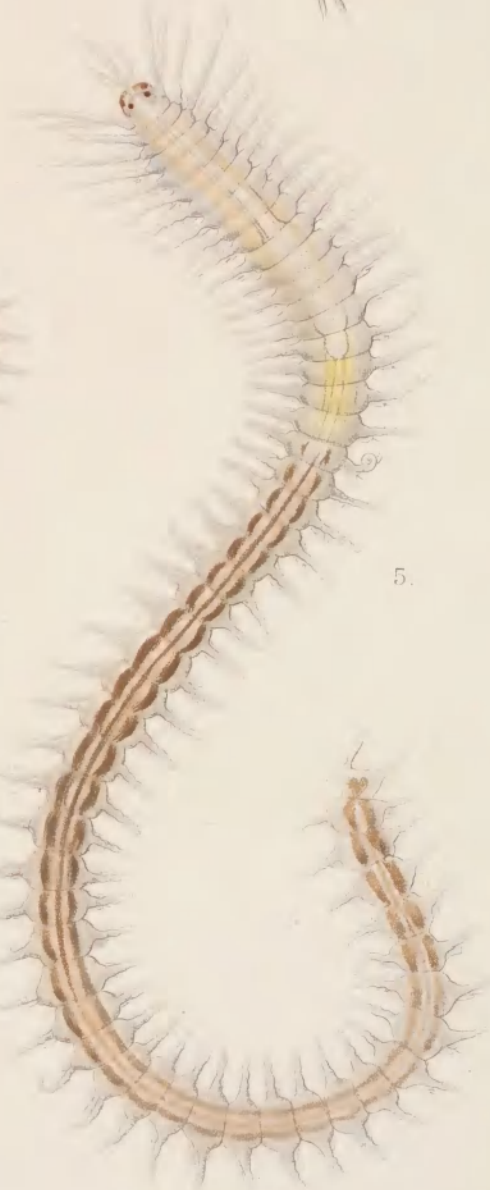
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PLATE L.

Fig.

1. Early stage in the development of *Nephthys*, October 23rd, 1897. × 100.
2. An older stage of the same date. × 100.
3. Specimen captured a few days later (October 28th) showing certain alterations of the head and body. × 100.
4. Head of *Eulalia bilineata*, Johnst. Enlarged.
5. Outline of the head and anterior region of *Eumida sanguinea*, from St. Andrews. Enlarged.
6. Young *Phyllodoce*, from St. Andrews, June 15th, 1898. Enlarged.
7. Dorsal cirri of a variety of *Phyllodoce lamelligera*, Linn., from Plymouth. Enlarged.
8. Head of *Phyllodoce rubiginosa*, De St. Joseph, from a Plymouth specimen. Enlarged.
9. Head of *Trypanosyllis zebra*, Grube, from Plymouth. Enlarged.
10. Tail of the foregoing. Enlarged.
11. Pelagic male *Autolytus* (= *Polybostrichus*). Enlarged.
12. Larval *Nereis* (*Alitta*) *virens*, from St. Andrews Bay, October 26th. × 50.
13. Older larval stage apparently of the same form, from St. Andrews. × 45.

14 and 15. Dorsal and front views of larval *Nereis*, from St. Andrews. × 100.

16. Post-larval *Nereis* (*Alitta* ?), September 26th, St. Andrews. × 40.
17. Head of *Nereis irorata*, Grube, from Plymouth. Enlarged.

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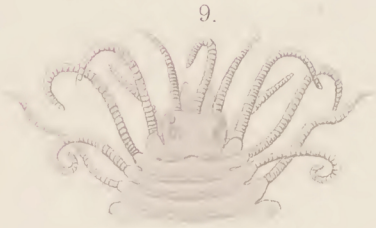

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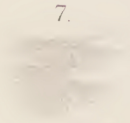

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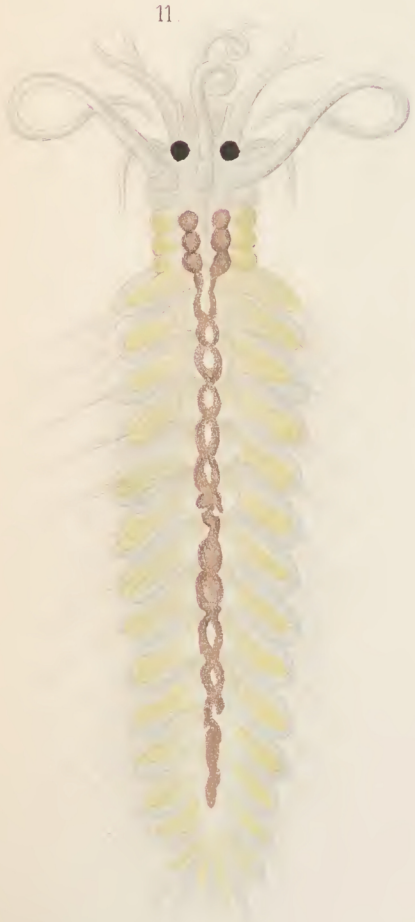

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Fig.1 W.C.M. Caetera A.H.W. del.

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PLATE LVII.

Fig.

1. Head of *Nephthys cæca*, O. Fabr., from the dorsum. Enlarged.
2. Under surface of head and anterior region of the same. Enlarged.
3. Extruded proboscis of the foregoing—from the ventral surface. Enlarged.
4. Extruded proboscis of the same form viewed from the free end. Enlarged.
5. Proboscis slit longitudinally and exposing the teeth. Enlarged.
6. Head of *Nephthys Hombergii*, Lamk., from the dorsum. Enlarged.

6*a*. Extruded proboscis of the same species from the dorsum. Enlarged.

7. Under surface of the foregoing, showing the mouth and the parts behind it. Enlarged.

7*a*. Head of the same with eyes from St. Magnus Bay (Dr. Gwyn Jeffreys). Enlarged.

8. Head and exserted proboscis of *Nephthys hystricis*, McI., from the dorsum. Enlarged.
9. Lateral view of the same proboscis. Enlarged.
10. Dorsal view of the head and proboscis of *Nephthys longisetosa*, Œrst. Enlarged.
11. Proboscis of the same partially extruded. Enlarged.
12. Proboscis of the foregoing wholly withdrawn. Enlarged.
13. Head of *Nephthys Grubei*, McI., from the dorsum. Enlarged.
14. Ventral surface of the foregoing. Enlarged.
15. Head of *Nephthys Johnstoni*, Ehlers, viewed from the dorsum. Enlarged.
16. Ventral surface of the same. Enlarged.
17. Head of *Nephthys cirrosa*, Ehlers, with extruded proboscis, from the dorsum. Enlarged.
18. The same from the ventral surface. Enlarged.
19. Head and anterior region of *Nephthys incisa*, Mgrn., from Galway. Enlarged.
20. Ventral surface of the foregoing showing the mouth. Enlarged.

6ª

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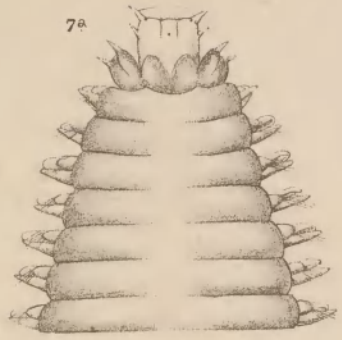

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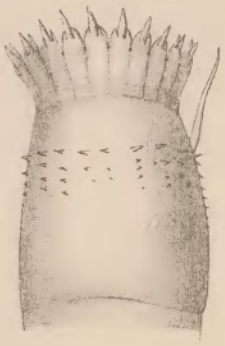

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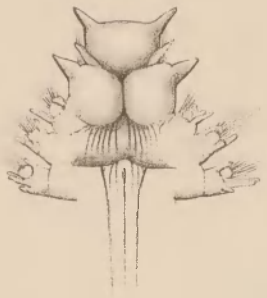

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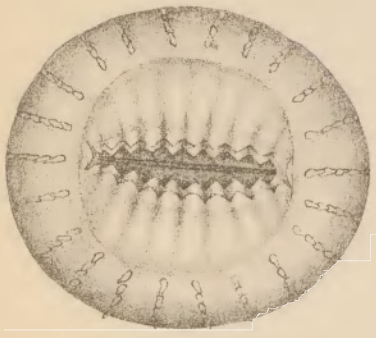

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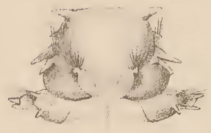

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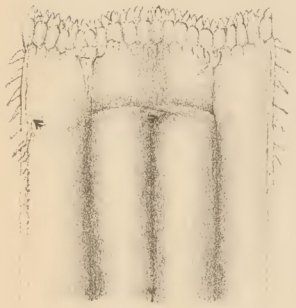

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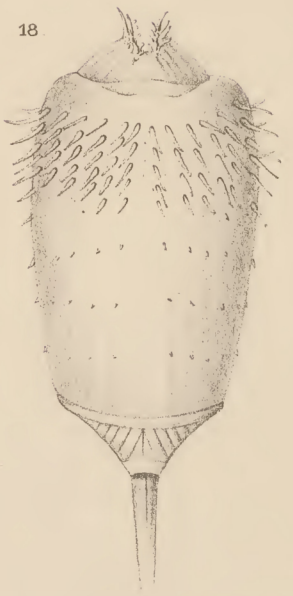

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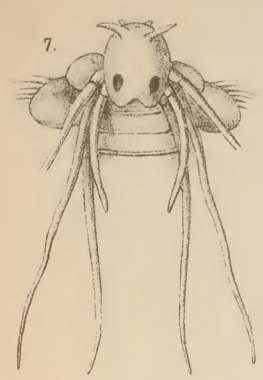
E.L.&A.H.W. del.

f.ª P.W.M.T. impr.

PLATE LVIII.

Fig.

1. Head of *Eulalia nebulosa*, Mont., from the dorsum. Enlarged.
2. Head of the foregoing with the proboscis extruded. Enlarged.
3. Head of *Eulalia viridis*, O. F. M., with the proboscis extruded. Enlarged.
4. Head of *Eulalia macroceros*, Grube. Enlarged.
5. Head of *Phyllodoce grœnlandica*, Œrst., from St. Andrews. Enlarged.
6. Head of *Anaitis Kosteriensis*, Mgrn. Enlarged.
7. Head of *Anaitis Jeffreysii*, McI., from Valencia Harbour. Enlarged.
8. Head of *Genetyllis hibernica*, McI. Enlarged.
9. Head of *Eteone arctica*, Mgrn., from H.M.S. 'Valorous.' Enlarged.
10. Head of *Mysta barbata*, Mgrn., dredged off the Isle of Man. Enlarged.
11. Head of *Mystides Lizziæ*, n.s., from Cape Sagres, 'Porcupine,' 1870. Enlarged.
12. Head of *Ophiodromus flexuosus*, D. Ch. Enlarged.
13. Anterior end of the foregoing with the proboscis extruded. Viewed from the ventral surface. Enlarged.
14. Head of *Castalia arctica*, Mgrn., from west coast of Ireland. The frontal tentacles have been lost. Enlarged.
15. Dorsal surface of the head of *Castalia fusca*, Johnst. Enlarged.
16. Ventral view of the same species with the proboscis exserted. Enlarged.
17. Head of *Leocrates atlantica*, Roule. The specimens unfortunately were injured and imperfectly preserved. Enlarged.
18. Head of *Dalhousiella Carpenteri*, McI., from an indifferent specimen. Enlarged.
19. Head (imperfect) of "*Sphærosyllis ovigera*, Lghns.," from Dr. Allen. × about 35.
20. Head and extruded proboscis of *Phyllodoce lamelligera*, L. (drawn by Mrs. Sexton). Enlarged.
21. Head of *Phyllodoce maculata*, L., with proboscis extruded (drawn by Mrs. Sexton). Enlarged.
22. Head of *Eumida sanguinea*, Œrst., with proboscis exserted (drawn by Mrs. Sexton). Enlarged.
23. Head of *Eulalia tripunctata*, McI., with proboscis thrust out (drawn by Mrs. Sexton). × 17.
24. Abnormal tail of *Phyllodoce maculata*, L., with one large and four smaller anal cirri in pairs, from St. Andrews. Enlarged.
25. Tip of tail of *Phyllodoce rubiginosa*, De St. Joseph, from Plymouth. Enlarged.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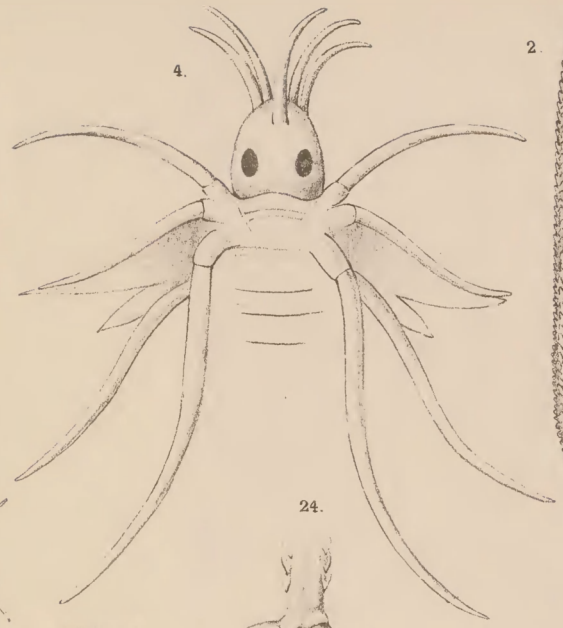
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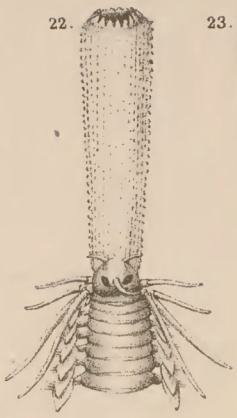
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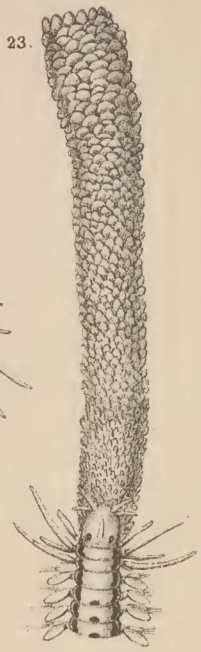
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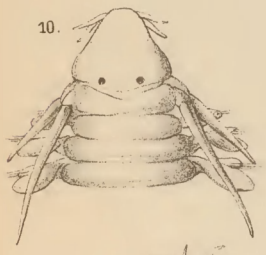
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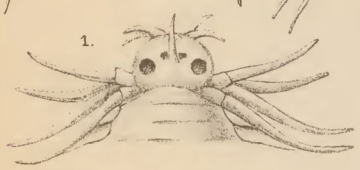
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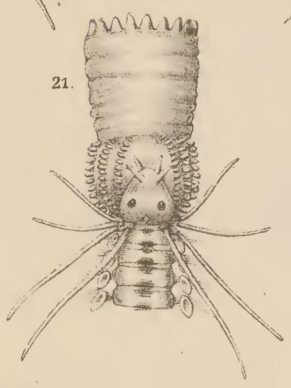
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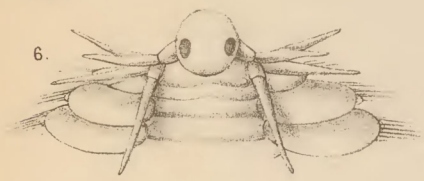
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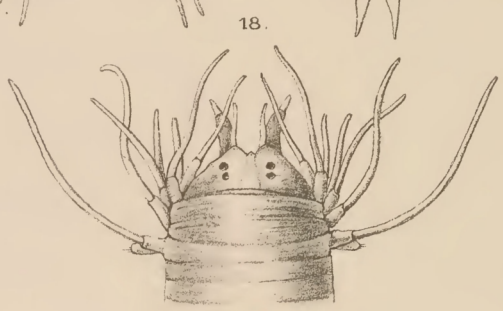
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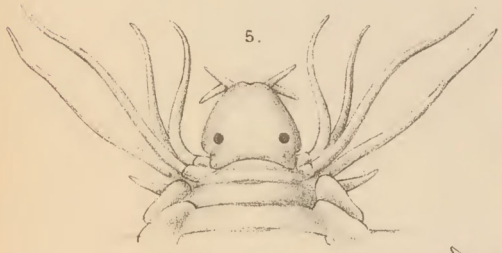
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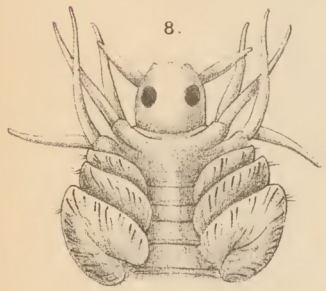
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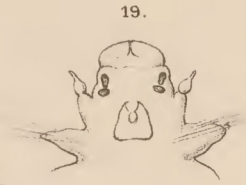
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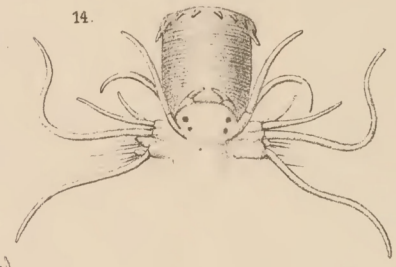
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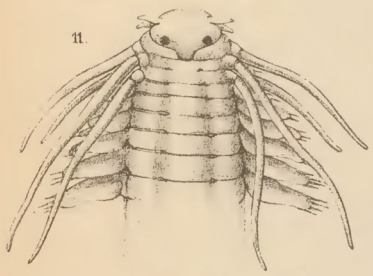
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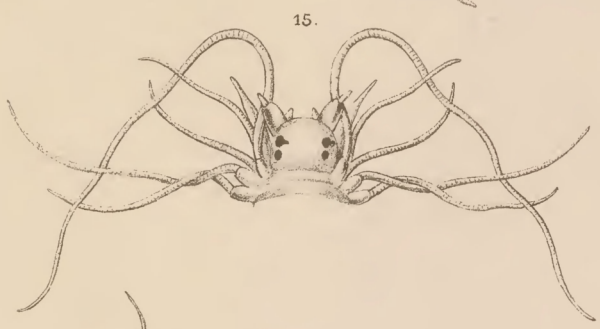
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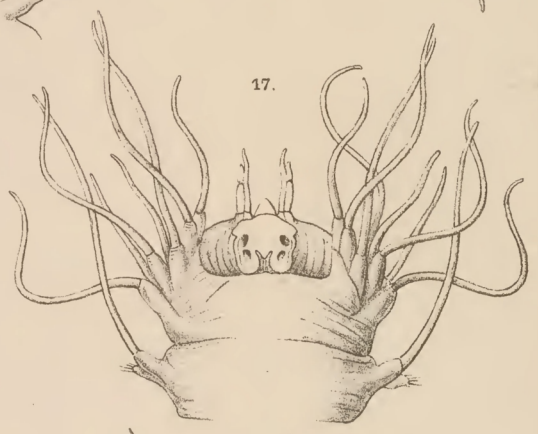
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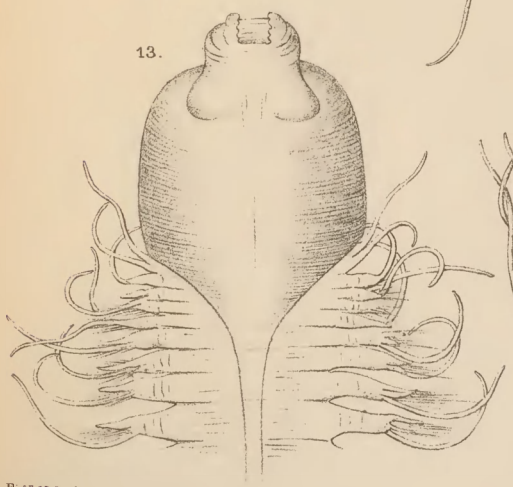
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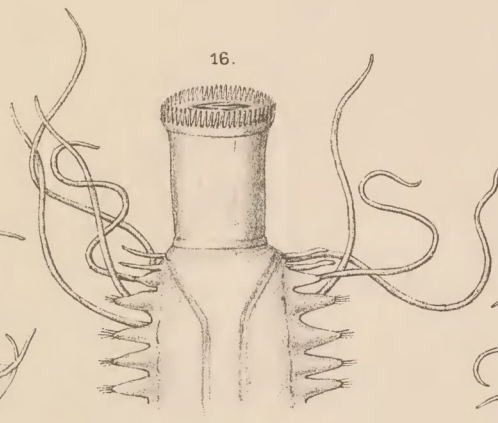
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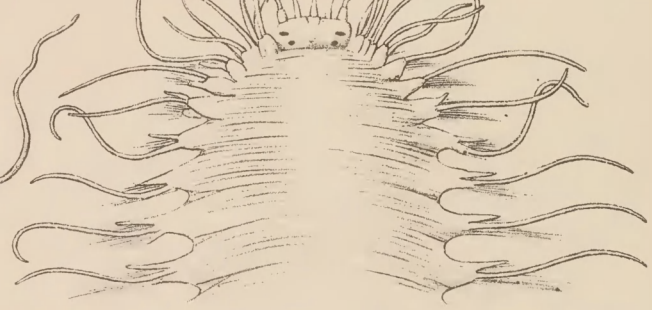
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Figs 12 & 13, W.C.M. 24, R.M. 20-23, Mrs S. cætera A.H.W. del.

fa P.W.M.T. impr.

PLATE LIX.

Fig.

1. Head and anterior region of *Magalia perarmata*, De St. Joseph. Enlarged.
2. Caudal region of the same. Enlarged.
3. Female of *Sphærosyllis hystrix*, Clap., with ova attached to the ventral surface. Ventral view. Enlarged.
4. Male example of the foregoing with long (swimming-) bristles, from the coast of Co. Down, Ireland. Enlarged.

4*a*. Head of the foregoing species. × Zeiss oc. A, obj. 4, with draw-tube.

5. *Exogone gemmifera*, Pagenstecher, from St. Andrews, with flask-shaped embryos attached to feet on the ventral surface; *c* natural size, *a* and *b* enlarged.
6. Proboscis of the same and the proventriculus. Enlarged.
7. *Xenosyllis Kinbergi*, n.s., from the dorsum. Enlarged.
8. Head of *Sphærosyllis hystrix*, Clap., with an additional eye-speck on each side in front. The tentacles are incomplete. Enlarged.
9. Anterior region of *Microsyllis Marenzelleri*, n.s. (fragmentary), from the Sound of Harris. × about 40.
10. Head of *Pionosyllis prolifera*, Krohn, var. *Malmgreni*. Enlarged.
11. Anterior region of *Eusyllis tubifex*, Gosse, in life, showing the arrangement of the proboscis, proventriculus, and stomach. × about 45.
12. Head of *Pionosyllis divaricata*, Keferst. Enlarged.
13. Head of *Eusyllis tubifex*, Gosse. Enlarged.
14. Head and anterior region of *Odontosyllis gibba*, var. *Robertianæ*, in life, from Guernsey. Enlarged.

14*a*. The same in spirit. Enlarged.

15. Head and anterior region of *Odontosyllis fulgurans*, Aud. and Ed. Enlarged.

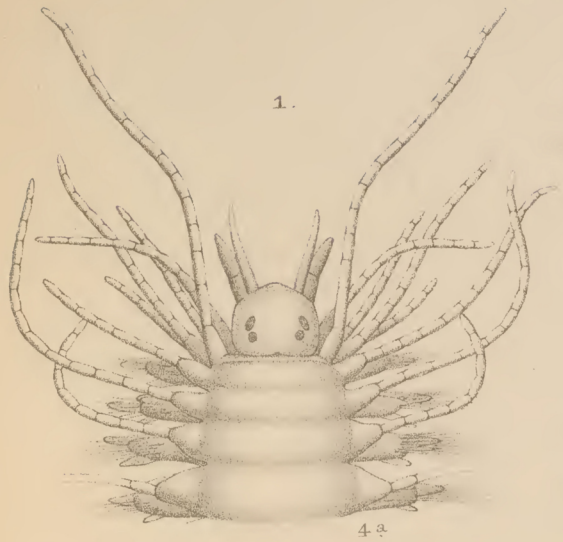
15*a*. Tail of the same. Enlarged.

15*b*. Tail (incomplete) of example of the foregoing from Plymouth. Enlarged.

16. Head of *Ioida* from Plymouth, September 14th, 1905. Enlarged.

16*a*. Tail of the foregoing. Enlarged.

1.



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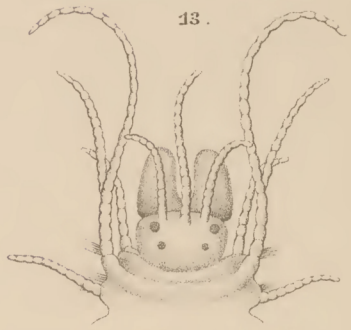

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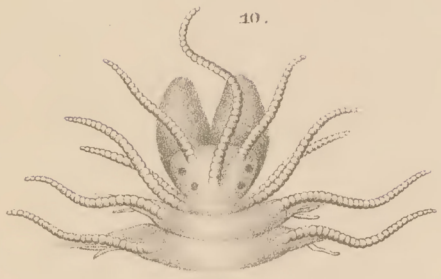

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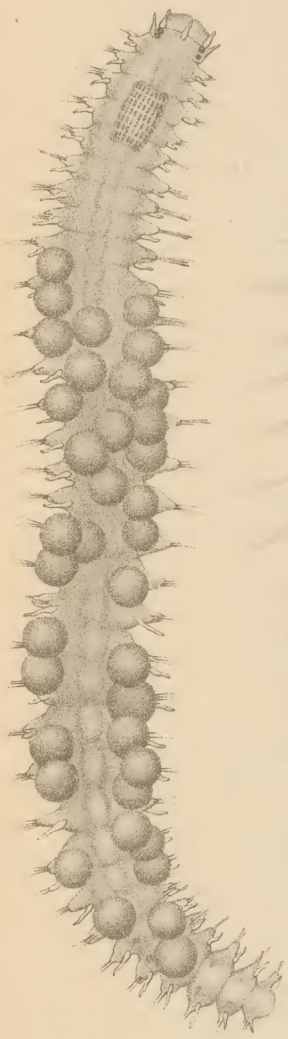

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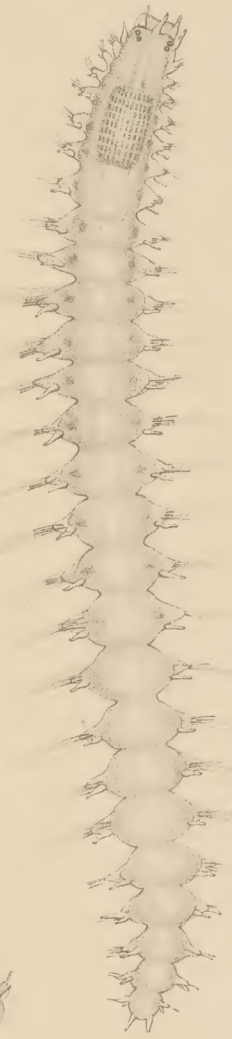

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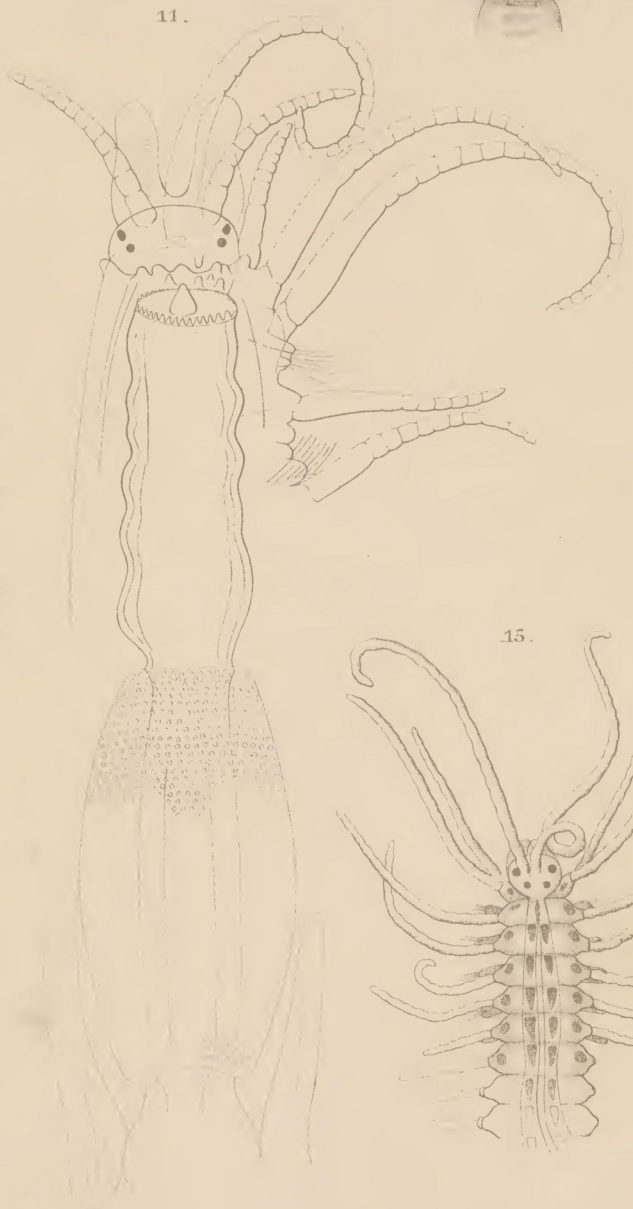

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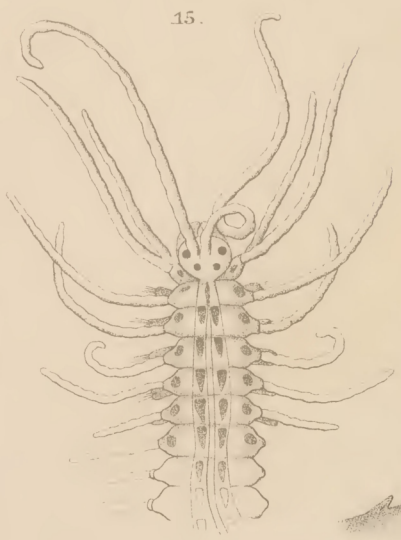

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Figs 5.6.11. W.C.M. cætera A.H.W. del.

fa P.W.M.T. impr.

PLATE LX.

Fig.

1. Head of *Syllis armillaris*, O. F. M. Enlarged.
2. Head of *Ioida macrophthalma*, Johnst. Enlarged.
3. Head of *Syllis cucullata*, McI. Enlarged.
4. Early larva of *Autolytus prolifer*, O. F. M., from the sac. × 100.

5 and 5*a*. Anterior and posterior ends of free bud of *Autolytus*, St. Andrews, May 25th, 1885, the former from the ventral surface. Magnified.

6 and 6*a*. Dorsal and ventral aspects of the head and proboscis of *Nereis pelagica*, L. Enlarged.

7 and 7*a*. Dorsal and ventral views of the head and proboscis of *Nereis cultrifera*, Grube. Enlarged.

8. Head of *Nereis irorata*, Mgrn., from the dorsum. Enlarged.
9. Head and proboscis of *Nereis Marionii*, Aud. and Ed., from the dorsum. Enlarged.
10. Proboscis of *Nereis Dumerilii*, Aud. and Ed., from the ventral surface (partly extruded). Enlarged.

10*a*. Proboscis of the same from the ventral surface (from St. Andrews). Enlarged.

10*b*. Head and proboscis in an epitokous form, in which the eyes are much larger than usual. Enlarged.

10*c*. Epitokous male from the surface of the sea, Castle Bay, Barra. Enlarged.

11. Head and proboscis of *Nereis diversicolor*, O. F. M. Enlarged.

11*a*. Ventral aspect of the foregoing. Enlarged.

12. Head of *Marphysa Belli*, Aud. and Ed. Enlarged.

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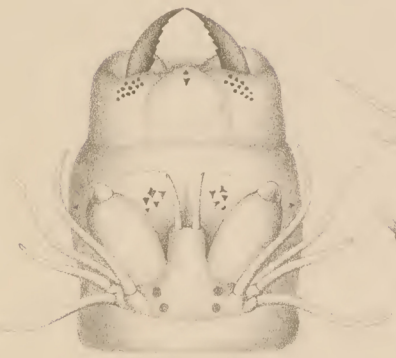

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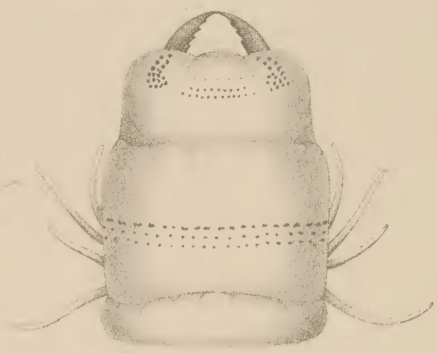

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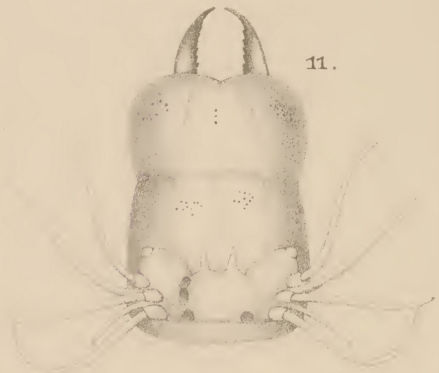

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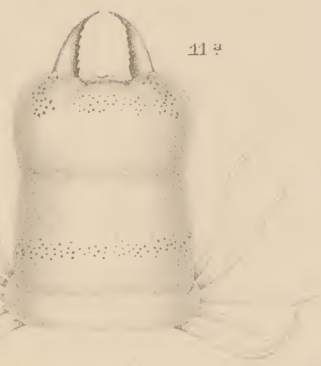

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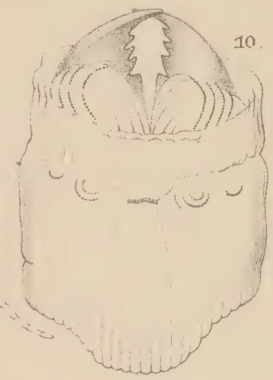

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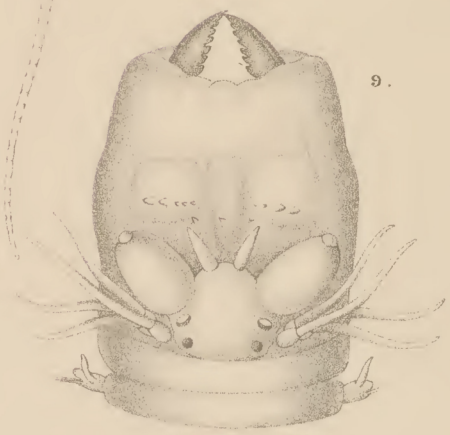

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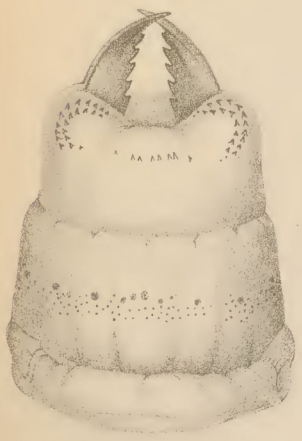

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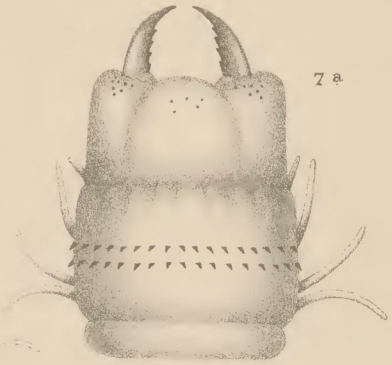

PLATE LXI.

Fig.

1. Head of *Eunereis longissima*, Johnst., from St. Magnus Bay, Shetland. Enlarged.
1*a*. Head and proboscis of the same from Montrose Bay. Enlarged.
1*b*. Ventral patches of teeth (paragnathi) on the proboscis of 1*a*. Enlarged.
2. Dorsal view of head and proboscis of *Nereis* (*Alitta*) *virens*, Sars. Enlarged under a lens.
2*a*. Ventral aspect of the foregoing. Enlarged.
3. Cœlomic corpuscles of this species. × 700.
4. Contracted muscular fibril showing peculiar cross-striations. × 700.
5. Another contracted fibril with a granular band in centre, and transparent sarcolemma (*b*) externally. × 350.
6. Dorsal view of head and proboscis of *Nereilepas fucata*, Savigny. Enlarged.
6*a*. Ventral view of the same. Enlarged.
7. Upper dental apparatus of *Staurocephalus rubrovittatus*, Grube, from Herm. Seen from below. × about 40.
7*a*. Shorter teeth of the same. × Zeiss oc. 2, obj. D.
7*b*. Longer (outer) upper teeth. × Zeiss oc. 2, obj. D.
7*c*. Mandible of the foregoing. × 55.
8. Mandible of *Staurocephalus Kefersteini*, McI. × Zeiss oc. 2, obj. D.
9. Dental (upper) apparatus of *Staurocephalus ciliatus*, Keferst., from St. Peter Port, Guernsey. The specimen is incomplete. × Zeiss oc. 2, obj. D.
9*a*. Mandible of the foregoing. × Zeiss oc. 2, obj. D.
10. Young example of *Ophryotrocha puerilis*, Clap. and Mecz. Enlarged.
10*a*. Dental apparatus of the same. × Zeiss oc. 2, obj. D. Reduced from original drawing.

1.

1a.

2.

2a

3.

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5.

6.

6a.

7.

7a.

7b.

7c.

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9a.

10.

1b.

10a.

Figs 3 4 & 5 W. C. M. cætera A. H. W. del.

f.a P. W. M. Trap impr

PLATE LXII.

Fig.

1. Dental apparatus of *Lumbriconereis fragilis*, O. F. M., viewed from above. × about 14.
1*a*. Mandibles. × about 14.
2. Mandibles of *Lumbriconereis impatiens*, Clap. × 35.
3. Head of *Lumbriconereis hibernica*, n.s., twenty-five miles off the Blasquet. Enlarged.
3*a*. Proboscis extruded. Enlarged.
4. Head of *Lumbriconereis gracilis*, Grube, from the dorsum. From Loch Slyne, Co. Cork. Enlarged.
4*a*. Armature of the proboscis as extruded. × 41.
5. Head of *Lumbriconereis G*. Enlarged.
6. Head of *Zyglobus laurentianus*, Grube. Enlarged.
6*a*. Dental apparatus. × about 50.
6*b*. Mandibles. × about 50.
7. Head of *Drilonereis Elisabethæ*, n.s., with the proboscis partly protruded. From the stomach of a haddock, St. Andrews. Enlarged.
7*a*. Dental apparatus. × 20.
7*b*. Mandibles of the same. × Zeiss oc. 2, obj. A.
8. Ventral surface of the head of *Arabella iricolor*, Mont., from Guernsey. Enlarged.
8*a*. Dental apparatus. × 20.
8*b*. One side of the same in another example. × about 40.
8*c*. Mandibles. × about 25.
9. *Notocirrus scoticus*, McI., from the dorsum. From Lochmaddy. Enlarged.
9*a*. Dental apparatus drawn from an example from the Isle of Man, off Peel. The anterior fang of the maxillary plates (second from rear) was broken off. × 50.
9*b*. Mandibles of the same. × 50.
10. Dental apparatus of *Eunice Harassii*, Aud. and Ed. × 30.
10*a*. Mandibles of the same. × 30.

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2.

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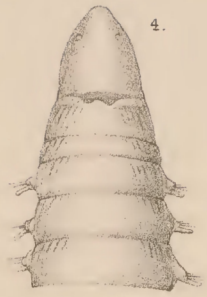

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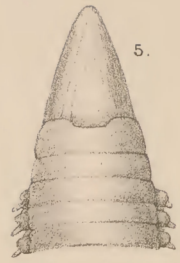

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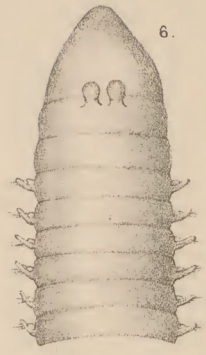

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4a.

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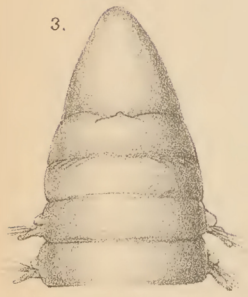

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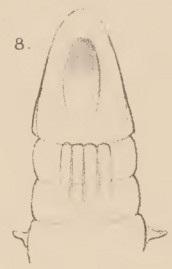

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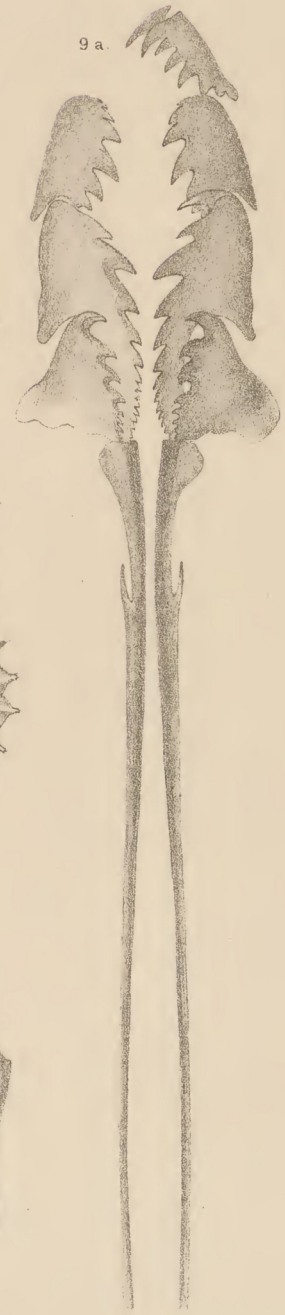

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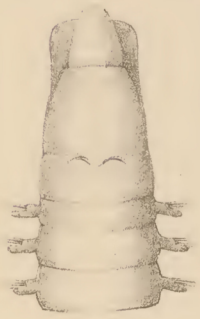

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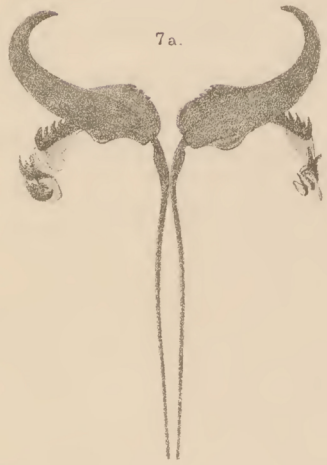

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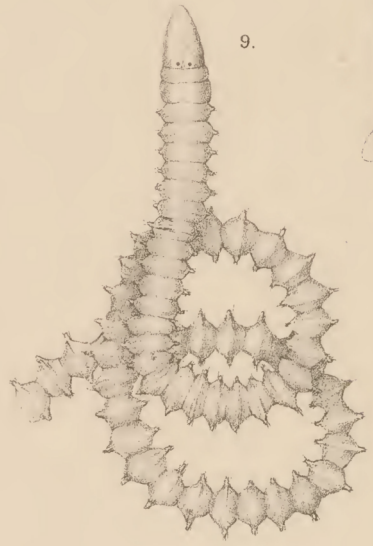

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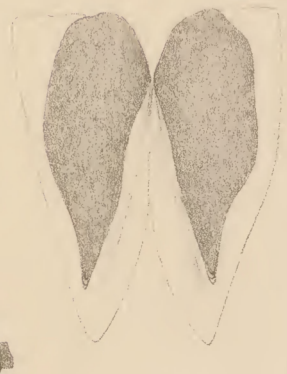

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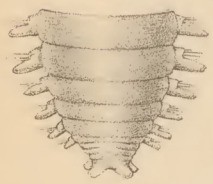


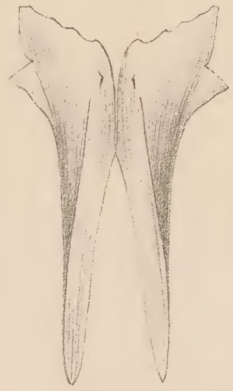
8c.

8b.

8a.

10.

10a.



9b.

A.H.W del

f.a P.W.M. Trap impr.

PLATE LXIII.

Fig.

1. Dental apparatus of *Marphysa sanguinea*, Mont. × 15.
1*a*. Mandibles. × 15.
2. Dental apparatus of *Marphysa Belli*, Aud. and Ed. × 15.
3. Dental apparatus of *Eunice vittata*, D. Ch. (= *limosa*, Ehlers), from Galway. × Zeiss oc. 2, obj. A.
3*a*. Mandibles. × Zeiss oc. 2, obj. A.
4. Dental apparatus of *Eunice norvegica*, L. From Norway. × about 30.
4*a*. Mandibles of ditto. × 55.
5. Dental apparatus of *Nematonereis unicornis*, Grube. Incomplete. × 21.
5*a*. Mandibles (unfortunately imperfect). × 21.
6. Dental apparatus of *Lysidice Ninetta*, Aud. and Ed. × 20.
6*a*. Mandibles. × 20.
7. Head of *Onuphis britannica*, McI. Enlarged.
7*a*. Dental apparatus. × 50.
7*b*. Mandibles. × 50.
7*c* and 7*d*. Tubes of this species composed of shells and secretion. Enlarged.
8. Dental apparatus of *Onuphis brevibrachiata*, Ehlers. × 20.
8*a*. Mandibles. × 20.
9. Dorsal view of *Onuphis conchylega*, Sars, in its tube. Enlarged.
10. Head and anterior region of *Onuphis brevibrachiata*, Ehlers, after figure by Ehlers (Taf. III, fig. 2). Enlarged.
10*a*. Ventral surface of the same, after Ehlers. Enlarged.

1.

1a.

2.

2a.

3.

3a.

4.

4a.

5.

5a.

6.

6a.

7.

7a.

7b.

7c.

7d.

9.

10.

10a.

8.

8a.

Figs 7c & 7d J.M.A. cætera A.H.W. del.

f.a P.W.M. Trap impr.

PLATE LXIV.

Fig.

1. Dental apparatus of *Onuphis conchylega*, Sars. From the ' Knight Errant.' × 30.
1*a*. Mandibles. × 30.
2. Dental system of *Onuphis quadricuspis*, O. Fabr. × 30.
2*a*. Mandibles. × 30.
3. Head of *Onuphis* (*Diopatra*) *fragosa*, Ehlers. Enlarged.
3*a*. Dental apparatus. × Zeiss oc. 2, obj. A.
3*b*. Portion of tube (of mud) from Norway. Enlarged.
4. Ventral surface of the head of *Onuphis sicula*, De Quatref. Enlarged.
4*a*. Dental apparatus of the foregoing. × as before.
4*b*. Mandibles of the same. × as before.
4*c*. Tube of the same from Plymouth. Enlarged.
5. Head of *Hyalinœcia tubicola*, O. F. M., from the mouth of Bantry Bay. Enlarged.
5*a*. Dental apparatus. × 21.
5*b*. Hyaline tube containing annelid. Enlarged.
6. Anterior end of *Goniada maculata*, Œrst. Enlarged.
6*a*. The same with proboscis extruded. Enlarged.
6*b*. Row of V-shaped denticles of the proboscis. × 100.
6*c* and 6*c*′. Intermediate small denticles. × Zeiss oc. 2, obj. D.
6*d*. Larger denticle somewhat palmate in outline. × Zeiss oc. 2, obj. D.
7. First and part of second region of the body of *Glycinde Nordmanni*, Mgrn. Enlarged.
7*a*. Tail. Enlarged.
7*b*. Smaller denticles of *Glycinde Nordmanni*. × Zeiss oc. 2, obj. D.
7*b*′ and 7*b*″. Larger denticles. × Zeiss oc. 2, obj. D., with 1 in. draw-tube.
8. Proboscis (exserted) of *Glycera siphonostoma*, D. Ch., from Balta. Enlarged.
8*a*. Tip of a regenerated tail in an example from Herm. Slightly enlarged.
9. Tooth of *Glycera capitata*, Œrst. × 380.
9*a*. Tooth of *Glycera lapidum*, De Quatref. × 350.

1.

1a.

2.

2a.

4a.

3a.

3b.

3.

4.

5b.

4b.

5a.

6c.

7b.

7b'.

4c.

6.

6c'.

7b''.

5.

9.

6b.

6a.

8.

8a.

7a.

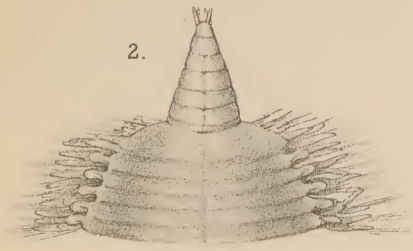
6d.

9a.

PLATE LXV.

Fig.

1. Terminal region of the extruded proboscis of *Glycera alba*, H. Rathke. Enlarged.
2. Anterior end of *Glycera Goësi*, Mgrn. (somewhat contracted). Enlarged.
2*a*. Proboscis extruded. Enlarged.
3. Head of *Aricia norvegica*, Sars. Enlarged.
4. Head of *Scoloplos armiger*, O. F. M. Enlarged.
4*a*. Tip of tail, from Symbister Harbour, Shetland. Enlarged.
5. Dorsal view of the head of *Naidonereis quadricuspida*, O. Fabr. Enlarged.
5*a*. Ventral view. Enlarged.
6. Head of *Eteone pusilla*, Œrst. Enlarged.
7. Head of *Eunice floridana*, Pourtales. × about 15.
7*a*. Upper dental apparatus of the foregoing. × 12.
7*b*. Mandibles of the same. × 15.
8. Upper dental apparatus of *Lumbriconereis impatiens*, Clap. × about 21.
8*a*. Mandibles of the foregoing. × 15.
9. Foot of *Nematonereis unicornis*, Grube. × 90.
10. Proboscis of *Magalia perarmata*, Mar. and Bobr., from the figure given by these authors. Enlarged.
11. Upper dental apparatus of *Marphysa Belli*, Aud. and Ed. × 50.
11*a*. Mandibles of the foregoing. × 50.
12. Upper dental apparatus of *Lumbriconereis Nardonis*, Aud. and Ed. × 50.
12*a*. Anterior region of the mandibles of the same. × 50.
13. Upper dental apparatus of *Onuphis britannica*, McI., in which reproduction of the maxillæ has occurred. × Zeiss oc. 2, obj. A.
14. Ninetieth foot of *Marphysa sanguinea*, Mont. × 55.
15. View of the mouth and adjacent parts of *Hyalinœcia tubicola*, O. F. M., from life. Enlarged.
16. Foot of *Exogone gemmifera*, Pag., after Viguier.
17. Mandible of *Staurocephalus rubrovittatus*, Grube. × Zeiss oc. 2, obj. D.
18 and 18*a*. Isolated teeth of *Staurocephalus Kefersteinii*, McI. × Zeiss oc. 4, obj. C.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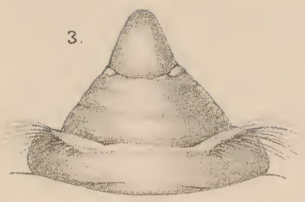
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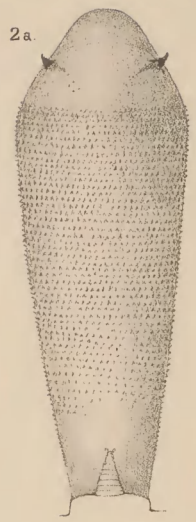
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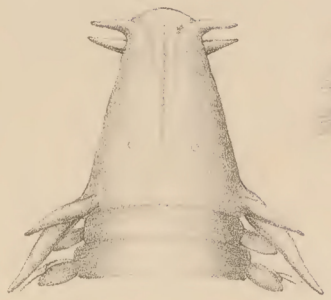
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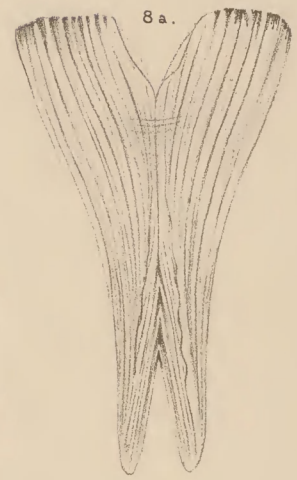
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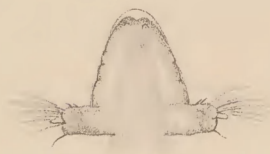
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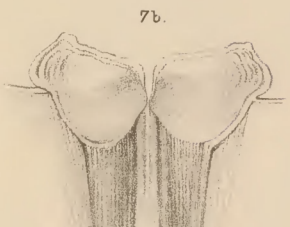
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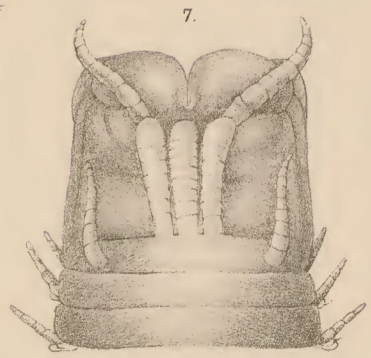
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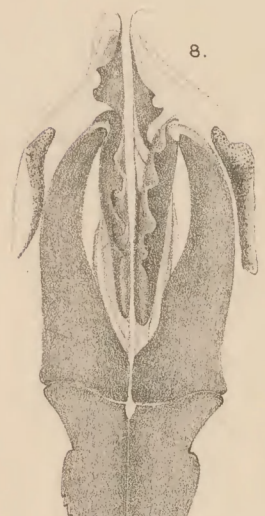
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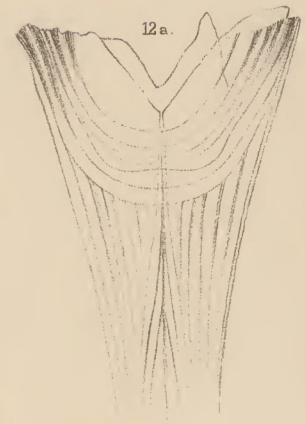
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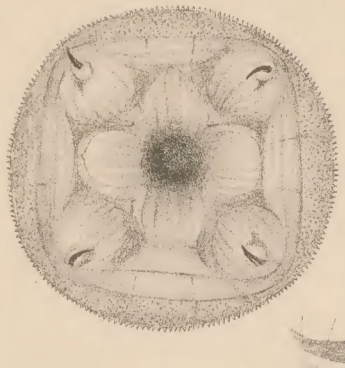
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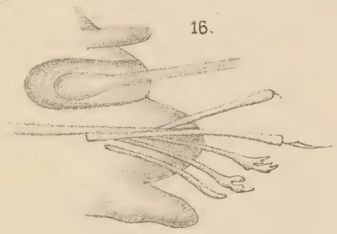
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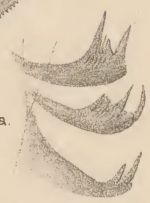
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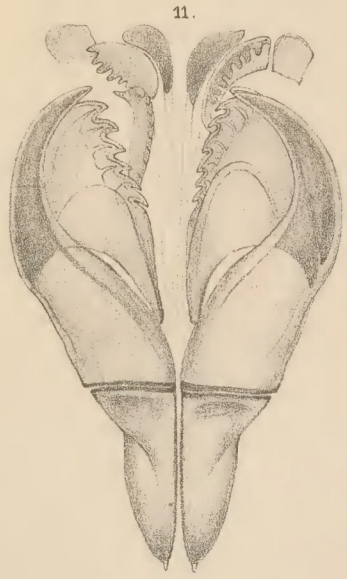
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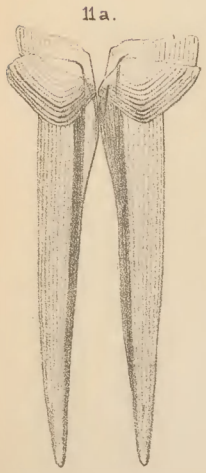
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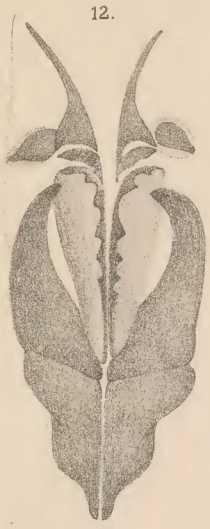
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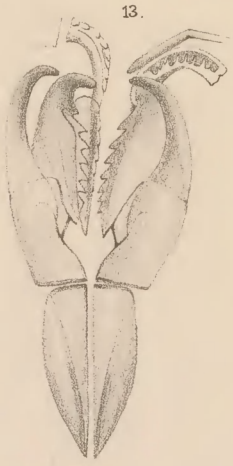
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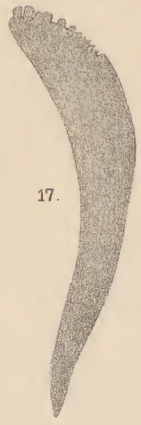
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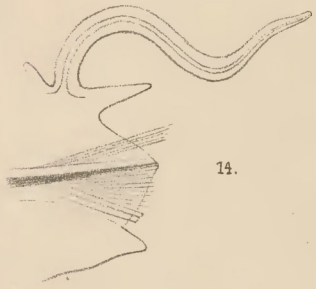
14.

PLATE LXVI.

Fig.

1. Anterior foot of *Nephthys cæca*, O. Fabr., from the front. × 50.
2. Posterior foot of the same from the front. × 50.
3. Anterior foot of the variety *ciliata* (*N. longisetosa* of Johnst.). May 17th. × about 50.
4. Anterior foot of *Nephthys Hombergii*, Lamk. Similarly magnified.
5. Anterior foot of *Nephthys Hombergii* var. *Kersivalensis*. × about 50.
6. Posterior foot of the same. Similarly magnified.
7. Anterior foot of *N. Hombergii* var. *vasculosa*, from twenty-five fathoms, Buono Bay, 'Porcupine.'
8. Posterior foot of the same. × 90.
9. Anterior foot of *Nephthys ciliata*, O. F. M. × 50.
10. Anterior foot of *Nephthys hystricis*, McI.

10*a*. The same viewed from the edge. × about 50.

11. Anterior foot of *Nephthys longisetosa*, Œrst. Enlarged.

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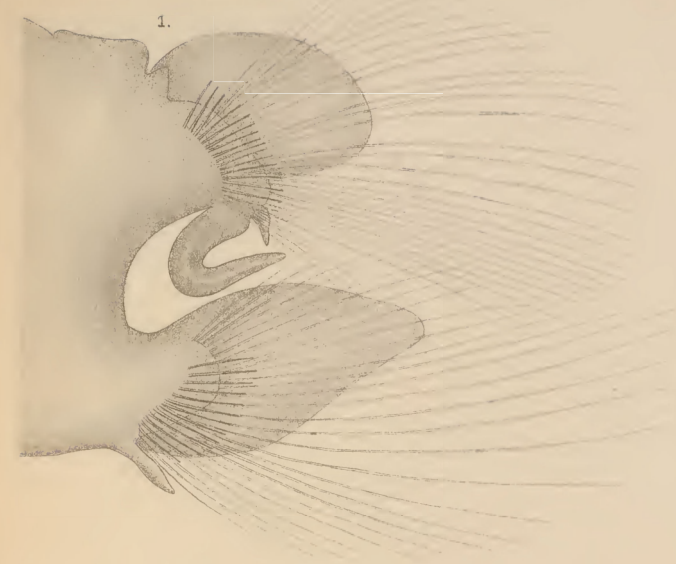

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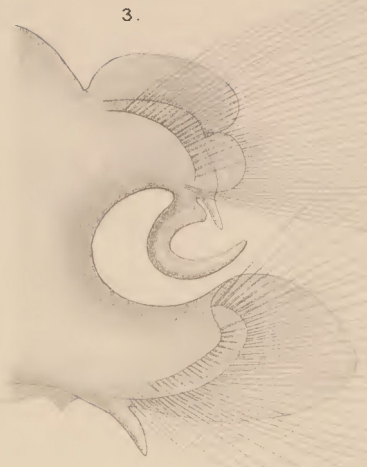

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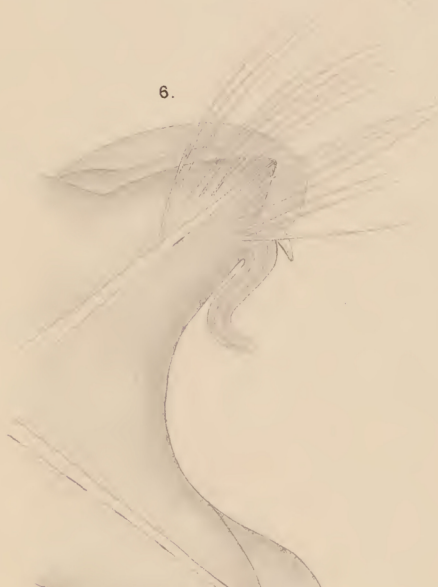

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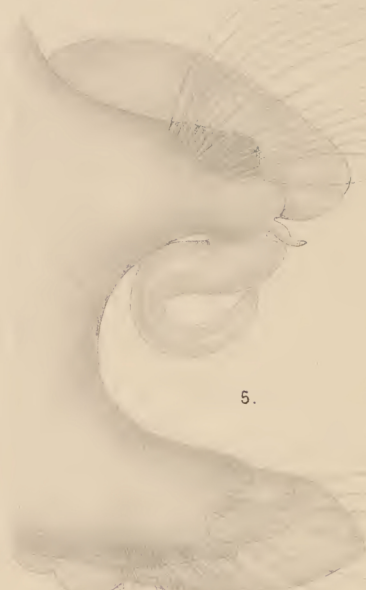

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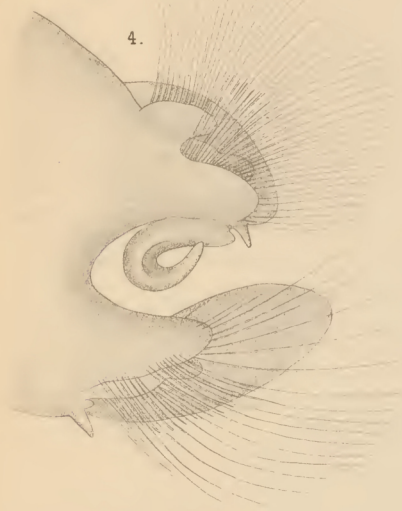

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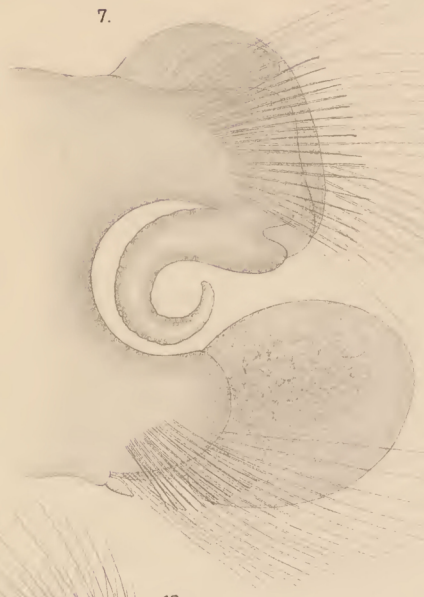

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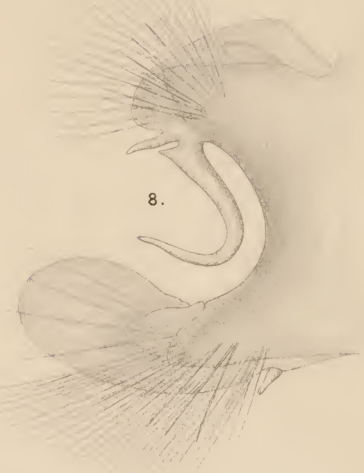

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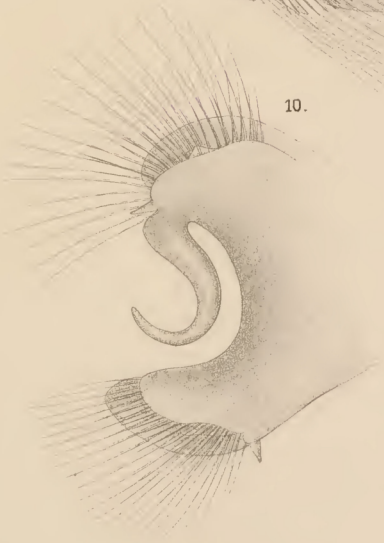

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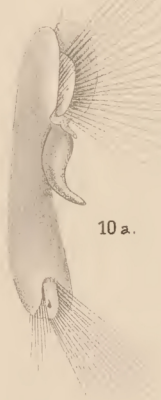

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E.L. & A.H.W. del.

f^a P.W.M. Trap impr

PLATE LXVII.

Fig.

1. Anterior foot of *Nephthys Grubei*, n.s. × 40.
2. Typical foot of *Nephthys Johnstoni*, Ehlers, from Balta. × 50.
2*a*. Foot from the same region of an example from the West Sands, St. Andrews. × 50.
3. Typical foot of *Nephthys cirrosa*, Ehlers. × 50.
4. Typical foot of *Nephthys incisa*, Mgrn., from Connemara. × 55.
5. Foot of *Notophyllum foliosum*, Sars. × 55.
6. Foot of *Eulalia bilineata*, Johnst. × 100.
7. Spermatozoa of foregoing. × 400.
8. Tenth foot of *Eulalia nebulosa*, Mont. × 90.
9. Fortieth foot of the same. × 90.
10. Tenth foot of *Eulalia viridis*, O. F. M., St. Andrews. × 210.
11. Fortieth foot of the same. × 210.
12. Anterior foot of *Eulalia* (*Pterocirrus*) *macroceros*, Grube. × 35.
13. Anterior foot of *Eulalia tripunctata*, McI., from Herm. × 210.
14. Tenth foot of *Eumida sanguinea*, Œrst., from Lochmaddy. × 90.
15. Sixtieth foot of the foregoing. × 90.
16. Twentieth foot of *Marphysa Belli*, Aud. and Ed., from Plymouth. × 15.

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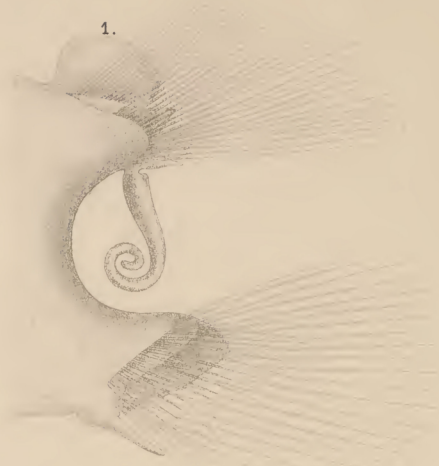

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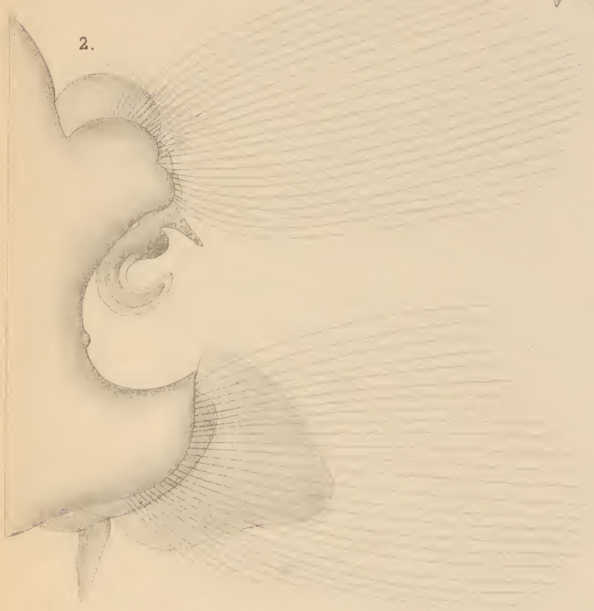

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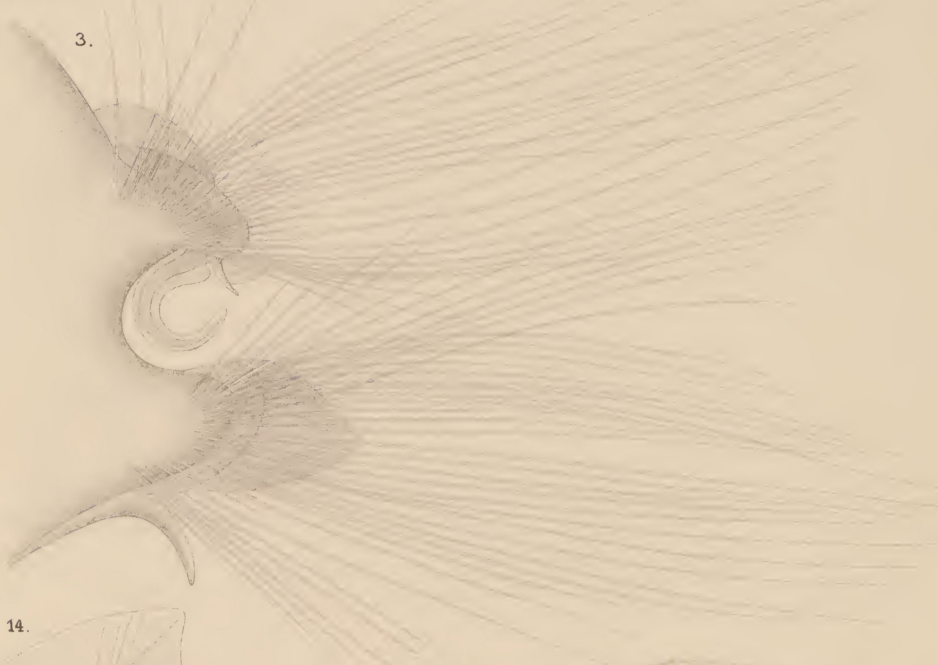

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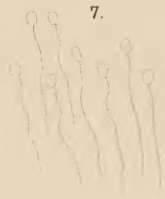

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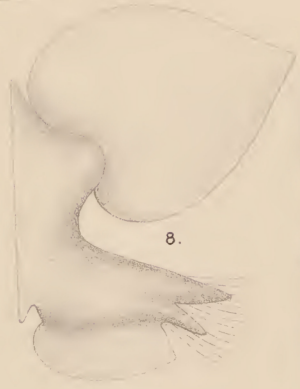

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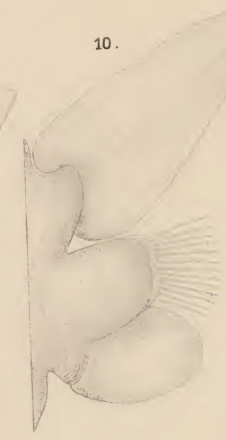

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E.L. & A.H.W. del.

f^a P.W.M. Trap impr.

PLATE LXVIII.

Fig.

1. Tenth foot of *Phyllodoce lamelligera*, L., from the West Voe, Scalloway. × 55.
2. Sixtieth foot of the same specimen. × 55.
3. Foot (about sixtieth) of an example from Naples. × about 90.
4. Tenth foot of *Phyllodoce grœnlandica*, Œrst., from St. Andrews. × about 60.
5. Sixty-seventh foot of the same. × 60.
6. Posterior foot of the foregoing example. × 60.
7. Tenth foot of *Phyllodoce maculata*, L., from St. Andrews. × about 102.
8. Sixtieth foot of the foregoing. × about 102.
9. Foot of *Phyllodoce rubiginosa*, De St. Joseph. × about 55.
10. Tenth foot of *Phyllodoce vittata*, Ehlers, from St. Magnus Bay. × 210.
11. Fiftieth foot of the foregoing. × 210.

11*a*. Foot of the same form, middle of body. × about 180.

13. Foot of *Anaitis rosea*, McI. × about 150.
14. Tenth foot of *Anaitis kosteriensis*, Mgrn. × 90.
15. Thirty-fifth foot of the same. × 90.
16. Tenth foot of *Anaitis Jeffreysii*, McI. × 210.
17. Fortieth foot of the same. × 210.
18. Tenth foot of *Genetyllis lutea*, Mgrn. The ventral cirrus is seen obliquely. × about 55.
19. Fiftieth foot of the same. × about 55.
20. Tenth foot of *Genetyllis citrina*, n.s. × 55.
21. Sixtieth foot of the foregoing. × about 60.

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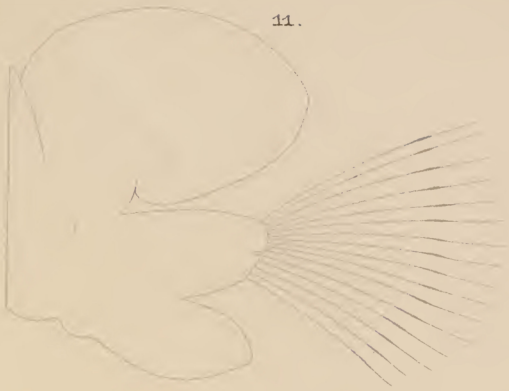

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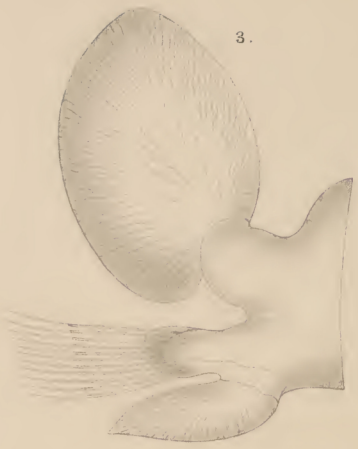

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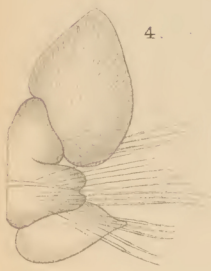

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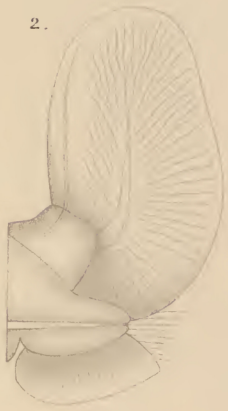

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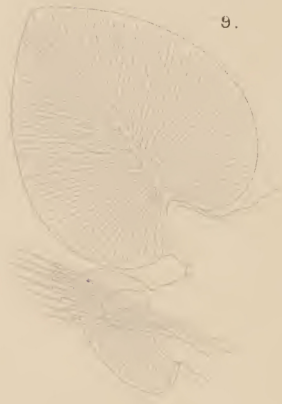

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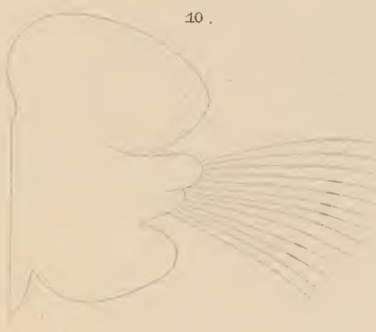

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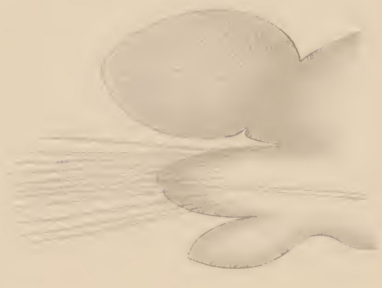

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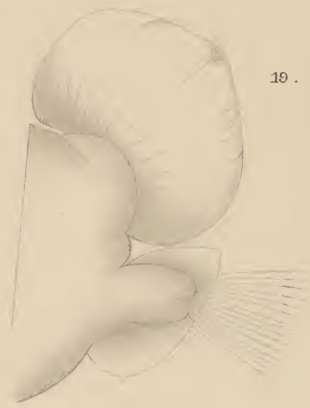

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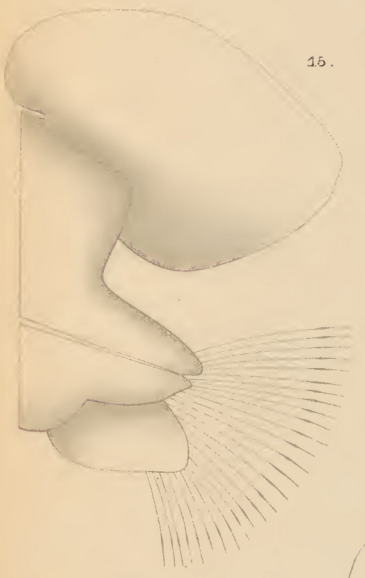

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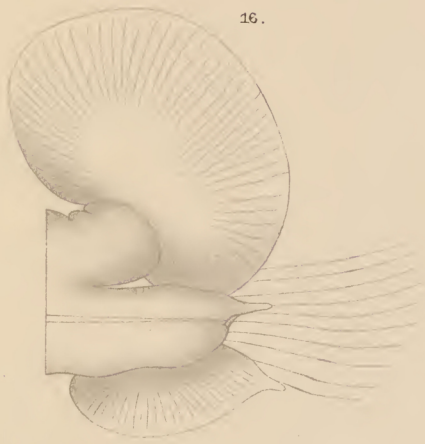

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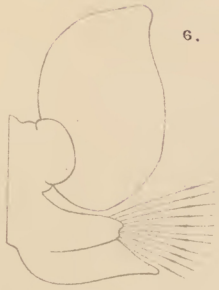

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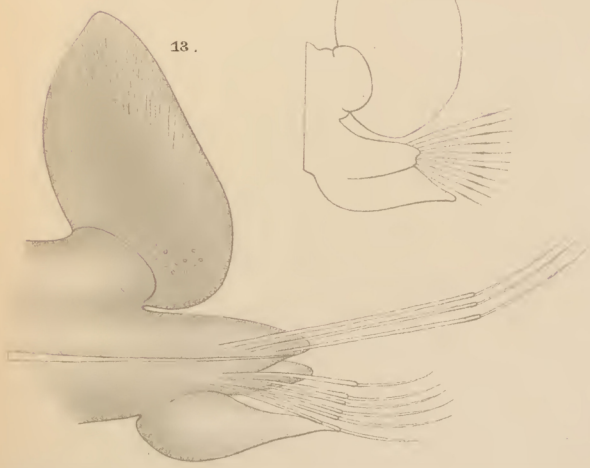

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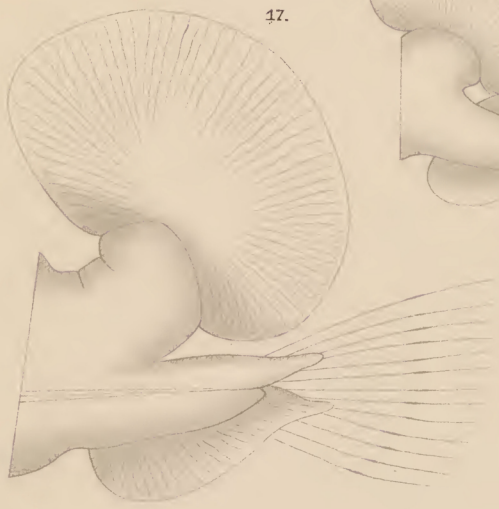

E.L. & A.H.W. del.

f.a P.W.M. Trap impr.

PLATE LXIX.

Fig.

1. Tenth foot of *Genetyllis hibernica*, McI. × 90.
2. Fortieth foot of the same. × 90.
3. Twelfth foot of *Eteone picta*, De Quatref. × 210.
4. Thirtieth foot of the foregoing. × 210.
5. Tenth foot of *Eteone spetsbergensis*, Mgrn. × 50.
6. One hundredth foot of the same. × 50.
7. Seventieth foot of *Eteone pusilla*, Œrst. × 50.
8. Tenth foot of *Eteone arctica*, var. *Robertiana*, from the West Rocks, St. Andrews. × 50.
9. Seventieth foot of the foregoing. × 50.
10. Foot of *Mysta barbata*, Mgrn. × about 90.
11. Tenth foot of *Mystides Lizziæ*, n.s. West Sands, St. Andrews. × 90.
12. Fiftieth foot of the same. × 90.
13. Typical foot of *Ophiodromus flexuosus*, D. Ch.: *a*, dorsal lobe; *b*, ceratophore of dorsal cirrus; *c*, long papilla of superior division; *d*, long papilla of the ventral division; *e*, ventral cirrus. × about 100.
14. Anterior foot of *Castalia punctata*, O. F. M. × 90.
15. Anterior foot of *Castalia arctica*, Mgrn. × about 100.
16. Anterior foot of *Castalia fusca*, Johnst. × about 100.
17. Foot of *Leocrates atlantica*, Roule. × about 35.
18. Foot of *Magalia perarmata*, De St. Joseph. × 50.

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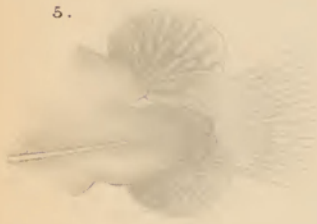

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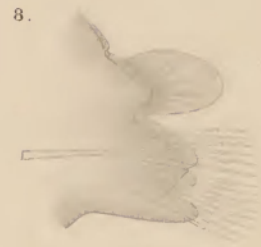

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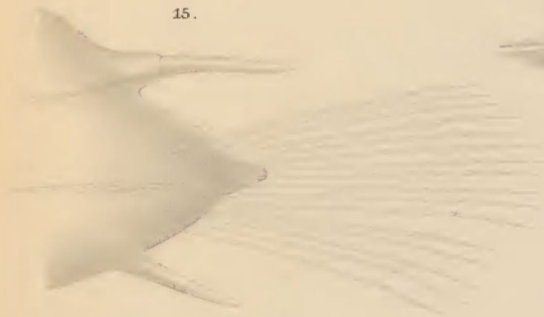

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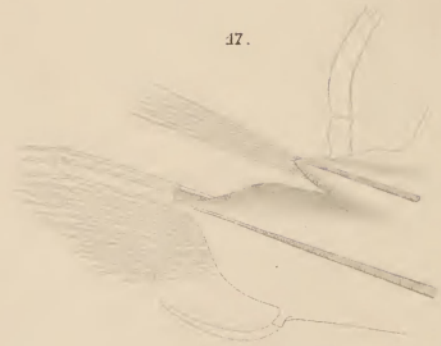


EL & A.H.W. Fig. 13 W.G.M. del.

Fs P.W.M. Trap impr.

PLATE LXX.

Fig.

1. Foot of *Sphærosyllis hystrix*, with swimming-bristles, from sea off Co. Down (Professor G. Brady). × 180.
2. Foot of *Xenosyllis Kinbergi*, n.s. × about 50.
3. Foot of *Microsyllis Marenzelleri*, n.s., from the Sound of Harris. × 250.
4. Foot of *Pionosyllis prolifera*, Krohn, from Guernsey. × about 50.
5. Foot of female bud of the foregoing, with swimming-bristles, from Scalloway. A papilla appears at the tip dorsally, and thus the example differs from the type. × about 50.
6. Foot of variety (?) of the same form, from Herm. × about 50.
7. Foot of *Pionosyllis divaricata*, Keferst. × about 50.
8. Foot of *Trypanosyllis zebra*, Grube. × 50.
9. Foot of *Eusyllis tubifex*, Gosse. × 50.
10. Foot of bud of *Autolytus prolifer*, from St. Andrews. The swimming-bristles are developing. × 50.
11. Foot of *Odontosyllis fulgurans*, Clap. × about 50.
12. Foot of *Odontosyllis ctenostoma*, Clap. × about 50.
13. Foot of *Odontosyllis gibba*, var. *Robertianæ*. × about 50.
14. Foot of *Syllis armillaris*, O. F. M. × about 50.
15. Foot of *Ioida macrophthalma*, Johnst., with long swimming-bristles. × about 50.
16. Foot of *Syllis cornuta*, var. *Collingsii*, off Sark. × about 50.
17. Foot of *Syllis cucullata*, n.s. Luccomb Chine. × about 50.
18. Foot of *Syllis macroceras*, Grube, from Whitecliff Bay, Isle of Wight. × about 50.
19. Foot of *Syllis Cunninghami*, n.s. × Zeiss oc. 2, obj. A, 1 in. draw-tube.

19*a*. Foot of bud of the foregoing. × about 50.

20. Foot of *Syllis brevicirrata*, n.s., from Herm. × about 50.
21. Foot of pelagic form of *Syllis spongicola*, Grube. × about 50.
22. Foot of *Syllis cornuta*, H. Rathke, from St. Magnus Bay, Shetland. × about 50.

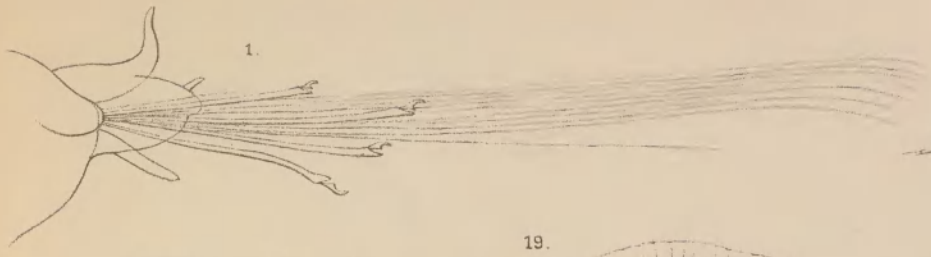
22*a*. Foot of variety of the same form (off the Hebrides). × about 50.

22*b*. Foot of another specimen from Donegal Bay. × about 50.

23. Foot of *Syllis Buskii*, n.s. × about 55.
24. Foot of *Pionosyllis* (*Syllis*) *hyalina*, Grube. × about 55.
25. Anterior foot of *Syllis gracilis*, Grube. × about 55.

25*a*. Foot of the foregoing from the posterior part of the middle region of the body. × about 55.

26. Foot of *Sylline rubropunctata*, Grube. × Zeiss oc. 4, obj. A.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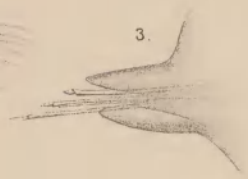
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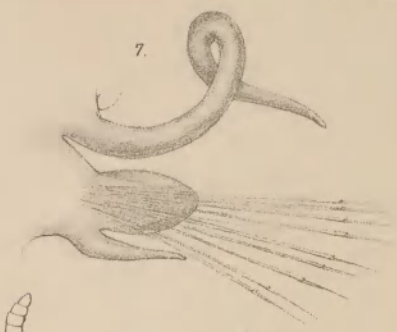
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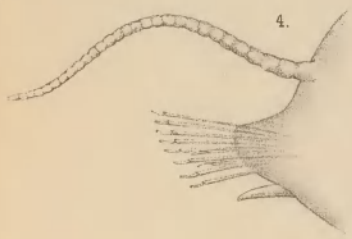
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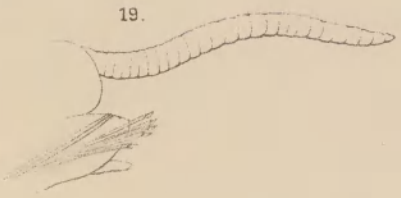
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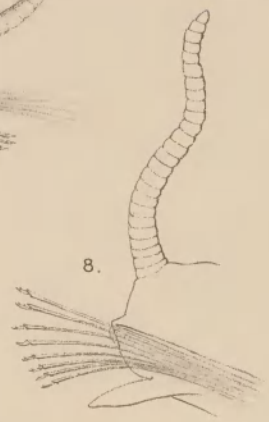
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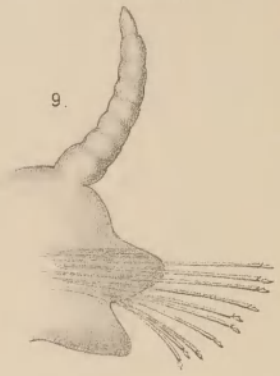
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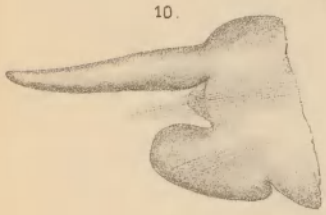
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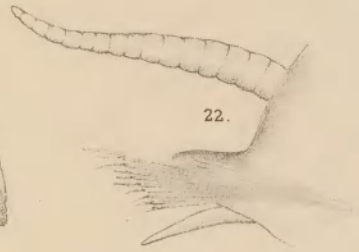
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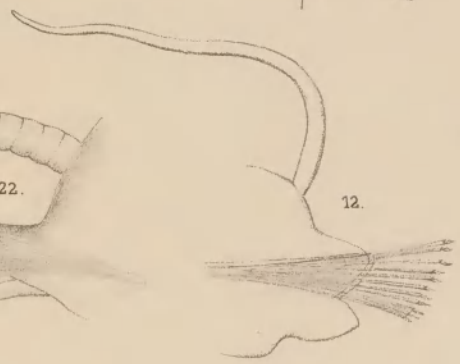
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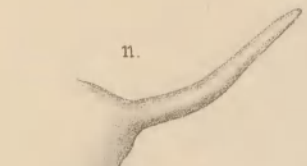
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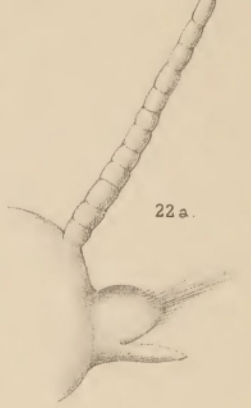
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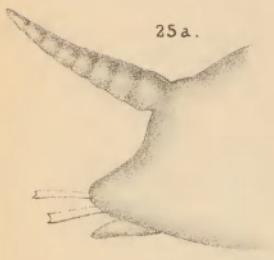
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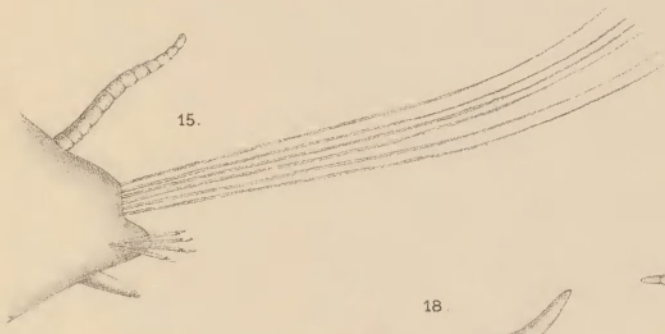
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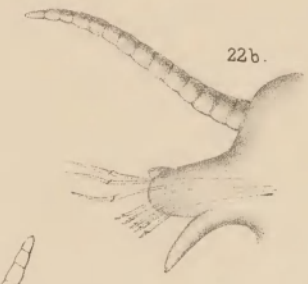
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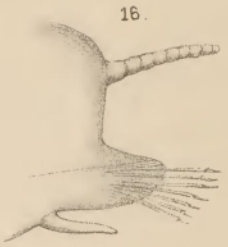
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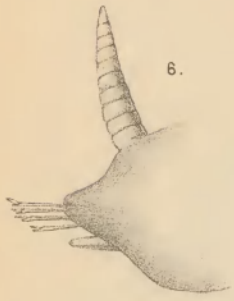
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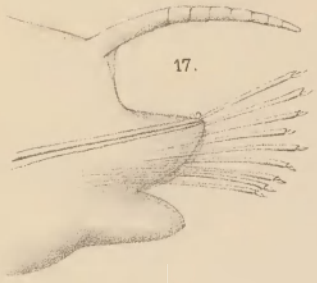
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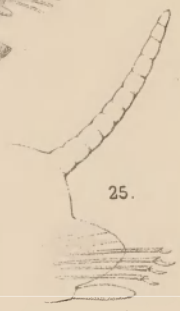
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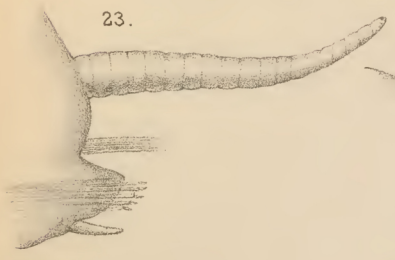
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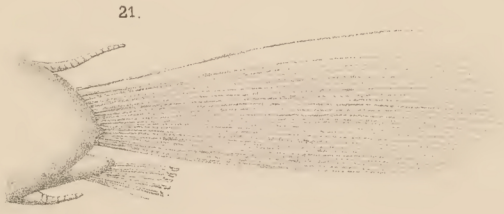
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